

THE
IIOAB
JOURNAL

VOLUME 7 : NO 1 : APRIL 2016 : ISSN 0976-3104

SUPPLEMENT ISSUE

Institute of Integrative Omics and
Applied Biotechnology Journal

Dear Esteemed Readers, Authors, and Colleagues,

I hope this letter finds you in good health and high spirits. It is my distinct pleasure to address you as the Editor-in-Chief of Integrative Omics and Applied Biotechnology (IIOAB) Journal, a multidisciplinary scientific journal that has always placed a profound emphasis on nurturing the involvement of young scientists and championing the significance of an interdisciplinary approach.

At Integrative Omics and Applied Biotechnology (IIOAB) Journal, we firmly believe in the transformative power of science and innovation, and we recognize that it is the vigor and enthusiasm of young minds that often drive the most groundbreaking discoveries. We actively encourage students, early-career researchers, and scientists to submit their work and engage in meaningful discourse within the pages of our journal. We take pride in providing a platform for these emerging researchers to share their novel ideas and findings with the broader scientific community.

In today's rapidly evolving scientific landscape, it is increasingly evident that the challenges we face require a collaborative and interdisciplinary approach. The most complex problems demand a diverse set of perspectives and expertise. Integrative Omics and Applied Biotechnology (IIOAB) Journal has consistently promoted and celebrated this multidisciplinary ethos. We believe that by crossing traditional disciplinary boundaries, we can unlock new avenues for discovery, innovation, and progress. This philosophy has been at the heart of our journal's mission, and we remain dedicated to publishing research that exemplifies the power of interdisciplinary collaboration.

Our journal continues to serve as a hub for knowledge exchange, providing a platform for researchers from various fields to come together and share their insights, experiences, and research outcomes. The collaborative spirit within our community is truly inspiring, and I am immensely proud of the role that IIOAB journal plays in fostering such partnerships.

As we move forward, I encourage each and every one of you to continue supporting our mission. Whether you are a seasoned researcher, a young scientist embarking on your career, or a reader with a thirst for knowledge, your involvement in our journal is invaluable. By working together and embracing interdisciplinary perspectives, we can address the most pressing challenges facing humanity, from climate change and public health to technological advancements and social issues.

I would like to extend my gratitude to our authors, reviewers, editorial board members, and readers for their unwavering support. Your dedication is what makes IIOAB Journal the thriving scientific community it is today. Together, we will continue to explore the frontiers of knowledge and pioneer new approaches to solving the world's most complex problems.

Thank you for being a part of our journey, and for your commitment to advancing science through the pages of IIOAB Journal.



Yours sincerely,

Vasco Azevedo

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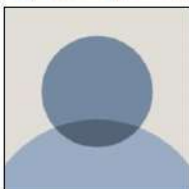
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INVESTIGATION OF DESIGN AND ANALYSIS OF HYBRID DRIVE SYSTEM WITH WIND POWER

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ABSTRACT

One of the main problems of irreversible resource (oil derivatives) resource relate to their irreplaceability. This caused the engineers direct their attention toward building Hybrid cars to use other forms of reversible energy in industrial designs. The research aim is to build Hybrid cars by means of wind power, of course, the design has been applied successfully by Japanese, American, French and German car companies. But, what depicts the difference this research from others relate to the fact the design of rotor and rotor placement. To evaluate the project success, through Fluent, Gambit and Solidwork softwares, the exerted pressure on rotor would be calculated. Through having pressure and applying the governed relations on system, the amount of rotor circulation would be calculated to help main shaft. Then the rate of increase in fuel consumption due to exert Drag force toward moving the system based on rotor existence would be calculated. The results show, designing such system increase %27 of fuel consumption.

Received on: 30th-March-2016

Revised on: 22nd-May-2016

Accepted on: 26- May-2016

Published on: 5th-June-2016

KEY WORDS

Hybrid Cars, Solid Work, Gambit, Fluent, Rotor

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INTRODUCTION

The researchers from BMW, a Germanic company, regarding to design wind hybrid vehicles in 2012 [1], triggered the first sparks of motivation for the engineers of this Germanic company to build such vehicle. But, because of rotor placement on the car shaft, and due to adding an opposed force toward fuel consumption increased. Thus they couldn't find an economic justification to the project. As a result, the project of this Germanic company failed. The researches of Toyota Company regarding to design a wind hybrid vehicle in 2012 [2] encouraged the engineers of TOYOTA Company to decide on building such vehicles. Because of unsuitable designing of rotor on the shaft and adding a positive force in movement caused the increase in fuel consumption and they couldn't find an economic justification to the project. As a result, the project of this company failed, too. The researches were done by Phlox, a Germanic car company, in 2001 [3]. Phlox was the first company with suggestion in designing such cars Emanuel, in American, investigated the impact of Air turbulence in vehicles ahead influenced on steep in front part of the cars [4 - 5]. In this regard, he found the more increase in vehicle's ahead step, the less air turbulence in car's ahead part. Thus, in designing the canal, ducts and rotor, one should take the rotor performance into consideration such that the length of vehicle's ahead experiences no increase. Eljur (2010), in Spania, investigated the air turbulence analysis in the car's ahead [6]. In this regard, the impact of vehicle's dimension on air turbulence was discussed. To investigate these two moods by means of software, having to build a spindle / duke form is the best one, which help to experience the least drag force in front of the vehicle. Migind (2010), in U.S.A, analyzed aerodynamic turbine's air blades with Combit software [7-10]. Metyl bench, solved Navier Stokes unlinear equation to calculate the turbine's rotor speed through numerical and analytical methods. Their method in solving such equation is in Navier-stokes linear un-homogenous equation with considering the assumption according to equation (1, 2) and getting derivation from it and placing it in Navier-stokes equation, we have:

$$\psi(X;Y) = u_{xx} + V_{yy} + \psi(X;Y) \quad (1)$$

$$V(X;Y) = \int F(X;Y) \sin \frac{n\pi}{L} dx \quad n = 1; 2; 3 \dots \quad (2)$$

Navier-stokes equation is converted into homogenous linear equation and then solves it through inseparable way. The manner of air turbulence and airflow pass by mean of software is depicted in fig (1) [14]. It shows air turbulence in the front part of vehicle is far more than the back part. For this, it is better to design the rotor and air inlet channel is designed in the front part, to maintain air turbulence such that falling pressure by the rotor cause decrease drag force from the front part of vehicles.

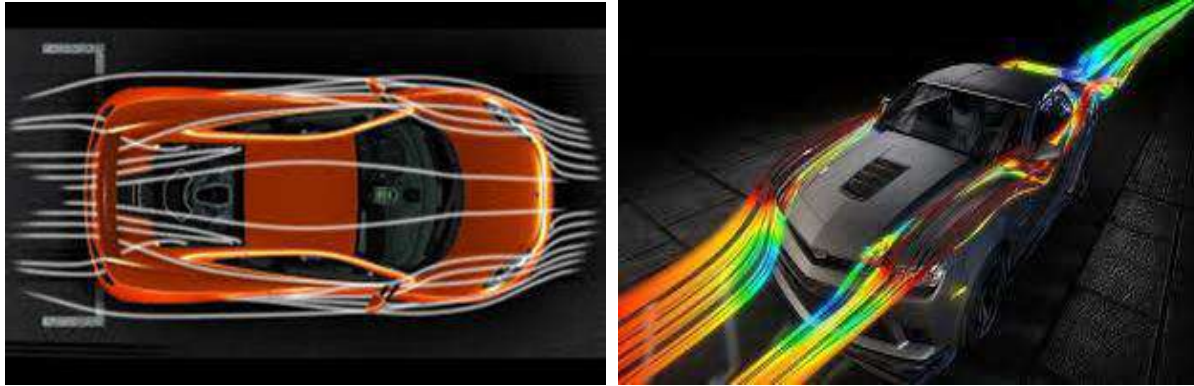


Fig: 1. Airoidynamic Analysis of the vehicle along with the car [14]

In a book titled "Turbomachine Principle", how to calculate the rotor speed based on the exerted force on rotor used by project, which the amount of this speed is [15]:

$$V_n = \frac{n_{st} \sqrt{P}}{\sqrt{\rho} (gh)^{\frac{3}{4}}} \quad (3)$$

Where: V_n is the speed of air collision with rotor, n_{st} undimensional speed; P , is pressure, ρ is density, $g = 9/81$; V is inlet air speed, A is channel cross-section. To calculate the received power from rotor based on air collision speed to rotor the equation (4) is used [16]:

$$P = 0.3925 C_p \cdot \rho \cdot d^2 \cdot v^2 \cdot \sqrt{C_d^2 + C_L^2} \quad (4)$$

Where: C_p is power coefficient, ρ is density, V is speed, C_d is drag coefficient and C_L is lift coefficient. Relayed each other as rotor blades.

In the Allen's book titled " Mechanical motors " it is expressed, the fuel consumption percentage due to exerting an opposite force in the direction of the movement [17] , vehicle route, vehicle fuel consumption increased considerably. The percent of increase in fuel consumption depends on some factors including: gear coefficient, the exerted force on the system, difference coefficient..., reffered it in (5). The percent of increase in fuel resulted in exerting an opposed force in the order of move equals:

The % of increase in fuel consumption

$$= \frac{\text{rotor power} \times \text{gear coefficient}}{\text{difference coefficient} \times \text{power coefficient} \times \text{the created turning by rotor}} \quad (5)$$

The research evaluated the effective factors on Drag force in New York, Genoa, Department of Mechanics [18_20] . including: the material employed in the vehicle body, the lines on vehicles body, and vehicle appearance. One of the factors considered in designing the vehicle is to operate in some parts of vehicle, the nodes, and / or the other word to happen turbulences [21-24]. The purpose of aerodynamic currents is air movement on the body surface. Generally, the air passed on the surface of vehicle body divide into 2 parts: Laminar current, the current which move with a specified order on the vehicle body. These currents have no turbulences and irregularities in the vehicle movement, and occur, mainly, in the front, lower side and two sides of vehicles. The lines on the body help to direct these currents [25]. Turbulence current: these currents have some irregularities. These cause a huge turbulence and appear, mainly, in the back part of vehicle. The amount of these currents in Sedan vehicles has far more drag force than other vehicles. The

engineers and designers to remove these currents through improving the aerodynamic characteristics. The less turbulence current occurs in the vehicle, the less drag force would be experienced in the vehicles [27-31].

To design channel and rotor

$$Q=VXA \quad (6)$$

If the changes in the cross-section of channel be stable because the primary and secondary. Cross-section is equal, the average speed of inlet air would be equal with air collision speed to rotor. With increase of cross-section, the area of outlet air become more than inlet air. The air collision average speed with rotor is less than inlet air. As a result, less turn would create. With gradual decrease of channel cross-section the speed of air collision is more than the inlet air. As a result, with increase of air collision speed with rotor, the rotor turning increase is more than two other modes. On the other hand, with decrease of channel cross-section, the rotor length placed on the channel bottom decrease based on two previous moode which cause decrease in rotor weight. As a result, the applied channel in the project decrease the cross-section gradually. In solid works, a rectangular channel with gradual decrease of cross-section with inlet dimensions of $150 \times 50 \text{ cm}^2$ and outlet aspects of $100 \times 40 \text{ cm}^2$ and a rotor with the length of 100 cm and radius of 20 cm was designed and, at least, the designed rotor and channel are assembled together. The assembled channel is saved in solid work environment and mustered in Gambit and networked in Gambit environment. The networked channel is saved in Gambit environment and mustered in fluent environment. With considering the turbulent, compressible and air inlet speed of $30 \frac{\text{m}}{\text{s}}$, the air pressure into kpas channel is 100 and 25°C temperature the problem was solved and pressure / fluid pressure the rotor is changes obtained.

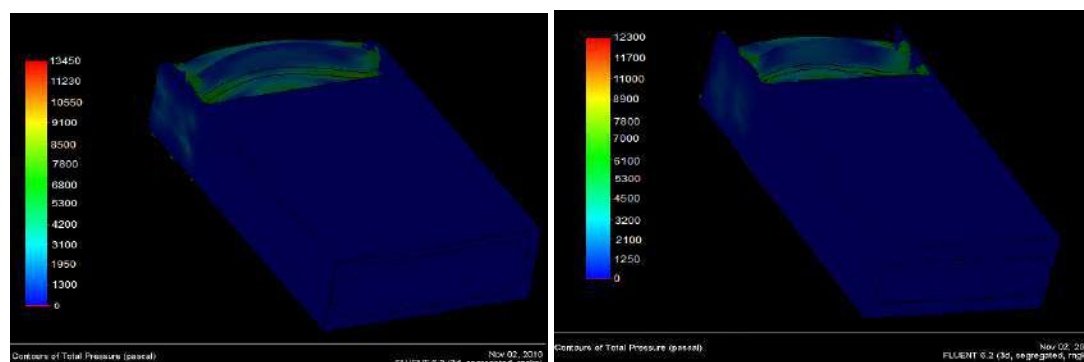


Fig 2: The analysis of systems force changes in fluent environment

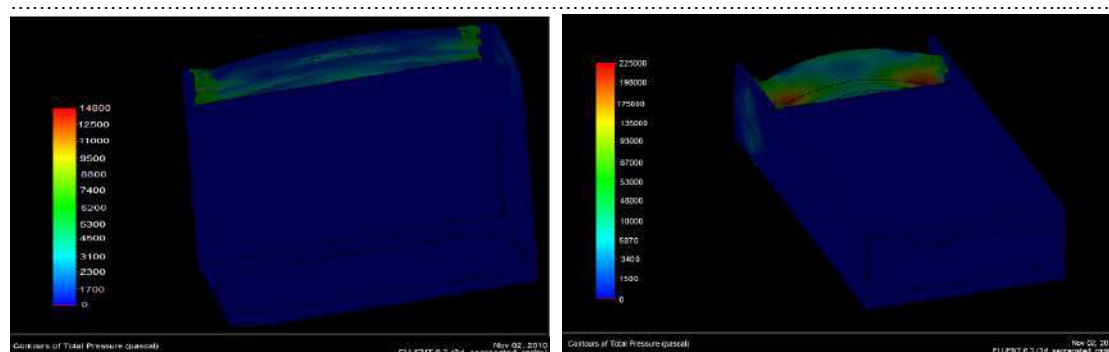


Fig 3: The analysis of systems force changes in fluent environment

To compare the pressure changes in rotor surface one should calculate the pressure in several point of surface. From the left part, in the equal distance, 12/5 cm, the points 1-9 would be clarified.

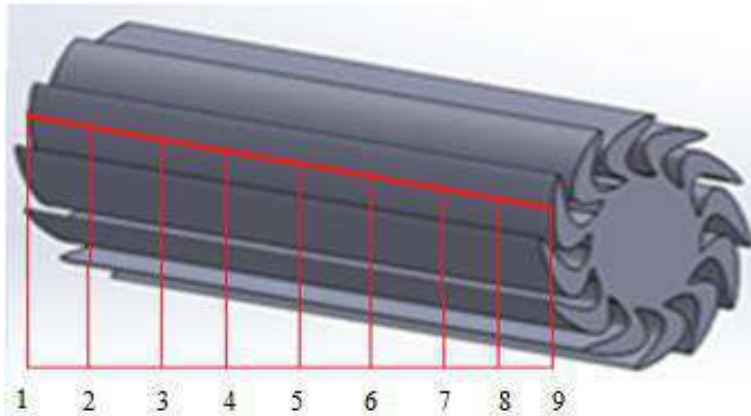


Fig: 4. To divide the rotor into 8 parts to analysis the pressure changes

At first, the bladder-formed rotor, the changes of pressure in bladdered rotor surface is shown in the purposed points in [Table-1](#).

Table: 1. To examine the pressure changes in points 1-9 in bladdered shape rotor surface

point of surface	1	2	3	4	5	6	7	8	9
Pressure Bladdered rotor	83.11	78.2	68.01	61.2	55.73	61.2	68.01	78.2	83.11

The changes of pressure in Elliptic rotor surface are shown in the purposed points in [table-2](#).

Table: 2. To examine the pressure changes in Elliptic rotor surface

point of surface	1	2	3	4	5	6	7	8	9
Pressure Elliptic rotor	87.02	79.23	70.68	65.09	89.72	65.09	70.68	79.23	87.02

The force changes in triangular rotor surface in the purposed points are depicted in [table-3](#).

Table: 3. To examine the pressure changes in the points (1-9) in triangular rotor surface

point of surface	1	2	3	4	5	6	7	8	9
Pressure triangular rotor	93.05	84.01	76.54	71.08	63.08	71.08	76.56	84.01	93.05

Table: 4. The changes pressure in airfoil rotor surface is depicted in table

point of surface	1	2	3	4	5	6	7	8	9
Pressure airfoil rotor	85.78	78.36	69.4	62.98	57.24	62.98	69.4	78.36	85.78

The pressure change in rectangular rotor surface in the purposed points of table -5 is shown.

Table: 5. the pressure change in the points 1-9 in the rectangular from rotor surface.

point of surface	1	2	3	4	5	6	7	8	9
Pressure rectangular rotor	91.18	85.42	73.38	67.06	64.28	67.07	73.38	85.42	91.18

Based on the tables of pressure changes in the surface of bladded, rectangular, triangular, elliptical and airfoil in the points (1-9) are drawn in diagram (1) with Excel software.

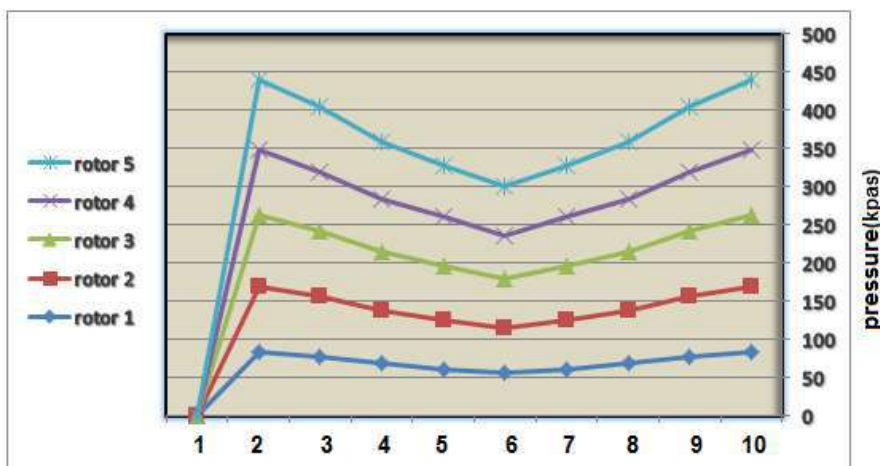


Fig: 5. Chart of force change in 5 rotors

According to diagram (1) , the least force relates to bladded rotor, so bladder-formed rotor are the basis of the work. Inlet air speed is $30 \frac{m}{s}$, rotor length is 100 cm, and rotor radius is 20 cm and channel rectangular cross-section has $20 \times 100 \text{ cm}^2$ dimensions. The force which exists on this rotor surface, according to table (1-5) is 55.73kpas. The temperature is 25°C and air pressure is 100kpas. Thus the sound speed in the environment is: thus the air Mach number equals:

$$V_c = \sqrt{\gamma RT} = \sqrt{1.4 \times .287 \times 298.15} = 10.18 \quad (7)$$

$$M = \frac{V}{V_c} = \frac{30}{10.18} = 2.94 \quad (8)$$

Since Mach number is more than so, inlet air current into channel are compressible, and the density of inlet air equals:

$$\rho = \frac{P}{RT} = \frac{100}{0.287 \times 298.15} = 1.169 \frac{\text{Kgr}}{\text{m}^3} \quad (9)$$

From fluid mechanics, we remember the pressure loss of compressible current equals:

$$p_1 - p_2 = G (V_2 - V_1) - \frac{R}{A} \quad (10)$$

$$G = \rho_1 V_1 = \rho_2 V_2 = 1.169 \times 30 = 35.07 \quad (11)$$

Thus, the air speed in the channel, when collisioning with rotor equals:

$$\begin{aligned} 100 - 55.73 &= 35.07(V_2 - 30) - \frac{0.287}{0.2} \\ V_2 &= 31.28 \\ \rho_1 V_1 &= \rho_2 V_2 \\ 1.169 \times 30 &= \rho_2 \times 31.28 \\ \rho_2 &= 1.138 \frac{\text{kg}}{\text{m}^3} \end{aligned} \quad (12)$$

Air collision speed to rotor of V_n gives:

$$V_n = \frac{n_{st} \sqrt{p}}{\sqrt{p} (gh)^{\frac{1}{4}}} = \frac{31.28 \sqrt{73.18}}{\sqrt{1.138} (9.81 \times 0.1)^{\frac{1}{4}}} = 39.66 \frac{\text{m}}{\text{s}} \quad (13)$$

To clarify the outlet air current condition, Mach number of outlet air is calculated from channel. If Mach of outlet currents be $0.4 < M < 1$, air current is subsonic. If $M > 3$, outlet air current is ultra sound.

$$M = \frac{V}{\sqrt{\gamma RT}} = \frac{V}{\sqrt{\rho g RT}} = \frac{V}{\sqrt{p g}} = \frac{39.66}{\sqrt{73.18 \times 9.81}} = 4.581 \quad (14)$$

Thus, outlet air current of channel is ultra-sound.

C_d coefficient is equal 0/38, $C_L = 0.42$, $C_P = 2$. Thus the power rotor is equal:

$$\begin{aligned} P &= 0.3925 C_P \cdot \rho \cdot d^2 \cdot v^2 \cdot \sqrt{C_d^2 + C_L^2} \quad (15) \\ P &= 0.3925 \times 2 \times 1.138 \times (0.4)^2 \times (39.66)^2 \times \sqrt{(0/38)^2 + (0/42)^2} = 125.87W \end{aligned}$$

The created torque by rotor, according to dynamic relations equals:

$$\text{The created torque} = \frac{P \cdot r}{v} \quad (16)$$

Thus the created turn by rotor equal:

$$T = \frac{125.87 \times 0.2}{39.66} = 0.635 \text{ n.m} \quad (17)$$

With adding the rotor, an opposite power added in the direction of system should be calculated. What amounts of vehicle power would spend to overcome this force. In calculating the increase in fuel consumption by opposite force, this equation is answered:

The %of increase in fuel consumption=

$$\frac{\text{rotor power} \times \text{gear coefficient}}{\text{difference coefficient} \times \text{power coefficient} \times \text{the created turning by rotor}}$$

To calculate the gear coefficient and difference coefficient table (6) is used:

Table: 6. Difference and Gear Coefficient

Gear Coefficient 1	3/455
Gear Coefficient 2	1/850
Gear Coefficient 3	1/200
Gear Coefficient 4	0/9687
Gear Coefficient 5	0/756
Vehicle Difference Coefficient	4/529

Because the speed is more than $30 \frac{M}{S}$, then the gear coefficient and difference coefficient equal: 4/529. Thus the vehicle fuel consumption is equal:

$$\text{The \% of increase in fuel consumption} = \frac{125.87 \times 0.756}{4.529 \times 38 \times 2} = 0/27 (19)$$

Adding the rotor to vehicle about % 27 of fuel consumption would increase, means if in the vehicle in 100km 8l fuel is assumed, with adding rotor in 100km 10/16 l fuel would be assumed.

DISCUSSION

The research aim was to bring change in designing rotor, in the system (to create a rectangular channel under the vehicle and placing the rotor under the vehicle and placing the rotor at the bottom of channel) to modify other related works with designing this system in solid work environment, networking the system in the Gambit environment in a mode with the least pressure on the rotor in the inlet speed 30 M/S for the inlet air entered the channel and with obtaining the pressure and doing the calculation by the aim of the governed relation on system this project encountered with fault, because :

1. Adding rotor under the vehicle increase the fuel assumption about %27, while the aim saving in the gasoline consumption as a resource is irreversible.
2. According to the increase in the system designing cost against the common vehicles, about 38 N/m torque was applied in flywheel rotation, in which this few rotation can't meet the required propulsion for movement of vehicle.
3. Another important aim is to reduce the pollution, produced due the increase in fuel consumption the rotor produce more greenhouse gases.
4. High cost of designing and producing such system under the vehicle, according to increase in fuel consumption there is no economic justification.
5. Opposite power toward movements is far more than drag power existed in the front part of vehicle. As a result, the vehicle need more acceleration for move.

ACKNOWLEDGEMENT

We thank for Islamic Azad University (Sanandaj branch) for support this thesis.

CONFLICT OF INTEREST

There is no any form of conflict of interested.

FINANCIAL DISCLOSURE

No financial support was received for this work.

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TEMPERATURE DISTRIBUTION IN AN INDUSTRIAL HALL

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ABSTRACT

Industrial hall in a large thermal power plant is of great importance for its operational efficacy, inspection, and maintenance. The temperature in the operational or production room is generally very high due to the large amount of steam in a thermal plant. Therefore, people working in those conditions face several difficulties. An efficient ventilation system to control ambient temperature as well as fresh air is therefore essential in such environment. Here, we distributed air flow in the room in order to improve temperature conditions. We calculated the temperature distribution of the turbine hall using fluid dynamics and heat transfer calculations were performed using Fluent software. The modeling was performed at room temperature in real dimensions. Because of symmetrical and identical conditions, a fourth hall dimensions (32 x 42 x 49 mm) is considered and k- ϵ turbulence model and thermal diffusion model at 34° C ambient air temperature was analyzed. Inspection of temperature distribution shows CFD methods is a good tool to analyze the situation and different scenarios for improving the situation. By examining the various models we also suggested a model to improve the situation.

Received on: 10th-March-2016

Revised on: 29th-May-2016

Accepted on: 02nd - June-2016

Published on: 5th-June-2016

KEY WORDS

Temperature distribution,
FLUENT, CFD.

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INTRODUCTION

Heat stress can lead to a series of problems such as blistering of the skin, dizziness, and anesthesia among others. Early symptoms of heat stress such are generally fatigue and drowsiness. The lack of stability and balance in decision-making can lead to serious accidents and without immediate treatment, the symptoms such as convulsions and anesthesia can expand critical condition. In Iran, the issue is severe as reported in recent studies [1-2]. Ventilation and thermal comfort providine favorable conditions to enterprises to maintain the rights of workers, reduce unintentional errors, increase focus, increase working hours, and avoid errors and high cost that cones from environmental hazards.

The aim of this study was to investigate the temperature in the salon industry using numerical modeling and software with ANSYS Fluent and Gambit [1]. Navier-Stokes equations and the energy equation in the hall, within a networked environment, and indoor temperature field around heating tools are determined. We considered horses as a heat source, and natural convection air was investigated Applying Matthews and Arndt's method (2003) to examine the ventilation in a stable horse [2].

We evaluated different models also. Natural ventilation model by Dutt et al in 2003 [3] on wind tunnel and Horak's model 2010 [4] on distribution of air flow and the temperature in buildings using computational fluid dynamics were considered. We used computational fluid analysis to evaluate the physical configuration of the intake and exhaust vents and temperature and flow patterns inside a hall.

MATERIALS AND METHODS

In order to investigate the process of heat transfer in the hall we used computational fluid dynamics. We solve the conservation equations using ANSYS FLUENT-15 modules. For Grid, we used Gambit Version 2.4.6 .

We used Governing equations of conservation of mass, momentum, and energy. Usually turbulent air flow created by the temperature gradient is in the hall. Therefore, from the Governing equations it can be averaged. In this approach, the entire range of computing and computational cells conservation equations of mass, momentum and energy are solved. We also included the Reynolds stresses are modeled in our study. Next we averaged the various methods to determine the final air flow and heat transfer models ($k-\epsilon$ and $k-\omega$) that are having superior air flow and heat transfer with sufficient accuracy.

RESULTS AND DISCUSSION

Models

A comparison between different software and models, a simple mode was introduced in the hall geometry and numerical solution for constant temperature mode. The comparison between the results of numerical and measurement is performed to solve the model of turbulence and the heat flux output is obtained from various German levels. Comparison of results are shown in [Table-1](#).

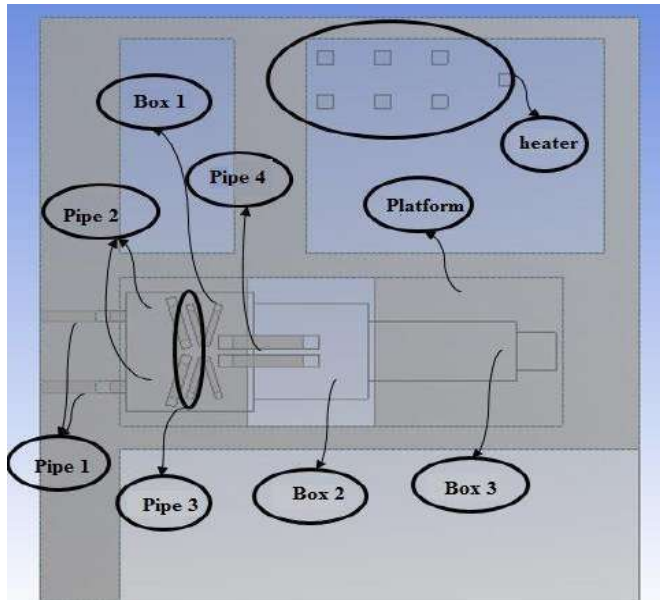


Fig: 1. View from the top model Gambit

Table: 1. Constant flux boundary condition element in the turbine hall

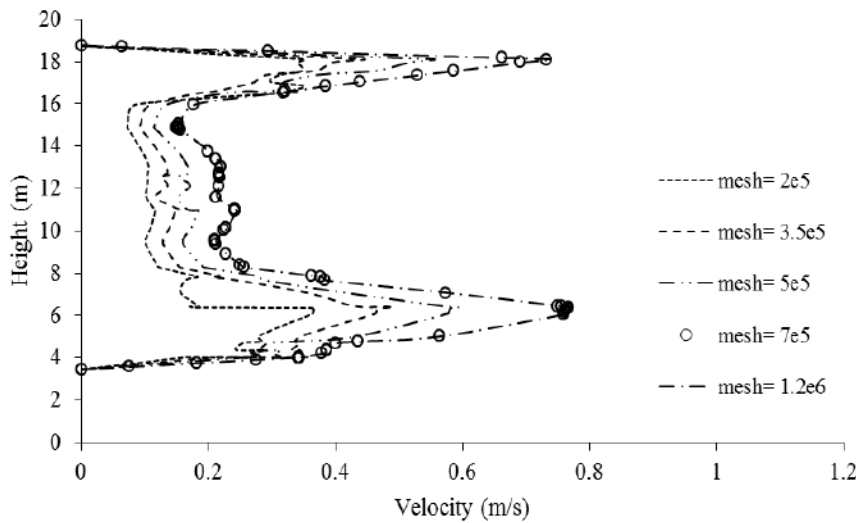
Difference (%)	Heat flux (w / m 2), Numerical heat flux	Heat flux (w / m 2), Numerical heat flux	Surface (m2)	Temperature (°C)	Element
9	188	205	520	62	Heather
4	701	730	70	80	Pipe 1
6	371	395	55	68	Pipe 2
2	497	511	54	75	Pipe 3
8	355	385	102	70	Pipe 4
3	401	415	131	70	Box 1
4	137	143	140	55	Box 2
3	22	27	120	47	Box 3

As seen in the table above, The differences between the results of manual calculations and analytical solution is 9% therefore, ither method is acceptable.

Sensitivity

To evaluate the sensitivity of grid size, we used $k-\epsilon$ turbulence model. In order to solve a number of different mesh was done. Numerical Solution of five modes: 200000, 350000, 500000, 700000 and 1200000 mesh was conducted and the results are compared. Boundary conditions and geometry of the solution was the same as the previous that was solved using a constant temperature levels. Hall geometry software and networked was drawn by Gambit and

the mesh of the type of organization was chosen. After defining the boundary conditions, the program initializes and implemented The convergence condition every time the program based on the criteria determined .The remaining error in the momentum balance and other quantities was less than $Az4-10$ and energy balance was less than 6-10. The results of Fluent suggests that even after 10,000 repetitions, the energy balance remains about 4-10 and are not changed. In a resolution CFD, when convergence is achieved, the remaining amount of velocity or temperature was less than the standard value and therefore, a convergence has been achieved. The results of the sensitivity of the network is shown in Figure-2. It is found that, when the mesh number is increased to more than 700,000 there is a significant change in the speed graph. It can be used to check the number of mesh. The temperature distribution in proposed model is given in Figure-3.



Fig; 2. Sensitivity analysis

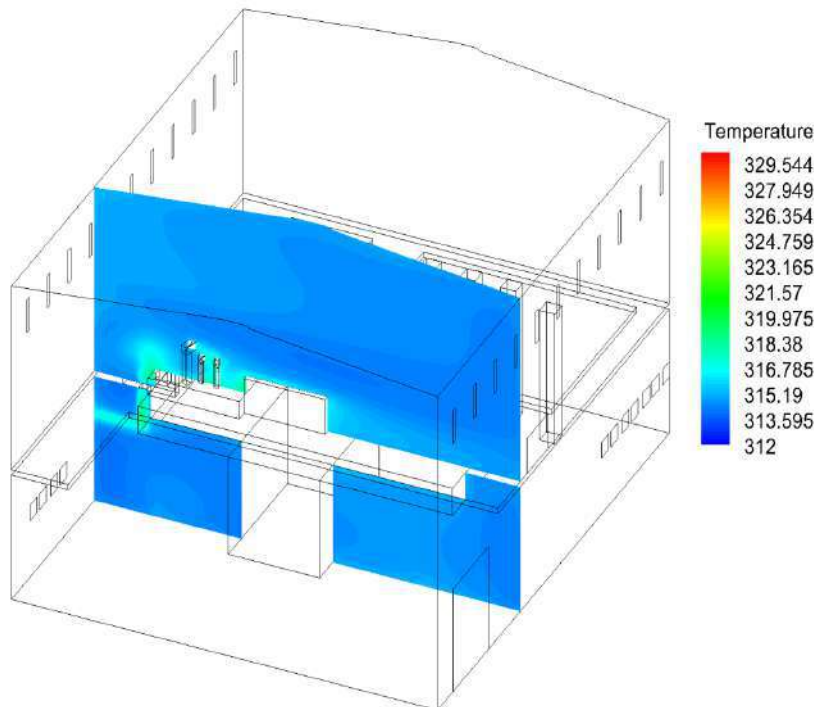


Fig:3. Temperature distribution, the proposed mode

CONCLUSION

Here we carried out a simplified numerical simulation of the hall. At temperature of 34°C we found the removal of heat from the outside air temperature. k-ε turbulence model found best in our study.

ACKNOWLEDGEMENT

We thank for Islamic Azad University (Sanandaj branch) for support this thesis.

CONFLICT OF INTEREST

There is no any form of conflict of interested.

FINANCIAL DISCLOSURE

No financial support was received for this work.

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THE INQUIRY IN TAXATION CULTURE AND ANALYSIS OF THE REASONS FOR INSOLVENCY IN TAXPAYERS

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ABSTRACT

The present research is intended to analyze effect of culture of a certain country on solvency or insolvency of the given taxpayers to pay tax. It is mainly tried in this study to express the theoretical concepts in this regard and the empirical evidences will be proposed to prove the mentioned theories. The period of research conduction is five-year interval in economic environment. The multivariate regression has been utilized to analyze research data at combinatorial (integrated) mode in E-View econometric software. The tax insolvency has been employed as dependent variable in this study. Items of uncertainty avoidance, collectivism vs. individualism, masculinity vs. femininity, and power distance have been considered as independent variable in Hofstede four cultural dimensions. The research findings indicate that tax insolvency is significantly related versus high uncertainty avoidance, low individuality, low masculinity, and high power distance.

Received on: 25th-March-2016

Revised on: 29th-May-2016

Accepted on: 04th - June-2016

Published on: 08th-June-2016

KEY WORDS

Culture, Tax insolvency, Uncertainty avoidance, collectivism versus individualism, Masculinity versus femininity, and power distance

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INTRODUCTION

Tax culture is deemed as one of the relatively new methods for collection of taxes if improved it may cause upgrading efficiency in taxation system and finally tax justice therefore to realize this important factor it should be emphasized in rising commitment to ethical issues among taxpayers and improving their taxation culture and this is the same as concept of theory of postmodern moral behavior. The postmodern thinkers argue that the real and pure ethics is not reflected from the enacted rules and regulations, but this type of ethics is procedural and mandatory morality that lack too value. The ethics is of real type when the given person assumes it as his/her duty to express fact and reality as a result expression of fact is not derived from the stipulated regulations in financial reporting that is followed by tax declaration but it is reflected from believe in moral subjects in one's mind and this the real meaning of morality from postmodern perspective [1]. As financial reporters and mediators among enterprise and capital market, the accountants are responsible for crucial duty against the society. The immoral activities of accountants may also disrupt in efficient performance of taxation system in addition to tarnishing of public trust in accounting and reporting profession [1]. emerging of financial crises throughout the world and the damages exerted by them to economy and industry in countries over the world increased paying attention to ethical dimensions of accounting since those accountants were recognized as main guilty for occurrence of financial crises throughout the world that they have not properly fulfilled their reporting task (with some motives such as tax escape). Improper reporting of financial statements and situations was not caused by absence of practical potential of account ants but it was mentioned due to the gap caused by absence of professional ethics among actors in this profession. Despite of all ethical rules and principles that were formulated formally, the immoral behavior of accountant has challenged the validity of this profession and the related social role. Based on attitude of Buchan [3] in this regard, the individual and contextual effective factors on individual professional ethics should be examined among taxpayers as usual. Therefore, the main subject of this study is to explore individual ethics of great taxpayers based on ethical attitude of Foucault about the relationship among a person to his/ her own [5] is led to fact and reality.

Certainly, taxpayers are one of the influential factors on national taxation system in process of tax collection. Hence, attraction of their cooperation and satisfaction with voluntary solvency is assumed as original strategies for Iran National Taxation Administration. But in Iranian community is negative mentality of people about taxation subject is one of basic problems for tax collection. Taxpayers look at taxation officers as those persons who have been missioned by the government to take their capital. Surely, this negative attitude has historic background. Although, this negative attitude may not be verbally pronounced, the background of memory of this community has continued this negative attitude so that tax is supposed as a type of coercion and oppression. Tax is one of the important sources of revenues for governments in developed nations. Also in Iran as long as government does not achieve such a source it may not take step toward path of social development, public welfare, and improvement of economic parameters. Changing negative attitude of Iranian community and revival of tax collection culture requires creation of bilateral belief among government and people. This paradigm is not adequate only by giving needed information to people to spend costs of collected taxes to give services for public welfare since this awareness is not a complex task. This issue may be communicated in various media. Even one can exactly present the further quantization of social services through spending cost for collection of realized tax.

The current study examines role of national culture in description of taxation behaviors in taxpayers. Culture is a multidimensional concept and this study is also one of primary studies that reviews Hofstede cultural framework as an explanatory factor in taxation behavior of taxpayers. Accordingly, Hofstede four cultural dimensions have been employed for analysis on tax insolvency.

THEORETICAL BASES AND RESEARCH HISTORY

Taxation culture and escape from tax payment

Term 'culture' was used by British Edward Barnet Taylor (1871) in a book titled primary culture for the first time. About definition of tax culture, he implies, 'the culture is a complex group that covers information, beliefs, arts, ethics, rules, habits, and any other capabilities human acquires as a member of community' [6]. The main elements of tax culture include the items mentioned in the following tables according to attitude of Ghanadan:

Table: 1. The main elements of tax culture [6]

Culture					
Material culture	Non- material culture				
Technology	Beliefs and ideas	Attitude	Norms	Values	Symbols (languages)

As it seen, paradigms and beliefs and behaviors are assumed as the main elements in tax culture among communities so it has been also tried to explore specifically on ideas (beliefs) and moral behavior of taxpayers in practice. Thus, only the relevant cases to that subject are discussed about tax cultural factors and it is avoided from expressing other aspects.

Ideas and beliefs

They are the discovered (not enacted) informative subjects in relation to variables outside world that is called system of ideas. The public idea is the judgment accepted by total people and idea means what humans believe in the given idea and certainty.

Attitudes

Attitudes are general tendencies created in person and activate his/ her perceptions and emotions in sensible world. A group of stabilized subjective elements are called attitude in psychology. In fact, these stabilized elements originate from culture of community where personality of that person has formed.

Taxation culture has been specially addressed during several recent decades. One can assume the existing deficiency in national taxation system as the reason for rising attention to tax culture during recent years. These defects may be classified into three groups of cultural problems, taxation rules, and executive problems. The specific tax culture of a country may be deemed as related to all of the relevant formal and informal institutes to tax and the given performance including the created dependencies and relations by constant interactions which are composed of some factors such as taxation officials, taxpayers, policymakers, tax experts and academic personnel visible in the following figure.

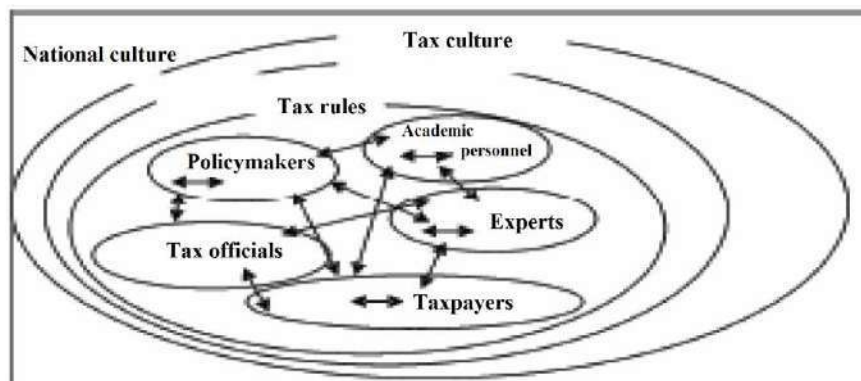


Fig: 2. The constituent factors of tax culture [7]

Michael Komedsus (1997) believes that tax culture may be improved by increase in tendency to pay tax, transparency of tax rules, and training of these regulations and among them the morality and review of ethical growth in taxpayers is key factor. Roman Berger concluded in a study that the governments might collect taxes in favorable size only when the citizens were inclined for tax payment. Although, rising tendency to tax payment requires a long-run plan to improve ethical growth in taxpayers and improvement of tax culture [8]. Tax culture in any country is highly influenced by public culture and historic, geographic, and social characteristics and ethical factors of their members. Unlike developing countries, tax payment is more prevalent in developed nations. In other words, there are more motives for tax escape than tax payment in developing countries. Such differences depend on social norms and non- commitment to moral issues in tax payment. If tax escape prevails over a country then it can be concluded that social norm for tax payment has been removed.

Berger [8] mentions three important and influential factors in tax culture that cover both dimensions of tax culture including taxpayers and policymakers and tax legislators:

Situation of national tax rules and system

As taxation system becomes more advanced, systematic, and effective, it may be more efficient in improvement of tax culture. Higher tax culture governs over developed nations since in developed countries their taxation system encounters lesser problems than in developing countries. Therefore, there are fewer barriers against progress of tax culture. Some measures should be taken for transparency of rules and making them more simplified and perceivable and spreading tax bases and fighting against corruption to improve tax culture in developing nations [8].

Role of Iran National Taxation Administration (INTA)

The efficiency of INTA organization depends on level of political and financial decentralization as well as rate of bureaucratic corruption in any country and tax collection under lack of political concentration is much difficult under situation with lack of financial centralization. Since the regional governments may possess stronger motive in sponsorship and collection of tax in this case and financial non- concentration reduces the motive in regional governments to contribute to economic enterprises in prevention and avoidance from tax payments [9].

Rate of public cooperation with INTA organization and voluntary tax payment

It is believed in this attitude that tax- escape is an anti-moral behavior and ethical growth should be analyzed and strengthened in taxpayers to avoid from this factor. The level of tax- escape and avoidance from tax payment varies in different countries. Of course, participation and tendency to tax payment depends on trust between taxpayers and INTA Organization rather than rising moral growth in these individuals as well. As a result, as long as ethical growth has not improved and the people does not trust in INTA organization, no one can expected that they prepare proper tax declaration and on time payment of tax and this case is realized by promotion of tax culture [8].

CULTURE

Culture includes a group of values, beliefs, perception, inference, and or thinking methods in which members of community (organization) have some commonalities and it is trained as a proper phenomenon to newcomer members. Culture represents unwritten and tangible part of community (organization). The goal of culture is to give

sense of identity to members of community (organization) and to create commitment to unbelievable ideas and values among them. Traditional values cause improvement and stability in society (organization) more than ever and they lead the newcomers to find and perceive the philosophy of existence for activities and events.

Culture interpretation

Interpretation and recognition of culture content requires the people to perceive something with respect to visible characteristics (coming to results). These features may be explored but it is not too easy task to perceive them accurately. A festival that is held in an organization to give awards to members includes different concept compared to a feast ceremony that is held in another enterprise.

In order to perceive accurately of what it occurs in an organization, these activities should be able to be analyzed deeply and with great care and in some cases it should be experienced similar to one member of that organization so that the organizational culture may be perceived. Some of important and visible aspects of organizational culture are as follows: ceremonies, feasts, and specific signs and language that are used in an organization.

In the following, subject of culture is analyzed with respect to various types of it:

Adaptability culture

One of the features of adaptable culture is that the outside environment is addressed from adaptability aspect and strategically and it is tried to meet requirements for customers. In this culture, those norms and beliefs are verified or strengthened thereby one can identify and interpret the existing signs and accordingly to react appropriately or take suitable behavior. This enterprise should react quickly versus new and main plans and it should be able to renovate their structure and take new behaviors to do new task. The marketing organizations, electronic companies, and manufacturing companies for cosmetics possess such a culture since they intend to attract their customers' satisfaction more quickly.

Mission culture

The organization over which such a culture governs may try to provide requirements for outside environment but it does not deem it as necessary to be subject to changes quickly. The common attitudes (in terms of organizational goal) are highly noticed in mission culture. This attitude determines type of activity of organizational members and these activities cover a concept that exceeds from their stipulated tasks of this mission. The members are placed entirely (and sometimes excessively) through the stream of activities and path from which a company should pass and type of role and goal of organization. Organizational leaders have common attitude and draw the image for future and present it to all of people and this image may act in such a way that is considered specifically for either of organizational members.

Participatory culture

The subject of participation and involvement of organizational members (in activities) and addressing of quick changes occur in outside environment are taken into consideration in participatory culture. If culture becomes excessively participatory, the given organization is controlled ethnically that is discussed in Chapter Nine. The customers' requirements are noticed in this culture more than anything else and organization adjusts their performance based on it. Participation causes a type of sense of responsibility and ownership to be created in members and as a result they will be more committed to the organization. Those companies which are active in clothing retailer industries may use this culture because such a culture the personnel and members of organization to innovate and to be able to react quickly versus changes occurred in taste of customers.

Continuity- based culture

The organization in which this culture governs it emphasizes in activities inside the organization and it tries to suppose their own in a fixed environment and to take continuous procedure in terms of type of behavior. Such an organization includes a culture in which method or technique of doing tasks are noticed and emphasized. Signs, emblems, heroes, and feasts cause more cooperation, verification of tradition, and execution of policies and techniques that are implemented for providing goals. In such an organization, members do not actively participate but continuity of procedure in behavior, adaptation of persons to the prevalent traditions; cooperation and synergy are deemed crucially important. The organizational achievement is subject to integration, solidarity and possessing high efficiency.

THEORY AND INVESTIGATION OF HOFSTEDE REGARDING CULTURE

'Culture as a subjective planning'

Any person considers a series of intellectual, emotional, and practical patterns that have been learned during lifetime. Most of these issues have been learned at childhood since the persons can perceive further during that period. As these intellectual, emotional, and practical patterns were internalized in human's brain, that person should forget them and learn other new subject and forgetting may be sometimes much difficult than relearning so culture is deemed as ordinary title for such way of thinking.

A certain culture may not assume another culture as inferior than what it is. Any culture only judges about their own since members of that culture are more actors than observers. The cultural correlation may not accept such customs and tradition neither for their own society nor for other communities; therefore, does it necessitate for us when we are exposed to non-local groups or communities to dispense with such judgments. Any person should thinking well about norms of an individual, group, and society before employing them in another community. The related information about nature of cultural difference between communities, routes, and their consequences should be judged and practiced.

Symbols, heroes, religious beliefs and values

Cultural differences are shown in various forms. Of several terms that were used to explain cultural effects, these four items play greater role including symbols, heroes, religious beliefs, and values.

Symbols, words, implications, images, and objects comprise of concepts which are perceivable for the persons with the common culture. Words in a language or jargon of a group such as clothes, flag, hairdo, Coca cola etc. make sense for their own group. When new symbols emerge the classic symbols are removed and symbols are copied from a cultural group by others.

Layers of culture

Almost all individuals are simultaneously dependent on various groups and regardless of existing intellectual layers the people pay attention different culture. For instance, National level is based on country of birthplace (or countries where people have emigrated in their lifetime); Local, religious, and lingual level on which they depend so that most of countries are composed of different cultures, religions, ethnicities, and groups; Gender level based on which someone was born as female and or male; Generation level depends on educational, occupational, and professional. The organization level exists in persons who are employed proportional to way of their socialization in their organizational business.

Dimensions designated by Hofstede to study on culture

Power distance

Three concepts created the distinct composition of power distance are as follows: questions about (1) fear of persons; (2) authoritative (behavior of boss indicates perception and imagination of respondents about their daily workplace; (3) it is that in which the respondent emphasize as their preferences or they like their workplace to be similar to that form.

In fact, these three questions are a part of a similar cluster that indicates there is close relations between real imaginations of an individual and his/ her real desires and tendencies at any country. In those countries where personnel do not fear much and the bosses do not take authoritative or patriarchal style, the personnel show their tendency to consultant style in making decisions and the boss is one who consults with his/ her subordinates before making a decision.

In contrast, in those countries where personnel are frightened from their bosses and also the bosses take authoritative or patriarchal style, the employed personnel in similar jobs may show lesser tendency to consult with their boss. Instead, a great number of them may show their tendency to have a boss with authoritative or patriarchal style but some experts change their direction to other side. For example, a boss may prefer to manage by majority of vote namely s/he may not make decision personally in general. In practice, achieving the majority of vote is a difficult task in most of organizations and few numbers of personnel may observe their boss acts by this style (those bosses who claim for such practice they are accused to manipulation and fraud).

Briefly, the distinct advantages of power distance make us aware of dependency relations in a country. In countries with lower power distance, the subordinates are less dependent on the bosses and they tend to consultation. In other

words, the dependency among boss and employee is of internal type of dependency. The emotional distance is relatively low among them. The subordinates take completely clear and mutual with their bosses. In countries with power distance at high level, the subordinates are noticeably dependent on their boss. The subordinates respond to this dependency with inclination (as authoritative or patriarchal boss) and or totally reject it that is psychologically characterized as mutual dependency (interdependency). Namely, it is dependency with a negative symptom. Therefore, countries with high power distance indicate a bipolar model among dependency and interdependency. In such cases, the sympathy is deep among subordinates and their boss. The subordinates do not tend to proximity and they directly oppose to their bosses.

Thus, power distance may be defined as follows: The level of less powerful members of institutions and organizations of a country expects for and accepts that power has been unequally distributed. Institutions are assumed as the basic elements in a community such as family, school, and society. The organizations are some places where personnel work.

Inequality is revealed in social classes of any community i.e. well-to-do, middle class, and lower class. In any case, this classification may vary in different countries. These classes differ from each other in terms of chance to their access for use of social benefits out of which one is education. The higher education may automatically promote someone to middle class at least. The education, in turn, is considered as one of determinant criteria for type of occupation someone wishes for it so that practically education level and job are interrelated together in most of communities with various social classes. Such disparities in revenue may be further expanded by taxation system [11] and may potentially lead to creating higher tax insolvency. While the persons in environments with lesser power distance do not accept such inequalities and they believe that power and wealth may not necessarily put together. Moreover, the communities with lesser power distance do not tolerate political scandals that mainly show the end of political job. Unlike countries with higher power distance, distinction in income is at lower level in countries with lesser power distance that is reduced mainly by systems with rising taxation rate. Hofstede supports this idea that rising power distance in a country is relevant to higher corruption level. Accordingly, this assumption may emerge that the activities which are supposed as corruption such as tax insolvency or escape more frequently found in environments with higher power distance and vice versa such corruptions are fewer in environment with lower power distance.

Individualism/ collectivism

A great number of people in our world are living in communities in which collective interest are preferred to individual benefits. We call these communities as collectivist. This word may comprise of implicit political meaning for many readers but here the given political concept does not apply and it is not referred to power of government versus individual but it concerns with collective power.

The family is the first group in our life where we are born. In any case, structure of families is different from each other in different communities. In many collectivist communities, the family in which a child grows up includes members who live together. Not only parents and other children but also for example grandfathers, grandmothers, paternal and maternal uncles, paternal and maternal aunts, servants, and other members in the same house. This type of family is well-known as wide family in cultural anthropology (humanism). Few majorities of people of our world are living in societies in which individual benefits are preferred to benefits of group and we called these communities as individualist. Individualism denotes communities where the relationships are poor and weak among members so that it is expected from an individual to exclusively think for his/ her own and family. In contrast, collectivism signifies communities in which after birth the persons are dependent on strong and integrated groups and are supported by them versus maintaining their loyalty to those groups throughout their lifetime.

Individualism levels are totally different between various countries as it is different among individuals. Thus, it is important for us to compare countries according to their sampled scores.

Hofstede (1999) suggests the relation among collectivism and corruption (blackmail and extortion). Specifically, he indicates that the concerns of individualism for group- ring of a member of family, friends, and/or cohorts- may lead to breach of written laws; particularly, when they act against an ethical principle. In addition, implies that collectivist communities assume legal norms as a global concept and by distinct presentation where the regulations and laws should be different among groups while in individualist communities it is believed that the rules and regulations should be equal for all of people. The countries with higher individualism level tend to stronger economy and countries with more powerful economy usually include fast and firm (diligent) regulatory systems.

Taxation revenues of production are higher in these countries and therefore people lesser tend to fraud in tax (due to better regulatory systems) and this means tax payment. Thus, people in higher individualist culture should lesser undergo tax escape than people with lower individualist culture.

Masculinity versus femininity

Masculinity refers to the limits in which gender roles are different and to the extent traditional masculine values emphasize in performance and visible achievement in comparison to traditional feminine values in communications, care, and training. High score in masculinity dimensions is characterized in competition and achievement of financial success. In contrast, the given lower score refers to femininity and achieved by supervision and achieving higher quality of life. With respect to attitude of Hofstede (1991), the culture with high masculinity level in a community with performance is focused on pursuance to financial success in an unjust world. On the other hand, the culture with lower masculinity level is focused on training of value in care for others and in general world is observed as only place used for providing the minimum quality of life for all by tax to give financial aid to lower classes. Hofstede (1999) found that higher masculinity in a culture is accompanied to higher corruption level (blackmail and extortion) in that country. The countries with higher masculinity level, the financial success and tendency to acceptance of escape from tax payment is more frequent than in country or environment with lower masculinity in which it is more emphasized in quality of life, people, and environment. Alternately, the individual may easily move at opposite direction. For example, literature of financial reporting shows that the results of masculinity and disclosure are constantly mixed. In some studies, it was found according to majority of vote (five out of nine) that there was a positive relationship among masculinity and disclosure and they showed that the countries with higher masculinity level more likely dealt with disclosure of information to persons out of an enterprise. This is visible according to higher tendency of masculinity culture to performance, financial successes, and achievement. The boasting culture may be aware of responsibility for taxation compliance since higher vision (along with more financial success) may be led to more accurate investigation (e.g. rising probability in tax auditing) by taxation officials. This point is confirmed by Hofstede (2001: 319) that it refers to negative significant correlation among masculinity and parameter of national omission (negligence) and shows that countries with higher masculinity level are less authorized especially against lawbreakers. The countries with higher masculinity level are mainly focused on punishment while the countries with lower masculinity more tend to mild reaction sand correction and recovery.

Uncertainty avoidance

Hofstede (1991: 113) implies uncertainty avoidance as the level at which sense of uncertainty and or unknown situations is threatened for members of a culture. The culture with higher uncertainty avoidance tends to prevention from uncertain and ambiguous conditions that may lead to higher anxiety levels. Nevertheless, uncertainty avoidance is not the same as prevention from risk. While this culture is employed for coping with risky behavior to reduce ambiguity such as starting a struggle as a preventive effort or increase speed in highways to save time- if risky measure reduces anxiety with respect to a specific condition, the high uncertainty avoidance culture is often interacted with risky behaviors to reduce ambiguities. In contrast, the low uncertainty avoidance culture is better capable to responsibility for addressing uncertain and ambiguous conditions and as a result lower anxiety level. Hofstede (2001) shows that public trust in their national public institutes is negatively correlated to uncertainty avoidance so that the countries with lower uncertainty avoidance level may trust more in their national public institutes while the persons in countries with higher uncertainty avoidance level tend to sense of alienation toward public systems that have influenced their life. Furthermore, the people in countries with high uncertainty avoidance level often feel that legal system is against them so they do not oppose to break unfair law. Regarding this attitude, the findings from other researches show that the countries with higher uncertainty avoidance level include lower economic freedom or higher tax. Thus, persons in a community with higher uncertainty avoidance may assume escape from tax payment as a tool to reduce ambiguity and uncertainty. For example, mistrust in their own institutes may encourage for non-observance of tax that acts as a tool for minimization of probable abuse of treasure finds by government and the related statesmen. While tax insolvency may lead to increase in anxiety due to fear from involvement, this rising anxiety is reduced by this idea that many countries do the same and compensate for potential belief in abuse of financial sources by the government. In contrast, the individuals in a community with low uncertainty avoidance level where the institutions are more reliable, it is less likely that they notice to observe non-compliance of tax as a durable choice.

RESEARCH LITERATURE AND HISTORY

The tax culture denotes taxpayers' commitment to their tax-related task that is an objective to which all of world taxation systems long for realization. Fulfillment of this ideal is subject to spreading tax culture and culture for voluntary tax payment. The motive for tax escape among persons stems from social, political, economic, and even religious conditions in the country. Therefore, given many people know it more or less that the tax is supposed as one of the important source in governmental revenue portion to execute national projects and plans, they possibly avoid from tax payment due to various reasons. The presence of many religious beliefs from the past time and before Islamic Revolution has also led to increase motive for tax escapes. It was believed before Islamic Revolution that whereas oppression and tyranny governed over the country, tax payment might be assumed as contribution to strengthen it. Hence, the motive for tax escape formed completely as religious target and it was turned into a part of public culture and habits. Such an approach also inadvertently impacts on social strata.

In fact, the rate of cooperation between individuals and taxation system and their tendency to tax payment depends on degree of social growth and public belief in mission of taxation system. Therefore, taxation system should think about the measures to increase public belief in taxation system and provide their trust. If tax payment is assumed as a national and Islamic value and it is internalized as belief and accepted by taxpayers, it makes it possible for public participation in appraisal and collection of tax.

In a survey titled 'The ethical cases to which taxpayers are exposed', Marshal et al (2009) studied and examined standard of occupational behavior of taxation officers and taxpayers. Their investigation comprised of some results as follows:

Conservation of public interests, merit, professional competency, integrity, and reliability are deemed as foremost ethical cases in the studied group. Incapacity and omission are assumed as major and permanent moral problems. The inadequate regulations (defective and not interpretable) cause tax escape. In another research that was conducted by Putnam (2000), someone preferred to notice personal interests as priority in individualistic cultures. Usually in such cultures, the workers try separately from their employers and to improve their own personal benefits. Likewise, the employers made their decisions based on the preplanned assumptions and employer paid least attention to moral and emotional obligations versus their agents and in contrast workers showed the least ethical commitments to their employers and they tried not to propose their work favorably if found opportunity for work.

Jenson and Drake (2004) explored culture dimensions based on attitude of Hofstede. They expressed that individualism and collectivism are shown in the society when their related cultures in community emphasize in individual or collective interests. In other words, acceptance of individualism or collectivism depends on national culture in any community and society.

They found that the individualist cultures of contract were based on more favorable behavior of that contract according to their result and outcome. Madison and Smith (2006) and Blanthorne et al [12] explored the effect of training and preparation of platform for moral growth during study period of accounting students. Their findings showed that the presence of these trainings during education might lead to reduction in rate of tax escape and tendency to execution of moral behaviors in students based on a constant and continuous approach (not temporarily). Hu and Wang (2008) analyzed the rate of compliance of morality to acceptance of tax among taxpayers in Hong Kong. The results of their study indicated that the compliance among morality and acceptance of tax was improved when taxpayers had stronger beliefs regarding phenomenon of tax escape as an anti-value (immoral act). Similarly, their findings showed that making effort for ethical growth might positively and significantly impact in acceptance of tax among taxpayers.

Blanthorne et al [12] explored the preparatory and efficient factors in immoral behaviors among employees in accounting profession at Turkey from philosophical perspective. The result of their study showed that 44 factors might play role in arising of immoral behaviors where these immoral behaviors more influenced the honesty and commitment to ethical behavior procedure in accounting than other subjects and undermined them. The results also showed that the immoral requests imposed by employers (e.g. tax escape) noticeably impacted on occurrence of such immoralities and their inadequate awareness of destructive effects from immoral behaviors on presence and life of accounting profession is one of other factors that essentially influenced on doing immoral behaviors among accountants.

Piccard and Prince [15] studied on behavioral dynamics and tendencies for escape from tax payment. The results of their research indicated that neoclassic ethical approach might not orient well the behaviors and cause growth in behavioral model and prevention from tax escape, but optimal interactions among taxation legislators and taxpayers and preparation of ground for further trust might play important role in acceptance of tax payment or reducing occurrence of unethical behaviors regarding tax escape.

Holms and Marriott [13] explored behavior of students in respective of tax tendencies according to their completed questionnaire and their real behavior in empirical environment. The results of their study showed that there was significant relationship among ethical behaviors regarding tax tendencies in students according to the completed questionnaire and their real behavior in the simulated environment. Similarly, it was characterized that the females versus males, the older people versus younger ones, and students at higher semesters than their younger classmates (students at lower semester) showed more ethical reactions personally.

In his investigation, Parsons (2009) stated that the female taxpayers compared to male taxpayers lesser tended to do unethical behaviors and tax escape where this issue was due to difference between females and males in terms of attributes and perceived decision-making methods. Likewise, Shower and Sweeney (2009) expressed that as age is older; tendency to unethical behaviors is reduced in individuals.

Given that rising tax solvency is considered as one of techniques to increase tax revenues and realization of governmental objectives and payment of real tax is subject to familiarity of taxpayers with their tasks and obligations the important point about this issue is to prepare appropriate platform to increase trust in performance of INTA organization and ethical growth in taxpayers to perceive this issue better that tax escape is an immoral, destructive, and anti-value phenomenon and finally the above factors are led to optimization of tax culture in society.

RESEARCH HYPOTHESES

Major hypothesis

There is significant relationship among tax solvency and culture in any country.

Minor hypotheses:

1. There is relationship among tax solvency and power distance.
2. There is relationship among tax solvency and collectivism versus individualism.
3. There is relationship among tax solvency and masculinity versus femininity.
4. There is relationship among tax solvency and uncertainty avoidance.

Research variables

To test hypotheses, variables of this study are divided into two groups of independent and dependent variables.

Independent variable

The independent variable used in this study was as follows:

Culture is the independent variable in this research. According to Hofstede four cultural dimensions items of uncertainty avoidance, collectivism versus individualism, masculinity versus femininity, and power distance in this study are considered as independent variable.

Dependent variables

The dependent variables utilized in this study are related to tax insolvency. Whereas it is impossible to determine this variable thus the alternative criterion has been used instead of tax insolvency in these studies. The individual perceptions were employed for determination of tax insolvency in previous studies that have examined and discussed this subject. In this section, we have used the relevant economic estimations to unreported real revenues in the country as a criterion to determine tax insolvency. The shade economy of a country divided by GDP is expressed as national tax insolvency. Schneider (2004) defines the shaded economy as estimation of legal products based on goods and service markets which are deliberately omitted from public access.

DISCUSSION

The researchers explored effect of Hofstede (1980) cultural dimensions on tax insolvency among various countries in this study. As general, the results came from this study by means of testing research hypotheses may be assumed as supporter for national culture proposed by Hofstede in description of tax insolvency among different nations. The model given for determination of relationship among research dependent variables and independent variable indicated that Hofstede three cultural dimensions were related to insolvency at international level. In particular, the results showed that higher uncertainty avoidance and power distance levels were related to higher level of tax insolvency and on the other hand higher individuality level was related to lower level of tax insolvency. The result came from this investigation is consistent with the studies that have examined the relationship among Hofstede framework and global financial reporting particularly for uncertainty avoidance and individualism. At the same time on the other hand, it was concluded that dominance of masculinity in a community might lead to lower tax insolvency.

Suggestions

The current study has acted as a tool to describe tax solvency in different environments with Hofstede cultural framework. The results show that the culture is deemed as an important factor in describing levels of tax insolvency in different countries. Based on these findings, we can describe a culture with low tax insolvency as a culture with higher levels of uncertainty avoidance, lower individualism, lower masculinity, and higher power distance. These findings may be a start point for conducting studies regarding investigations about tax solvency.

ACKNOWLEDGEMENT

None.

CONFLICT OF INTEREST

There is no any form of conflict of interested.

FINANCIAL DISCLOSURE

No financial support was received for this work.

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THE EFFECTS OF HUMAN UTILIZATION AND FOREST MANAGEMENT ON SPREAD OF *LORANTHUS GREWINGKII* IN ZAGROS FORESTS, IRAN

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ABSTRACT

The spread of *Loranthus grewingkii* is the certain factor in Zagros forest decline. The present study was conducted to assess the impacts of human utilization (agroforestry systems) and forest management (coppice and high forest). For this purpose, 100 sample plots (10 Ares) based on random systematic method in 200 × 100 m sampling grid were taken in different forest types including natural forest, agroforestry area, coppice and high forest. Tree canopy was classified into three classes of upper, middle and lower parts. Each class was graded as follow: grade zero (without infection), grade 1 (low infection or the time that less than 50% of branches are infected), grade 2 (high infection or the time which more than 50% of branches are infected). The results showed human utilization had significant effects on the presence and spread of *Loranthus grewingkii*. The high infection up to completely high infection was more in agroforestry area in respect to natural forest. Besides, the *Loranthus grewingkii* infection in high forest was more than that in coppice.

Received on: 04th-April-2016

Revised on: 09th-May-2016

Accepted on: 14th – May-2016

Published on: 10th-June-2016

KEY WORDS

Loranthus grewingkii, Zagros forest, High forest, Dwarf Mistletoe Rating

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INTRODUCTION

Mistletoes (*Loranthus* spp) are widespread aerial hemi-parasites of trees, ranging from the boreal zone to the tropics [1]. They play a significant role in forest diversity by providing keystone food resources for many animal species due to the availability of their fruit in seasons when other food is scarce [2]. However, the main mistletoe species are considered tree pests in forests and plantations [3, 4]. Because they disturb the water and nutrient balances and reduce photosynthesis and respiration, so debilitating infected trees [5, 6]. Because of the debilitation, extensive mistletoe infection may lead to serious damages of infected trees or even tree death [7, 8]. The presence of mistletoes on host trees has also been observed to be associated with individual tree features such as tree size, biomass and the occurrence of branches of main diameters [9, 10]. Therefore, the distribution and damages of mistletoe plants in the forest is likely to coincide with the distribution of host trees with the most favorable tree characteristics [10]. Watson [2] reported that the distribution of mistletoes is strongly related to the distribution and population of birds. In this regard, the mistletoes seed are germinated on trees from bird's excrement after consuming by birds.

Zagros forests are the second natural forest ecosystem in Iran, and as the most extensive forests have an important role in economic development and guarantee the sustainability of water and soil in the Zagros region [11]. The central Zagros Mountain range is one of the most important sites of oak forest in the west of Iran. Approximately 3 million ha of the forest is covered by different oak species, mainly dominated by *Quercus persica*, *Quercus infectoria* Olive and *Quercus libani* Lindl [12].

Mistletoes have various physiological and morphological effects on their host. The emergence, spread and damages of mistletoes has been reported in different parts of Zagros forest on various tree species such as almond, pear, apple, and oak [13, 14]. However, there was not conducted a comprehensive investigation on pronounce and human utilization on the spread of *Loranthus grewingkii* in Kermanshah province, west of Iran. Therefore, the present study was carried out to assess the effects of human utilization (agro-forestry systems) and forest management (coppice and high forest).

MATERIALS AND METHODS

Site description

To investigate the effects of human utilization (agro-forestry systems) and forest management (coppice and high forest) on *Loranthus growingkii* distribution, Haidarbaigi district in Kermanshah province, Zagros forest, was selected [Figure -1].

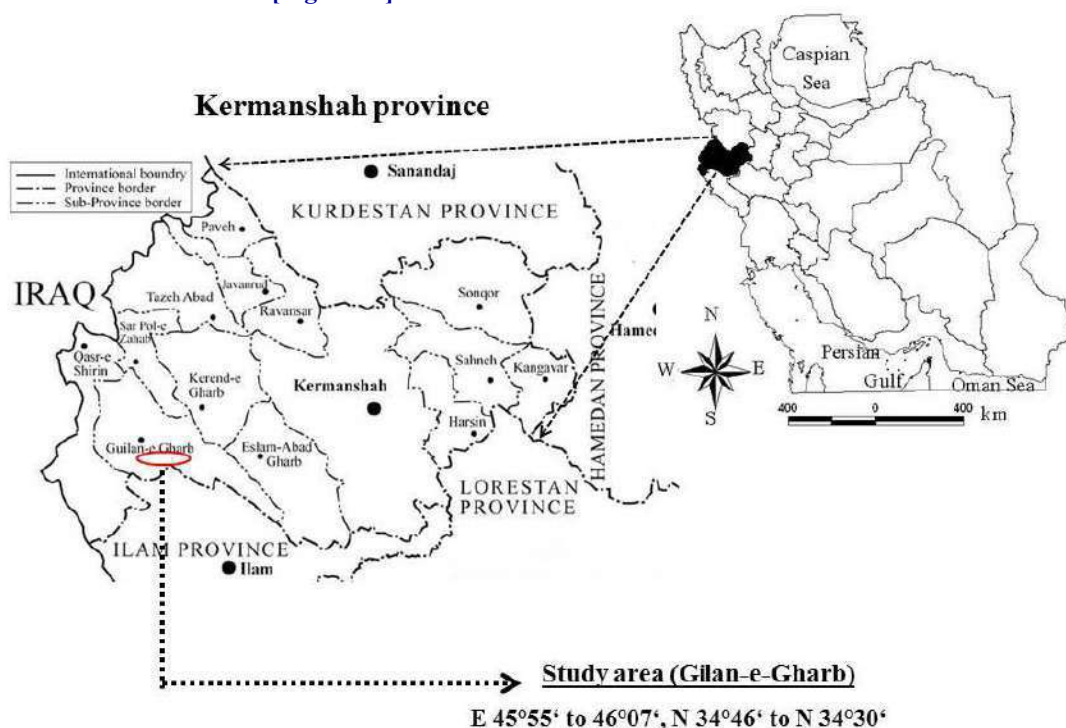


Fig: 1. The location of Gilane-gharb district in Iran

Methods

100 sample plots (10 Ares) based on random systematic method in 200×100 m sampling grid were taken. The characteristics of each sample plot including positions of sample plot (UTM etc.), different forest management (high forest and coppice with standards), the infection to *Loranthus growingkii* based on DMR in three parts of tree crown (upper, middle and lower), the number of *Loranthus growingkii* masses on branches, branch diameter of host and its distance from the ground were measured. The most common and acceptable method to determine the prevalence of mistletoe is DMR [15]. Dwarf Mistletoe Rating (DMR) method was first applied for just dwarf mistletoe, then it was used for all types of mistletoe [16]. In this method, tree canopy was classified into three classes of upper, middle and lower parts. After that, each part was graded as follow: grade zero (without infection), grade 1 (low infection or the time, which less than 50% of branches are infected), grade 2 (high infection or the time, which more than 50% of branches are infected). The intensity of infection was calculated by the sum of grades. In this method, the highest and lowest infection of mistletoe belonged to grade 6 and 0, respectively [15].

Statistical analysis

The data were submitted to SAS and SPSS. Kolmogorov - Smirnov test was used to assess the normality of data. Besides, independent t-test was applied to compare the intensity of infection with the mistletoe in natural forest, agro-forestry area, and coppice and high forests.

RESULTS

To investigate the effect of human activities and forest management systems on the infection with *Loranthus growingkii*, the classification of canopy and grading was applied to the forest stands.

Table 1: Independent t test to compare the infection with *Loranthus growingkii* in agro-forestry area and natural forest

Parameters of <i>Loranthus growingkii</i>	t	df	p-values
The intensity of <i>Loranthus growingkii</i> infection	3.489	882	0.001
The number of <i>Loranthus growingkii</i> per tree	4.606	882	0.001

The results of [Table-1](#) shows there was a significant difference between agro-forestry area and natural forest for the infection intensity and the number of *Loranthus growingkii*.

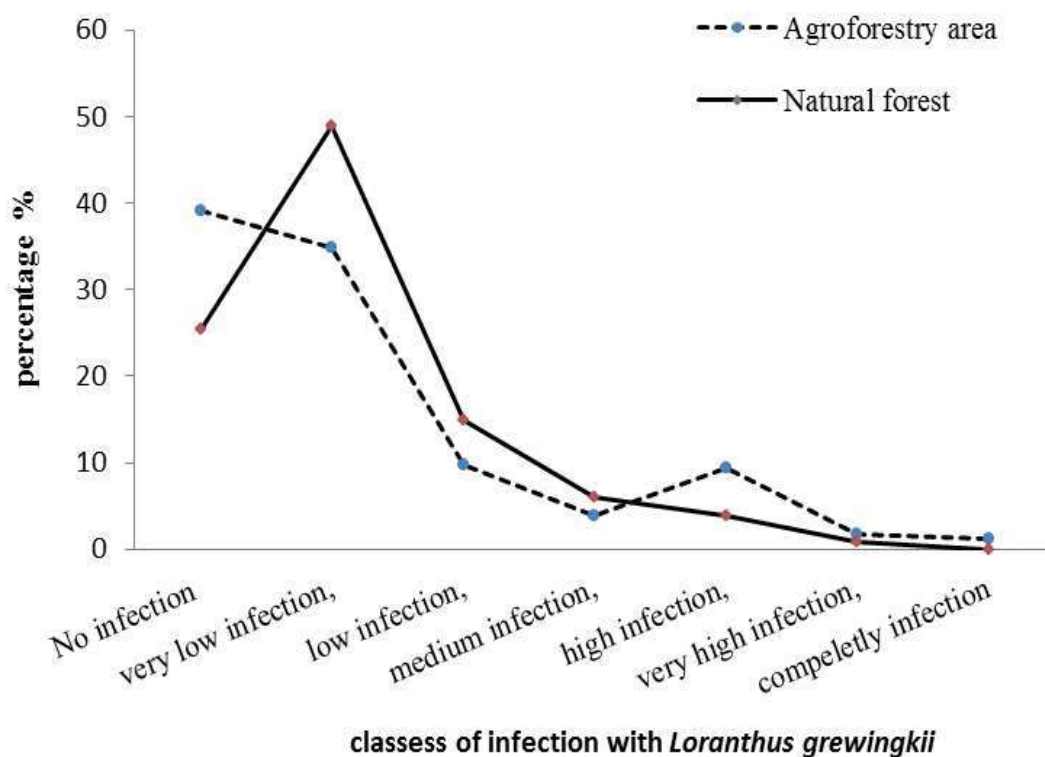


Fig: 2. The comparison of tree percentage based infection of *Loranthus growingkii* per tree in natural forest and agro-forestry area.

As shown in [Figure- 2](#), the trees with high, very high and completely infection in agro-forestry area were more than those in natural forest, while totally the infection with *Loranthus growingkii* in natural forest was more than agro-forestry area.

As shown in [Figure- 3](#), the maximum *Loranthus growingkii* infection was observed in natural forest was 74.6%.

The *Loranthus growingkii* infection in coppice and high forest

Table: 2. Independent t test to compare the infection intensity and the number of *Loranthus growingkii* in coppice and high forest

Parameters of <i>Loranthus growingkii</i>	t	df	p-values
The intensity of <i>Loranthus growingkii</i> infection	10.212	882	0.000
The number of <i>Loranthus growingkii</i> per tree	10.026	882	0.001

There was observed a significant difference between coppice and high forest for intensity of infection and the number of *Loranthus growingkii* [Table- 2].

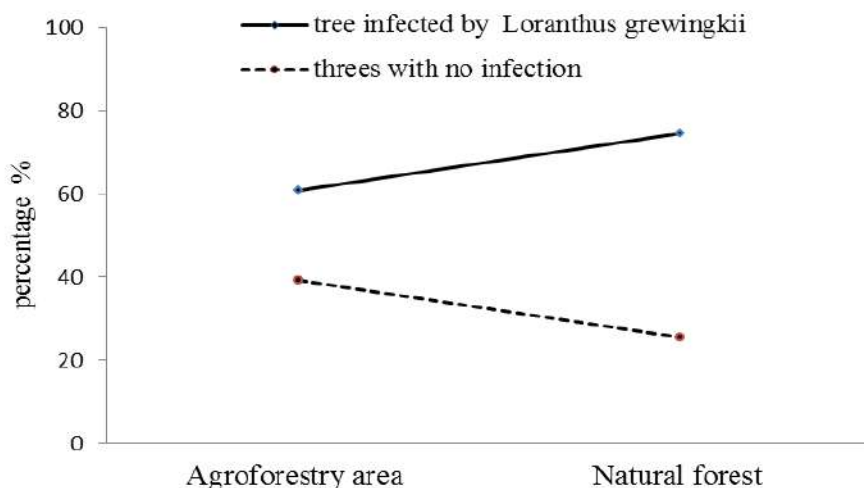


Fig: 3. The comparison of tree infected by *Loranthus growingkii* and trees with no infection in natural forest and agroforestry area

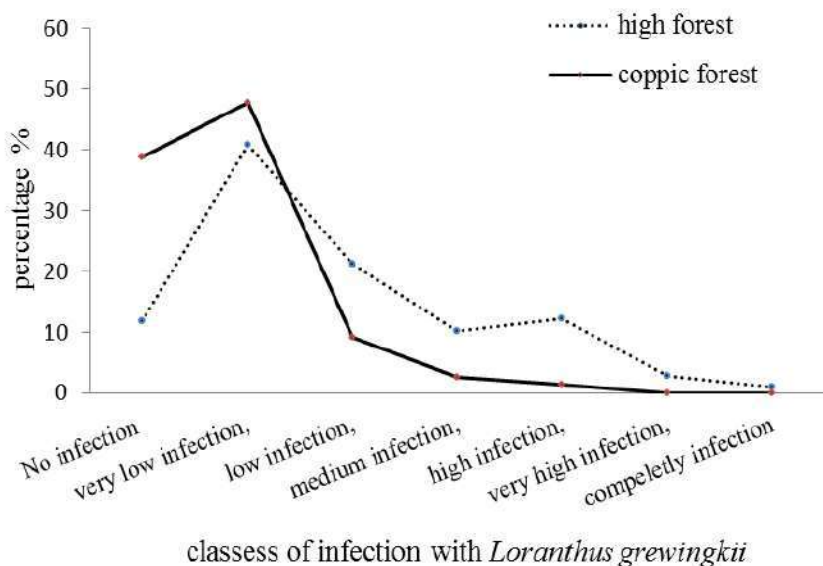


Fig: 4. The comparison of the number and percentage of trees in classes of infection with *Loranthus growingkii* in coppice and high forest

As shown in [Figure-4](#), the low, medium, high, very high, and completely high infection in high forest was more than those in coppice. However, the very low and without infection in coppice was more than those in high forest. 88.2 % of high forest trees were infected with *Loranthus grewingkii*, while this value was obtained as 61% in coppice.

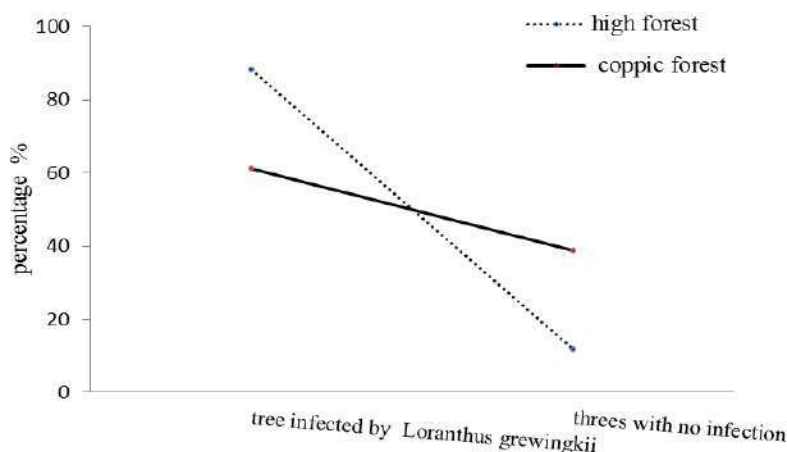


Fig: 5.The comparison of tree infected by *Loranthus grewingkii* and trees with no infection in in coppice and high forest

DISCUSSION

The forests of Kermanshah province were located in center of Zagros region, which cover 600000 ha of Zagros forest. In recent years, the emergence and spread of *Loranthus grewingkii* has been considered as the main factor of forest decline in Zagros region.

Agro-forestry and the presence of *Loranthus grewingkii*

The results showed trees ranging high infection to completely infection in agro-forestry area were more than that in natural forest, whereas the trees with low and medium infection were mostly located in natural forest. The maximum trees infected with *Loranthus grewingkii* were observed in natural forest [\[Figure- 3\]](#). The results of independent t test indicated a significant difference for infection intensity and the number of *Loranthus grewingkii* infection per tree between agro-forestry area and natural forest so that the infection in natural forest was more than that in agro-forestry area [\[Table- 1\]](#). In this regard, different authors reported that human activity and utilization are the main factors on the presence of mistletoes, which are accordance with our findings [\[17-19\]](#).

Loranthus grewingkii in coppice and high forest

The *Loranthus grewingkii* infection from low up to completely high in high forest was more than that in coppice, while trees with very low and without infection was more observed in coppice in comparison to high forest [\[Figure- 4\]](#). High forest is the most appropriate place for regeneration and development of *Loranthus grewingkii* so that 88.2 % of this parasite was observed in high forest [\[Table- 2\]](#). The type of forest stand is an important factor to determine the distribution of *Loranthus grewingkii*. Azizi [\[20\]](#) reported that trees with high diameter and high forest are more appropriate to presence of semi-parasite, which their findings support our results.

ACKNOWLEDGEMENT

I thank to Islamic Azad University (Sanandaj branch) for its support to this research.

CONFLICT OF INTEREST

Author declares no conflict of interest.

FINANCIAL DISCLOSURE

No financial support was received for this work.

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IDENTIFYING AND PRIORITIZING FACTORS AFFECTING CUSTOMERS LOYALTY IN INSURANCE INDUSTRY WITH AHP APPROACH

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ABSTRACT

Change of population processes, globalization and increased competition in various fields of production and service have brought about a growing importance in the subject of customers' loyalty and job satisfaction. The aim of the present research is to identify and prioritize factors associated with customers' loyalty in Moalem Insurance Company. The present research is a survey study by kind. For data collection, questionnaire instrument was used, for which a number of 10 experts in insurance industry were taken as research sample. For data analysis, a hierarchical analysis and multivariate decision-making approaches were used along the software pack Super Decision. The results of the research suggested that the criterion interest in insurance brand took the greatest priority, customer's recommendation to other people the middle priority, and in the end customer's repurchase took the least priority. In addition to this, the research revealed that among the sub-criteria of customer's repurchase namely customer's satisfaction, perceived quality, perceived value, trust, and company image, trust factor takes on the greatest importance.

Received on: 10th-July-2016

Revised on: 24th-July-2016

Accepted on: 10th-Aug-2016

Published on: 12th-Aug-2016

KEY WORDS

Loyalty of customer, customer's recommendation to others, Interest in brand, Customer's repurchases

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INTRODUCTION

Today, it necessitates for recognition and predication of customers' requirements to economic enterprise in order to acquire competitive advantage and market division and share. The customer is assumed as key and pivotal factor in improvement of organizational agility and for orientation of all goals, strategies, and resources around path of attraction and maintenance of customer. Maintenance and improvement of customer's loyalty is considered as a challenging strategy for enterprises that are concerned with keeping and developing their competitive position. Therefore, loyalty of customers is deemed as commercial achievement key for the organization; in other words, following to improving customers' loyalty it can be expected that market share and rate of profitability to be enhanced. Market perception is led to long- term benefits for economic enterprises by planning and taking appropriate strategies to make customers loyal and to increase rate of their loyalty [1]. Loyalty is not automatically created; of course, so it is influenced by other factors. Studies have shown that quality of services, customer's satisfaction, and image of enterprise, perceived trust and value of corporate services and/ or products may affect on customer's loyalty [2-3]. Due to importance of customer's loyalty for organizational growth, it is crucially important to recognize concepts and model of loyalty. Lack of such recognition may lead the enterprises to select parameters improperly for measurement of customer's loyalty and they cannot relate customer' loyalty to performance parameters and consequently to make mistake in design of loyalty plans and recognizing proper behaviors of customers [4]. On the other hand, following to expansion of number of private insurance companies in Iran, competition has been increased to acquire more market share and therefore customers' loyalty is considered as a competitive advantage for them in insurance industry however unfortunately the efficient factors on loyalty of customers and the rate of importance for each of them has not been adequately noticed in insurance industry. Thus, with respect to aforesaid issues, present research is tended to give answer to this question: What factors may affect on loyalty of customers in insurance industry? What is the importance for each of these factors?

It can be implied regarding importance and necessity of research that today following to competitive nature of markets and constant environmental changes, organizations have found this fact that they are no longer exposed to a developing economic system and growing market similar to the past; hence, any customer possesses specific value

and they should campaign for acquisition of more market share. Making customer loyal and obliged has special position at present and growth in customer's relationship and efficient relation with him/ her may lead customers of an organization to act as colleague inside an organization and behave as supporters and fans outside it. Therefore, only those customers are assumed as capital for organizations if they feel sense of attachment to organization with profitability and long-run loyalty.

It is hoped this study to be useful for upgrading insurance services in accordance with value-driven utilities of consumers, presentation of information to directors of insurance companies, preparation of appropriate strategies to provide the needed information for enterprises and also supportive plans made by central insurance organization for insurance companies.

Concept of loyalty and the governing theoretical bases

According to attitude of Oliver [5], loyalty is customer's deep commitment to return or repurchase of certain commodity or service in future despite of presence of marketing effects and efforts by rivals to change purchase behavior of customer. [6] argue that two approaches are visible in definition of loyalty: behavioral loyalty and attitudinal loyalty. Behavioral loyalty denotes customers' inclination for repurchase of services and products and keeping relationship with service providers while attitudinal loyalty is related to rate of psychological attachment of customers and their attitudinal support from service providers [6].

According to opinion of Jacobi and Chest Knelt [7] loyalty of customer is created through ideological (quality of services), affective (satisfaction), and cognitive (loyalty of customer) processes. Oliver [5] suggests that developing process of customer's loyalty follows pattern of cognitive loyalty, affective loyalty, conation loyalty, and action loyalty. At first phase (cognitive loyalty), consumers prefer a certain brand to other trade marks based on assessment of quality of services. At second step (affective loyalty), the level of interest is increased in a product with positive attitude toward specific brand based on experience and satisfaction. At third phase (conation loyalty), commitment is created to specific brand for repurchase and tendency is objectified to repurchase. Finally, at the process of action loyalty, inclination to return product is converted into purchase of it. In other words, customer's intention and purpose is turned into action [7].

Nonetheless, Oliver [5] claims that intention and purpose is not always converted into action. Conation loyalty signifies that attitudinal loyalty should be accompanied to eager and enthusiasm to be actualized e.g. repurchase of a type of specific brand so that to convert given intention or commitment into action. It should be mentioned that model of process for four aforesaid types of loyalty is sequential and loyalty is intensified at any step and becomes deliberately and purposively in such a way that intensity of loyalty is weak at cognitive level and it is at the necessary highest level at action phase [2]. [3] has determined six different types of loyalty in a general framework. Monopoly loyalty: At the point there is no other alternative for purchase.

Inertia loyalty: The time at which customers do not actively look for alternated source.

Convenience loyalty: Under condition when customers remain loyal only due to their own position and conditions.

Price loyalty: If customer expresses loyalty under influence of the lowest price.

Incentivized loyalty: When the loyalty is created due to the benefits resulting from rewarding plans and scorecards.

Affective loyalty: It is acquired when customers are influenced by effect of factors e.g. brand [8].

Results showed that the loyal customers might be assumed as a vital and important factor for survival of business since absorption of new customers would be remarkably more expensive than keeping former customers. Thus, enterprises should try to improve their market share by maximization of maintenance of customers [9].

Customer's loyalty model

Interpretation of model: With respect to Fig (1) derived from the conducted studies by [9] loyalty of customer is a dependent variable and satisfaction of perceived value, perceived quality, and image of enterprise are independent variables. The main theme of this study is to identify effect of each of loyalty variables and type of their relationship and finding of foremost variable in loyalty of customer.

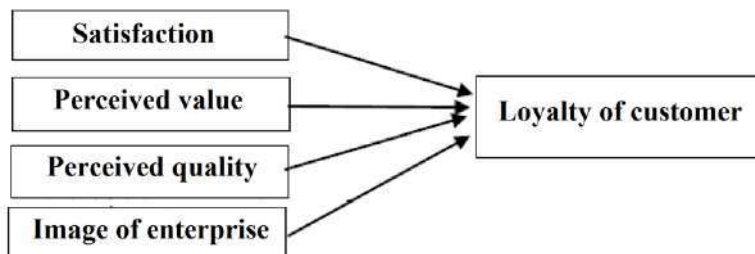


Fig: 1. Customer's loyalty model

Concept of dimensions of model

Customer's satisfaction: It denotes sense of joy or despair of a person due to comparing of a product or perceived performance of services regarding his/ her expectation [10]. Perceived value: It has been defined as perceiving quality, social psychology, interest and money [3]. Perceived quality: It includes general assessment of customer about standard trend of receiving services by customers [11] and/ or rate of compliance among perceived performance and customers' expectations [12]. Image of enterprise: It denotes perception and subjectivity of referent customers to trade name and/ or the given enterprise of that brand and products and services and/ or organization [13].

Literature review

In a survey done by Rajabi et al [14] they explored efficient factors on customers' satisfaction with E-services of travel agencies and the results of this study showed that pragmatism, applicability, and interactive potential of E-services in travel agencies might affect on customers' satisfaction with these services and such satisfaction might also impact on intention of use of E-services by customers. In an investigation, Najafi [15] analyzed and interpreted effective factors on customer's loyalty to E-banking among customers of Mellat Bank E-payment and finding this study indicated that satisfaction was the foremost effective variable on formation of customer's loyalty while perceived reputation and value were considered as the paramount factors in satisfaction and at the same time reputation and quality of services were assumed as foremost factors influenced in customer's trust. In a study, Rezaei [16] explored effective factors on loyalty of customer in Iranian software industry in Sepidar System Company as a member of Hamkaran System E-payment where the results of study showed the customer's satisfaction, organizational image, and cost of displacement affected on loyalty of customer and at the same time customer's satisfaction has impacted on organizational image and two factors of quality of services and perceived value on satisfaction of customer and quality of services influenced in perceived value. In a survey done by Karimi Amoli [17] he examined and identified efficient factors in organizational image and analyzed their effect on loyalty of customer. The findings indicated that variables of physical environment, level of services, communications, perceived value of services by customer, and customer's expectations were positively and significantly related and also organizational image might affect on loyalty of customers. In a study titled 'effective factors on loyalty of customer to E-banking', Maarofi came to the result that the observed value, perceived quality, trust and reputation of company might impact on loyalty of customers to E-banking in Iran. Johan et al [17] in their study explored efficient factors in loyalty of customer in airplane industry in Malaysia in which variables of perceived importance and quality and value, customer's satisfaction, and image of enterprise affected on loyalty of customer respectively. With respect to theoretical bases and literature of study, the conceptual model may be proposed in this study by hierarchical approach in Fig (2).

MATERIALS AND METHODS

The present research is an applied study in terms of objective and nature of given problem and it is of survey type in terms of data collection technique, and it is a descriptive study in terms of methodology as well. Questionnaire was administered for collection of research data.

Measurement tool (questionnaire)

Questionnaire is the tool for data collection in current research. Researcher designed a questionnaire using the existing variables in customer's loyalty model (Adreassen and Lindestad, 1998) and distributed it among respondents after verification of validity and reliability of questionnaire. The approved questionnaire by the experts

deals with pairwise comparison of main criteria based on objective, pairwise comparisons of main criteria with each other (interactions between main criteria), and pairwise comparisons of parameters with main criterion.

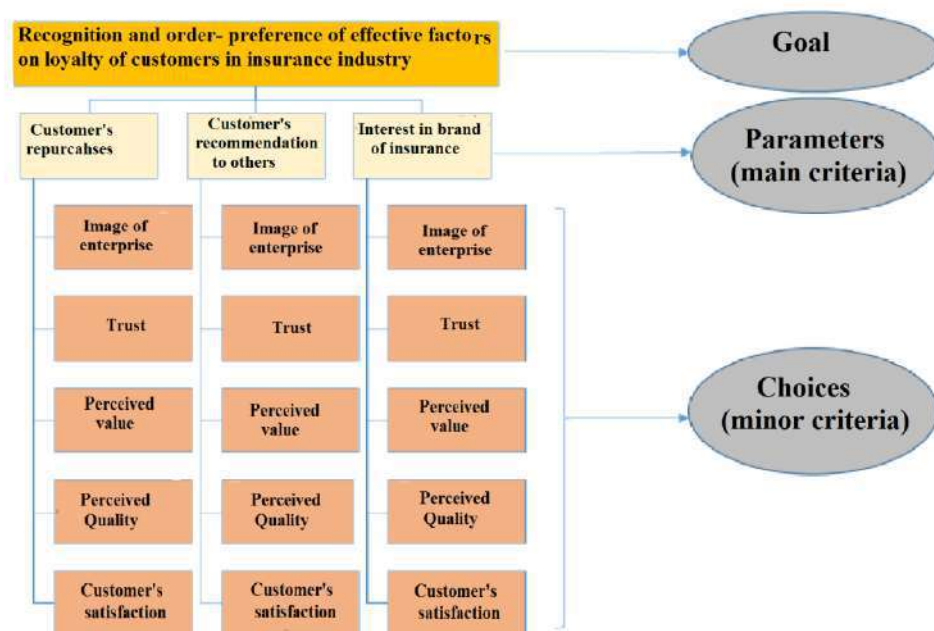


Fig: 2. Research conceptual model by hierarchical approach. Source of model: Customer's loyalty model Adreassen & Lindstad (1998)

Data analysis

Analytic Hierarchical Process (AHP) method and Multi-Criteria Decision- Making (MCDM) approaches were taken along with Super-Decision software pack for data analysis.

Population and statistical sample

The statistical population of this study includes directors and expert of Moalem Insurance Company. Whereas AHP is a subjective process that does not need to involvement of a lot of experts [5] and also researchers employ AHP technique in many studies thus use of small samples (10 members or fewer) was assumed as adequate in this research [6]. Thus, according to polling of ten experts from Moalem Insurance Company the foremost parameters of effective factors on loyalty of customers in insurance industry have been also investigated.

Reliability and validity of questionnaire

The conceptual and content validity has been acquired through comments from experts and study on literature of given subject in present research and reliability of data has been approved with respect to AHP analysis with inconsistency rates less than ten percent.

Step 1: Calculation of vector of sum of weights: Multiply pairwise comparison matrix to columnar vector 'relational weight'. Call a new vector as Weighted Sum Vector (WSV) thereby it is acquired.

Step 2: Divide elements of weighted sum vector into relational preference vector. The resulting vector is called Consistency Index (CI).

Step 3: Mean consistency vector element (λ_{max}) is derived by calculation of λ_{max} .

Step 4: Calculation of consistency index (CI): Consistency index is defined as Formula 1:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (\text{Formula 1})$$

denotes number of existing choices in problem.

Step 5: Calculation of inconsistency ratio: Inconsistency ratio is derived by dividing consistency index (CI) to Random Index (RI) as Formula 2.

$$CR = \frac{CI}{RI} \quad (\text{Formula 2})$$

This formula expresses consistency index 0.1 or smaller consistency in comparisons.

Random index is extracted from Table (1).

Table 1: Random Index (RI)

N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

RESULTS

Table 2: Demographic variables of research

Variable	Status	Quantity	Percent
Gender	Male	8	80%
	Female	2	20%
Marital status	Single	1	10%
	Married	9	90%
Age	31-40	2	10%
	41-50	5	60%
	>50	3	30%
Education	BA	3	30%
	MA	5	40%
	PhD	2	40%
Working background	10-15	3	30%
	16-20	4	40%
	21-30	3	40%
Position	Administrative	8	%80
	Expert	2	%20

Inferential findings

Determination of order preference for loyalty factors using Analytic Hierarchical Process (AHP)

At first step in this study, order- preference of effective criteria and sub-criteria on customer's loyalty has been determined in insurance industry. The research criteria and sub-criteria are given in Table (3).

Table 3: Main criteria and the related sub-criteria

Symbol	Main criteria	Sub-criteria	Symbol
C1	Customer's repurchase	Image of enterprise	S11
		Trust	S12
		Perceived value	S13
		Perceived quality	S14
		Customer's satisfaction	S15
C2	Customer's recommendation to others	Image of enterprise	S21
		Trust	S22
		Perceived value	S23
		Perceived quality	S24
		Customer's satisfaction	S25
C3	Interest in insurance brand	Image of enterprise	S31
		Trust	S32
		Perceived value	S33
		Perceived quality	S34
		Customer's satisfaction	S35

Source: Researcher's findings

A schema of criteria and symbols is displayed in the figure -3.

Then, Analytic Hierarchical Process (AHP) analysis is employed for determination of order-preference of performance factors.

Saaty 9-degree scale was utilized for pairwise comparisons. Saaty 9- degree scale has been presented by Thomas Saaty as founder of AHP theory.

Determination of main factors based on goal.

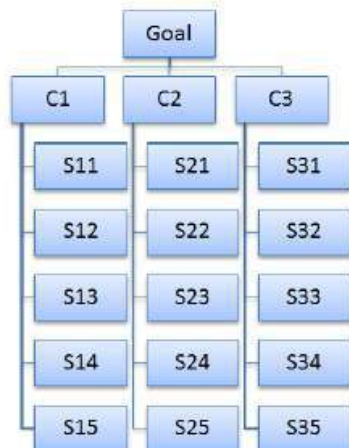


Fig: 3. Hierarchical pattern of studied variables

At first step, main criteria have been compared according to goal as pairwise. Since there are three criteria thus according to number of conducted comparisons is derived by Formula 3:

$$\frac{n(n-1)}{2} = \frac{3(3-1)}{2} = 3 \quad (\text{Formula 3})$$

Therefore, 3 pairwise comparisons have been carried out by group approach from experts and they have been integrated using technique of geometric mean based on experts' viewpoint. The resulting pairwise comparisons matrix based on experts' attitude is given in Table (4).

Table 4: The pairwise comparisons matrix resulting from integration of experts' attitude to determine order-preference of main criteria

	Customer's repurchases	Customer's recommendation to others	Interest in insurance brand
Customer's repurchases	1	0.692	0.732
Customer's recommendation to others	1.466	1	0.428
Interest in insurance brand	1.365	2.339	1

Source: Researcher's findings

The next step is calculation of geometric mean of any row to determine weight of criteria:

$$\pi_1 = \sqrt[3]{1 * 0.692 * 0.732} = 0.797$$

Then, geometric mean is calculated for other rows.

$$\pi_2 = 0.852$$

$$\pi_3 = 1.473$$

Afterwards, sum of geometric mean is computed for all rows.

$$\sum_{i=1}^m \pi_i = 0.797 + 0.852 + 1.473 = 3.121$$

The normal weight is derived by dividing geometric mean of any row to sum of geometric means of rows and that vector is also called eigenvector. Summary of results are listed in Table (5):

According to table, eigenvector for preference of main criteria will be expressed as W1.

$$W_1 = \begin{pmatrix} 0.225 \\ 0.273 \\ 0.472 \end{pmatrix}$$

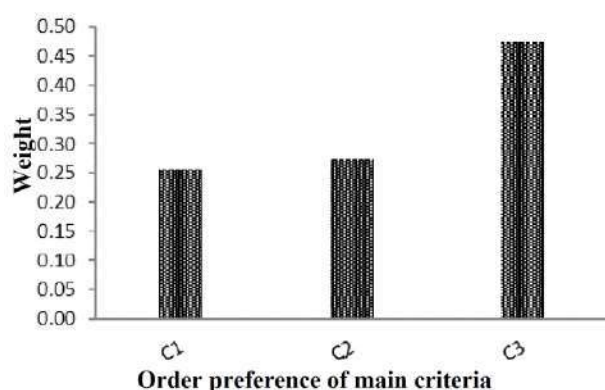
Based on the derived eigenvector:

- Criterion of factors for interest in insurance brand has the highest preference with normal weight 0.472.
- Criterion of customer's recommendation to others is placed at medium preference with normal weight 0.273.
- Criterion of customer's repurchases includes the lowest preference with normal weight 0.255.

Table 5: Determination of order- preference of main criteria

	Customer's repurchases	Customer's recommendation to others	Interest in insurance brand	Geometric mean	Eigenvector
Customer's repurchases	1	0.692	0.732	0.797	0.255
Customer's recommendation to others	1.446	1	0.428	0.852	0.273
Interest in insurance brand	1.365	2.339	1	1.473	0.472

Source: Researcher's findings

**Fig 4: Graphic view of order preference of main criteria. Source: Researcher's findings**

Inconsistency ratio was derived 0.088 for the conducted comparisons where it is smaller than 0.0 therefore the given comparisons can be trusted.

Comparison and determination of order preference of sub-criteria

At second step in AHP technique, group of the related sub-criteria for any criterion has been compared as pairwise in the related cluster and order preference has been determined for them. Summary of results of pairwise comparisons of sub-criteria has been separately presented.

Determination of order preference of sub-criteria of customer's repurchases

Sub-criteria of customer's repurchases are as follows: Customer's satisfaction, perceived quality, perceived value, trust, and image of enterprise. Here, the group comments of experts have been utilized as well. Attitude of 10 experts has been collected. Since there are five sub-criteria thus number of conducted comparisons is as follows:

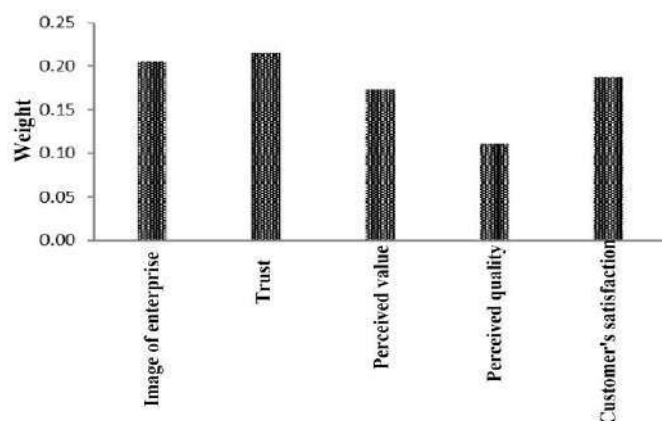
$$\frac{n(n-1)}{2} = \frac{5(5-1)}{2} = 10$$

Conducted calculations for determination of order- preference of customer's repurchases criteria are listed in Table (6).

Table 6: Order- preference of customer's repurchases criteria

	Image of enterprise	Trust	Perceived value	Perceived quality	Customer's satisfaction	Geometric mean	Eigenvector
Image of enterprise	1	0.562	1.286	1.636	1.035	1.254	0.205
Trust	1.779	1	0.727	1.582	1.342	1.312	0.215
Perceived value	0.777	1.376	1	0.826	0.590	1.058	0.173
Perceived quality	0.611	0.632	0.632	1	0.387	0.677	0.111
Customer's satisfaction	0.966	0.745	1.695	2.585	1	1.148	0.188

Source: Researchers' findings



Customer's repurchases criteria

Fig 5: Graphic view of determination of order preference for customers repurchases criteria. Source: Researchers' findings

Based on the given eigenvalue:

- Variable of trust possesses highest importance. (weight= 0.215)
- Variable of image of enterprise is placed at second preference with weight 0.205.
- Customer's satisfaction is classified at third rank with weight 0.188.
- Perceived value is located at fourth preference with weight 0.173.
- Perceived quality is placed at fifth priority with weight 0.111.

The consistency ratio was derived 0.051 for the conducted comparisons and this is smaller than 0.1 thus one can trust in conducted comparisons.

Determination of order- preference for sub-criteria of customer's recommendation to others

The sub-criteria of customer's recommendation to others are as follows: Customer's satisfaction, perceived quality, perceived value, trust, and image of enterprise where the results of their order-preference are listed in Table (7).

Table 7: Determination of order-preference of sub-criteria of customer's recommendation to others

	Image of enterprise	Trust	Perceived value	Perceived quality	Customer's satisfaction	Geometric mean	Eigenvalue
Image of enterprise	1	1.669	2.726	2.551	1.013	1.353	0.263
Trust	1.599	1	0.721	0.883	0.905	0.808	0.157
Perceived value	0.579	1.386	1	1.440	3.152	1.295	0.252
Perceived quality	0.645	1.133	0.694	1	0.542	0.772	0.150
Customer's satisfaction	0.987	1.105	0.317	1.844	1	0.914	0.178

Source: Researcher's findings

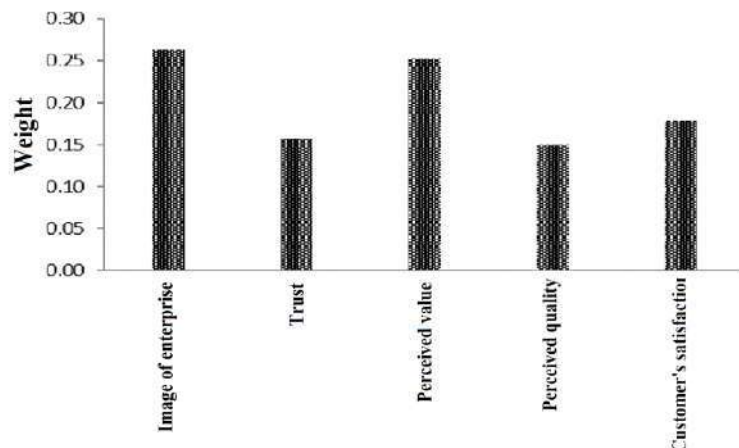
Based on the given eigenvector:

- Variable of image of enterprise possesses the highest importance with weight 0.263.
- Perceived value is placed at second position of importance with weight 0.252.
- Customer's satisfaction is ranked at third position with weight of 0.178.
- Variable of trust has the fourth position with weight of 0.157.
- Perceived quality enjoys the lowest importance with weight 0.150.

Similarly, consistency index has been extracted 0.062 for the conducted comparisons and it is smaller than 0.1. Thus, it can be trusted in the given results.

Determination of order- preference of sub-criteria of interest in insurance brand

The sub-criteria of interest in insurance brand are as follows: Customer's satisfaction, perceived quality, perceived value, trust. Conducted calculations are given for sub-criteria of interest in insurance brand in Table (8).



The sub-criteria of customer's recommendation to others

Fig 6: Determination of order preference for sub-criteria of customer's recommendation to others. Source: Researcher's findings

Table 8: Determination of order-preference of sub-criteria of customer's recommendation to others

	Image of enterprise	Trust	Perceived value	Perceived quality	Customer's satisfaction	Geometric mean	Eigenvect or
Image of enterprise	1	1.096	1.049	0.869	1.074	1.014	0.203
Trust	0.912	1	0.861	1.111	1.705	1.083	0.216
Perceived value	0.953	1.161	1	0.818	0.923	0.965	0.193
Perceived quality	1.151	0.900	1.223	1	0.869	1.019	0.204
Customer's satisfaction	0.931	0.587	1.083	1.151	1	0.926	0.185

Source: Researcher's findings

Based on eigenvector:

- Variable of trust enjoys the highest importance with weight 0.216.
- Perceived quality is ranked at second position with weight 0.204.
- Image of enterprise is classified at third rank with weight 0.203.
- Perceived value has the fourth position with weight 0.193.
- Customer's satisfaction enjoys the lowest importance with weight of 0.185.

Likewise, consistency index was also extracted as 0.062 for conducted comparisons and this value is smaller than 0.1. Therefore, one can rely on the given results.

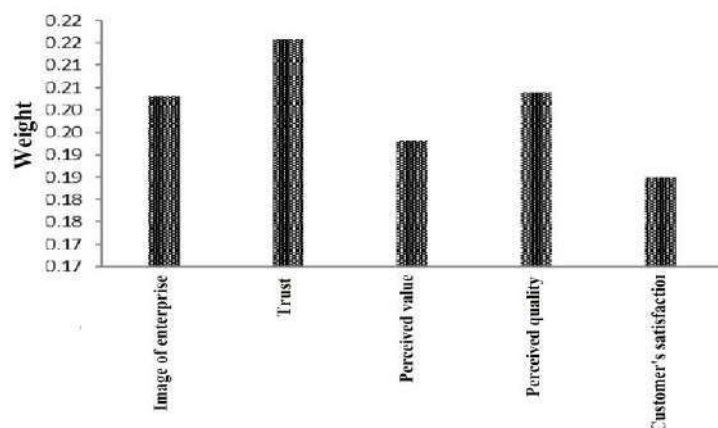
Analysis of findings

The main effective factors on customer's loyalty in insurance industry are respectively classified in this study as follows: Interest in insurance brand, customer's recommendation to others, and customer's repurchases where according to attitude of researcher it is because of this fact that as rate of interest in a subject and especially in the field of purchase is greater, typically loyalty of customer and his/ her motive for purchase will be also at higher level.

The results of determination of order- preference

The related results for preference of sub-criteria of customer's repurchases

The sub-criteria of customer's repurchases are classified with respect to analysis in this study based on order-preference as follows: trust, image of enterprise, customer's satisfaction, perceived value, and perceived quality where based on researcher's opinion, the reason is related to this fact that after first purchase by customer, what it is led to increase motive and inclination of customer for customer's repurchases more than ever is trust to which customer has achieved at first purchase.



The sub-criteria of interest in brand

Fig 7: Determination of order preference for sub-criteria of interest in brand. Source: Researcher's findings

The given results from determination of sub-criteria of customer's recommendation to others

The sub-criteria of customer's recommendation to others are determined with respect to analysis on this study based on order- preference as follows: image of enterprise, perceived value, customer's satisfaction, trust, and perceived quality where the latter variable has the lowest importance and based on attitude of researcher this is because of the fact that presence of image and perception about a certain product or brand, which can remain in customer's mind and thought is more important other sub-criteria for interpretation and recommendation and promotion for that product or brand by customer to others.

The given results from determination of sub-criteria of interest in insurance brand

The sub-criteria of interest in insurance brand are determined with respect to analysis in this study based on order-preference respectively as follows: Trust, perceived quality, image of enterprise, perceived value, and customer's satisfaction. According to attitude of researcher this may be due to this fact that after first purchase by customer, what it increases motive and inclination in customer for his/ her repurchases more than ever, is trust to which customer has acquired at first purchase.

DISCUSSION

This study tended to analyze and assess order- preference of main criterion and minor criteria of survey with respect to title of loyalty of customers so that the given results included the main effective factors on customer's loyalty in insurance industry out of which criterion of factors of interest in insurance brand possessed the highest priority. After this criterion, sub- criterion of customer's recommendation to others is located at the medium priority while criterion of customer's repurchase has the least preference. Sub-criteria of customer's repurchases in this study are determined according to order- preference as follows: trust with highest importance and then image of enterprise is placed at second priority and then customer's satisfaction is ranked at third position and at the same time perceive value has fourth preference and at last perceived quality possesses fifth rank. In this investigation, sub- criteria of customer's recommendation to others are specified according to order preference as follows: Image of enterprise with highest importance; perceived value is placed at second position of importance; then customer's satisfaction is located at third priority and trust at fourth position and finally perceived quality enjoys the lowest importance. Sub-criteria of interest in insurance brand are determined in this study according to order preference as follows: trust at first priority, perceived quality at second position, image of enterprise at third rank, perceived value at fourth position, and finally customer's satisfaction enjoys the lowest importance. Eventually, it can be concluded that interest in insurance brand is assumed important as preference of main criterion and also trust and image of enterprise are classified as priorities of sub- criteria regarding loyalty of customer.

ACKNOWLEDGEMENT

None.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

FINANCIAL DISCLOSURE

No financial support was received for this work.

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SENSITIVE LOAD SENSOR BASED ON PIEZORESISTIVE PROPERTIES OF MULTI-WALLED CARBON NANOTUBE

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ABSTRACT

The fabrication of a micro-electro-mechanical systems (MEMS) piezoresistive load sensor is reported. The sensor has the shape of a cantilever beam on a paper substrate. Printable multi-walled carbon nanotube (MWCNT) ink was fabricated to be used as a sensing component, because of its excellent piezoresistive and electromechanical properties. The results show that using MWCNT ink with proper sonication duration can result in a considerable force range and gauge factor for the fabricated sensor, which are two important designing factors. The results illustrated a linear resistance change with the applied forces. The force range, force resolution, and sensitivity were found to be 25 mN, 60 μ N, and 1.6 mV mN⁻¹, respectively. Furthermore, the effects of sonication time, number of printing, and temperature on the ink resistance are experimentally studied. Finally, in order to decrease the noise levels monolithic integration of a signal-processing circuit was used. This sensor is inexpensive, simple to fabricate, light-weighted, and disposable.

Received on: 12th-July-2016

Revised on: 26th-July-2016

Accepted on: 12th-Aug-2016

Published on: 14th-Aug-2016

KEY WORDS

load sensors, carbon nanotubes, stem cell, piezoresistivity

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INTRODUCTION

Carbon nanotubes (CNTs) exhibit unique structural, electromechanical, and thermal properties as well as their nanometer scale diameter and high aspect ratio, which make them ideal sensing components in applications for load and strain sensors [1]. When CNTs are subjected to mechanical deformations, their resistance varies due to the applied changes in their band structures. This matter implies the potential use of CNTs as sensing component in piezoresistive load sensors. Both individual single-walled carbon nanotubes (SWCNTs) and multi-walled carbon nanotubes (MWCNTs) were found to show a repeatable load-unload relationship between their mechanical deformation and their electromechanical properties [2-5].

A review paper by Obitayo and Liu, has presented some important features of CNTs for strain sensing [6]. Dharap et al. have used pure SWCNT films (bulky paper) as sensing component in strain sensors [7]. In addition, CNT composite films can also be used for strain sensing. For example, Pham et al. have fabricated a poly (methyl methacrylate)/MWCNT composite film based sensor [8]. Also, a new type of polyisoprene/MWCNT composite strain sensor was reported by Knite et al., Kang et al., and Loh et al., which have cited the use of CNT/polymer composites as strain sensors for structural health monitoring [9-11]. Moreover, Li et al. have proposed a freestanding MWCNT film (bulky paper) as a strain sensor [12]. In 2011, two outstanding studies on stretchable carbon nanotube strain sensors were conducted by Yamada et al. and Lipomi et al., which claimed to facilitate the detection of human interaction, human-motion, and biofeedback [13,14].

In the commercial micro-electro-mechanical systems (MEMS) products, silicon materials are used as conventional substrates and microfabrication processes are used as manufacturing approaches, which all require access to cleanroom equipment [15]. Although silicon based MEMS products show excellent performance, both materials and fabrication processes are expensive. Another alternative for sensor substrate is polymer composites. In Spite of recent attempts to use polymer materials (e.g. polydimethylsiloxane, polyethersulfone) as flexible substrates [16-20], the costs of these materials and complex fabrication process have restricted their applications. Recently, paper has drawn much interest as a new alternative technology for fabricating simple, low-cost, portable, and disposable analytical devices for many applications [21-25]. In 2011, Liu et al. reported the fabrication of a paper-based piezoresistive force sensor [26]. In order to measure force, they took advantage of the piezoresistive effect generated by graphite ink as a conductive material that was patterned on a paper substrate. After that, Ren et al. suggested a paper-based Piezoresistive sensor based on Liu et al. work [27]. In this work, graphite was used as sensing component, and they tried to develop a less expensive fabrication process than the previous work; for example, they substituted silver ink for contact pads to copper foil.

Here in this paper, we have developed a new high-performance paper-based load sensor by using MWCNT ink as a sensing component, which is an excellent piezoresistive material. Printable MWCNT and silver inks were fabricated, and the electrical properties of MWCNT ink were studied. In order to reduce time, cost, and waste during fabrication, also increasing reliability, repeatability, and sensitivity of the sensor, inkjet printing process was used to create electrical circuits onto the paper. Basic parameters of MWCNT/paper load sensor, e.g. rang of linearity, sensitivity, and force resolution were measured. The effects of sonication time, number of printing, and temperature on the ink resistance were investigated. This load sensor is inexpensive, simple to fabricate, light-weighted, and disposable. Due to these characteristics, this sensor can be recognized as an appropriate single-use device in analytical applications such as medical diagnostics.

MATERIALS AND METHODS

Principle of Paper-based Load Sensor

Piezoresistivity is a common sensing principle for many micromachined sensors. The main principle of sensors like this is using the piezoresistive effect of the sensing components. In this study, MWCNT was used as sensing component, and the paper-based sensors were formed in the shape of cantilever beams, using a laser cut. In addition, the conductive components were printed using a HP Deskjet 1600CN printer. By applying a concentrated force at the free end of the cantilever beam and measuring the change in the resistance of the sensing component, as a result of deflection, it was possible to calculate the quantity of the applied load (see Supplementary Information for details regarding the designed setup for measurement).

Inkjet Printing Process

For obtaining printable inks from different particles, e.g. CNTs and silver powder, the listed factors should be considered. (1) The diameter of the particles should be less than 1/100 the size of the nozzle diameter, if not nozzle clogging would normally happen [28]. (2) Ink viscosity, affecting the formation of drops, should be in the range of 2-30 mPa s [29]. (3) Ink surface tension, dictating the spherical shape of the liquid drops coming from the nozzle, should be up to 60 mN m⁻¹ for reaching an acceptable printing process [29]. Inks with high surface tension may not wet or travel through the cartridge assembly, which results in a clogging or irregular printing. On the other hand, low surface tension can lead to an ink leakage from the cartridge and may make the print head to flood during the printing process. (4) Stability is an essential factor to achieve a suitable ink. Different methods are used for obtaining inks with high stability such as: (i) placing functional groups like carboxyl ((CO₂H)_n) on the surface of the particles, (ii) using different dispersion methods (e.g. ultrasounds or flow impingement) [29], (iii) using different surfactants like pluronic F127 (triblock co-polymer) [28], methanesulfonic acid [30], dioctyl sodium sulfosuccinate [30], poly(N-vinyl-2-pyrrolidone) [30], and polyelectrolytes [31]. The appropriate stability time for an ink is about one week at room temperature, which in this period the particles should not settle or agglomerate [29].

MWCNT Ink Preparation

For obtaining an efficient dispersion of CNTs in the solvent, the hydrophobic surface of the nanotubes needs to be changed to a hydrophilic surface by attaching polar groups such as carboxyl, interacting with solvent molecules and forming hydrogen bonds. It is important to know that CNT ink is not a true solution; therefore, CNT ink can be described as a colloidal suspension, which is either stable (colloid) or sediments with time (suspension) depending on the CNTs concentration. In order to prepare CNT ink, a suspension including the following material should be prepared: functionalized MWCNTs (MWCNT-(CO₂H)_n), distilled water as solvent, IPA and DEG as co-solvents, and CTAB as surfactant. MWCNTs used in this study were produced by Research Institute of Petroleum Industry (RIPI) through the chemical vapor deposition (CVD) method. They were characterized by an average diameter of

10-50 nm, length of 1-3 μm , and carbon purity of 96%. IPA, DEG, and CTAB were purchased from Merk. Details regarding the process of fabricating a printable MWCNT ink are mentioned in the Supplementary Information.

Silver Ink Preparation

In order to prepare the silver ink, Ag powder was purchased from American Elements with the characteristics of powder particle sizes average in the range of 10-50 microns and electrical resistivity of $1.586 \mu\Omega \text{ cm}$. Because Ag powder was not functionalized, it was crucial to use an appropriate surfactant in order to have a stable ink. Same as the work done by Kosmala et. al. [28], pluronic F127 was used as surfactant in the silver ink. F127 is a triblock co-polymer, which comprises poly ethylene oxide (PEO) and poly propylene oxide (PPO) sections organized in a PEO-PPO-PEO arrangement. One of these sections is hydrophilic (PEO) and the other is hydrophobic (PPO). The hydrophobic Ag particles are encapsulated by the PPO section. These encapsulated particles are covered by a layer of free PEO, which helps the Ag particles to remain stable [32]. Same as CNT ink, distilled water was used as solvent and both IPA and DEG as co-solvents (see Supplementary Information for the process of silver ink preparation).

Sensor Fabrication Process

In order to prepare the cantilever beam, an A4 paper with a thickness of $340 \mu\text{m}$ was chosen as the substrate and it was patterned to the required dimensions ($44.5 \text{ mm} \times 7.7 \text{ mm}$) using a laser cut with a precision of 0.12 mm . In the next step, MWCNT ink was printed at the initial section of the cantilever beam using a HP Deskjet 1600CN printer. The electrical contact pads were printed using the fabricated silver ink. In order to certify the connections between the printed contact pads and sensing component (MWCNT ink) a small drop of silver ink was placed on the connections using a painting brush. At the end, by connecting the contact pads to the multimeter (Keithley 2400 source meter), it was possible to read the resistance change of the system. A simple illustration of the final cantilever beam sensor can be observed in Figure 1.

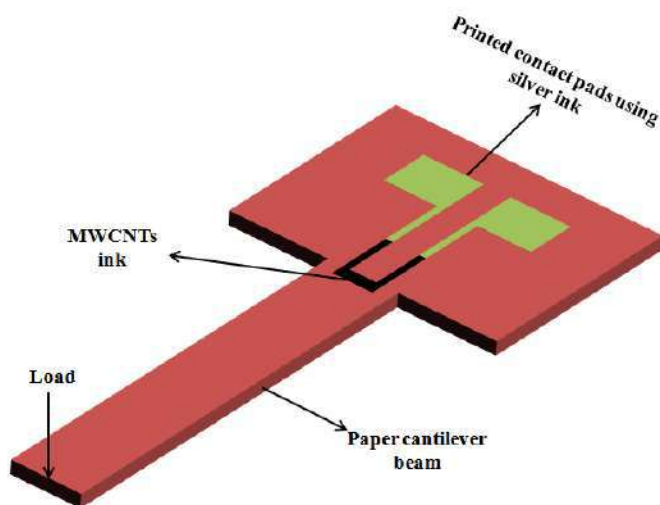


Fig. 1: Schematic view of a paper-based cantilever beam load sensor using a MWCNT resistor as the sensing component cantilever beam

RESULTS

Sensor Mechanical Analyses

At first, we determined the stiffness of the paper beam by applying forces as a function of deflection to the free end of the beam (Figure 2a). As the results demonstrated, the stiffness of the paper beam was about 2 GPa. Then the Young's modulus of the beam was calculated by Equation 1:

$$E = 4FL^3 / \delta WH^3 \quad (1)$$

Here the young's modulus is shown by E, the applied force to the end of the beam is presented by F, the deflection by δ , and the length, width, and thickness of the paper beam are shown by L, W, and H, respectively. By applying Equation 1, the young's modulus calculated for the paper beam was about 2 GPa, which is much lower than that of silicon (130-170 GPa) [26].

Moreover, COMSOL Multiphysics 4.2 finite element software was used for extracting the stress distribution, in order to determine the location of the connections on the sensor. The number of elements for modeling the sensor was about 1200, which gave sufficient resolution for the present simulation. Figure 2b shows the Von-Mises stress contour for the designed sensor, when a point force is applied at the free end. The induced stress on the surface is uniaxial and increases from zero at the free end to maximum at the clamped end. The stress at the clamped end is readily amplified by a constriction. Owing to the fact that we have the highest concentration of strain in the bending point (Figure 2b), unlike other works that have located the connection points on this area [26,27], we have shifted the connection between the contact pad and the sensing component to a lower point. In this way, we have decreased the effect of resistance change of silver ink, as the contact resistance, on the total resistance change of the system. The effect of silver ink on the measured resistance is explained as follows [12]:

$$R_{\text{measured}} = R_{\text{contact}} + R_{\text{MWCNT}} \quad (2)$$

The measured resistance (R_{measured}) includes the contact resistance (R_{contact}) and the resistance of MWCNT (R_{MWCNT}). As it can be seen in Equation 2, by changing the location of the connections we have eliminated the irreversible and non linear contact resistance (R_{contact}) in order to minimize the noise in the system.

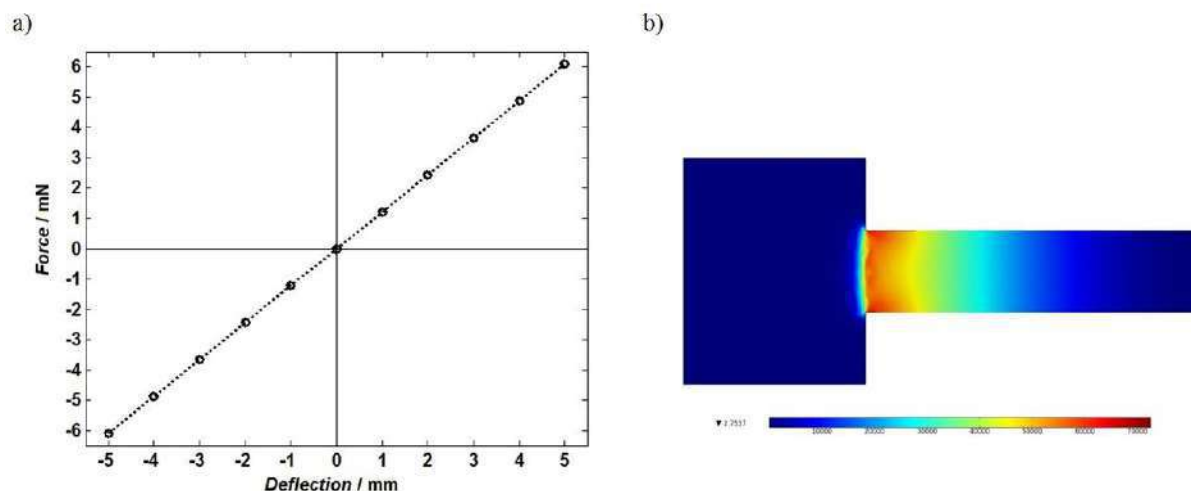


Fig.2: a) Calibration plot of force–deflection. b) Von-Mises stress contour calculated by finite element analyses (FEA) using COMSOL Multiphysics 4.2.

Ink Electrical Properties

The effect of sonication time, as a processing parameter, has been investigated in this work (Figure 3a). It has been observed that the resistance of the MWCNT ink significantly decreases by increasing the sonication time, as shown in Figure 3.

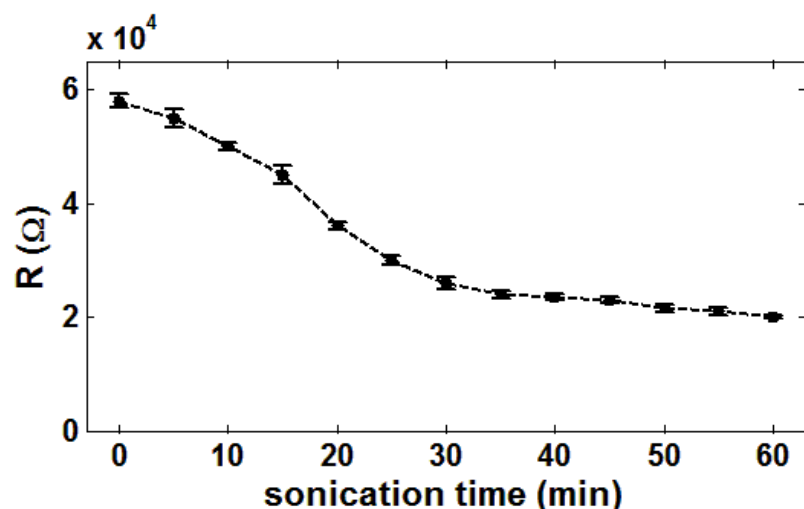


Fig. 3: The resistance values of the multi-walled carbon nanotubes ink versus sonication time.

Generally, due to the strong van der Waals interactions among individual CNTs, they are mostly observed as a group of individual tubes forming thicker ropes with longer lengths (Figure 4a). These rope structures are commonly referred to as CNT ropes, which are the usual form of the synthesized CNTs with the current synthesis processes (rather than individual tubes). It has been shown that by increasing the time and power or the sonication process, these CNT ropes can be separated to individual tubes or smaller sized ropes [33,34] (Figure 4)

By conducting the centrifugal process along with the sonication, we are actually eliminating the large ropes remaining after sonication. Hence, by continuing this process, or better to say increasing the sonication and centrifugation time, a gradual reduction in the CNT rope size (decrease in the diameter and length) can be observed (Figure 4). As will be explained later, this fall in the size of CNT ropes (shorter and thinner ropes) increases the piezoresistive sensitivity of the fabricated sensor by raising the number of inter-tube contacts, increasing the ratio of tunneling resistance to the overall resistance of the thin film [35-37].

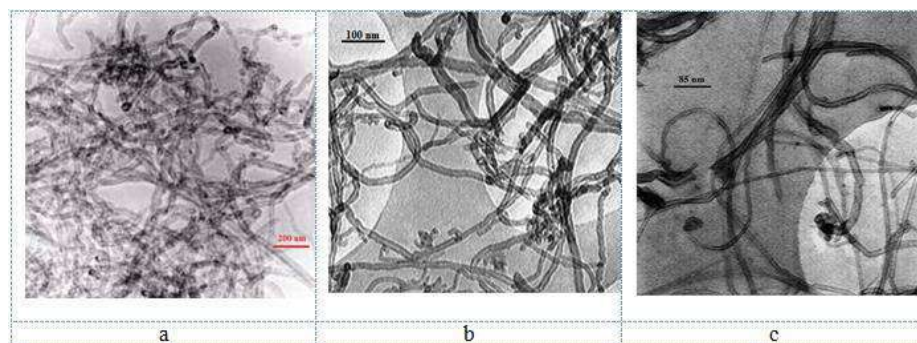


Fig. 4: TEM images of MWCNTs after a) 30 min, b) 4hr, and c) 7hr sonication.

Also, the surface resistance of the MWCNT and silver deposit printed on the paper sensor are plotted versus the number of printing in Figures 5a and 5b, respectively. Based on the ASTM D-254 standard, sheet resistances were performed at room temperature. It was found that the electrical resistance drops with increasing the number of prints, as the layer of nanotubes increases in thickness and achieves the percolation threshold (after printing 12 times).

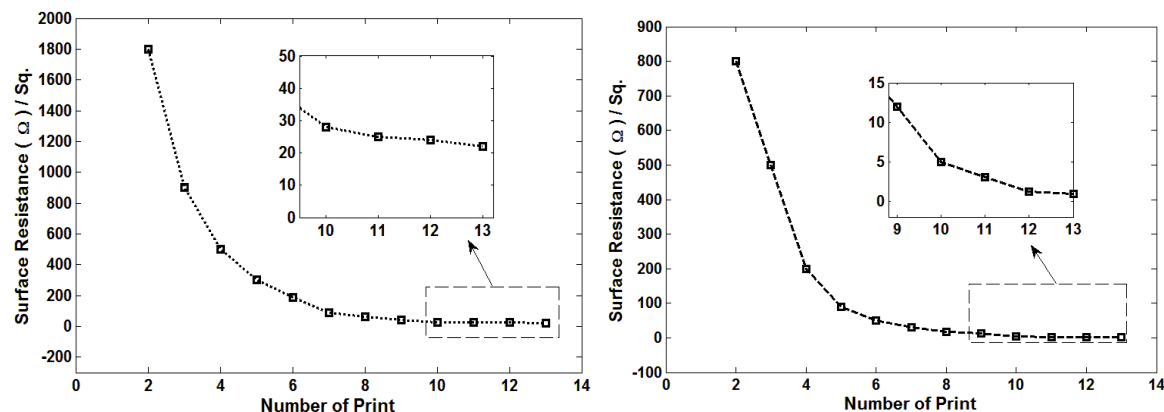


Fig. 5: a) The surface resistance versus the number of printing for MWCNT. b) The surface resistance versus the number of printing for silver.

However, gauge factor of the fabricated sensors presented different behaviors, regarding the number of printing (film thickness). Our work indicated the fact that sonication time can play a decisive role in determining the importance of this factor on the sensor's performance. As Figure 6 shows, the gauge factor of sensors fabricated using inks with low sonication time illustrated none or small dependence on the number of printing. On the other hand, by increasing the sonication duration up to about 7 hrs, reaching CNTs with shorter lengths and smaller diameters, an intense positive relation was observed between the number of printing and the sensors gauge factor. A clear understanding has not yet been reached on the mechanisms involved in the thickness-dependent piezoresistive response of the fabricated sensors; however studying Figure 6a clearly shows the compound influence of the detailed packing structure of MWCNTs. Up to now, several works have focused on studying the geometric packing of thin-rods or fibers [38-40], which in most of them rod excluded volume is considered as an important physical factor in dictating rods structure. This volume is referred to the area around a rod which is not accessible for the center of another rod. This volume is usually estimated by dL^2 , where d and L are respectively the diameter and length of the rods. According to the mentioned parameter, the number of randomly packed rods in a unit volume, rod packing density, can be approximated by $1/dL^2$ [41]. Luo et al. [41] have proven the direct relation between gauge factor and packing density for large deformations. Hence, by increasing the sonication time and number of printing, we are actually increasing the packing density via decreasing the diameter and length of the CNT ropes. Figure 6b illustrates the SEM image of the packing structure of MWCNT thin fills.

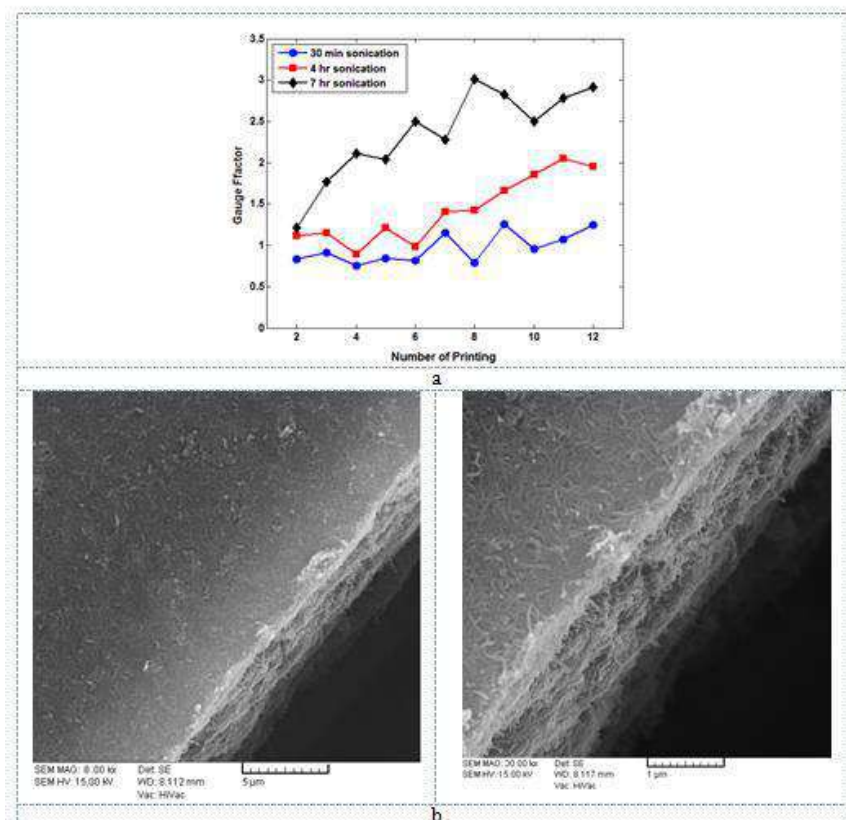


Fig. 6: a) The effect of number of printing (film thickness) and sonication duration on the gauge factor of MWCNT thin film piezoresistive sensors b) SEM image of the packing structure of MWCNT thin fills.

Figure 7a illustrates the measured voltage-current (V-I) characteristics of the MWCNTs film. The linear ohmic V-I behavior indicates the correlation between the piezoresistivity of MWCNTs and the deflection caused by the loaded force. The results determined a resistance of 20.54 kΩ for the resistors. Moreover, other factors have proved to have significant effects on the electrical resistivity of MWCNTs which we have investigated below.

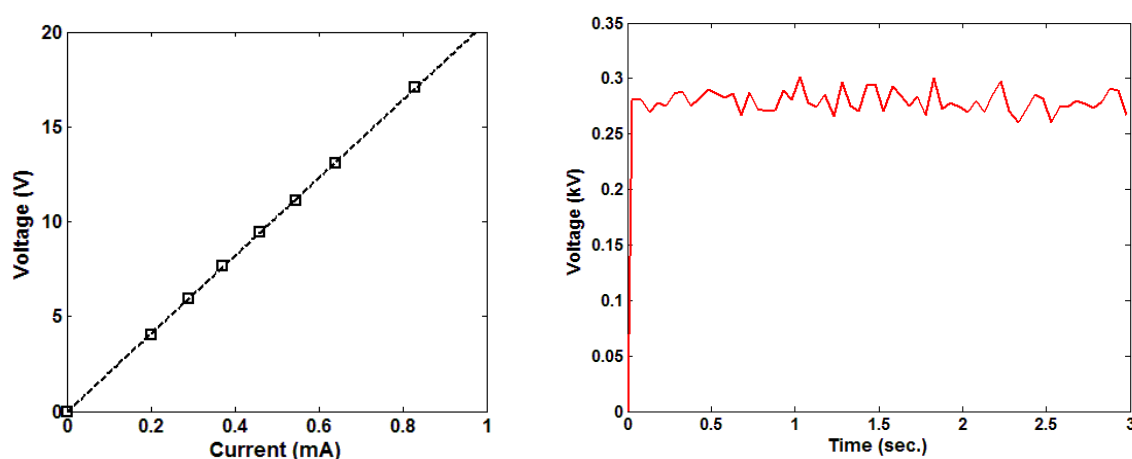


Fig. 7: a) Linear current-voltage curves for MWCNT ink resistors, showing the ohmic I-V characteristics of a good conductor. The line represents a linear fit to the experimental data with a regression equation: $y = 20.54x$ ($R^2 = 0.999$), b) Voltage stability of the MWCNT ink under free conditions (zero load)

The output voltage of printed MWCNT ink under free load condition (zero load) is shown in Figure 7b. The input current applied to the samples under free load condition was 150 mA and as the graph shows, the output voltage of MWCNT ink took a very short time to stabilize.

Calibration

In order to perform the relation between the applied compressive strain to the free end of the paper beam (input) and the resistance change (output) of MWCNT film, we have calibrated the paper-based sensor by using a multimeter. Figure 8 presents the calculated correlation between the experimental outputs as a function of inputs for printed MWCNT ink fabricated with different sonication times. The results have illustrated a linear resistance change with the applied force/strain. By studying the calibrated results (Figure 8), the average sensitivities (kslope) of paper-based sensor with 30 min, 4h, and 7h were calculated to be 0.00017, 0.0002 and 0.0004 (mN⁻¹), respectively. As expected, increasing the sonication time enhances the resistance change for a certain applied force/strain. Again, this matter could be explained by the positive effect of sonication time in decreasing the length and diameter of MWCNTs, leading to a raise in the packing density of the MWCNT thin film.

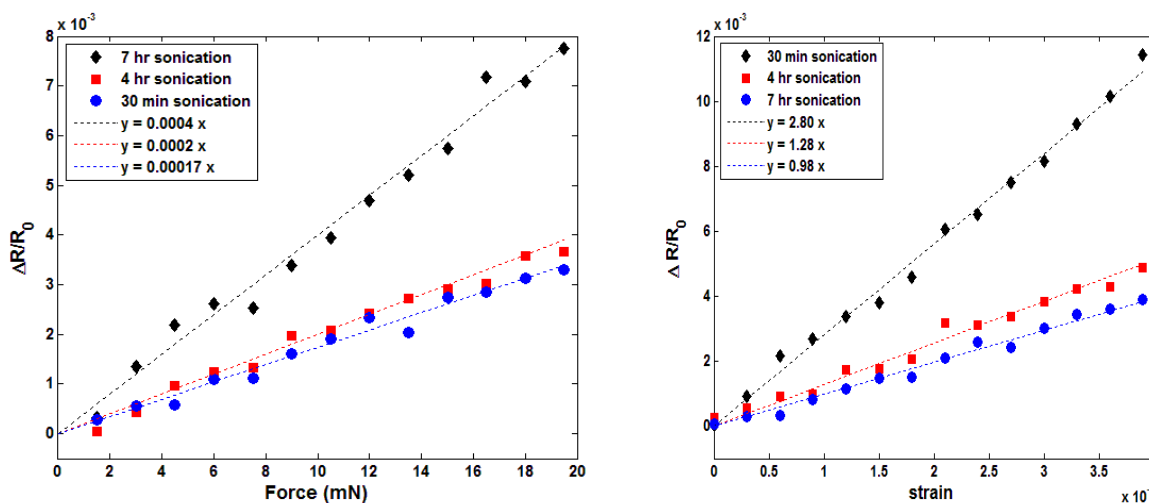


Fig. 8: Calibration plot of the output of the sensor (resistance change) as a function of applied a) force and b) strain for printed MWCNT.

Table 1 compares the measured gauge factors obtained from the fabricated sensor in this work with similar works in the field. By bearing in mind the simple fabrication process and the low price of the paper-based sensor, the presented results in Table 1 indicate an acceptable performance for the fabricated sensors using MWCNT inks with higher sonication times.

Table 1. Comparison between measured gauge factor values of CNTs sensors in different researches.

Work	gauge factor
This work (MWCNTs)	0.98 (30 min. sonication)
	1.28 (4 hr. sonication)
	2.8 (7 hr. sonication)
X Li et al. [12] (MWCNTs film)	2–3.76
Song et al. [42] (MWCNTs film)	0.01–1.25
Sickert et al. [43] (SWCNTs bundle)	2
Luo et al. [41] (SWCNTs film)	1–5

The observed piezoresistive behavior of CNTs in this study can be considered as the result of two parallel processes. First, losing the conductive channels by breaking down the existing conductive network, due to the applied strain, then forming new conductive networks due to the rearrangement in the conductive particles.

In order to analyze the behavior of CNTs under strain we first have to point out the network structure of carbon nanotubes as the main cause of the piezoresistive phenomena in this study. Carbon nanotube network consists of two

main resistances named the intrinsic, RCNT, and inter-tube. Moreover, the inter-tube resistance itself is divided into two types: the resistance caused by the tubes that are physically in contact, called the contact resistance, RC, and the resistance caused between the CNTs that are separated by a small gap which is called tunneling resistance, RT, (Figure 9) [6]. Changes in RCNTs, RTs, and RCs are closely related to the CNT network attributes, CNTs stress, positional and angular displacements of tubes, CNT volume fraction, etc. [44]. Therefore, the effect of deflection in CNTs resistance change in this study could primarily be explained by the modification in intrinsic resistance and inter-tube resistance.

Intrinsic Resistance of Carbon Nanotubes (RCNT)

Due to the one-dimensional structure of CNTs, which facilitates the electronic transport in the CNT network, they are known as materials with favorable electrical properties. It has been observed that intrinsic resistances have low values. As an example, this amount is as low as 0.2–0.4 kΩ s μm⁻¹ for MWCNTs [45,46]; however, they are highly sensitive to mechanical loading. As presented in different works [1,47-49], the high sensitivity of CNT can be explained by the fact that energy band gaps, which have a significant effect on CNT conductivity, are highly sensitive to the applied strain. To be more specific, the resistance of a conductive tube could be quantitatively explained by the following equations [3]:

$$RCNT(\epsilon) = R_0(1 + e\beta\epsilon) \quad (3)$$

Where:

$$\beta = (1/KT)(dE_{gap}/d\epsilon) \quad (4)$$

$$dE_{gap}/d\epsilon = 3t_0(1 + \nu)\cos(3\phi) \quad (5)$$

R_0 (kΩ) is a constant, E_{gap} is the band gap energy, t_0 is normally equal to ~ 2.7 eV and is the tight-binding overlap integral of carbon bond C-C, ϕ is the chiral angle ($0 < \phi < 30$), ϵ is the applied strain, and ν is volume concentration of CNT.

Inter-tube CNT Resistance (RC and RT)

Due to the fact that inter-tube resistance is much larger than intrinsic resistance, the conduction of CNT network cannot be only explained by studying intrinsic resistance. Inter-tube resistance is divided into two groups, the contact and tunneling resistances.

Contact resistance, RC, is defined as the resistance between the physically connected tubes. In this case, the conductions between tubes take place through electron diffusion from the connected points. Studies illustrate that contact region acts as a deciding factor in the quantitative amounts of contact resistance [50,51].

There are different factors such as extent of interfacial surface and the alignment of molecules across the interface affecting the amount of RC in a CNT network, which any modification in these parameters can change RC from a few hundred to a few thousand kΩ s [44].

On the other hand, sometimes there are no exact connections between the tubes, where conduction takes place through the small gap between the tubes using a mechanism called tunneling (Figure 9). In this case, the inter-tube resistance is called tunneling resistance, RT [52], and it can be quantitatively explained using the following equations:

$$RT = R_0 (e\lambda s) \quad (6)$$

For small bias voltage and rectangular barrier:

$$R_0 = (1/C_1)(S/k^{1/2}) \quad (7)$$

$$\lambda = C_2 k^{1/2} \quad (8)$$

Constants C_1 and C_2 are respectively equal to $C_1 = 3.16 \times 10^{10}$ and $C_2 = 1.0125$, k presents the average height of the potential barrier (eV), and S equals the gap width (Å).

As it can be observed from Equations 6-8, the applied strain can modify the inter-tube resistances by widening the gaps between CNT tubes, which this matter increases the resistance in the CNT network (Figure 9).

Although both intrinsic and inter-tube resistance increase by applying a mechanical load, their extent of contributions are found to be different. In this regard, since paper (as a load transfer medium) lacks the ability to efficiently transfer the externally applied mechanical load to each individual CNT tube, the effect of RCNT on the overall piezoresistive response of CNT thin film can be neglected. On the other hand, the applied load mostly varies the gap and conductive paths between the unconnected and connected tubes, respectively. This matter leaves RC and RT mainly responsible for the piezoresistive response of the fabricated sensor. Considering the numerical and experimental studies conducted by Theodosiou et al. [53] and Luo et al. [41,54], it can be concluded that RT is the

most important factor responsible for the piezoresistivity of CNT thin film. The direct relation between the amount of packing density ($1/dL^2$) and the number of conductive paths can support this idea. A decrease in the size of the CNT bundles (smaller length and diameter, higher sonication time) increases the packing density, resulting in an increase in the number of inter-tube contacts. This matter increases the effect of tunneling resistance on the overall resistance of the thin film [55,36].

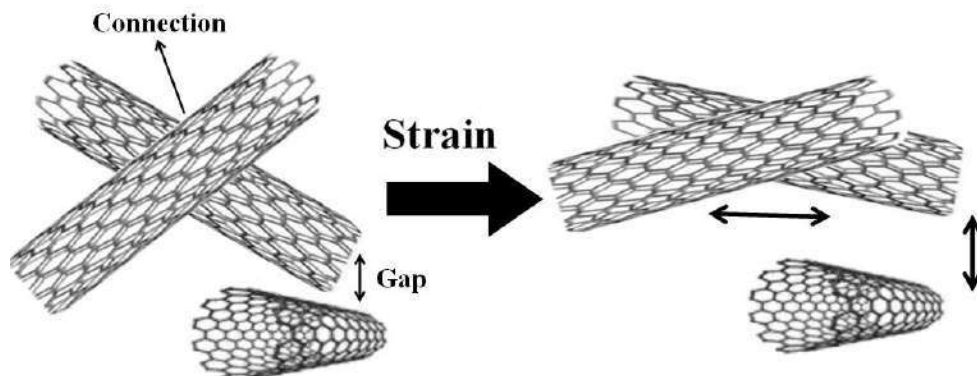


Fig. 9: Schematic of CNTs network after applying strain.

The stability of the fabricated sensor was examined through 1200 times repeated bending, Figure 10. The plotted data after each 200 cycle are the average of 5 times testing. Figure 10 depicts the change in the gauge factor of the synthesized sensor during 1200 cycles. The results illustrate a 7% increase in the gauge factor after the 1200 cyclic loading, indicating a considerable stability for the fabricated paper based sensor. This matter can be explained by the good network structures formed by the entanglement of CNT bundles/ropes and their good bonding with the paper substrate.

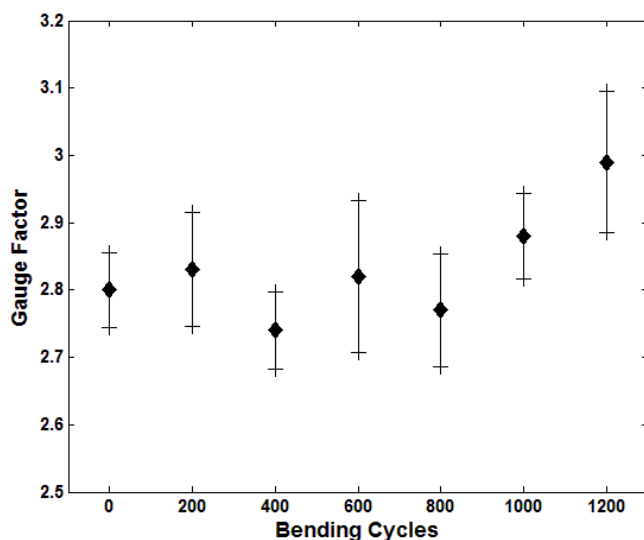


Fig. 10: Stability evaluation results for the selected MWCNT thin film sensors under 1200 cyclic tensile mechanical testing.

Moreover, the experiments revealed that there is a linear relationship between temperature and change in resistance. A raise in temperature resulted in an increase in the conductivity of the nanotube thin film as demonstrated in Figure 11. In this case, the resistance changed by 0.8Ω for a temperature difference of 35°C . According to the tunneling mechanism, electrons tend to jump from nanotube to nanotube across the gaps. With increasing the temperature these gaps expand, which makes it difficult for the electrons to jump between them. The rise in the gap lengths depends on the stiffness of the substrate. Increasing the temperature tends to reduce the stiffness of the paper, and correspondingly enlarges the tunneling gap. This enlargement of the gaps reduces the effect of the increase in electronic activities, due to the temperature rise.

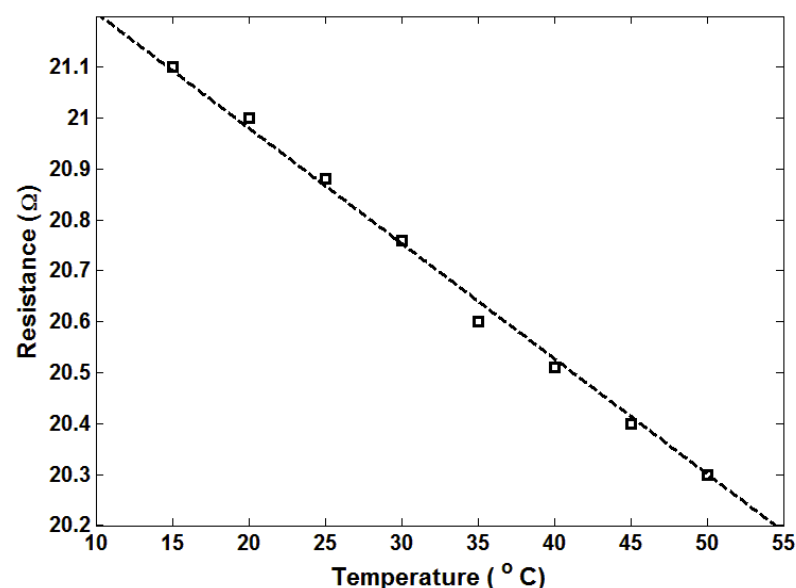


Fig. 11: Resistance as a function of temperature (from 15 °C to 50 °C).

However, the fabricated sensors have high amounts of CNTs, which elevate the number of contacts between the tubes, and decline the gap lengths. When the numbers of electrical contacts are sufficiently large, the conduction by electronic movement is dominant. Therefore, higher temperature tends to increase the electronic movement, resulting in higher electrical conductivity. This matter could also be explained by the semiconductive charge transport behavior of CNTs. The charge transport in CNT thin films is dictated by a variable-range hopping mechanism [56,57], which facilitates the charge carrier mobility and reduces the resistance at high temperature.

Monolithic Integration of a Signal-processing Circuit onto the Paper Device

Converting the change in the resistance to a more reliable signal (voltage) was done using a Wheatstone bridge circuit. However, in this study instead of using a printed circuit board (PCB) and wire-bonding for electrical connections; we have printed the conventional signal processing circuit on the paper. The structure and properties of the applied Wheatstone bridge circuit has been mentioned in the Supplementary Information. After integrating a Wheatstone bridge circuit, the sensitivity was measured to be 1.6 mV mN⁻¹.

DISCUSSION

Research activity in the areas related to carbon nanotubes has seen phenomenal growth in the last one and half decade. In this paper, an attempt has been made to use piezoresistive property of MWCNT ink in the sensing application. We have developed a paper-based sensor on the basis of piezoresistive property of MWCNT ink for measuring the magnitude of applied loads. We have prepared MWCNT ink with these constituents: functionalized MWCNTs (MWCNT-(CO₂H)_n), distilled water, isopropyl alcohol (IPA), diethylen glycol (DEG), and cetyltrimethylammonium bromide (CTAB). The sensor was in the shape of a cantilever beam, which was patterned on a paper substrate (340 μm thick) using a laser cut. Our sensor has exhibited these characteristics: natural frequency of 25 Hz, force range of 0-25 mN, force resolution of 60 μN, and sensitivity of 1.6 mV mN⁻¹. It was also found that an increase in sonication time, temperature, and number of printing resulted in a decrease in resistance. Finally, a monolithic integration of a signal-processing circuit was developed in order to decrease the footprints and noise effects.

ACKNOWLEDGEMENT

None.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

FINANCIAL DISCLOSURE

No financial support was received for this work.

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ARTICLE

REVIEW AND EVALUATE THE GEOLOGICAL STRUCTURE USING GRAVITY DATA-CASE STUDY

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ABSTRACT

This article focuses on the study of geological structure and gravity data using fractal techniques in an area of southern Iran. Try that with the help of fractal geometry (variogram) density determined by Nettleton. Which is the most widely used method for determining the density improves our promotion. The study area is regional oil that its data was collected by gravity the results are acceptable agreement with geological studies and drilling in the region.

KEY WORDS

Geology, variogram, bouguer anomaly

Published: 01 Sept 2016

INTRODUCTION

The word fractal is derived from the Latin word 'fructus' which means an irregularly broken and ground rock. It was brought up in 1975 for the first time by Benoit B. Mandelbrot. In recent years, Mandelbrot's brownian fractional surfaces have attracted a lot of attention because of their noticeable similarity to topography [2-4]. Observing shapes in the nature, it is concluded that Euclidean geometry is not able to state and explain natural complex and apparently irregular shapes. In Euclidean geometry dimension is an integer such as one, two and three. As a consequence, Euclidean geometry is able to explain one, two, three and higher dimensional phenomena. The other observation is not to consider dimension of phenomena and events to be integer. In addition, we accept that dimension can be changed continuously from zero to one, one to two, two to three etc. For example, if a line is of dimension one and a plate is of dimension two, a dimension between one and two can be attributed to a hundreds-of-times broken line in accordance with intensity of breaks in the figure produced.

MATERIALS AND METHODS

Fractal Method (Variogram)

Variogram method is widely used to identify dimension of fractal. Taking a large sample of couples of points (with different positions and distances) along with a profile and calculating the difference among their values, fractal dimension is easily obtained by drawing completely logarithmic graph of variance with respect to distance growth and calculating graph slope. Using this method, optimal density of the area can be achieved.

Geology of area

The considered area lies between longitudes 53° and 54° to 54° and 24' east and latitude 26° and 43' to 26° and 56' north. This area is spread out to Lavarán from the east, to Dehno Maragh and Bahmani from the north, Kalat and Mazra'e Jobran from the west and to Persian Gulf from the south. From a geological point of view and considering partitioning Iran, this under-research area is in Zagros area covering north parts of Bandar Abas to the west of Lenge port. Districts in this area belong to the end of mountains in south west of Zagros which is made up of two sub-areas of high Zagros and jagged Zagros. The main difference between these two sub-areas in the related part of Hormozgan province is mostly of structural differences, but taking sequences of stones into account, they do not differ.

Implementation theory of the method in the area

Calculations on the data of complete bouguer anomaly of the studied area made by surface Variogram method are as follows. Firstly, a point in the area with identified longitude and latitude is considered as center and a circle, centered at this point with the largest possible radius to draw, is drawn to include data as much as possible. This maximum distance is divided to 30 equal groups. Then, variance of bouguer data difference for each group is calculated and its logarithm is drawn with respect to logarithm of each group differences [1]. After investigating the graph, points which are supported by Earth's rigid crust and show fractal feature are selected and then we fit the regression line of least squares with them. The slope of this straight line which satisfies the formula $y=mx+b$ demonstrates fractal dimension of line,

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$$E\{(Z_p - Z_q)^2\} = K(d_{pq})^{2H} \quad (1)$$

where Z_p and Z_q are surface values in the points p and q , d_{pq} horizontal difference among the points and H is equal to $(3-D)$. Drawing logarithm of variance of differences caused by local complications of the surface with respect to logarithm of distance among the points results in a graph which the existence of a linear relation along the domain implies self-similarity along that domain, and its fractal dimension is gained by slope b of a drawn line in domain point. $D=3-b/2$

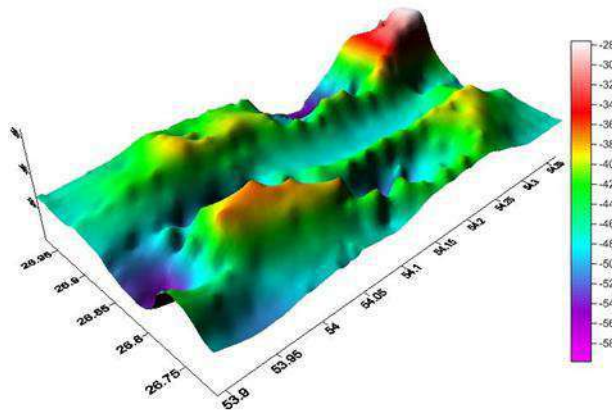


Fig. 1: Complete bouguer anomaly with density (2.5)g/cm³

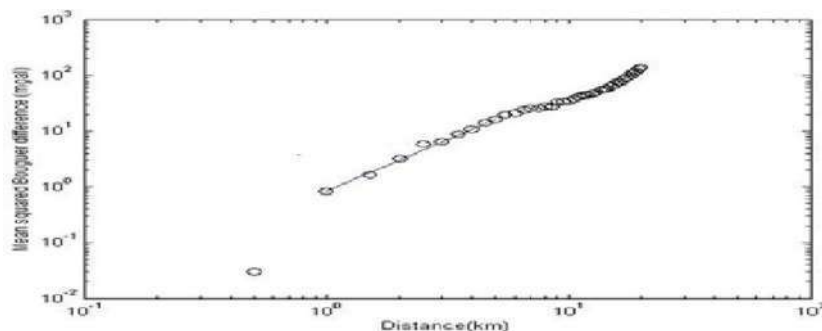


Fig. 2: Complete regression line of bouguer anomaly of the area with fractal dimension (2.33)

Identification scheme of optimal density in the area

In this section, to reduce the dimension of surface roughness of bouguer anomaly, optimal density is determined, and to achieve this goal, firstly, complete data of bouguer anomaly of the area with different density should be calculated. Then, fractal dimension of each new obtained data series is calculated using mentioned method and draw the results with respect to their density [5,6]. In the obtained graph, the minimum shown dimension has the best density which is $(2/8g/cm^3)$ for the under-research area.

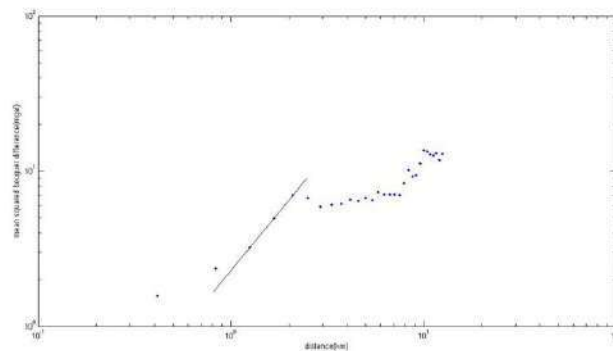


Fig. 3: Complete regression line of bouguer anomaly of the area with optimal density (2.8g/cm^3) with fractal dimension (2.21)

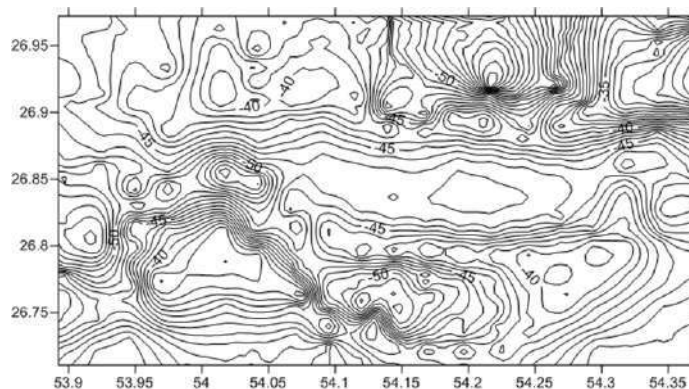


Fig. 4: Contour map. The complete Bouguer anomaly of the region with the density (2.8g/cm^3) and the balance distance 1 mm Gal; by using the Variogram's method

RESULTS

Usage of small and large amount of bouguer density in the bouguer plate and topography correction makes extra effect of topography on the results of bouguer anomaly. Supposing that gravitational field has usually less roughness in comparison with topography, we determine bouguer density with minimizing surface roughness of bouguer anomaly. The amount of this roughness has been determined by dimension of surface fractal.

In the west of the area (about 53.92, 26.81) the anomaly caused by salty dome in contour map with density of 2.7 is determines more clearly and more definite. In the north of the area (54.10, 26.95) the salty dome in contour with density of 2.8 with respect to contour map with density of 2.3 is more clearly distinguishable. Windows in Mishan formation (about 54.03, 26.86) which because of erosion caused displacement of Asmari limestone and is distinguishable in the contour map of topography of the area, in the contour map of bouguer anomaly with density of 2.7 is well-represented more clearly. In the center inclined to the west (54.03, 26.86) in the contour map with density of 2.8 a special anomaly can be seen that is likely caused by Barund's fault performance of north east-south west which made formations break and move and made waterway in the valley that cannot be seen in the contour map with density of 2.5.

CONCLUSION

Variogram method is widely used to identify dimension of fractal. Taking a large sample of couples of points (with different positions and distances) along with a profile and calculating the difference among their values, fractal dimension is easily obtained by drawing completely logarithmic graph of variance with respect to distance growth and calculating graph slope. Using this method, optimal density of the area can be achieved.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The authors are thankful to Hon'ble Dean and Management

FINANCIAL DISCLOSURE

None.

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RESEARCH

UNDERGROUND DAM MODELING USING SWAT SOFTWARE

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ABSTRACT

An effective approach for supplying water for various sectors especially in arid and semi-arid regions and fighting drought stress is to enhance underground water reserves. In this research, required properties for locating underground dams and water balance in Daragah watershed in Hormozgan province are investigated. These properties include the main features required for initial location of underground dams considered in all studies dealing with underground dam construction; however, for the first time, subsurface flow is calculated by SWAT hydrological model. Therefore, three criteria and ten indices (subsurface flow volume, surface flow volume, drainage density, alluvium depth, axis length, fulcrum lithology, permeability, slope, reservoir volume, and upstream catchment area) were adopted for prioritization. The determined regions evaluated based on three criteria as hydrology, reservoir and dam axis and prioritized according to the indices. Thus, locating the suitable place for construction of dam using SWAT model and the discussed indices is a scientific methodology for this task. This approach significantly saves time and cost and is able not only to determine the suitable locations, but also to determine the best region for construction of underground dam.

INTRODUCTION

Water shortage has been a major challenge in arid regions including a large part of Iran country. In these regions, it is extremely difficult to improve available water supply. Therefore, the main way to combat water deficit in these regions is to accurately protect and use the available water by a correct management. An effective way for accurate use of water in arid regions is to collect the water existing in these regions [1]. Use of groundwater has long has spread in Iran, which does not have an abundance of surface water resources. From the distant past to the present, sensitive exploitation of groundwater resources for reasons of social, technical and economic is considered more than other water sources. On the one hand, they are very good quality compared to surface water, existing endowments tanks under the ground, and etc., and has caused a lot of interest in water supply in the country. The use of underground water, although it is extracted, it is usually more expensive than water withdrawals from rivers, which for the following reasons is the most interest:

- They are usually free of pathogens and thus don't require purification.
- They have constant chemical composition.
- Underground waters are often colorless and lack darkening materials.
 - Underground waters are not affected by short term droughts [2].

The main problem in the development and creation of underground dams is the complexity of determining appropriate areas for dam construction. This problem stems from the fact that involved norms and many factors including physical, social and economic criteria in their proper location [3]. In this study, is consider simulated Daragah watershed water balance using the SWAT hydrological model and identify appropriate locations, in terms of surface and underground water flows and using the layers that is obtained SWAT model, as well as other layers of information to be taken to determine suitable locations for underground dam construction [4].

Research hypotheses

It is possible to anticipate the behaviors of artificial groundwater aquifers using underground dam modeling.

MATERIALS AND METHODS

In general, the present study is carried out in five steps as follows:

1. Identification and selection of the regions with high potential for construction of underground dam.
2. Identification of suitable points within these regions.
3. Determination and preparation of parameters required for prioritization.
4. Running SWAT model and simulation of runoff and subsurface flow.
5. Decision making.

At the first step, regions with high potential for construction of underground dam were evaluated. For this purpose, we used of extracted data from the base map, findings in this field, as well as expert opinions. This potential area is including alluvial bed rivers that are having maximum slopes of 5%, and there is no agricultural, industrial and residential land therein. In addition to the above conditions, this alluvial bed should not be based on linear structures, such as faults. To expedite decision making and also avoidance of to gather additional information to requirements about the studied issue, at first, we need to delete

KEY WORDS

SWAT Model,
Underground Dam,
Subsurface Flow,
Daragah Watershed,
Location.

Published: 10 Sept 2016

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inappropriate places taking into consideration a number of criteria and key factors. According to surveys and studies that have been conducted in other countries by researchers and experts about underground dams, suitable slope of waterways, to be able to create a suitable underground water tank with underground dam construction, where should not be more than 5%.

Regions Prioritization Criteria

The first step in evaluation of regions with high potential for construction of underground dams is to determine criteria and sub-criteria playing role in location of dams. To achieve the expected objectives, a model composed of three levels of goal, criteria, indices and items (classes) was developed. Level one is the target of research, which is the identification of suitable areas for the implementation of underground dam. At the second level, there are criteria for decision making or the parameters affecting this value including hydrological factors, factors related to dam construction site of related to the dam reservoir. On the third level there are sub-criteria. Sub-criteria or indicators of hydrology include subsurface flow, runoff volume and drainage density [5].

SWAT Model

SWAT is a model with physical basis as it simulates the process of the original system at large scale based on basic equations of physics. Most of the relations in this model have physical basis showing the need for a large number of variables for accurate running of the model. This model is in the semi-distributed models group, because in it, is spatial information for similar units together with hydrological data and considers the scope and drainage for the same units, which is described each network by its own parameters, initial conditions and inputs of rainfall. As a result, it is possible to predict the location of hydrological processes and erosion anywhere in the watershed. Furthermore, this model has been continuous, because is having components that defines evaporation and perspiration and water movement in soils between rainstorms and therefore, is able to balance water and energy among rainstorms [6].

Preparation of Input Data

Basic maps include digital elevation model (DEM), land use map and soil map. Before running the model, input data including climatic and hydrological data, digital elevation model, soil map, land use map, stream network map and sub-basin boundaries were prepared. In addition to the cases mentioned, it is necessary that at least one station selected in the catchment areas studied as meteorological reference stations, and 14 statistical characteristics of long-term meteorological information to be provided on a monthly basis in the Wgn file to model. The model can be used these data to simulate failures meteorological data. These data are shown in Table: 1.

Table 1: The necessary data model for meteorological reference stations

Row	Parameter name	Parameter characteristic
1	Mean daily maximum temperatures per month	TMPMX
2	Mean daily minimum temperature per month	TMPMN
3	Standard deviation of daily maximum temperatures per month	TMPSTDMX
4	Standard deviation of daily minimum temperature per month	TMPSTDMN
5	Mean total rainfall per month	PCPMM
6	Standard deviation of daily precipitation per month	PCPSTD
7	Coefficient of skewness of daily rainfall per month	PCPSKW
8	Probability of rainy day after a dry day in the month	PR-W1
9	Probability of rainy day after a rainy day in the month	PR-W2
10	Mean rainy days in the month	PCPD
11	The maximum half-hour rainfall in total of collecting statistics	RAINHHMX
12	Mean solar radiation per month	SOLARAV
13	Mean daily dew point temperature in the month	DEWPT
14	Mean daily wind speed in the month	WNDVAV

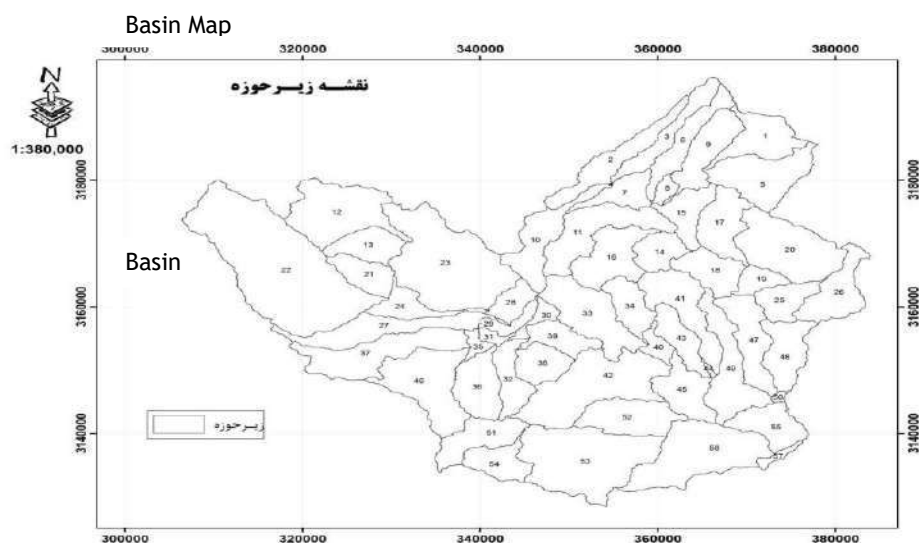
RESULTS

The Results of the SWOT Model

In SWAT model, sub-watersheds' maps are produced based on streams status of the watershed. Daragah watershed is divided in to 57 parts. Based on the results, the studied basin cover an area of 278512ha, 57 sub-watersheds and 286 hydrological reaction units (HRU) with the largest sub-watershed has 24599ha area and 5 HRUs (Table2).

Table 2: Profile of below catchment of inside basins provided by SWAT model

	Min height	Max height	Sub-basin	Min height	Max height
1	1676	2114	29	1478	2478
2	1595	1986	30	1475	2458
3	1595	2325	31	1487	1799
4	1594	1601	32	1475	1933
5	1676	2264	33	1448	2493
6	1584	2224	34	1448	1893
7	1583	1679	35	1514	1948
8	1579	1858	36	1514	1981
9	1580	2073	37	1541	2532
10	1594	2519	38	1432	1762
11	1562	2063	39	1433	2077
12	1602	2665	40	1339	1725
13	1603	2220	41	1290	2380
14	1528	2313	42	1338	1933
15	1527	1845	43	1296	1811
16	1563	2305	44	1289	1374
17	1475	2114	45	1294	2213
18	1476	2388	46	1541	2426
19	1430	1897	47	1233	1978
20	1430	2361	48	1232	1654
21	1659	2223	49	1222	2193
22	1660	2853	50	1222	1342
23	1522	2719	51	1637	2761
24	1522	2051	52	1324	2192
25	1359	1749	53	1324	2352
26	1359	1945	54	1637	2718
27	1496	2719	55	1085	2303
28	1496	2493	56	1084	2555

**Fig. 1:** Map of catchment of Daragah watershed mapped using the SWAT model

Calibration and Verification of Model's Prediction

The trend and period of calibration and verification of SWAT model for determining the prediction was performed for 30% of the remaining data to make prediction after ensuring its capability. Simulated average value of 50 river flow cycles was produced. Thus, after verification with respect to predictions was acting on the basis of the following forms to find the optimal value of the predictable cycle as advanced to acceptable and closer results, which then, they are compared with observational data [7]. The period of warming model was diagnosed with an important factor, while the forecast model.

Determine the Priority Axes

After accounting items related to each of the main criteria, indices of decuple, priority axes for each of the major and minor criteria were calculated separately in each of the branches of the decision-making and

finally, after mixing and collecting them, it was shown as a final number, which should be given the lower number, the desired axis is more value and a higher priority for underground dam construction.

Table 3: Prioritize the sub-criteria of the Hydrology main criteria

Axis Code	Volume of subsurface flow	Runoff volume	Drainage density
A 1	1	1	13
A 2	3	6	10
A 3	2	2	11
A 4	12	12	1
A 5	4	3	7
A 6	8	8	14
A 7	6	7	12
A 8	10	9	6
A 9	5	5	9
A 10	9	11	15
A 11	7	4	8
A 12	13	13	4
A 13	14	14	3
A 14	15	15	2
A 15	11	10	5

Table 4: Prioritize the sub-criteria of the dam construction main criteria

Axis Code	Depth of alluvium	Axis length	Abutments Lithology
A 1	9	8	1
A 2	5	9	2
A 3	6	10	5
A 4	7	13	5
A 5	10	7	4
A 6	12	3	1
A 7	2	6	1
A 8	3	5	1
A 9	13	12	3
A 10	4	14	2
A 11	15	4	5
A 12	11	2	3
A 13	8	11	3
A 14	14	15	2
A 15	1	1	1

Table 5: Prioritize the sub-criteria of the tank main criteria

Axis Code	Permeability	Slope	Tank capacity	Upstream basin area
A 1	2	14	12	12
A 2	8	3	4	10
A 3	4	9	10	9
A 4	7	8	5	13
A 5	6	1	3	5
A 6	1	6	9	11
A 7	11	15	14	8
A 8	10	10	13	1
A 9	9	4	2	4
A 10	13	12	8	14
A 11	15	7	7	3
A 12	14	2	11	6

A 13	3	11	6	15
A 14	5	5	1	7
A 15	12	13	15	2

As can be seen, axes A5, A15 and A5 were identified as the best places for construction of underground dams in Daragah watershed based on hydrological, dam construction and reservoir criteria; respectively. By combining all the findings, A5 is selected as the best axis. Final prioritization map of the studied axes is depicted in fig. 2.

Table 6: Prioritize the sub-criteria of the tank main criteria

Axis Code	Hydrology	Dam construction	Dam tank	Total
A 1	2	4	10	6
A 2	3	3	4	2
A 3	2	6	6	4
A 4	4	9	7	11
A 5	1	6	1	1
A 6	6	3	5	6
A 7	4	2	13	10
A 8	4	2	8	4
A 9	3	10	3	3
A 10	9	5	12	13
A 11	3	8	6	7
A 12	6	3	7	8
A 13	7	7	9	12
A 14	8	11	2	9
A 15	5	1	11	5

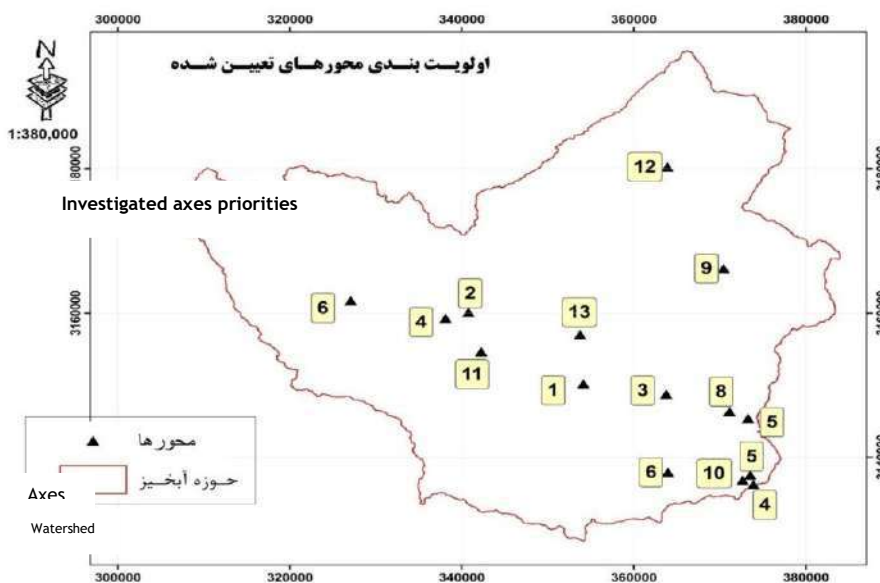


Fig. 2: The final map of investigated axes priorities for underground dam construction

CONCLUSION

The findings result from the first run of SWAT model and evaluation of simulation accuracy indices show that this model, in the first run and using default values of the parameters, was not able to accurately model the peak discharge time regarding coincidence with rainy months and real peak discharges. Obtain low values of evaluation indexes and unacceptable estimate compared to the actual values is not acceptable accuracy for runoff flow simulation of Daragah river watershed, and calibration of this model can help to improve results and increase accurately simulate it. So, after this step was done to verify the calibration of the model in order to improve the accuracy of runoff flow simulation in the Daragah watershed. Because achieving high levels of evaluation criteria, very good modeling, the time of occurrence of peak flows and based peak, and despite more estimates of peak discharges is desirable the modeling results. In general, the results obtained are indicative of the ability and acceptable accuracy of SWAT model in the simulation monthly runoff flow rate of Daragah watershed. The findings of this study

confirm the study's results of Goudarzi & et al (2009), Omani & et al (2006), Rostamian & et al (2008), Changbin & et al (2010), Shimelis & et al (2010), Tibebe & Bewket (2010), Xu & et al (2009), that in general, they have declared satisfactory the ability of SWAT model in simulation of river flow in the studied area.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None.

FINANCIAL DISCLOSURE

None.

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RESEARCH

DESIGNING BANDAR ABBAS RAILWAY STATION BY SUSTAINABLE ARCHITECTURE APPROACH (CLIMATIC SUSTAINABILITY)

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ABSTRACT

Increasing growth of population together with increased modifying activities of human in surrounding environment has caused fundamental and often catastrophic impacts on the earth's habitats including uncontrolled energy consumption, forest degradation, environmental pollutions and extinction of plant and animal species. This situation has rendered sustainable development and related issues as a major concern for current societies. Compared to other types of transportation, railway is considered as one of the safest transportation ways. Participants of this industry, however, have been always concentrated on increasing safety of transportation of railway vehicles. Obviously, the environment surrounding the rails and safety of trains' transportation interact with each other. Although the main concern in designing the railways is to maximize safety, the changes occurring at surrounding environment as a result of railways establishment may compromise safety of transportation and neighboring residents. The main objective of the present study is to design Bandar Abbas railway station based on sustainable architecture approach. This is a quantitative research based on analyzing climatic principles and data. Data were collected by library and field studies to gather climatic perspectives. Data were analyzed using climate software. In library study, standards and properties of railway station were investigated. Psychological study of train travelers and investigating similar designs constitute another part of this study. Moreover, designing principles in hot and humid climate were extracted from the relevant books. Filed study includes visiting the site, visiting train stations within the country and interviewing with the travelers via questionnaire.

INTRODUCTION

KEY WORDS

Railway Station,
Sustainable
Architecture, Bandar
Abbas, Workstation
Design

After technological changes during industrial revolution, emergence of new concerns and problems, and human conflict to gain his previous calm space and necessity to exploit the emerging phenomenon of iron century, have forced the human to consider aesthetic issues while using these products. In between, emergence of railroad as a widespread and indispensable transportation way was the first attempt of human to create a humanistic and not merely functional medium to meet his demands [1].

Railway is a fundamental and undeniable principle of transportation which is widely used all over the world; the use of this facility has been growing during recent years by astonishing progress in designing and manufacturing express trains. Major railway stations are urban symbols in European metropolises; often used as a site for creating magnificent architectural works regarding their important role in people life as rail gateways of the city. The old history of such architectural works indicates the prominent role of railway in human life in developed countries and highlights the need for innovation and creativity in designing urban and intercity train stations [2].

Also Iran, despite the fact that was not in such blind development, but inevitably is forced to use the achievements of this period, since the age of communication has its own language and to create communication, which is inevitable in human life should know the language. Railroad is the longtime economic activities in Iran, which according to its importance since their arrival in Iran, including centers that be attracted to it a lot of professionals and technologists and engineers in the country and be central to train the best technical personnel in the country. But the lack of development and its all-round development in the years after the launch in Iran is stagnating. This may be resolved in accordance with policy makers and planners in the country and rail transportation become a lucrative part of the country and attract and employ the most efficient technical and engineering personnel. In smaller dimensions, one of the ways of railways flourish in Iran is encouraging people to use the train to travel inside and outside the city [3]. There are various ways to attract people towards this mode of transportation, which is detectable in various aspects of civil, economic and sociological. But from an architectural standpoint, perhaps one of most effective strategy is to provide traveler comfort conditions in train stations. This comfort can be considered in several aspects: physical comfort (proper circulation), environmental comfort (to meet the needs of climate and environmental psychology), eye-catching of space station (in terms of beauty of form), proper ventilation and so on. On the other hand, the railway with low energy consumption is highest result in the transport sector, while according to the sensitivities of today about environmental pollution will enter the minimum harm to the environment. Therefore, the researchers intends to design the train station with the attitude and approach of sustainable architecture, which honoring the environmental conditions and are intended to user comfort, achieve a model for designing these spaces [4].

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Published: 10 Sept 2016

Research Hypotheses

- It seems that sustainability principles regarding climatic aspect of the bed can be designed in the context of shape.
- Sustainable designing of Bandar Abbas train station based on social and environmental issues and local and climatic properties of the city can be completely in alignment with performance of a train station.
- Presence of sustainable condition based on climatic properties in the railway station may improve travelers' satisfaction and comfort during the travel.

SUSTAINABLE ARCHITECTURE

Sustainable construction is defined as follows: "management of a clean and healthy environment based on effective use of natural resources and ecological principles"; the main objective of constructing sustainable building is to reduce its negative impact on environment, energy resources and nature following these rules [5]:

1. Reduce consumption of non-renewable resources.
2. Development of the natural environment.
3. Eliminating or reducing the use of toxic substances or harmful on nature in the construction industry.

Construction techniques in a broad zone try to provide quality integrated in terms of economic, socially and environmentally. Therefore, the rational use of natural resources and construction proper management has helped to preserve limited natural resources and reduce energy consumption (energy conservation) and will lead to improvement of environmental quality [6]. Sustainable design is architecture thoughtful collaboration with engineering of mechanical, electrical and structural. In addition to conventional design factors, such as beauty, fitness, and texture, shadow and light and the facilities that should be considered by the designer group, should pay attention to long-term factors of environmental, economic and humanitarian and consider the basics of it.

RAILWAY STATION SPACES

By examining the railway stations to conclude that different required spaces at the railway terminal is as follows [7]:

Travelers and greeters entrance: 1. Input platforms. 2. Travelers and greeters assembly hall. 3. Restroom. 4. Information. 5. Hotel reservation. 6. Warehouse gets objects for short-term. 7. Police. 8. Entry and exit gate. 9. ATM. 10. Parking.

Travelers and escort exit: 1. Parking. 2. Spaces for the establishment of porters. 3. Input and Input filters. 4. Police. 5. Room for waiting. 6. Travelers waiting hall. 7. Public relations. 8. Information. 9. Buy tickets. 10. Business sector. 11. Space for recreation. 12. Mother and child room. 13. Telecommunications, post and telephone. 14. Toilets. 15. Exhibition. 16. Output filters. 17. Exit corridors. 18. Exit platform.

Service-welfare spaces: 1. Restaurant. 2. Coffee shops. 3. Prayer room. 4. Services sector: dressing room, staff resting space, warehouse. 5. Emergency. 6. Bank. 7. Public transport stations. 8. Taxi within the city and the car parks. 9. Luggage warehouse and its side spaces.

Office spaces: 1. Supervision. 2. Assistance. 3. Conference. 4. Secretary. 5. Typing and filing. 6. Protective and night duty. 7. Procurement. 8. Public relations. 9. Center of Statistics and control. 10. Accounting. 11. Toilets. 12. Pantry. 13. Telecom.

Installation: 1. Required equipment spaces. 2. Access. 3. Department responsible. 4. Warehouse. 5. Electrical switchgear room.

MATERIALS AND METHODS

This is a quantitative research based on analyzing climatic principles and data. Data were collected by library and field studies to gather climatic perspectives. Data were analyzed using climate software. In library study, standards and properties of railway station were investigated. Psychological study of train travelers and investigating similar designs constitute another part of this study. Moreover, designing principles in hot and humid climate were extracted from the relevant books. Filed study includes visiting the site, visiting train stations within the country and interviewing with the travelers via questionnaire.

SITE

The target site is the current location of Bandar Abbas railway station.



Fig. 1: Map location of Bandar Abbas railway station, source: (wikimapia.com)

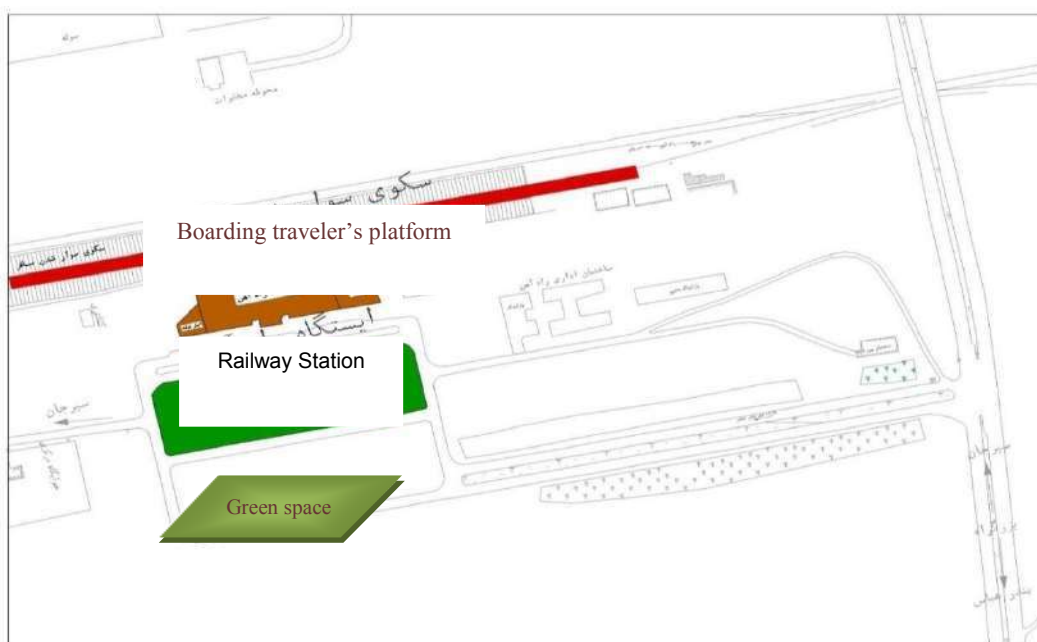


Fig. 2: Project land position, Source: (Author)

PRINCIPLES AND DESIGN CRITERIA

Criteria of Designing Railway Station

A railway station is composed of station lines, platforms, main connecting ways and terminal building. Considering planning of railway lines and location of station plan according to the network, three types of traveler stations can be used [8]: total station, terminal station, final station.

Yards and Terminal of Freight Trains

Railway yards represent workshops and facilities used for storing the materials relating to unused cars. Facilities of freight train terminal usually are composed of at least three parts: a receiving yard to which entering trains are directed from main line and stay temporally to become classified and separated later

[2]. Classification yard in which, the wagons are separated and classified into groups with common destinations. Exit yard in which, the separated cars are connected and entrained and retained temporally for making decision about movement to main line. In general, at least 50 feet is necessary for each freight car. There is an exception for repairmen lines that requires 55 feet for each uncoupled car and lines of special equipment in which the distance between two centers shouldn't be less than 13 feet. Exit yards should possess enough number of lines so that at least one of them is available for montage of a leaving train when necessary. The length of exit lines depends on the lengths of separated trains including locomotive. [2].

Design and Planning of the Railway Stations

From the standpoint of an engineer and designer of the railway, a station is including six main factors: 1. Rail route and signs. 2. Platforms. 3. Required spaces to facilitate the movement of travelers and pedestrians spaces. 4. Ticket sales booths and space related to retailers. 5. Parts of the trustee and the postal service. 6. The station entrance door.

To provide safety and transportation comfort for the travelers, all of these factors should be exactly defined, delimited and placed apparently near each other by applying suitable planning and signs. Suitability of connection routes among the train, platform, store and safety offices is also important for railway staff. Necessity for equipping the managers' offices with closed-circuit television systems and computer controls represents another urgent issue that should be considered in layout of railway stations. The number and length of platforms in a station are determined by position and application type of the station. The number of platforms depends to large extent on the number of trains moving through the station.

Table 1: Platform different widths

Minimum width from the edge of the platform, to the nearest obstacle	2500 mm
The minimum width of all platforms slate-discrete	4000 mm
Suggested width for a busy stations	8000 mm
Platform Set width to train the body to the extent permitted of m/h 100 (Km/h 160)	3000 mm

Table 2: Design and dimensions of the platform

Length	Higher than the maximum length of the train
End slopes	Up to 1 in 8
Cross slope	Typically 1 in 40
	At least 1 in 100
Platform height (from the top surface of the rails)	Up to 1 in 12
Wall indentation of the platform (from the platform under the level of top row)	915 mm
	300 mm
The maximum platform radial line length	360 m
The end of the platform	Top row of platform level should be coated with a resistant material and is marked by a continuous line in a bright color.

Traffic space of station hall, usually divided into the following places:

1. Information and ticket sales booths. 2. Waiting areas to see off or welcome the travelers. 3. Wait locations. 4. Restaurants, cafes, shops and book stalls. 5. Toilets. 6. Phone and office facilities. 7. Tourism information boards.

Access to light, lightness and safety are the primary considerations in designing the station, which to achieve the desired and standard levels of it, often is necessary use and application architecture tool. Stairs, escalator, lift and tilt, are tools that through them, change is possible in vertical surfaces. Incorporating the use of special materials and lighting are the main elements, which not only are used to determine the points that, will shift the angle to the direction of movement, but will be used to understand it, the diversion corridors or access staircase are leads in each episode.

The first travelers contact in station hall is at the ticket office. The other main site is related to service activities and postal and integrity in the distances between selling tickets locations and the platform railing. As well as shops and restaurants, which tend toward the phone booth and the location of the toilet are more traveler's visibility. Congestion associated with the packaging and cargo integrity, frequently occurs due to a covered wagons and multiple carts. Because of collisions that may occur with the in motion traveler, it is necessary the station designer to reduce collisions and motion friction is divided office space and pedestrians space. The station entrance door provides can be accessed directly to the private vehicles and other forms of public transport, and in order to convey different types of travelers and especially travelers, who come to the station as walking.

Station Design: Practical Considerations

External Traffic Space

Establishing problem-free connections, both within and out of the station, is an important factor for attracting customers' satisfaction. There should be apparent routes for travelers' access to side walk, main street, car parking, taxi stands, bus station and so forth. These routes should undoubtedly have ceiling, enough light and safety. External signs and routing maps according to their size, design and location and priorities are of great importance. Station layout should be in such a way that ensures vision routes in main traffic parts are not blocked by barriers. Separation between transportation and movement routes is very important. The travelers who enter or exit the station shouldn't use a narrow entrance at the same time.

Designing sidewalks and planting trees, both are a major factor. Paved sidewalks and parking section is better by asphalt, as well as tree planting in the lawn area is better than planting dense and luxuriant plants. Providing light, in terms of providing comfort and in terms of safety is one of the most important considerations. In this category are needed a combination of lighting equipment from the construction of electricity poles for lighting pathways and sidewalks, until lighting system around the input station area and street lighting and directions to the station.

Table 3: Access to the platform: Stairs

Width of stairs	mm 300
Height	150 mm
Width	1200 mm (min)
Length of end space (the junction of the last stair to the platform)	1800 mm (maximum, without intermediate railings)
	1850 mm (normally up to the edge of the platform)
Number of stair	Max 16
	Min 3
Stairs relating to persons with disabilities	Maximum the stairs between landing: 8
Railing	On both sides, continues to the 850 mm height and 50 mm diameter

Table 4: Access to the platform: sloping surfaces

Necessary slope	For all the levels, maximum 500 mm
Necessary slope	For all the levels more than 500 mm in conjunction with stairs
	Max 1 in 2
Slopes	1 in 20 preferably Maximum 10 m
Length	1800 mm
Landing (between Sloping surface)	1200 mm (min)
Width	1450 mm (preferably)
(The end part of the slope)	Resistant to slip

Internal Traffic Space

Within the station, travelers should be able to find their way easily from ticket kiosk to getting on the train without facing any barrier, confusion and desperation. The way of passing the four major parts of the station including entrance, information and ticket kiosk, waiting saloon and platform and trains should be exactly defined and more important parts such as ticket sale office should have a stronger architectural form. Width of movement routes in saloon should not only be proportional to traffic rate, but also represents function and symbolic role of each route. Traffic within the station saloon should be accompanied with movement comfort, calmness and speed, because all people don't move in the same direction, some have children with themselves and move slowly; thus it is necessary that movement be possible in all levels of speed. Providing comfort and calmness depends on availability of shelter, protection and suitable temperature in the station. It is necessary to establish indoor routes and application of glass enables the designer to use sunlight for supplying the required temperature without any cost.

Table 5: The station main parts

Entrance: A smooth flow with paths and clearly defined areas for pedestrians and displacement	Parking, arrival and entrance, selling tickets and information, waiting section and business services, platforms and trains	Exit: Providing a quick exit from the train up to station entrance doors

Study enough proper intervals in space hall should help to determine the priority of each section. Method of floor work doing and the type of used materials on the floor work should also contribute to determine the path and psychomotor motion and pedestrians between main station hall area.

Ticket Offices

Purchasing tickets customers should be able to easily find their own way to parts of ticket sales. In this section took place the money business, and in fact is where travelers and employees are in direct contact with each other. Environmental quality, comfortable double to talk and design on the ticket all must create good image and reassuring. Normally, station management office to pursue and effective oversight of the work and the behavior of the established relationship between employees and customers is overlooking and dominant on the sale hall. Staff offices, which are located behind the ticket sales booth, they should not be able to view from the sale and must be hidden by installing blinds from the customer viewpoint.

Business Sector

Shops, stores and restaurants inside the station meet customer service needs and to a large extent add to earnings railway. It is important that without compromising the current operation of the station provide the optimal balance in trade facilitation. It is better the phone, mailboxes and automatic machines must be placed near the paths of movement, rather than be installed individually and separately put on integrated together, so travelers do not have to prevent of collision be careful with them.

Waiting Areas

Waiting areas should provide the travelers with place, comfort, security and information. Such places should be located near the food and drink selling places or should be independent and self-sufficient spaces. Waiting saloons are often carpeted and equipped with heating system and furniture. The floor of waiting saloon is carpeted with fluffy cotton floorings, forest sturdy wood, carpet, rubber flooring and stainless steel. When travelers wait for the trains, they should be protected against natural factors and workplace of the employees should be sheltered appropriately. Station parasol should be stretched as long as the platform margin and view field permit. An important factor for securing the station is prevention from water penetration. Pavement of the station shouldn't be slippery when saturated with water.

Health Services

Although many trains have their own toilets. Construction of toilets at stations is an important factor in customer satisfaction. In places, where existed this possible should be using natural light and air conditioning. Equipped with toilets for disabled people with specific fences, extra width and complete washing facilities should be considered as an important issue.

Traveler's Specific Bridges

Construction of bridges generally preferred to traffic tunnels as a vehicle for passing on the rails and the transition from one platform to another platform. Bridges to avoid issues, such as throwing rocks and suicide are usually covered and roofed. Travelers crossing bridges are usually installed near the central part of the platform and near the entrance door to ticket offices, and usually are equipped slope surfaces and elevator.

Facilities for Disabled People

Station should be designed in such a way that people with disabilities can travel by train comfortably. Providing facilities for disabled persons is an important propaganda for railway firms and create a good image in customers' mind.

Information Signs

In Travel by train, it often happens that travelers to destination are changed several train. Information on timelines, expected time of arrival of trains, etc., must be displayed with a logical continuation and organized to inform travelers.

Information Announced by Using Audio and Sound Facilities

Information pages, illuminated displays and audio devices advised waiting travelers on the platforms from the time of arrival and exit of trains. Many travelers, such information derive from the ticket sales and information booth. Main display boards usually are more complete by electronic smaller screens that have been installed at the entries platform and close to eating places.

Workstation Design Dimensions

Site Selection

Stations should be located in areas with connection to other urban and regional infrastructures. It is better to establish the station in a region enriched by spectacular scenery. Thus, the main issue in site selection is availability of operational relation and landscape and scenery.

Internal and Subsidiary Parts of the Station

Both large and small stations include internal parts (internal-core) where ticket sale office and similar services reside and subsidiary parts including platforms, bridges and minor roads. Internal parts are often regarded as station center. This part includes ticket sale office, newspaper sale kiosk, departure time controllers and staff office. Applying simple shapes in the form of circle, polygonal, or triangular to indicate internal part is a suitable way to show the duties that should be considered. Offices, ticket sale kiosk, toilets, shops and cafeterias can be predicted as subsidiary parts that share a general space.

Providing Protection and Public Safety

One of workstation design goals was to create a feeling of security and peace in travelers. To achieve this goal, there are four main methods. Paying careful attention to design and details, design type, which is encouraging people to accept defense methods and care actions, They are providing adequate lighting and the use of facilities, such as closed-circuit television. The design of such parts, must in traveler create feels existed a safe area. Waiting areas is a guard in stations without operator, a potential line for travelers. To make sure that such places from all sides are in sight can be reduced this risk. In general, travelers feel that in a bright area faced with fewer risks than a dark field with low light and it can be regarded as station designer to increase the density lights in inner safe space.

Table 6: Platform lighting

Percentage of uniformity	1 to 25
Percentage of uniformity (Between minimum and medium exposure value) Recommended amount	Tiny station 100 lux Main station 150 lux Underground station 150 lux

Information about the Travel

Information about the travel by electronic display devices and install signs traditional time tables, usually presented in the internal, almost near the sites of ticket sales to travelers. In the case of installed electronic signs must be taken into account two factors: firstly, to ensure that all travelers around the station receiving information, and secondly, the installation of this equipment does not impact danger for indiscriminately trains that do not stopping at the station.

Environmental Standards

Providing warm and pleasing air is an important necessity to welcome the travelers at entrance, waiting saloon and ticket sale kiosks. Mechanical air conditioning system equipped with cooling system in summer and warming system in winter is of great importance.

Table 7: Environmental standards about the ticket offices

Heat	C 20, with the use of central heating local system
Ventilation	At least two air change or 28 m per hour, whichever is greater, in cases where heat exceeds that of 25 c, shall apply cooling system.
Light	Standard lighting services at levels overall 500 lux Workshop station 750 lux
Sound insulation	Noise levels at work stations should not exceed than 60 dbA. Noise level due to ventilation equipment in near work stations must be less than 50 dbA. Ticket office floor should be carpeted and also roof is sound attenuator.

Fire Protection

The design for fire protection should be considered the requirements and needs of every aspect and the resulting strategies based on them.

Announcement Systems

Graphical display devices, both traditional and electronic billboard and audio systems provide tools by them, are informed travelers that in which platform and at what time should be board the train. Information distributed through public information audio systems should clearly be audible and purely conceptual.

DESIGN

Schedule Table of Physics Project

Travelers Exit

Row	Description of space	Unit level (m2)	Number of units	Total area (m2)	Considerations
1	Purchase free shops	40	20	800	
2	Travelers waiting halls (monitoring)	4000	2	8000	
3	Coffee shop and coffee house	200	1	200	
4	Restaurant	500	1	500	
5	Prayer room	300	1	300	
6	Security and law enforcement	100	1	100	
7	Warehouses	20	7	140	
8	Toilet	30	8	240	Men and women
9	Clinic	120	1	120	
10	Quarantine	120	1	120	
11	Vip formalities	200	1	200	
12	Exhibition and reading rooms	400	1	400	
13	Communication spaces			4000	
14	Essential information	200	1	200	
15	Rail transport institutions booths	100	10	1000	
16	Control spaces and final page views	10	8	80	
17	Installations	100	1	100	
	The total area of the second part			16420	

Entrance Travelers

Row	Description of space	Unit level (m2)	Number of units	Total area (m2)	Considerations
1	Entrance	4300	2	8600	
2	Goods delivery and temporary storage	550	8	4400	For 8 platforms
3	Greeters waiting room	4500	1	4500	
4	Cafeteria	200	1	200	
5	Parking	25	200	5000	
6	Travelers and administration information	300	1	300	
7	Greeters information	50	1	50	
8	Warehouses	30	1	30	
9	Staff spaces	50	1	50	
10	Mechanical installations	800	1	800	
11	Electrical installations	1000	1	1000	
12	Communication spaces	3000	1	3000	
	Total public sector infrastructure, travelers entrance			24930	

Administrative Section

Row	Description of space	Unit level (m2)	Number of units	Total area (m2)	Considerations
1	Management space	100	-	100	
2	Deputy space	50	-	50	
3	Personnel offices	60	6	360	
4	Restaurant	300	-	300	For 100 employees
5	Conference hall	360	-	360	
6	Toilet	80	-	80	Men and women
7	Warehouses	25	-	25	

8	Archive	30	-	30	
9	Telecommunications new lines control	300	-	300	
10	Propagation space	20	-	20	
11	Support spaces	75	-	75	
12	Communication spaces			1150	
13	Computer site	150	-	150	
	Total area of the fourth main offices			3000	

Service-welfare

Row	Description of space	Unit level (m2)	Number of units	Total area (m2)	Considerations
1	Library	200	-	200	
2	Selling books booths	25	10	250	
3	Post, telegraph, telephone	100	-	100	
4	Children's entertainment space	240	-	240	
5	Computer games site	300	-	300	
6	Internet hall	240	-	240	
7	E-mail hall	120	-	120	
8	Toilet	6	15	90	
9	Communication spaces	500	-	500	
	Total			2040	

CONCLUSION

Extension of information in new era and limitation of study time have made it necessary to propose technical and scientific methods. Undoubtedly, a major hurdle for economic growth of the country is defects and weakness of transportation systems especially railway. Although the cost of establishing a two-line railway is equal to that of constructing a six-line street, the railway is still cost effective considering exploitation and retention issues. Railway is now the best transportation way and the most effective way for development of agriculture and business affairs. It has a critical economic role in Iran as well. Regarding geographical situation of Iran located at the junction of three continents of Asia, Africa and Europe, the country can play a unique role in goods transportation. Considering the fact that each region has its own climatic condition, most of the architectures believe that by understanding climate of a geographical region, the same designs can be used for similar regions. The results indicated that by considering all criteria of railway station design, sustainable design of Bandar Abbas train station according to social, environmental, local and climatic issues can be performed in accordance with functions of a train station.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None.

FINANCIAL DISCLOSURE

None.

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RESEARCH

ASSESSMENT OF CONSISTENCY OF SUSTAINABLE DESIGN PRINCIPLES IN HOT AND HUMID CLIMATE WITH THE PERFORMANCE OF THE TRAIN STATION IN BANDAR ABBAS

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ABSTRACT

Railway station is a starting point for travelers and newcomers to the city and presentation of concepts in the form of the body and the sense of belonging of citizens as well. The first memories of entry and the last memories of farewell take place in the space of station and travelers will always remember these memories. Sometimes a worthy station becomes an appropriate symbol for a city, as a result, the functional aspect of the station should not only be considered. City and climate are two man-made and natural systems that have close interactions with each other. Climate, to the extent that interacts with human comfort, is the result of factors such as: radiation, temperature, humidity, wind and precipitation. Climate of any geographic location has particular suitable conditions; however, it has limitations in the design of urban and rural areas as well. In the design of its various spaces, such as buildings, green spaces, streets and train stations, in addition to functional, visual and aesthetic qualities, the climate of the city and climatic design rules are essential; and lack of attention to this issue creates special problems in the city and its urban activities; problems such as preventing the flow of pleasant air in urban spaces and buildings, flooded streets and so on. The present study is to assess the consistency of the sustainable design principles in hot and humid climate with the performance of the train station.

INTRODUCTION

In fact, railway is the most important mean of transportation in the economy of each country that can have the most economical result with respect to high speed of shipping and low energy consumption. This feature led to fast development across the world in the nineteenth century and continues today. Today, consuming low energy, railway has the benefits in the transport sector, while, regarding the current environmental pollution sensitivities, it has the minimum harm to the environment [1]. In the process of natural growth of the world economy, various sectors of transport are developed in this way, and one each, in balance with others, has created a harmonious transport network by combining different means of transport.

This process, in Iran and many countries called developing countries today, has not been tailored to the economic needs of society. It is clear that the imbalance has been the result of international developments and the impact of external and internal factors. The slow growth of our country's transportation network proportional to the needs and economic necessities has become an obstacle to economic growth and development of the country [2]. The consequences of the current conditions of the country's transportation are before us today. Conditions in which there is no consistency between railway and the roads, and the number of train stations is not consistent with road transport terminals, as well as the airports. There are cities that do not have a railway station yet, but they have with airport. With the mentioned cases above, addressing the transportation industry in broad terms and train stations in small terms, seems necessary, and also the passengers' comfort supply on the one hand and homogeneous nature of the shipping industry which is the lack of damage to the environment on the other hand, make it necessary to pay more attention to the climatic design patterns in the area when designing stations in order to make the process of waiting easier in these buildings and provide the passengers' comfort on the one hand, and reduce the use of mechanical ventilation and electrical appliances resulting in lower the energy and fuel consumption on the other hand by utilizing the maximum natural preparedness possible.

Research Question

How much are the sustainable design principles in hot and humid climate consistent with the performance of the train station?

RESEARCH BACKGROD

Esmael Ayati, Faramarz Ghadirian and Mehran Mazari have examined some issues such as: types of railway stations and their performance, how performance of transit traveler stations, general guidelines of

KEY WORDS

Train Station, Sustainable design, Hot and Humid Climate, Performance, Bandar Abbas

Published: 10 Sept 2016

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railway stations design, spatial design, landscaping in front of the station, stations building, traveler service facilities, determine the number of transported travelers at the station of Mashhad, in current and future, number of traveler halls and trains of the country, in an article entitled "understanding railway stations, and investigate the possibility of developing them (Case Study station Mashhad railway)".

Ebrahim Mohammadi, Director General of the Tehran Railway and Seyed Mahdi Sharifi Moghaddam Kakhaki, Advisor to the Director General of Tehran Railway, in an article entitled "Rail safety in urban architecture" has discussed this issue. In this article, we will investigate the history and current state of urban area of Tehran compared to the railway and railway station, causes and how developing Tehran and statistics of rail accident causing death or injury of travelers in the region, and we analyze dilemmas and problems caused by interference from the city and railways, and we present some solutions according to the land use around the railroads and the location of stations and railway lines to reduce these accidents.

Ali Fathi Mozaffari and Mansoor Sharafieh, they discussed about this issue in an article titled "Risk Assessment of traveler railway stations rigs". In this paper, with the help of the risk assessment process, the safety of traveler rigs of railway stations have been examined, and finally, some solutions are proposed to increase safety and eliminate the risk, if possible.

Maziar Pourjamshidi and Shima Pourshahid have addressed this issue in an article entitled "Sustainable concepts of education, in higher education system, Challenges and Solutions". The method used in this article is based on documentary and literature, resources, experience and analysis. First, the ideas and goals of sustainable development are explained, and we explain the concept of sustainable architecture and sustainable architecture education history in the world and its principles. Then, by examining the challenges, some solutions are proposed, to institutionalize concepts related to sustainable architecture in higher education.

MATERIALS AND METHODS

In the present article, we try to principles and characteristics and definitions of sustainable architecture be classified, by exploring different articles and references, and then, principles and characteristics of vernacular architecture in hot and humid climate of Iran's cities and Iranian ports in the Persian Gulf was known, was extracted, and finally, the degree of correspondence between these characteristics and principles of sustainable architecture was investigated. This is a quantitative research based on analyzing climatic principles and data. Data were collected by library and field studies to gather climatic perspectives. Data were analyzed using climate software. In library study, standards and properties of railway station were investigated. Psychological study of train travelers and investigating similar designs constitute another part of this study. Moreover, designing principles in hot and humid climate were extracted from the relevant books. Field study includes visiting the site, visiting train stations within the country and interviewing with the travelers via questionnaire.

SUSTAINABLE DESIGN AND ITS BASIC PRINCIPLES

Sustainable design is thoughtful partnership of architecture and engineering, mechanical, electrical and structural. Besides the conventional design, such as beauty, proportion and texture, shadow and lighting features that should be considered, Department of Design should pay attention to the environment, long-term economic and human factors, and the basics of it, that they are as follows:

Environmental perception: if we are aware of the possibilities of the environment in which we can prevent us from hurting them. Understanding of the environment makes identifying the stages of design, including its orientation relative to the Sun, and arrangement of buildings on the site, and preserving the environment, and vehicle and pedestrian access of the system. [3]

Relationship with nature: building, whether is within the urban environment or in a more natural environment, Relationship with nature makes the environment design more attractive.

Understanding trends in nature: in the system in nature, there is no waste. The wreckage of a creature is an existing food. In other words, it causes, human respecting to the needs of a variety of natural species.

Understand the environmental impact: sustainable design is trying to understand the impact of the environment through assessment and analysis of the site, assess the energy consumption, materials and construction techniques.

Participatory process of design: sustainable designer, understand the importance of paying attention to every comment. Consulting engineers and specialists collaborate with others, done in the early stages of design. The designers also pay attention to the views of local residents and neighbors. (Siadi, Seyed Ehsan and Mahdavi, Seyed Mahdi. 2010: 25)

Understanding people: sustainable designer should pay attention to culture, religion and race, of people who want to design for them.

THE PRINCIPLES OF GREEN ARCHITECTURE

- 1- **Energy conservation:** Every building must be designed and constructed in such a way that requires the use of fossil fuels, be at least possible.
- 2- **Work with the climates:** buildings should be designed to be able to take advantage of the local climate and energy sources.
- 3- **Reduce the use of new resources:** Every building must be designed in such a way that, to minimize the use of new resources, and create a resource, to create other structures, at the end of their useful life.
- 4- **Respect for the site:** the building must touch the ground, soft and light.
- 5- **Holism:** all of green principles need to participate, in a holistic process, to build an artificial environment.

RECOGNIZING THE CONTEXT OF THE PROJECT

Bandar Abbas

Bandar Abbas is the center of Hormozgan province in south of Iran. Bandar Abbas now is the largest Iranian port. In regional division of Iran, Bandar Abbas is a part of the southern region. Bandar Abbas, leads to highlands and mountains in the north, and leads to the sea in the south, so the slope of the city is in the north to the south. The height of the city from sea level is 10 meters. The climate of the city is hot and humid. In general, Bandar Abbas has fine weather, since November to April. Dry air in May and June, the weather is wet during the months of July to October. Air temperature of Bandar Abbas is up to 44 degrees Celsius in the hottest days and up to 2 degrees Celsius in the coldest days. Bandar Abbas falls is about 200 mm.

Railway System

Every day, two passenger trains move towards Tehran from Bandar Abbas. Another train, called Gazelle, also passes the path of Bandar Abbas-Tehran and vice versa, every two days. A train to Isfahan and other train to Mashhad carry travelers from passenger railway station of Bandar Abbas.

SITE

The target site is the current location of Bandar Abbas railway station.



Fig. 1: Map location of Bandar Abbas railway station, source: (wikimapia.com)

PRINCIPLES AND DESIGN CRITERIA

Workstation Design Dimensions

Site Selection

Stations should be located in areas with connection to other urban and regional infrastructures. It is better to establish the station in a region enriched by spectacular scenery. Thus, the main issue in site selection is availability of operational relation and landscape and scenery [4].

Internal and Subsidiary Parts of the Station

Both large and small stations include internal parts (internal-core) where ticket sale office and similar services reside and subsidiary parts including platforms, bridges and minor roads. Internal parts are often regarded as station center. This part includes ticket sale office, newspaper sale kiosk, departure time controllers and staff office. Applying simple shapes in the form of circle, polygonal, or triangular to indicate internal part is a suitable way to show the duties that should be considered. Offices, ticket sale kiosk, toilets, shops and cafeterias can be predicted as subsidiary parts that share a general space.

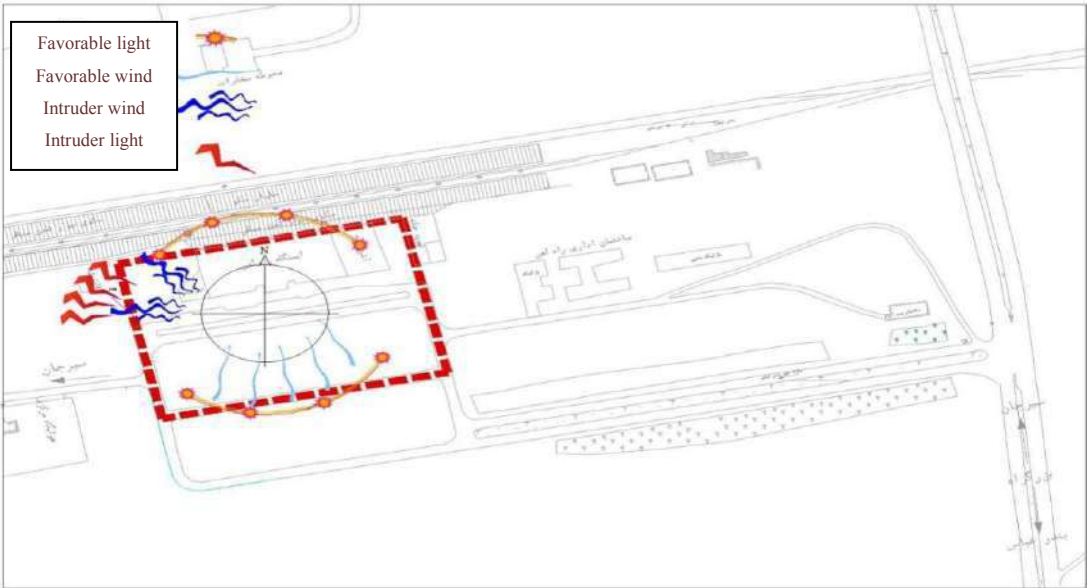


Fig. 2: Earth's climate project analysis, source: (Author)

Providing Protection and Public Safety

One of workstation design goals was to create a feeling of security and peace in travelers. To achieve this goal, there are four main methods. Paying careful attention to design and details, design type, which is encouraging people to accept defense methods and care actions, providing adequate lighting and the use of facilities, such as closed-circuit television. The design of such parts, must in traveler create feels existed a safe area. Waiting areas is a guard in stations without operator, a potential line for travelers. To make sure that such places from all sides are in sight can be reduced this risk. In general, travelers feel that in a bright area faced with fewer risks than a dark field with low light and it can be regarded as station designer to increase the density lights in inner safe space.

Table 1: Platform lighting

Percentage of uniformity		1 to 25
Percentage of uniformity (Between minimum and medium exposure value) Recommended amount		Tiny station 100 lux Main station 150 lux Underground station 150 lux

Information about the Travel

Information about the travel by electronic display devices and install signs traditional time tables, usually presented in the internal, almost near the sites of ticket sales to travelers. In the case of installed electronic signs must be taken into account two factors: firstly, to ensure that all travelers around the station receiving information, and secondly, the installation of this equipment does not impact danger for indiscriminately trains that do not stopping at the station.

Environmental Standards

Providing warm and pleasing air is an important necessity to welcome the travelers at entrance, waiting saloon and ticket sale kiosks [5]. Mechanical air conditioning system equipped with cooling system in summer and warming system in winter is of great importance.

Table 2: Environmental standards about the ticket offices

Heat	C 20, with the use of central heating local system
Ventilation	At least two air change or 28 m per hour, whichever is greater, in cases where heat exceeds that of 25 c, shall apply cooling system.
Light	Standard lighting services at levels overall 500 lux Workshop station 750 lux
Sound insulation	Noise levels at work stations should not exceed than 60 dbA. Noise level due to ventilation equipment in near work stations must be less than 50 dbA. Ticket office floor should be carpeted and also roof is sound attenuator.

Fire Protection

The design for fire protection should be considered the requirements and needs of every aspect and the resulting strategies based on them.

Announcement Systems

Graphical display devices, both traditional and electronic billboard and audio systems provide tools by them, are informed travelers that in which platform and at what time should be board the train. Information distributed through public information audio systems should clearly be audible and purely conceptual.

Climatic Design Principles in Bandar Abbas

Nowadays, the importance and necessity of the climate in the design and construction of all buildings, especially buildings used directly by humans and living creatures and paying attention to climatic characteristics, and its impact on the formation of the characteristics of the building is proven. These buildings are healthier and better. Daily and seasonal variation and change of light, temperature and air flow in the building create varied and pleasant spaces. The southern coast of Iran, who has been separated from the central plateau to the Zagros mountain range, constitutes the hot and humid climate of Iran [6]. The maximum temperature in summer, in these areas, is 35 to 40 degrees Celsius, and maximum relative humidity is 70%. Climate vital is among the factors that we can mention in relation to human comfort in climate, in which human comfort situation in relation to temperature, radiation, wind and relative humidity are examined. In this regard, the bioclimatic conditions of the study area checked using bioclimatic charts.

Table 3: The 46 years old average some of the climatic elements of Bandar Abbas

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp												
Average maximum Temperature (C)	23.4	24.5	27.6	31.8	36.5	38.5	38.3	37.6	36.7	34.9	30.2	25.5
Average minimum temperature (C)	12.3	14.1	17.4	21	24.9	28.1	30.4	30.3	27.8	23.7	18.2	13.7
Average Maximum humidity (percent)	83	86	85	83	80	82	82	83	83	84	79	81
Average minimum humidity (percent)	46	50	50	46	43	46	53	56	53	46	42	45
Rainfall (mm)	51.3	43.4	35	9.1	3.2	0	1	1.6	0.5	4.3	6.1	29.8

The Monthly Comfort of Bandar Abbas, According to Oleg Method

Among the elements of weather, temperature and humidity have a greater impact on human health and comfort. Most of the models for measuring human comfort, in relation to weather conditions, depend on these two elements. Oleg bioclimatic graph is one of these models. Daily comfort is obtained, by inserting Statistics of average maximum temperature and minimum relative humidity, with circles, and the night comfort calculates with a daily average temperature and average relative humidity recorded, with triangles [7]. The below graph shows the bioclimatic graph of Bandar Abbas.

As can be seen, Bandar Abbas, during the months June, July, August, and September, is outside the comfort zone, and is located far away from the maximum level, and in most months air temperature cannot be adjusted in the human comfort using air flow, and use of air conditioning systems is necessary. During the months December, January and earlier February, the city is located in the comfort zone. In the months October and November, it is located in the range of cold air which can be reached in comfort using materials according to the climate and solar energy.

The Monthly Comfort of Bandar Abbas, on the Basis of Gion

In this way, those characteristics that building needs to its interior air affected from climate conditions, in the comfort zone and in relation to ambient air conditions and changes in buildings, have been identified. Gion specifies the use of natural ventilation, building materials properties, adding moisture to indoor air, and also the necessity of using mechanical devices, in conjunction with various thermal conditions of the air around the building, for practical use, drawing on the psychometric curves, he called the resulting graph as bioclimatic building [8].

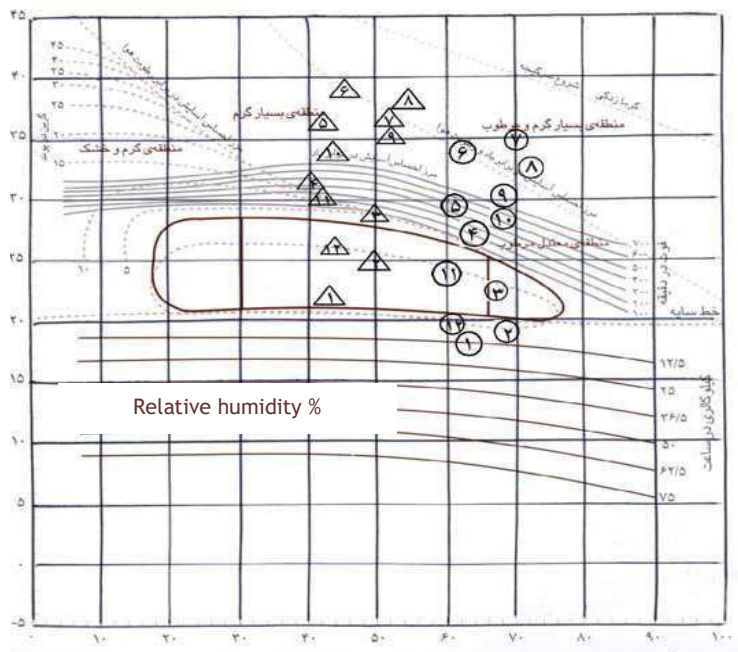


Fig. 3: Bioclimatic diagram of Bandar Abbas

Table 4: The comfort days and nights of Bandar Abbas based on Oleg method

Months	People feel per day	People feel per NIGHT
Jan	Cold	Cold
Feb	Cold	Cold
Mar	Comfort	Cold
Apr	Comfort	Comfort
May	Rather comfortable	Rather comfortable
Jun	Uncomfortable	Uncomfortable
Jul	Uncomfortable	Uncomfortable
Aug	Uncomfortable	Uncomfortable
Sep	Uncomfortable	Uncomfortable
Oct	Rather Uncomfortable	Rather Uncomfortable
Nov	Rather comfortable	Comfort
Dec	Comfort	Comfort

The climate of this city, in most months of the year is, warm and out of the comfort zone, somehow that we can in the comfort zone, using mechanical cooling systems. The study of changes in temperature and humidity in winter in Bandar Abbas, we conclude that the cold temperatures, is not much, and there is no need to use heating devices if the right materials and design principles according to the climate be used. Therefore, we conclude that such major problems in the city, are the control and reduction in air temperature in the warm months (summer and late spring) that it is possible, using mechanical systems. Therefore, design principles with regard to these two issues, must be observed.

Mahani Measure of Comfort to Bandar Abbas

In multiple climates, urgent cases may be inconsistent together in different seasons. To determine the relative importance of this necessity, we need to use the measurement method. In this assay, the duration and intensity of climatic factors must be considered. According to this method, the tables have been proposed by Mahani. In Mahani, information about temperature, humidity, rainfall will be used as follows [9]:

Using weather station records, numbers corresponding to the maximum average and minimum average of temperatures, entered in both the first row of the table. Average of air temperature range per month calculates by subtracting minimum average and maximum average, and it enters in third row. The largest maximum number and the smallest minimum number in twelve months were extracted and entered in a separate box which is at the bottom of the table. Average of annual temperature (AMT) is obtained, after obtaining the sum of these two numbers and dividing it by 2. Average of annual volatility (AMR) is obtained by determining the difference between these two numbers (the difference between maximum and minimum).

Table 5: Maximum and minimum average of Bandar Abbas monthly temperature in degrees Celsius in the period of 46 years old

Air temperature in C	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly maximum average	23.4	24.5	27.6	31.8	36.5	38.5	38.3	37.6	36.7	34.9	30.2	25.5
Monthly minimum average	12.3	14.1	17.4	21	24.9	28.1	30.4	30.3	27.8	23.7	18.2	13.7
Monthly swings average	11.1	10.4	10.2	10.8	11.6	10.4	7.9	7.3	8.9	11.2	12	11.8

Table 6: Humidity groups

Humidity group 1: if they are relative humidity less than 30%
Humidity group 2: 30-50% humidity
Humidity group 3: 50-70% humidity
Humidity group 4: over 70% humidity

Table 7: Maximum and minimum relative humidity of Bandar Abbas to percent

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly maximum average (morning)	83	86	85	83	80	82	82	83	83	84	79	81
Monthly minimum average (afternoon)	46	50	50	46	43	46	53	56	53	46	42	45
Average	64.5	68	67.5	64.5	61.5	64	67.5	69.5	68	65	60.5	63
Humidity group	3	3	3	3	3	3	3	3	3	3	3	3

Climate Elements of Old and New Architecture, and Offers Mahani Architecture in Bandar Abbas

1. Length of buildings in Bandar Abbas should be along the axis east - west, and long views should be to the north and south.

Due to the hot and humid climate in most months of the year, Bandar Abbas has warm climates. Therefore, its buildings should be extended to the east-west axis, so that, the sun of winter, southern view, have more surface area, and eastern and western view which receive sunlight only in summer, will be reduced.

2. Use double-covered roofs

In vernacular architecture, roofs often made of mud brick. These materials prevent heat from the sun into the building, in summer, but in the new architecture, brick and concrete have been used which cause rapid penetration of sunlight into the building. We can say that, vernacular architecture of Bandar Abbas is more compatible with Mahani standard.

3. Inner and outer walls

Use of heavy construction equipment, in external walls of the building, will reduce the transfer of heat from the outside air to the interior. Heavy building materials, keep the heat absorbed within itself, according to their type. During this time, if the outside air is cooled, the amount of heat absorbed in material transferred to the outside air.

4. Windows in Bandar Abbas should be smaller, about 20-40%.

Due to the hot and humid climate of Bandar Abbas, if the numbers of windows on the exterior surfaces of buildings are fewer and smaller, the amount of heat transferred to the interior spaces will be less.

CONCLUSION

According to the results obtained in the city of Bandar Abbas based on Oleg method, all times of the year are divided into three hot, cold and comfort regions. During the days of March, April and December, we have comfort, also in April, November and December; we have also comfort conditions during the night. During the months of June, July, August and September, it is very hot during the day and night in the region; and in the months of October and May, the heat intensity in the day is reduced. So, to achieve comfort in Bandar Abbas, principles of vernacular architecture must be respected in the region.

Bioclimatic graph shows that the building atmosphere in Bandar Abbas has not the problems of cold weather, and conditions of comfort can be achieved using materials appropriate to the climate. But, respecting the principles of vernacular architecture in the city in hot seasons, cooling facilities are still required in the building. To compare the new and vernacular architectures, Mahani criteria can be used. Based on the existing data and field studies carried out, vernacular architecture of Bandar Abbas is more consistent with Mahani proposed criteria compared to the new architecture. At the end, for more consistency of Bandar Abbas architecture with the hot and humid climate, the following strategies are provided:

- Creating shades on the surfaces and facades using wide and covered porches in homes' fronts.
- Using thermal insulation in the roof structure.
- Construction of residential spaces above the ground to prevent moisture penetration.
- Construction of wind towers with large spans facing the sea to use sea breezes.
- Using flat roofs and the use of local materials in their construction.
- Using wood in the body of the walls to prevent the entry of heat into the building.
- Construction of building using mud brick and materials with high thermal capacity due to lack of wood.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None.

FINANCIAL DISCLOSURE

None.

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RESEARCH

COMPARING HYDRAULIC JUMP IN OGEE SPILLWAYS WITH DIFFERENT SLOPES

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ABSTRACT

Torrents have been recognized as main factor of destruction of structures and barriers in downstream of spillways of the dams. For this reason, one of the important issues which experts face is prediction of hydraulic jump. Although many studies have been conducted to reduce hydraulic jump and reduce torrent energy, most of them have been discussed for use of optimal spillways and slope of spillways. In this paper, hydraulic jump has been studied after performing laboratory model of the ogee spillways with two different slopes of 28 and 18.8 degrees. At the end, results of tests were compared in two slopes and it was concluded that length of hydraulic jump for flows of 7 and 9 l/s in slope of 28 degrees for ogee spillways of 60 and 70 cm and hydraulic jump length for the similar flows in slope of 18.8 degrees for ogee spillways of 45 and 65 cm. this has shown considerable reduction of hydraulic jump in slope of 18.8 when compared with slope of 28 degrees.

INTRODUCTION

KEY WORDS

Ogee Spillways,
Hydraulic Jump, Spillway
Slope, Hydraulic Jump
Length, Dam Spillway.

One of the major factors of gradual destruction of hydraulic structures and the used barriers in downstream of dams and spillways is passage of torrents with high turbulence. High speed of passage through spillways of dams to downstream caused destruction and gradual erosion of the riverbed and can cause hazards for the structure. For this reason, stilling basins are mostly used to reduce kinetic energy of the flow in downstream of the dams. Length of the stilling basins embedded for reduction of hydraulic jump is a very important and determining factor [1,2].

In all stages of design and construction of spillways, all possible tools are used to reduce kinetic energy. The type of spillway is determining. In addition, reaching optimal slope of design for controlling hydraulic jump and reducing flow energy in construction of spillways are of the issues which attracted attention of many researchers [3].

Published: 10 Sept 2016

Many studies have been conducted in the field of hydraulic jump in smoothbeds, for example, studies by Yarnell (1934), Patrika (1957), Rajaratnam (1967). Rajaratnam(1968) was the first person who studied hydraulic jump in the corrugated bed. he defined a parameter called $K=K_e/y_1$ (relative roughness) where K_e is Equivalent Roughness Height and y_1 is depth of the initial inflow on rough bed. He showed that hydraulic jumps formed in rough beds were shorter than those formed in smooth beds. Ead and Rajaratnam (2002) conducted experimental study on hydraulic jump on the corrugated beds and showed that depth of the downstream fill required for hydraulic jump on the corrugated beds was lower than depth of the downstream fill required for jump on the smooth bed and also shear stress was almost 10 times as much as shear stress in smooth beds [4]. Characteristics of hydraulic jump on beds with rectangular tape roughness with two heights of 2.5 cm and $t=1.5$ and five spaces of block ($s=1.5, 3, 4, 6, 7.5$) in range of Froude numbers 3 to 10 were studied by Gohari and Farhoodi (2009). Based on results of this research, increase in space of blocks reduced secondary depth of jump. Change in height of roughness didn't have considerable effect on characteristics of hydraulic jump.

METHODS

Spillway of dams includes different types of geometrical shape. In this research, two types of ogee spillways have been studied in different slopes. Ogee or smooth spillways have a control overflow as ogee spillway or with S-shaped profile. The upper part of the curve is designed such that it can match with the lower profile of aquifer which has been aerated on a sharp-pointed overflow. Prevention of air into the aquifer causes contact between the spillway and spillway crest profile [5,6].

To design the best energy dissipation state, it was mentioned that steeped spillways in different slopes of 28 and 18.8 with edentate downstream spillway with height of 3 cm were studied to form hydraulic jump

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in the experimental model. Then, results of tests and measurement of hydraulic jump for each optimal slope of spillway are discussed [7]. Most phenomena in fluids mechanics complexly depend on geometrical parameters and flow parameters. To understand each of the problems, effective parameters of each phenomenon should be evaluated [8,9].

Modeling

An experimental set which includes a channel, spillway and stilling basin in downstream has the following facilities: stilling basin in upstream of channel, spillway glassy channel with width of 20cm, length of 4m and glassy walls with height of 50 cm with slope variability, horizontal channel of the basin with depth of 40 cm in the free edge with width of 20 cm and length of 4m , downstream basin of the channel with dimensions of 3.5 m in 3 m and depth of 70cm with 10 cm free edge , centrifuged pump with maximum discharge capacity of 60l/s in height of 10 m , gate valves with diameter of 10 cm (4 inches) with general length of 11.5 m. to measure different parameters of flow along spillway channel and sandy channel, the following facilities were used : magnetic flow meter, electronic altimeter, magnetic floater altimeter in downstream basin , triangular spillway, clinometers, piezometer of the stilling basin in upstream of spillway channel.

The experimental model will be conducted by changing the slope, height, tread and riser of stair, and also the dentations which have been created at the end of the downstream route [10,11].

In the first test, steeped spillway was placed in slope of 28 degrees and placed at the end of the downstream spillway to create dentated hydraulic jump with height of 3 cm. Change in flow directed hydraulic jump to spillway to measure parameters of jump such as length of jump and secondary height. Then, to measure parameters in the second test, steeped spillway slope was reduced to 18.8 degrees with the same dentated height of 3 cm and parameters of hydraulic jump were studied and measured. Results of both tests for calculation of parameters of hydraulic jump are shown in Tables 1 and 2.

Table 1: Specifications of hydraulic jump with steeped spillway with slope of 28 degrees and dentation of 3 cm

Flow (lit/se c)	Initial depth (cm)	Secondary depth (cm)	Length of roller (cm)	Jump length (cm)	Jump location (cm)	Fr_2	Lj/Y_2
7	3	7	25	60	145	0.6	8.57
9	4.1	7.4	35	70	245	0.7	9.46
11	0	0	0	0	0		

Table 2: Specifications of hydraulic jump with steeped spillway with slope of 18.8 degrees and dentation of 3 cm

Flow (lit/se c)	Initial depth (cm)	Secondary depth (cm)	Length of roller (cm)	Jump length (cm)	Jump location	Fr_2	Lj/Y_2
7	3	7	15	45	70	0.6	6.43
9	4.2	7.5	20	64	170	0.7	8.6
11	5.8	7.7	25	70	230	0.82	9
13	0	0	0	0	0		

RESULTS

As shown in Table 1, hydraulic jump in flow rates of 7 and 9 l/s was created with the mentioned specifications but in higher flow rates, hydraulic jumps have been created in 4 m of downstream. Therefore, it is not measurable and range of flow rates is low.

Considering changes and information taken from Table 2, it can be found that length of jumps and sometimes length of roller has been reduced with steeped spillway with slope of 28 degrees and dentation of 3 cm. in this case, for flow rates of 7 and 9 l/s, roller length has been reduced from 25 and 35 cm in slope of 28 to 15 and 20 cm for similar flow rates. As length of hydraulic jump was calculated and extracted for flow rates of 7 and 9 l/s in slope of 28 degrees for ogee spillway of 60 and 70 cm and length of jump for similar flow rates has been calculated as 45 and 65 in slope of 18.8 degrees.

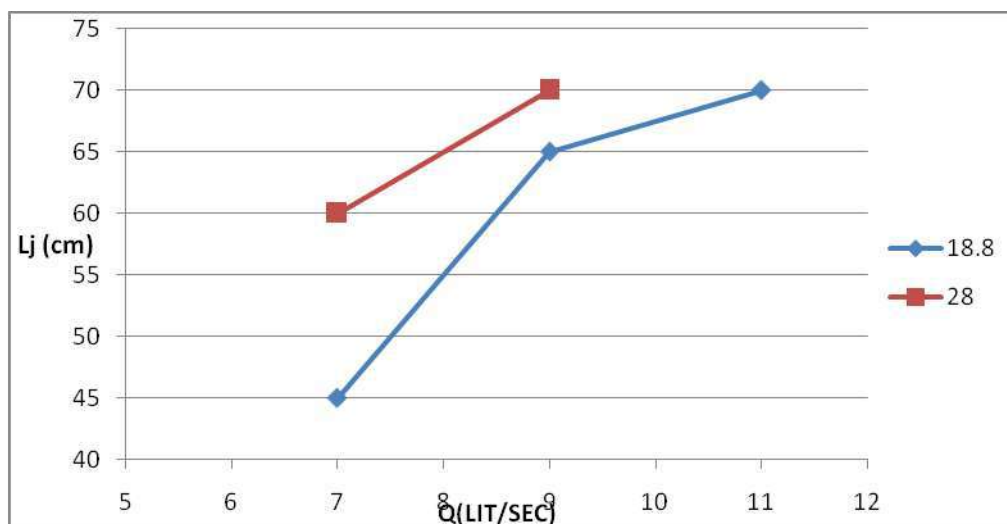


Fig. 1: Steeped spillway with fixed dentation of 3 cm with slope of 18.8 and 28 degrees

As it is estimated in Diagram 1, comparison of results of both spillway tests with slopes of 28 and 18.8 degrees shows slope of 18.8 as the second tests of roller length and lower jump length compared with the first test of spillway with slope of 28 degrees.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None.

FINANCIAL DISCLOSURE

None.

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RESEARCH

THE ROLE OF PHYTOREMEDIATION IN REDUCTION OF ENVIRONMENTAL POLLUTION

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ABSTRACT

Petroleum hydrocarbons are among the most important environmental organic pollutants and their existence in nature has caused many concerns due to toxicity, carcinogenic and genetic modification. These pollutants can be absorbed to surface of soil particles or organic particles in the soil and gradually increase their concentration and enter surface water along with surface currents. There are several chemical and physical methods to deal with oil pollution in soil, most of which are used less due to high costs and harmful side effects. Thus, biology techniques such as phytoremediation have attracted more attention in recent years. Phytoremediation is a new and emerging technology in which resistant plants are used to remove or reduce the concentration of organic and inorganic pollutants and hazardous substances from the environment. This technique contains a series of technologies using natural or transgenic plants for refining of organic and inorganic environmental pollution of soil, water and air. In fact, phytoremediation using human interference such as agricultural technology will create right conditions for growth and plant establishment and will increase the normal activities of cleaning. The greatest advantage of this method compared to other methods is its low cost and simplicity. Appropriate plant selection is very important in this method which depends on climatic conditions of area, type and rate of soil contamination. Khuzestan province is considered as one of the most important centers of Iranian oil with vast oil and gas reserves and massive amounts of pollutants are transferred to this province due to the fact that it is near Persian Gulf. Crude oil well No. 69 of Marun 3 Oilfield which was sprayed to soil as oil contaminant in this study was injected into gas chromatography device in Microliter after extraction from soil with Soxhlet and bitumen asphalt. Each of the normal alkanes was calculated after presenting the GC peak of areas under the curve. Results of analysis of variance showed that using NPK fertilizer and regular aeration during modification process coincided with the growth of heterotrophic bacteria degrading oil had a significant effect on oil decomposition on the level of five percent. 37% of oil decomposition was observed in the control soil which has been due to regular aeration of oil and creation of 25-30 ° C soil temperature and humidity suitable for bacterial activity.

KEY WORDS

Phytoremediation,
Environmental Pollutants,
Heterotrophic Bacteria,
Oil Pollution, Khuzestan
Province.

Published: 10 Sept 2016

INTRODUCTION

The relation of today's humans with environment has faced a crisis. This crisis in the environmental is due to irrational intervention and exploitation and utilitarian destruction and leads to harmful effects for humans and the environment. Use of phytoremediation in remediation of any contaminated system that plants can grow in it has been recently considered. Purified plant are a collections of plants which are used to remove organic materials, metals, pesticide residues and residues of radioactive substances from soil or waste. This Herbal Technology can be used both independently and in combination with other purification methods. According to this definition, a purified plant must accumulate have at least 100 mg / g (10% of dry weight), cadmium, arsenic and some rare metals, 1000 mg / g (0.1 percent dry weight) cobalt, copper, chromium, nickel, lead, and 10000 mg / g (1% of dry weight) of magnesium and nickel in its tissues. Phytoremediation using green plants engineering including Herbaceous and woody plants is used to remove pollutants from soil and water or reduce the risk of environmental pollutants such as heavy metals, trace elements, organic compounds and radioactive materials. Unlike water and air, soil contamination is not easily measurable in terms of chemical composition and a clean or pure soil cannot be defined. Thus, we have to study the potential problems of soil contamination in the context of the risks and possible damages in soil function.

In phytoremediation, plants are classified based on adsorption mechanism and pollution with heavy metals is reduced using chemical, physical and biological methods. Based on researches of Environmental Protection Agency Office of Water and soil pollution, soil decontamination is usually carried out with two methods of in place and out of place. In out of place method, the contaminated soil is shifted to another place and returned after decontamination. In another method which does not require shifting, biological absorption of pollutants decreases by making them organic. Green plants and their relation with soil microorganisms are used to reduce soil and groundwater contamination in technology of using plants as phytoremediation. This technology can be used to remove both organic and inorganic pollutants in the soil. The main objective of this research was feasibility and evaluation of potential of soil decontamination form cyanide using non-woody plants such as grasses and seeds. In addition, the rate of accumulated cyanide in the plant was evaluated in comparison with the amount of destroyed cyanide by plant or other environmental and climate factors. Results of this research can be used by industries, especially gold extraction mining industry for natural treatment of containing cyanide and cleaning soils contaminated with cyanide in addition to expanding knowledge of phytoremediation [1].

Lee et al. (2002) stated that root developmental zone which is rhizosphere has more and more active microbial population compared to soil without root. Plants are able to release nutrients and fluids through the soil and transport oxygen to the root zone and Stimulate and enhance microbial activity damaging pollutants [2].

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Schwab and Banks (1994) also noted the further reduction of total concentration of petroleum hydrocarbons in the presence of vegetation in comparison with the control without vegetation. Ferro et al (1999) also reported the significant reduction of Payrn, chrysene and fluoranthene in the presence of plant with permanent grass in their in greenhouse studies. Ayotamon et al (2006) concluded in the study about effects of phytoremediation of agricultural soil contaminated with crude oil in Nigeria that applying fertilizers will increase biodegradation of oil-contaminated soil and reduce hydrocarbon pollutants by 50 to 95 percent. The effect of applying fertilizer on stimulation of biological processes and increasing the biological treatment in Soils Polluted with crude oil were studied in this research [3].

METHODS

Firstly, agricultural soil was passed through 2 mm sieve after air-drying and then crude oil of well No. 69 of Marun oil field with is paraffin oil was sprayed on the soil to the ratio of 1 wt% in a way that soils were completely homogeneously contaminated by oil. All of the soils were accumulated after inoculation and were stored for 2 weeks for uniform distribution and adsorption on soil particles. Contaminated soils were treated in the next step. 3 fertilizers including urea fertilizer with 26% nitrogen, ammonium phosphate dioxide with 21% nitrogen and 46% phosphorous and potassium sulfate with 40% potassium were used in order to apply chemical fertilizer. NPK Chemical fertilizers were mixed in the ratio of 10: 10: 20 for N: P: K according to three fertilizer treatment levels. Nitrogen fertilizer was split into 2 phases and potash and phosphorus were given at the beginning of experiment. The treated soils were placed in greenhouse under controlled light and temperature conditions and phytoremediation process was studied there for 10 weeks [4]. Soil moisture was kept at field capacity (F. C) during this period in for activity of crude oil order to create condition degrading and soils were stirred 2 times a week to alleviate the lack of oxygen and create aerobic soil condition [5, 6]. CHROMAFIL CA / S 045 micron syringe filters were used in order to sterilize the crude oil.

MPN method was used in the next step is to count heterotrophic bacteria which is decomposition of hydrocarbons. In this method, 3 g of soil sample which has been collected at the right time is mixed with 10 ml of Bushnell Haas environment in order to create suspension after preparing the medium and ml of suspension is added to 9 ml of culture medium after half an hour and a series of diluted solution is prepared from 10⁻¹ to 10⁻¹² using this method. Resazurin reagent and then sterilized crude oil were added to each tube to the rates of respectively 90 microliters and 0.2 ml and prepared tubes were incubated for 2 weeks. After two weeks of regular evaluation of tubes, when changing of color from blue to pink was observed (which shows the heterotrophic bacterial growth), tubes were removed from the incubator and bacteria were counted based on MPN table [5].

In order to evaluate oil change, Oil present in the sample was initially extracted by Soxhlet and chloroform organic solvent and was injected into gas chromatography in microliter after asphaltene. The initial temperature was 50 ° C and the final temperature was 320 ° C and temperature rise in it was 5 ° C per minute. Rock Eval and Kjeldahl method were used respectively in order to measure total organic carbon and total nitrogen content [7]. These experiments were carried out in form of completely randomized factorial statistical design with three replications. A total of 25 pots were used per treatment in this study. Soils of 20 pots were polluted by cyanide and soils of 5 pots were used as control group without contamination with cyanide. Clay loam and grain loam textures of soil was used. There were not plants in 6 pots contaminated with cyanide and the aim of experimenting these pots was evaluation of effect of irrigation and atmospheric factors on reduction of soil cyanide. Variables of pots were: the initial cyanide concentration added to the soil (C) at five levels of C1 to C5, Purification agents (M) with five levels of M1 to M5 and type of plant (P) with three levels of P1 to P5. Description of different levels of variables of initial cyanide concentration, purification factors and type of plant are mentioned in (Table 1). Two plants including Fescue (lamb pasture grass) with endophytic and without endophytic and Sorghum were selected in this research after necessary studies on useful and available plants. These two plants have history of usage in phytoremediation of other pollutants and have good tolerance against unfavorable conditions [8].

Soil of each pot was infected with a known concentration of potassium cyanide (KCL). Planting of all pots was done on a specified day. Previously amplified plants were used for planting of fescue and seed was used for sorghum. Plants were irrigated simultaneously with about 760 cubic centimeters of water per irrigation and with the same frequency. All plants in pots were taken out of soil after 98 days along with their roots and were stored in sealed envelope after drying and turning into powder. Soil in the pot was also crushed and mixed after drying so that it becomes thoroughly uniform and was then stored in sealed envelope [9].

Samples were distilled in order to measure total cyanide in soil and plant samples in accordance with the procedures of standard method and then colorimetric method was used for measuring cyanide using spectrophotometer [10]. Measured Cyanide in the soil was in terms of milligrams of cyanide per kilogram of soil (mg CN / kg soil) and in terms of milligrams of cyanide per kg of dry plant (mg CN / kg dry biomass) in plant. The accuracy of measuring of used device (spectrophotometer) to test the cyanide was 0.001.

Table 1: statistical summary of data related to measuring cyanide existing in soil and plant after removal of plant

Statistical parameters	Existing cyanide (mg/kg)		Ratio of existing cyanide compared to the initial value	
	soil	plant	soil	plant
Number of absorptions	60	36	60	36
Maximum (100%)	7.71	14.34	99.2	78.41
Median (50%)	1.49	0.09	49.58	0.80
Minimum (0%)	0.01	0.01	2.9	0.01
Range	7.30	14.34	96.3	78.4
average	2.21	1.89	48.84	18.04
SD	2.16	3.45	27.47	26.55

Statistical analysis of data collected in this study was done using statistical software such as SAS, SPSS and Excel. Methods of analysis of variance (ANOVA, Analysis of Variance) were used to evaluate the significance effect of variables as well as their interaction on soil cyanide removal and efficiency of cyanide accumulation in plants [10].

RESULTS

This experiment was done in form of split plot design with three replications in completely randomized design. The main factor of fertilization treatment was with 3 levels of 0, 1 and 2 tons and the factor of time included 2 levels of 5 and 10 weeks as secondary factor. SAS software was used for data analysis. Mean comparison for significant factors was done using Duncan method.

As it can be observed in table 1, cyanide removal efficiency from soil has had many changes in a way that the highest amount of cyanide in soil is 31.7 and its lowest amount is 0.008 and its average is 2.212 Mg per kg of soil. The highest soil cyanide reduction is 99.2 percent and its lowest rate is 2.9 percent and its average is 48.4 percent. Also the maximum amount of cyanide accumulation in plant is 14.34 and its lowest amount is 0.001 and its average is 1.89 Mg per kg dry plant. The highest, lowest and average percentage of cyanide accumulation in plant is respectively 78.405, 0.0045 and 18.04.

Effects of two variables of initial soil's cyanide concentration with four levels of C1 to C4 and purification agents with five levels of M1 to M5 were on cyanide removal efficiency were evaluated in factorial model of cyanide removal and results analysis of variance of related data are shown in table 2. This statistical analysis was conducted at confidence level of 99% (1% significance level). F calculated for effect each variable on soil cyanide removal rate must be used with its critical F value and if the calculated F is smaller than the critical F, that variable has no significant effect on the cyanide removal efficiency and the observed difference is due to random errors. It can be observed in (Table 2) that both variables of initial cyanide concentration and "purification agents" as well as their interactions have had significant impact cyanide reduction efficiency. It also shows that Interaction between the initial concentration × purification agents is also significant but it is less effective than main variables in the soil cyanide removal efficiency changes.

Table 2: Analysis and Variance of reduction percentage of cyanide in the soil

	Source of change	Degree of freedom	Sum of squares	Average squares	Calculated F	Critical F	P value
Model		19	39958.00	2103.05	18.47	2.73	<0.0001
	Purification agents	4	23218.0	5804.55	50.98	3.83	<0.0001
	initial cyanide concentration	3	10383.2	3461.07	30.4	4.31	<0.0001
	Purification x concentration	12	6356.6	529.72	4.65	2.66	<0.0001
Error		40	4554.36	113.86			
Total		59	44512.37				

We can compare different data averages related to different modes of variable in Fig.1. In different concentration of initial soil's cyanide, the maximum efficiency of cyanide reduction has occurred in C1 concentration with the mean of 70.13% and its minimum rate has been in C4 concentration with average of 34.30 percent.

Also among different purification factors, the maximum removal efficiency of cyanide is in M3 (sorghum) which is equal to 76.742 percent and its minimum rate has been in M5 (without plants and irrigation) which has been equal to 16.085. These results show that Pots with plants had better cyanide removal efficiency than the unplanted pots and sorghum has played as better role in phytoremediation of cyanide-polluted soils compared to Fescue which is due to cyanogenic feature of sorghum.

In factorial model of soil cyanide accumulation in plants, effects of two variables including initial soil's cyanide concentration with four levels of C1 to C4 and type of plants with three levels of P1 to P3 were evaluated on percentage of soil cyanide accumulation in plants and only changes of type of plant made significant changes in the efficiency of cyanide accumulation in plants and changes of Cyanide concentration have no significant effect on the percentage of cyanide accumulation in plants. In addition, interaction between the percentages of the initial concentration of cyanide accumulation in plants does not have such difference at the level of 1%. Thus it was concluded that the increasing amount of initial soil cyanide concentration will not increase percentage of cyanide accumulation in plants. It can be observed that percentage of cyanide accumulation in plants has increased a little at low level of initial soil's contamination cyanide in a way that highest percentage of cyanide accumulation in plants has been in C3 concentration. It seems that C3 concentration has been the threshold of tolerance of plants and by increasing soil pollution more than C3 concentration cyanide accumulation in plant efficiency has reduced due to the incidence of cyanide toxicity of the plants. It has been observed in practice that Fescue dried and died slowly in C4 concentration. This observation again confirmed the fact that phytoremediation is an appropriate method for contaminated soils with low concentration. Also it can be observed with comparison of mean percentage of cyanide accumulation in different plants that the highest amount of accumulation has been in sorghum with 52.952 percent and its lowest amount has been related to fescue without endophyte with 0.448 percent. In pots with Sorghum, sorghum has had the main role in removal of soil cyanide with the highest concentration of cyanide but concentration of cyanide in plant is not significant in pots with fescue.

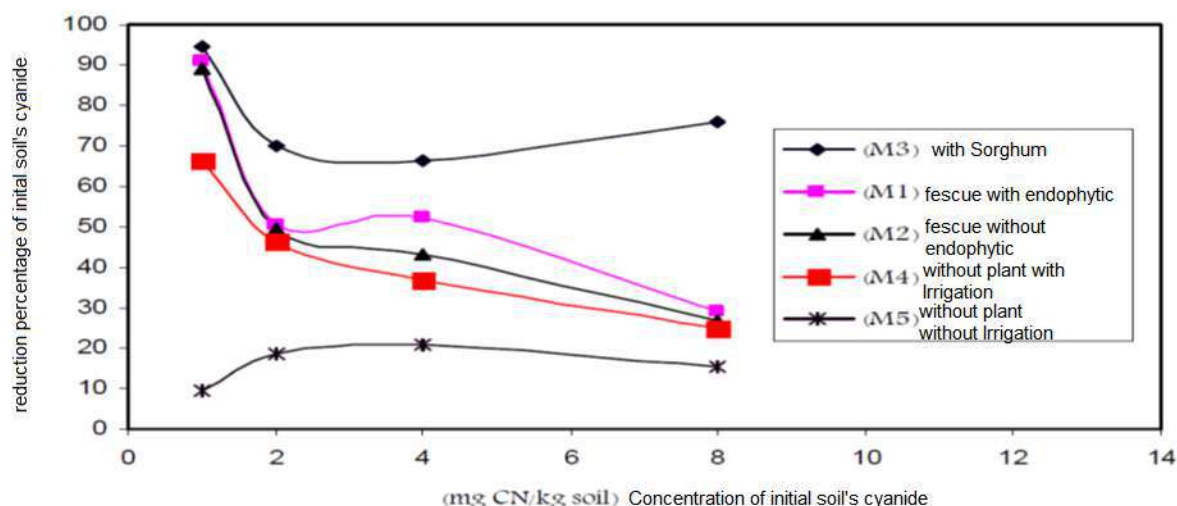


Fig. 1: Reduction percentage of soil cyanide in different forms of purification agents for initial cyanide concentration in soil

CONCLUSION

Results of analysis of variance showed that application of NPK fertilizer and regular aeration during the process of coincides reforming with increasing growth of heterotrophic bacteria have had significant effect as the level of five percent. 37 percent of oil decomposition was also observed in control soil which has been due to regular soil aeration and temperature conditions ((25-30°C) and suitable humidity for bacterial activity. The effect of time factor on oil decomposition was significant at 1% probability. It can be observed in (fig.3) that oil decomposition has slowed down with time and oil decomposition is more in fifth week compared to tenth week. This is entirely consistent with the growth of heterotrophic bacteria and highest bacterial growth has occurred in the fifth week. The activity of bacteria and oil decomposition has been probably more in first 5 weeks of treatment due to presence of rapid decomposition normal alkanes the abundance of mineral nutrition but over time, petroleum compounds which are difficult to decomposition, have long-chain and residual nitrogen deficiency remain and bacterial growth and thus oil decomposition reduce [11]. Oil decomposition increases with an increase in microbial population in the soil and this increase is faster during the first month of Treatment and this process decreases with time. Oil decomposition has statically significant difference in the samples treated with samples not treated at level of 1 percent. There is also significant difference between the average soil decomposition in the both time extraction of soil (5 and 10 weeks) and average oil decomposition in soil is higher in five weeks compared to ten weeks (Fig.2).

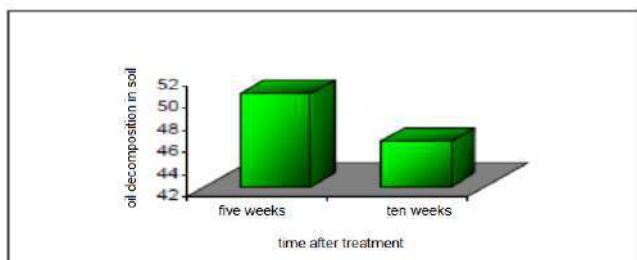


Fig. 2: Comparison of the average effect of oil decomposition in soil

Analysis of variance shows significant difference results between effects of different treatments with NPK fertilize compared to C / N of soil. Ration of C / N in the samples without treatment is higher than treated samples (Fig. 3) because the lack of mineral nutrients in control sample limits growth of hydrocarbon degrading bacteria and oil decomposition and C / N ratio rises. C / N ratio was about 3 times bigger in control samples compared to the treated samples.

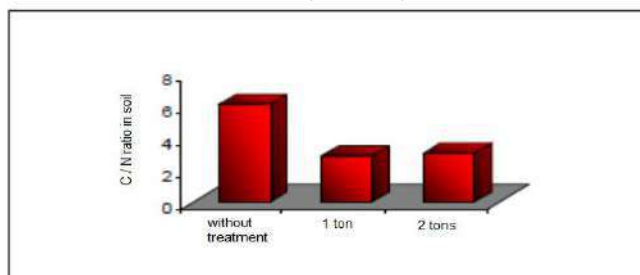


Fig. 3: Comparison of the average effect of chemical fertilizer treatments to C / N in soil

C / N ratio decreased with the passage of time of the treatment but this ratio is lower in fifth week compared to the tenth week because there are enough food available for bacteria in the fifth week but mineral deficiencies reduces over time and limit bacterial growth and oil decomposition. Average ratio of C / N in soil has statistically significant difference in treated samples and control group. This C / N ratio is higher than in the control samples compared to treated samples. It was observed in evaluation comparing the average effect of time on ratio of C / N in the soil that there is a significant difference at 1% probability in the soil at both decomposition times and C / N ratio is higher in 10th week compared to 5th week.

Results of Analysis of variance showed the significant effect of chemical fertilize on the growth of heterotrophic bacteria degrading petroleum in hydrocarbons contaminated soils at the level of five percent probability. There is a significant difference between the treated samples with control samples in terms of bacteria growth (figure 4). The growth of heterotrophic oil degrading bacteria has significantly increased due to the effect of treatment of mineral nutrients containing nitrogen, phosphorus, and potassium which increased oil decomposition and decreased C / N ratio. In fact, a major aspect of phytoremediation operation involves the use of nutrients such as nitrogen and phosphorus fertilizer, aeration use of hydrocarbon degrading microorganisms in contaminated areas [12].

In the present research, bacterial growth and oil decomposition are high at the fifth week due to normal presence of alkanes and environmental conditions and good nutrition but only aromatics and asphalts remaining in tenth week and Nutrient deficiency occurs which will reduce phytoremediation process. The average growth of bacteria in treated samples has statistically significant difference with control samples and bacterial growth is lower in treated samples compared to non- treated samples (figure 4). Evaluation of comparison of the mean effect of time on bacterial growth in the soil confirms that the growth of bacteria decreases with time.

Crude oil of well No. 69 of Marun Oilfield which was sprayed on soils in this study was injected into gas chromatography device in Microliter after extraction from soil with Soxhlet and bitumen asphalt. Each of the normal alkanes was calculated after presenting the GC peak of areas under the curve. Priest and titanium were used as internal standards [10]. In order to facilitate consideration of changes in normal alkanes, they were divided into six categories follows based on the proximity of their chemical composition: <C13, C13-C16, C17-C21, C22-C25, C26-C29, C29-C36.

As it can be observed, C13-C16 category has formed about 12% of the total crude oil and largest volume of normal alkanes and C26-29 category has formed the lowest volume with only 4% of crude oil. According to composition of crude oil which includes gasoline (C4-C10), kerosene (C11-C12), diesel (C13-C20), oils (C21-C40) and residues <C40, crude gasoline oil in this sample is 23% and non-cyclic isoprenoids of Priest and Phytane are respectively 1.34% and 1.55% of total oil.

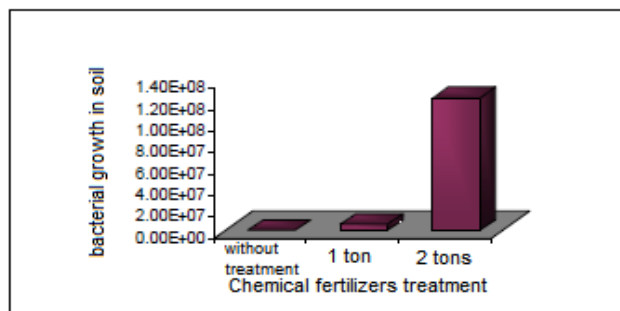


Fig. 4: Comparison of the average effect of chemical fertilizer treatments on bacterial growth in soil

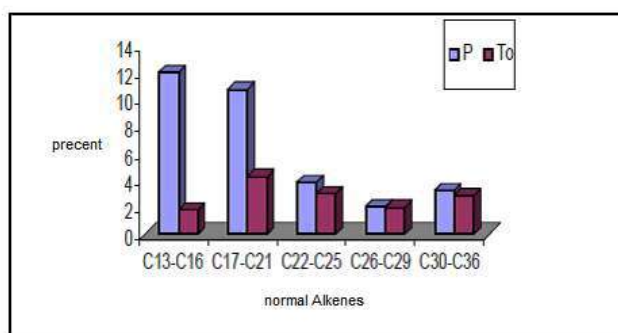


Fig. 5: Comparing the percentage of normal alkanes in the control sample (T0) with primary crude oil

Fig. 6 compares the effect of chemical fertilizer treatment in both 5 and 10 weeks on normal alkane's oil changes with the control samples. This figure shows that approximately 80% of normal alkanes C13-C16 are decomposed after the fifth week which shows the extent of consumption of hydrocarbons by bacteria. Extensive use of this category is due to short carbon chain and the abundance of mineral nutrition and environmental conditions at this stage but C17-C21 and C22-C25 categories have only had decomposition for 35-38 percent which shows Low consumption of medium-chain paraffins by studied bacteria due to low decomposition of odd normal alkanes in these two categories. These normal alkanes with terrestrial origin (horsetail) are decomposed in a small amount by oil degrading bacteria. The fourth and fifth categories which are respectively C26-C 29 and C30-C36 have been decomposed by 60% compared to the control samples.

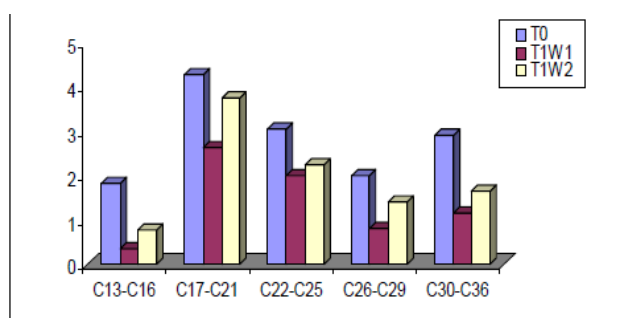


Fig. 6: Comparing the percentage of normal alkanes in the treated samples with one ton of chemical fertilizer in the fifth week (T1W1) and in the tenth week (T1W2) with the control sample (T0)

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None.

FINANCIAL DISCLOSURE

None.

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ARTICLE

THE GOVERNING PRINCIPLES OF ARBITRATION USING ONLINE TECHNIQUES

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ABSTRACT

Today, people tend to conduct their transactions in online environment due to multiple advantages. Therefore, like conventional transactions, the parties might face dispute while conducting the transactions. Online transactions need to be resolved in online environment. Online arbitration is one of dispute settlement practices in cyber space. Based upon the previous studies, it is concluded that traditional arbitration rules need to be followed in online arbitration by parties and arbitrator. Written arbitration agreement is one of principles to follow. Impartiality and equality need to be respected. Like traditional arbitration, issued judgments resulting from online arbitration are valid and irrevocable. To this end, some factors need to be prepared for individuals' tendencies although they resolve their disputes online. Trust to arbitration is one of important factors in this regard. Other factors are authentication and establishment of security in exchanging information and privacy supplied by digital signature or encryption in order to smooth the path for online arbitration using online techniques. Appropriate rules need to be developed in this regard.

KEY WORDS

Cyber Space, Settlement of Disputes, Alternative Methods, Arbitration, Online

INTRODUCTION

With the growing use of the Internet, disputed arising from e-commerce is also rising. Most traditional mechanisms of settling disputes, including traditional arbitration are inappropriate to resolve such disputes. This mechanism is time taking and costly and creates serious issues concerning the jurisdiction and enforcement of judgment. In other words, cyber space with a large volume of technological facilities, as a new phenomenon in law literature, has challenged the traditional international commercial arbitration. Therefore, arbitration can start with the statement that e-conflicts that occur in cyberspace must be electronically resolved. Electronic arbitration is a dispute settlement procedure whereby all arbitration process including the presentation of bill to the Court of Arbitration and the whole process of arbitration process is carried out through online networks, e-mail, and chat or video conference rooms. Today, some arbitration institutions with a long history in arbitration provide electronic services to resolve disputes. For example, arbitration is electronically performed in World Intellectual Property Organization, International Chamber of Commerce, and Arbitration Association of America. The emergence of this new institution of proceedings creates legal questions regarding the authenticity of electronic agreements, the entry into force of the issued judgment, identifying them, and numerous questions. Responding all of these questions is undoubtedly impossible without adoption of the law or code. Since one article cannot eliminate all ambiguities, this article aims to explain the online arbitration so that arbitration agreements are described. Then, the processes of arbitration and effective factors in online arbitration development are discussed.

ONLINE ARBITRATION AGREEMENT

The first step to establish online arbitration is to sign agreement between parties and arbitrator. Considering the presence in the Age of Communication, arbitration agreement is signed by electronic devices such as Internet instead of conventional forms with prints and hand-made signature, while legal frameworks related to such agreements including the 1958 New York Convention was passed and popularized in the years before the adoption of the Internet. Similar to traditional arbitration, written agreement is one of online arbitration credibility requirements pointed out in Article 72 of the UNCITRAL Model Law, stating that arbitration agreements must be written. Concerning written agreement, Paragraph 2 of Article 9 of the 2005 Convention states that whenever a law necessitates the written condition of a contract or considers consequences for lack of written agreement, such necessity is met through electronic procedures. If the information in agreement is accessible which can be used for future reference, all contents concerning the credibility of various e-documents cover all topics and smooth the path for technology in modern law. Such information is set in a way to be adaptable with future progress concerning commercial relations [1]. The term "written" is a contractual concept in which the most important objective is to prevent the denial of parties' obligations by recording and preserving its provisions. Recording and maintaining an agreement is far more accurate and safer by an electronic device than paper systems. Written agreement in an online arbitration is far stronger than paper systems. Parties to a commercial transaction tend to use e-mail and clicking on mouse rather than letters, telegrams, and faxes. This way, they are able to sign an arbitration agreement. Exchanging emails is similar to telegram and letter concerning the concept and performance. It is, in fact, an advanced mechanism similar to telegram and letter with the same consequences [2]

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Published: 12 Sept 2016

Electronic devices such as e-mail and website are somewhat considered equal to traditional communication tools such as telegrams and letters. The concept of electronic devices will improve in the future by the advancement of technology. Article 2 New York Convention, Article 72 of the UNCITRAL Model Law, and 1449 and 1677 Belgium Arbitration Act have pointed out to this issue. Article 72 of the UNCITRAL Model Law provides a wider understanding of "written" word. A treaty is written in case providing signed document, letters, telex, telegram, or other communication tool which provide a recorded report is mentioned in the treaty.

The definition of written involves any communication method which can act as a recorded report. UNCITRAL Model Law and the New York Convention are not designed in a way to typically validate the electronic arbitration. Electronic devices, however, are considered equal to traditional communication tools such as telegram and letters. Therefore, considering the objective and function, we can generalize this interpretation in accordance with contemporary technology and New York Convention [3].

ONLINE ARBITRATION PROCESS

Here, we review the arbitration proceedings in online arbitration. Then, notifying the arbitration and sentencing are then reviewed.

HOW TO ISSUE THE VERDICT AND ITS VALIDITY

Concerning the verdict, online arbitration might be performed in different ways. One method is to use current regulations for conventional arbitration such as UNCITRAL Arbitration Rules. Another method is to consider appropriate communication tools in online arbitration. It is important to know that arbitration rules cannot be ignored and some parts of traditional arbitration needs to be taken into account even if all the procedures are online. Otherwise, fair trial or the government's commitment to the court verdict cannot be guaranteed [4]. According to the principle of autonomy, both parties are free to agree to conduct a part or all parts of online arbitration using electronic devices, or ignore electronic devices [5]. We need to emphasize that any type of arbitration including online arbitration needs to be performed in line with general principles of arbitration and mandatory norms. Such rules must not be ignored by both parties because the principle of autonomy cannot underestimate the existing mandatory norms. The principles of neutrality and equal treatment of the parties, expressed in articles 12 and 18 of the Model Law, are among important mandatory rules. If such rules are not respected, similar to that of traditional arbitration, online arbitration is challenged concerning the validity [2]. In order to ensure the justice and respect for the principles of mandatory arbitration procedures, the use of electronic devices, regardless of its scope of function, need to be appropriately applied in the process of arbitration by the court or arbitrator. It must not violate the mandatory principle in order to validate and formalize it. Therefore, both parties are to some extent free to whether or not choose electronic devices in the process of arbitration. Such agreement must not violate the mandatory rules. The court or arbitrator can make decision to use electronic devices. Online arbitration might have some unsolved problems such as subpoena witness and interrogation. Providing the reasons and hearing require the presence of both parties. Arbitrators need to make decisions regarding when and where to follow arbitration formalities. The objective of online arbitration is to reduce costs and accelerate the process of arbitration. Procedures which guarantee the correct and fair arbitration must not be ignored [6]. Some procedures which cannot be performed online are physically performed such as when the arbitration is performed online but a paper document is required for the verdict. In such circumstances, the arbitrator or court needs to physically perform it and no online procedure is required. Such problems are gradually disappearing since most arbitration institutes fill out the form based upon the online rules and regulations [7]. In an online process, one party can ask for arbitration through e-mail. Informing the party can be performed through e-mail. Interestingly, most people are able to use electronic documents in the international business environment. In most cases, they convert paper documents into electronic ones. Concerning the validity, electronic requests are equal to paper ones. In terms of the function, they are equal to printed papers. In other cases, both parties can agree to follow the arbitration based upon online technology without oral hearing. In online arbitration, both parties might decide to continue online hearings. Witnesses, experts' opinions, and many other issues might be performed online using teleconferencing or video conferencing, if possible. Online arbitration can alone be enough to record the events of a given document [8]. It, however, faces two main limitations: technology and law. Concerning the former, there are some intricate issues which need to be taken into account. For example, quality technology is not accessible everywhere and impeccable communication cannot always be established. On the other hand, non-verbal cues, tone of speech, and physical behavior of parties cannot be sensed which are one of the most effective factors in arbitrator's decision [9]. The latter is associated with legal nature of some procedures in online arbitration. For example, can oath be taken online? In such cases, arbitrators are advised to perform the process of online oath as a respected observer or similar mechanism that would do credit to provide the oath (ibid). Another important issue is the place of arbitration. As it is known, place of arbitration is a determinant in conventional arbitration. If arbitration is fully performed online and both parties and/or arbitrator are in different location, then determining the place of arbitration seems impossible. Some researchers have concluded that cyber arbitration has no location [10] because it is not related to geographical territory [9]. Some other authors also believe that online arbitration has no place based upon the theory of lack of spatial settlement [6]. Such interpretation is problematic, challenging the online arbitration. Determining the place of arbitration is very difficult in online arbitration [1]. In international arbitration, the place of arbitration is geographically clear with multiple legal consequences

[11]. Article 20 of the UNCITRAL Model Law, taken by modern and advanced arbitration rules, gives the freedom to select their place of arbitration [6]. In cases where the location of arbitration cannot be agreed, the place needs to be determined by the court considering the circumstances such as the comfort of parties. Therefore, determining the place of arbitration can be obtained through the both parties and arbitrators. Another question worth mentioning is the validity of issued verdicts. Are they valid or not as that of conventional verdicts? Undoubtedly, the basis of verdict's validity concerning the electronic arbitration is the New York Convention. Despite written nature of verdict, the convention emphasizes that both parties must follow a signed verdict. It is, however, implied that it means the traditional verdicts mainly issued through paper formalities. The uncertainty here causes us to interpret the convention in favor of online arbitration. Some national rules are, however, inconsistent with formal requirements applicable for online arbitration. Some scattered rules have caused the researchers to hesitate the fact that e-verdict is applicable or not. Some researchers have recommended that New York Convention review can be beneficial for more legal safety of e-verdicts. Therefore, it is claimed that secure e-document, considering the ultimate objective of New York Convention, can be considered the main document. It seems that passing rules concerning the validity of e-documents and internet documents can certainly be an important issue in online arbitration [2].

Notification and enforcement of arbitration issued online

Notifying arbitration is important because it dramatically affects the procedure of online arbitration. This allows the parties to know the verdict and then take the next steps because the verdict in arbitration is judged immediately after notifying [12]. Therefore, notifying is very important and effective. Notifying through electronic devices is very easy and exact using the current rules notifying a verdict by a safe e-mail can record concerns regarding this issue such as date of notifying, time of reception, and even time of studying. Undoubtedly, 1996 English Arbitration Act is one of the freest and best national rules in this regard which can be considered an appropriate model. Article 1 Section 55 states that both parties are free to agree on the condition of notifying the verdict. In such cases, both parties can easily agree on being notified by e-mail, or accessed by any safe operating system [9]. It seems that using e-devices for notifying the verdict is correct and valid considering the principle of autonomy because Article 458 Code of Civil Procedure argues that if both parties have not predicted a special method for notification, this will be performed by the court based upon the Code of Civil Procedure. It means that if a certain method is considered for notification, the principle of autonomy requires that the same certain method is validated [13]. In organizational arbitration, if both parties have not agreed on the notification of arbitration, it is preformed based upon rules, meaning that it can be done by e-mail, too provided that e-mail is able to clarify the time and date of notification and all security procedures have been met [12]. Arbitrator can determine how to notify the verdict. Therefore, it seems that sending and notifying the arbitration and even warnings are expectable by e-devices such as fax and e-mail. In developed countries, Internet, post, telephone, etc. are used to notify the verdicts [14]. Online notification does not meet the legal requirement of written notification. In order to meet the safety procedure, the verdict needs to be archived, too (ibid). Enforcement of arbitration happens after the notification. International enforcement is one of the most attractive and distinguished features of international business arbitration. Online arbitration has the same features of conventional verdicts and they are final and ultimate. 1958 New York Convention is an acceptable document by most countries worldwide, providing sufficient guarantee to recognize and enforce arbitration. Based upon the Article 5, the winning party can ensure the formalities of enforcement. This convention along with the principle of neutrality and independence has caused practically easier enforcement of verdicts than public ones. In online arbitration, real world rules are applicable to identify and enforce the arbitration. Concerning the enforcement, all parties are not expected to follow the verdict after notification. Likewise, it does not happen in conventional and traditional arbitration. Undoubtedly, no difference is found between the conventional and electronic verdict. Therefore, it seems that the executive mechanism of New York Convention necessitates the consideration of New York Convention as the spinal cord of international online business arbitration [2].

EFFECTIVE FACTORS TO DEVELOP ONLINE ARBITRATION

Most people imagine that a good relationship is required between parties and arbitrator for a successful arbitration. However, this is not enough for a correct arbitration. The arbitrator needs to learn the fair and neutral arbitration. To achieve such goal, other factors are essential to develop arbitration as follows:

Building Trust

Trust is one of features of arbitration. It is essential to have trust between parties and arbitrator. In online arbitration, building trust is a little more complex than conventional arbitration because parties do not know each other. The fact that the parties do not know each other and the communication is performed through cyberspace makes the arbitration more difficult in order to manage the actions and reactions, or use the skills to realize the cyberspace and reactions [15]. It is also more difficult to maintain and strengthen the trust. Therefore, online arbitration must have a special strategy in this regard.

Parties` Identities and Digital Signature

Lack of clear identity is another important issue discussed in arbitration. The identity needs to be authenticated. One of the best strategies is encryption performed through the digital signature. Digital signature can play a key role to guaranteeing the accuracy and correctness, and ultimately building trust. Fortunately, in Iran, positive measures have been taken in this regard after the adoption of the Electronic Commerce Act and requirement of public state organizations to use e-government instead of paper procedures including e-identity and signature in banking system. In Europe, e-signatures are considered an appropriate alternative for conventional signature. Authentication and witnesses introduced by both parties is performed by the arbitrator and the arbitrator can take advantage of IT specialist in order to ensure the correct procedure [4].

Information security

The security of information is another important factor worth mentioning in Internet exchange. In most online arbitrations, one or both parties tend to confidentiality of all process. Internet is an open network which might have a lower level of security compared to fax, letter, or telephone. Hackers are a threat to disclose the information. Encryption is therefore an important factor in the security of information. Encryption enables both parties to communicate safely. Confidentiality is an essential element for a successful online arbitration. All communications is performed in unsafe forms online. There are multiple temporary versions to transfer information online which is the nature of Internet [2]. Therefore, encryption is the best method to maintain the security of information. Encryption is automatic process of making information inaccessible to unauthorized persons performed by an algorithm and code. Decryption is the reverse procedure. It is a good method to guarantee the confidentiality of an asymmetric system. There are two keys for encryption and decryption. It means that no one is able to read the message without the code. The code is separately sent to the receivers. When the confidentiality is ensured by encryption, both parties and arbitrators are allowed to check the process of arbitration any time. It is not necessary to write any document since everything is digital

Privacy

Privacy is another important issue in online arbitration. Parties need to be aware of places where the secured information is used and saved. This is possible using a strategy to guarantee the maintenance of privacy of all people involved in online arbitration. Encryption plays a key role to maintain the privacy. It is necessary to know that HTTP technology is used for online arbitration because is a beneficial technology in the security of network. Meanwhile, it can be dangerous and abused.

Developing electronic infrastructures

Access to Internet is a basic need for successful online arbitration worldwide. Internet is required prior to online arbitration. This is fortunately welcomed in Iran so that 7.5 million people have been using Internet in 2006. Iran scored the second in using Internet in the Middle East. The growth was, however, not similar in different parts of Iran. Most Internet users are residents in urban areas and teenagers and the young account for most of users. Quality Internet is another important factor. Positive steps have been taken in recent years to reach the international standards in this regard [2]

CONCLUSION

By expanding the use of electronic devices for transactions in cyberspace, some methods need to be taken into account to resolve the disputes resulting from the electronic transactions. Online techniques are one of these methods. All measures in conventional arbitration need to be followed in online arbitration. Arbitration agreement is one of written arbitration rules pointed out in many rules. Neutrality and equality are two important principles which need to be respected otherwise they would violate the verdict. Online verdicts are valid similar to conventional ones so they need to be notified to both parties. The ground needs to be prepared to encourage people to use online arbitration. Building trust is one of them. Authentication, security of information exchange, and privacy need to be guaranteed through encryption and digital signature. Therefore, some rules are required in this regard.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None.

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ARTICLE

EFFECT OF KNOWLEDGE MANAGEMENT ON EMPLOYEES' PERFORMANCE IMPROVEMENT

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ABSTRACT

In the today world that the production of goods and delivery of the services have seriously been knowledge-based, the knowledge is a key property for achieving the competitive superiority. The knowledge management has been paid more attention in the world and in this basis, the introduction of capabilities and performances and the effects of knowledge management has been driven onto the focus of daily-increasing necessity. The knowledge management possesses many advantages for the organizations among which the improving of job quality, having updated information, increasing the effectiveness, improving the efficacy, improving the decision-making, increasing the workout response to the basic needs and changeability and adaptation can be counted. This research analyzed the effect of knowledge management on performance improvement of the employees in Tax Affairs Administration of East Azerbaijan. The results of the research shows the positive impact of the dimensions of knowledge management (creating knowledge, acquiring knowledge, organizing knowledge, distributing knowledge and applying knowledge) on the performance improvement of the employees in the Administration.

KEY WORDS

Knowledge
Management,
Performance
Improvement,
Employees, Organization

INTRODUCTION

The various organizations and companies have started joining the progress of knowledge in the recent years and the new concepts such as knowledge job, knowledge worker, knowledge management, and knowledge-based organizations announce the intensification of this progress. Drucker uses these lexicons to inform creation of a new type of organizations in which the mind power has dominance over muscle power. Based on this theory, only can those of communities expect the development in the near future that possess much more knowledge. In this regard, maintaining the natural resources cannot be as important as knowledge. A knowledge-based organization reaches those of capabilities that can create an enormous power out of a minor force. The factors such as globalization, miniaturizing the governments, citizen-based and collaborating necessity of citizens entail a special attention to the knowledge management. Since the human beings are the fundamental bases of the knowledge, it should have a dynamic and flexible structure. The motivational factors play vital roles in using, sharing and creating the knowledge.

CONCEPT OF KNOWLEDGE MANAGEMENT

Quite a few definitions have been presented for the knowledge management ever since. The knowledge management observes a set of processes during which the flow of knowledge in a society is guided continuously and increasingly [1].

The knowledge management is the process of identifying the intelligent property and of creating the culture and infrastructures that encourages collaborating and leaning. This process is to follow the intelligent capital by achieving, nourishing and using all things that the employees need and are aware of. In the collective organizations, this capital creates a situation, bringing about the added value by transferring the new products and services.[2]

In fact, a basic point is to determine and mine the pearl of knowledge from the deep sea of information. Since the value could be both material and spiritual, the knowledge management is known as the art of creating the value from the valuable properties [3]. This management maintains the intelligent capitals from destroy, searches the opportunities by increasing the quality of decisions, services and products by means of adding knowledge (awareness) and value and providing the flexibility.[4] It also distinguishes the critical operations and potential dilemmas (which divert the flow of knowledge) by making distinctive the intelligent capitals. In this respect, the human resources can encounter the organization with the intended situations and can help the organization predict the future effectively [1]

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Published: 12 Sept 2016

CONCEPTUAL MODEL OF RESEARCH

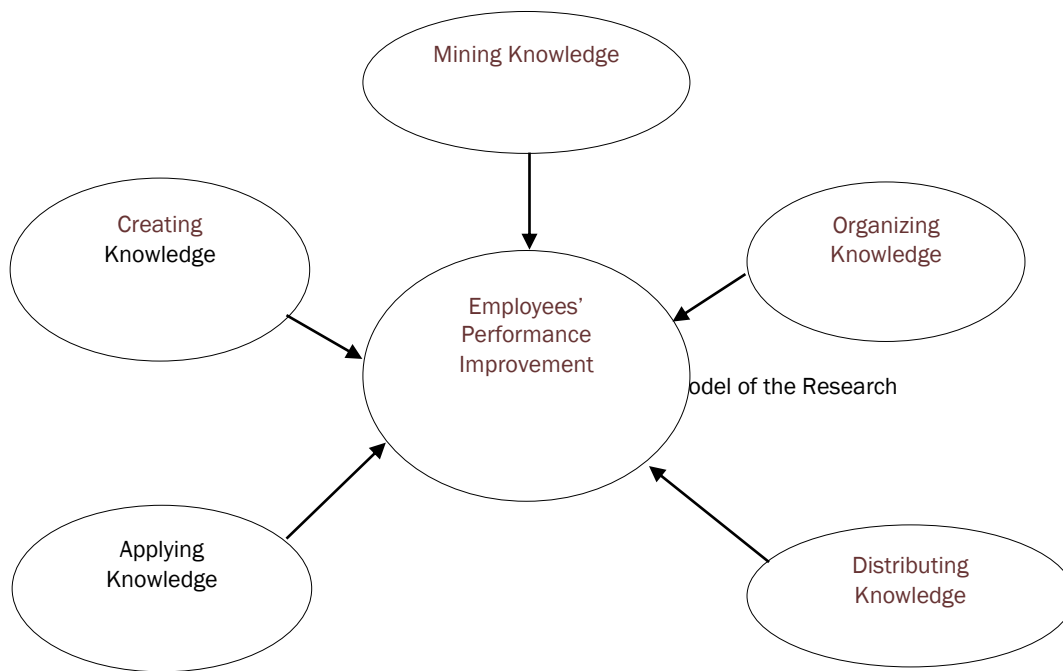


Fig. 1: Model of research

According to the conceptual model of the research [Fig-1] , the following hypotheses have been intended:

- 1) Creating knowledge has a positive and significant influence on employees' performance improvement.
- 2) Acquiring knowledge has a positive and significant influence on employees' performance improvement.
- 3) Organizing knowledge has a positive and significant influence on employees' performance improvement.
- 4) Distributing knowledge has a positive and significant influence on employees' performance improvement.
- 5) Applying knowledge has a positive and significant influence on employees' performance improvement.

METHODS

The current research analyzes the current situation of the variables and their relations in Tax Affairs Administration of East Azerbaijan. Therefore, this research is an applied one by its aim because the applied studies are conducted to acquire new scientific and technical knowledge for which special application is allocated. In addition, the research is a survey-based one by its method and is a descriptive study based on its conclusion. This research is generally aimed at analyzing the influence rate of knowledge management on the employees' performance improvement. It uses the descriptive-correlational method based on its topic and aims.

The research community in fact includes all the elements that the subject of a specific research becomes true based on it and we tend to infer about it. The limits of a research community are determined based on its definition. The definition of a community is represented by integrating the mutual features that the elements of that community have and is accounted important as well based on the research topic. The research community of this study includes 300 employees from Tax Affairs Administration of East Azerbaijan.

The appropriate sample size is calculated 169, using Cochran formula with 5% error level.
Data Analysis

The statistical data analysis and hypotheses testing have been assigned by means of correlational method via SPSS Software. Normality of the variables' distribution and hypotheses testing have been respectively done. The relationship between the variables and efficacy of the model have been evaluated using multiple coefficient of determination (R^2). The results suggest that the knowledge management affects the improvement of employees' performance and the hypotheses are confirmed.

RESULTS AND CONCLUSION

The organizations need to be knowledge-based to increase and promote their effectiveness and power in the contemporary era.[5] The knowledge management is a science that is able to execute it in an organization.[2] The execution turns into a system later on. Moreover, there are challenges and opportunities in this course that can help promote the knowledge management in an organization.[6] Therefore, the prospective success is for organizations that can institutionalize the knowledge in the organization and manage it accordingly.

Relatively, majority of the governmental organizations offer services to the citizens to provide welfare for them. Some of the governmental organizations also deliver specific services to the social classes which are different according to the job and business of people. Overall, the governmental organizations are places where the employees as human resources of the organizations interact with the referees as clients. Thus, the matter of knowledge management is very necessary for both parties during the interaction. As long as each of the parties do not share the knowledge management, that organizational will definitely not achieve its macro goals.

Finally, the following recommendations are accounted:

- 1) Establishing the system of management performance should be paid more attention as one of the most effective and important management instruments to develop the organizations.
- 2) Necessary organizing and tracking should be done to establish the system of management performance.
- 3) The needed review and reform entail all aims and objectives of an organization.
- 4) The performance of employees and organizations should be documented to be used in the subsequent years.
- 4) The results of performance evaluation should be taken into consideration in order to improve the performance of organization in the next years.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The authors are thankful to Hon'ble Dean and Management

FINANCIAL DISCLOSURE

None.

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ARTICLE

THE RELATIONSHIP BETWEEN CORPORATE GOVERNANCE AND FIRM VALUE IN COMPANIES LISTED ON TEHRAN STOCK EXCHANGE (TSE)

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ABSTRACT

This article aims to study the relationship between corporate governance and firm value in companies listed on Tehran Stock Exchange (TSE). Corporate governance was measured through a check list divided into two sections (Internal and external governance components). Tobin Q ratio was employed to operate the firm value. Data were collected using 62 companies listed on TSE from 2009 to 2013. Combined data analysis and multivariate regression were used to analyze the data. The study has two hypotheses. The results indicate that internal and external elements of corporate governance have a positive, significant relationship with firm value.

KEY WORDS

Corporate
Governance, Firm
Value, Tobin Q Ratio

INTRODUCTION

Through the development of information and communication technology, global arena has created a small and compact world. Globalization has been applied not only to trade but also to many other professions. Accounting is not an exception and tries to keep pace with its rapidly changing environment. During the last few years, the competition among economic firms has caused multiple changes in accounting. TSE growth is the last few years led to numerous empirical studies in accounting and finance. Corporate governance is the most important tool to create trust in accounting [1]. One the most important tasks of corporate governance is to ensure the quality of financial reporting process. In case of appropriate structure, optimal performance of board of directors, and its supervisory role in financial reporting quality, violations can be somewhat reduced. This article aims to study the effect of corporate governance disclosure on firm value in listed companies in TSE. The importance of firm value and factors affecting it for the actual and potential shareholders caused to shed light on the topic. Multiple studies have been conducted in Iran and other countries concerning the factors affecting the firm value. This article would be beneficial considering the role of corporate governance and the creation of supervision on financial reporting through the creation of governance mechanisms for financial information transparency. The variable used here is internal and external corporate governance disclosure ability. Multivariate regression and combined data are employed to analyze two hypotheses.

METHODS

Statistical population, sample size, and methodology: This is a causal-descriptive applied study. Field study was employed to collect the data. Data collection is performed in two stages: In the first stage, articles and studies related to the topic are reviewed and then, the hypotheses are theoretically developed in order to examine the relationship between dependent and independent variables. In the second stage, essential information and documents are examined. To this end, financial statements are collected and the information is extracted. Therefore, data collection is performed through field study. The statistical population consists of all companies listed on TSE from March 2009 to March 2013 (5 years) through which they have maintained their membership in TSE. Systematic elimination sampling method was employed. Considering the inclusion criteria, the sample size consists of 62 companies for hypothesis testing.

Evaluation Tool

Financial statements and documents are collected in order to extract the essential information.

Definitions and Concepts Corporate Governance

Corporate governance is the system of rules, practices, and processes applied by board of directors and managers in order to determine the strategic path to achieve objectives, control risk, and consume resources responsibly. Corporate governance is divided into external and internal ones. Corporate governance consists of managing and monitoring the performance of managers and employees. It is a set of relationships between management, board of directors, shareholders and other stakeholders of the

Published: 12 Sept 2016

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company. Monitoring includes internal and external components. Internal monitoring consists of strong internal controls and internal audit. Internal controls are a set of practices developed by the management and implemented to reach the objectives. Internal audit is a department supervised by the board of directors. Its task is to ensure the optimal implementation of internal controls and help the efficient and independent audit. Independent audit is one of external components in corporate governance system. Quality, independent audit causes reduced agency problems and ensures the stakeholders to fairly display the financial statements.

The Concept of Corporate Governance

The term "corporate governance" did not exist in English until 1980. Therefore, the topics related to corporate governance have become important in both academic literature and public politics during the last two decades. Corporate governance was identified with ownership, financial restructuring, and institutional investors in this period [2]. Corporate governance is derived from the Greek word "Kyberman" which means to manage and guide. It changed into the Latin word of "Gubernare" and old French word of "Governor". The term has been defined in different ways by various organization or committees based upon their ideological interests [3].

Internal Components of Corporate Governance

They are a set of internal mechanisms to maintain the interests of stakeholders such as the Board of Directors characteristics including non-executive board members, number of board of directors' members, the proportion of managers in the company's stock ownership, and internal audit.

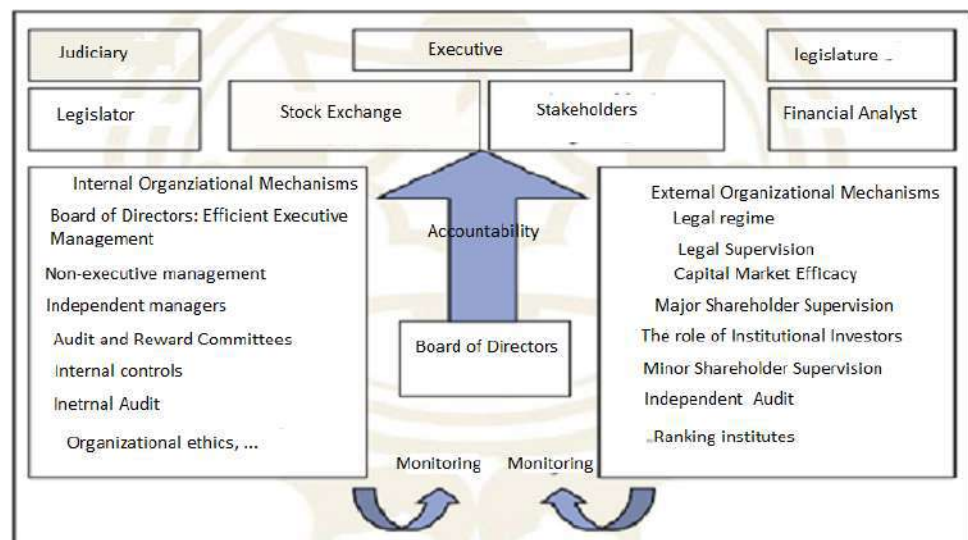
External Components of Corporate Governance

They are a set of external mechanisms to maintain the interests of stakeholders such as the institutional shareholders, government ownership, ownership concentration, etc.

Corporate Governance Mechanisms

Studies show that every country has its own corporate governance system. It is characterized by the number of external factors such as ownership structure, economic status, legal system, government policies, and culture. Some attempts to classify the corporate governance have faced some problems. Yet, internal and external classification is one of the best of these efforts welcomed by many scholars. External corporate governance is a system in large companies owned by external stakeholders, leading to the separation of ownership and management.

Table 1: Corporate Governance Structure



Firm Value

Firm value is an economic measure reflecting the market value of a business. Since measuring fair value of the net assets of the company is not easy, some indicators such as Tobin Q ratio are used to operate the firm value.

Tobin Q ratio

It is one of firm value indicators introduced by Tobin. It is calculated by total assets deducted by book value of equity added by the fair value of equity divided by total assets.

Non-executive members of board of directors

Since board of directors plays a key role in financial reporting process, it is considered an important corporate governance mechanism. Among multiple features of board of directors in corporate governance structure, the percentage of non-executive members is taken into account in this study. The board is the highest decision-making body in organizations, playing a key role in the company's fate. Selecting the chief executive officer (CEO), adopting many important organizational decisions, and monitoring the process of implementation are performed by the board of directors. Generally, board of directors consists of two independent groups. The first group is responsible for the management and directs the executive managers. Another group is non-executive members who are responsible for the firm. The latter has a determining role in the board of directors. The basis is to separate the executive tasks from monitoring and controlling ones [4]. Since the responsibilities of non-executive members are closely related to CEO, monitoring management is expected to be the responsibility of non-executive members of board of directors. Therefore, these members play a key role in solving agency problems among managers and owners [5]

Independence of Board of Directors (toward the non-executive members)

Independence of the Board of Directors can be viewed from two points of views:

Agency Theory

The presence of non-executive managers in the board of directors and their supervisory performance as independent individuals dramatically helps the conflict of interests among stakeholders and managers in the board of director meetings. With their professional and impartial opinions, non-executive managers judge the decisions. Fama and Jensen (1983) showed that non-executive managers are motivated to be effective observers in order to maintain their reputation. [5] Considering their independence from the company management, it seems that they are at better situations compared to executive managers for protecting the interests of stakeholders against managerial opportunism. Studies in this regard indicate that the effectiveness of the board of directors to support the interests of stakeholders follows a positive function of non-executive manager ratio in the board of directors [7]. This independence means not to select the members in the board of directors among the executive managers.

According to the Cadbury report, the balance of power is recommended between the members in board of directors so that no one would be unconditionally able to control the company decision making. This report recommends that the Chairman of the Board and CEO are not similar individuals. The Chairman of the Board is responsible for monitoring CEO performance and managing the meetings. If CEO and stakeholders have different interests, the influence of CEO would be problematic on the board of directors. If CEO is the chairman of the board, it is known as CEO-duality. Here, CEO is potentially authorized. This dual structure allows CEO to control the accessible information of the board of directors. Therefore, CEO might prevent the effective monitoring.

The size of Board of Directors

From the perspective of agency, it is argued that a larger board of directors is likely to be alert to agency problems because more individuals would control the management [8]. Most studies conducted in this field pays attention to the size of board of directors to evaluate the performance increase, not its role in improving financial reporting accuracy. Considering the fact that the main role of board of directors is to observe the management, studies concerning the size of board of directors are targeted at observation.

Institutional Investors

The composition of stakeholders is different in various firms. Partial ownership of companies is available to minority shareholders and individuals. This group relies on published financial statements in order to monitor the performance of managers. Yet, another part of ownership belongs to the professional shareholders. Despite the first group, the latter receives valuable internal information about the future prospects, commercial strategies, and long-term investment through direct communication with managers [9]. Institutional investors are large investors such as banks, insurance companies, and investment companies. It seems that the presence of institutional investors might change the behavior of companies. This is rooted in the regulatory activity performed by such investors [10]. Institutional investors have the opportunity, resources, and ability to monitor, regulate, and affect the managers. Monitoring companies through institutional investors can force managers to pay more attention for the firm performance and less

attention to opportunistic behavior. Institutional investors are considered expert investors who have higher capability to analyze the profit and normal and abnormal elements compared to the non-institutional ones.

The process of Corporate Governance in Iran

In Iran, Stock Exchange was founded since 1960s. It was partially raised in the amended Commercial Code in March 1995 concerning the establishment of companies. Corporate Governance was, however, introduced in the last few years in the early 1980s by Stock Exchange officials of Parliament Research Center. A specific committee was dedicated to corporate governance in the Ministry of Economic Affairs and Finance [11]. Corporate Governance was first offered in the national conference of Capital market, an Engine of Economic Development held by Allameh Tabatabaee University on November 27th and 28th, 2004 in Razi Convention Center. The article entitled "Corporate Governance and its Role in Capital Market Development" was presented by Hassass Yeganeh and then used in accounting in Ph.D. level entitled "Development of Accounting and Auditing Ideas". It was then presented in two seminars entitled "Financial Reporting and Future Development" and "Corporate Governance System and Internal Audit" on December 28th and 29th, 2004 and November 21st and 22nd 2005 in Razi Convention Center by the Iranian Institute of Certified Accountants. Following this, Capital Market Research and Development Center of Stock Exchange published the first version of Corporate Governance Code which is accessible in Stock Exchange website. Article 12 provides definitions, board of directors' tasks and stakeholders, information disclosure, accountability, and auditing. The code was devised considering the ownership structure and capital market status which is consistent with the internal organizational system of corporate governance.

RESULTS

Table 2: Descriptive Statistics

Variable	Mean	Median	Maximum	Minimum	Standard Deviation
TobinsQ	1.1428	1.1294	3.3203	-0.6896	0.0899
InterGover	5.6937	5.3245	8	3	0.2638
ExterGover	6.0354	5.6969	9	4	0.5631
PGSales	0.2413	0.2667	2.3454	-0.7652	0.2491
Cash	0.1836	0.2182	0.6842	0.0387	0.1664
CAPEX	0.3758	0.3889	0.8804	0.1123	0.1964
LEV	0.3894	0.4472	0.7356	0.1174	0.2016
ROA	0.2136	0.2182	0.4193	-0.1634	0.0668
Definition of Variables: TobinsQ: (Dependent variable) shows the firm value. InterGover: (Dependent variable) shows the ability of internal elements of corporate governance ExterGover: (Dependent variable) shows the ability of external elements of corporate governance PGSales: (control variable) indicate the annual sales growth in the past year Cash: (Control variable) shows the Cash Flow Ratio CAPEX (Control variable) shows the investment expenditure ratio ROA: (control Variable): Returns on Assets					

Source: Researcher calculation

As it can be seen concerning Tobins Q, the mean and median were 1.142 and 1.129, respectively. The median shows that almost half of data are greater than this value and the other half is less. The data also show that the maximum is 3.3203 and the minimum is -0.6896.

Table 3: The results of normal test of model residuals

Variable		RESIDUAL
Jarque-Bera test	P-value	1.8966
		0.1648

Source: Researcher calculation

As it can be seen in [Table 3], the normality test of residuals and significance level indicate that H1 is not verified and H0 is verified. In other words, residuals of regression model have no non-normal distribution.

Table 4: The results of model test

$$\text{TobinsQ} = \alpha + \beta_1 \text{InterGover} + \beta_2 \text{ExterGover} + \beta_3 \text{PGSales} + \beta_4 \text{Cash} + \beta_5 \text{CAPEX} + \beta_6 \text{LEV} + \beta_7 \text{ROA} + \varepsilon$$

Variable	Symbol	Coefficient		t-static	p-value
Constant factor	C	A	-1.4167	-9.2449	0.0283
Internal components of corporate governance	InterGover	β_1	0.1804	6.9368	0.0000
External components of corporate governance	ExterGover	β_2	0.2364	2.6093	0.0144
annual sales growth in the past year	PGSales	β_3	1.2056	2.4763	0.0438
Cash Flow Ratio	Cash	β_4	0.0698	3.2961	0.0263
investment expenditure ratio	CAPEX	β_5	0.1934	4.8904	0.0029
Financial leverage ratio	LEV	β_6	-0.4527	-1.2883	0.2179
Returns on Assets	ROA	β_7	1.4291	12.3648	0.0000
R2				0.4689	
Adjusted R2				0.4438	
F-static (p-value)				11.4487(0.000)	
D-W				1.9682	

RESULTS

First Hypothesis

Internal elements of corporate governance have a significant relationship with the firm value.

H0: No significant relationship is found between internal elements of corporate governance and the firm value.

H1: Internal elements of corporate governance have a significant relationship with the firm value.

In this hypothesis, firm value is dependent variable and internal elements of corporate governance are independent variable. According to [Table 4], t statistics for the dependent variable in the first hypothesis and significance level (p-value) are 6.9368 and 0.000, respectively. Since the significance level is less than 0.01, the first independent variable (interGover) is significant. It means that a significant relationship is found between corporate governance elements and firm value with Tobin Q ration at 99% confidence level. Therefore, the first hypothesis is verified.

The Result of the Second Hypothesis

Second Hypothesis

External elements of corporate governance have a significant relationship with the firm value.

H0: No significant relationship is found between external elements of corporate governance and the firm value.

H1: External elements of corporate governance have a significant relationship with the firm value.

In this hypothesis, firm value is dependent variable and external elements of corporate governance are independent variable. According to [table 4], t statistics for the dependent variable in the second hypothesis and significance level (p-value) are 2.6093 and 0.014, respectively. Since the significance level is less than 0.05, the second independent variable (exterGover) is significant. It means that a significant relationship is found between corporate governance elements and firm value with Tobin Q ration at 95% confidence level. Therefore, the second hypothesis is verified.

CONCLUSION

This article studied the relationship between corporate governance elements and firm value. The unit of measurement was Tobin Q. The results showed that both hypotheses are verified. In the first hypothesis, we examined the relationship between the internal elements of corporate governance and firm value. Internal elements of corporate governance consist of all features board of directors and other preventive factors. The variable was measured through a checklist related to the most important internal elements of corporate governance by financial statements and notes. According to the regression model, the results indicate that the internal elements of corporate governance have a positive, significant relationship with firm value with Tobin Q ratio. Therefore, the first hypothesis is verified.

In the second hypothesis, we examined the relationship between the external elements of corporate governance and firm value. External elements of corporate governance consist of all shareholders and other preventive factors. The variable was measured through a checklist related to the most important external elements of corporate governance by financial statements and notes. According to the regression model, the results indicate that the external elements of corporate governance have a positive, significant relationship with firm value with Tobin Q ratio. Therefore, the second hypothesis is verified.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The authors are thankful to Hon'ble Dean and Management.

FINANCIAL DISCLOSURE

None.

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ARTICLE

EFFECTS OF DISTRIBUTION MODEL OF OIL WEALTH ON THE ECONOMIC AND MIGRATION OF VILLAGES IN IRAN: CASE STUDY BIRJAND COUNTY

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ABSTRACT

In this research, first attempts to critical examine of distribution model of rent or oil wealth between the villages in Birjand County which is under the authority of the government and bureaucracy system. Then, we investigated effects of mentioned model on traditional sectors of the rural economy and spatial migration of rural population. The results show that Iran's oil revenues, especially on a regional scale has been turned into an instrument for the government's spending and are not applied to promote universal and spatial development, such that in the practical model of oil wealth distribution between rural settlements, such revenues have not been utilized to contribute to the economic and productive development of rural areas. The current model of intra-rural oil wealth distribution, with negative effects on the functioning of the traditional sectors of the rural economy, has led to the disruption of accumulation flow of spatial capitals in conflict with the interests of rural associations, which the process is considered to be a driver of spatial transformations by the country's bureaucratic and development system on a path rather than development, especially economic development.

KEY WORDS

Economic
Development, Oil
Wealth, Village,
Agriculture, Animal
husbandry, Migration

INTRODUCTION

Infection In human settlements of poor and underdeveloped countries, an enormous need is felt to wealth and capital for present management and planning at development horizon, and as Harvey says: "Capital is the main factor of production and spatial development" [1]. Capital along with population, goods, information and services is one of the factors that can establish economic link among human settlements in the region [2]. However, in the settlement system of least developed countries, urban areas are more preferred over rural associations for management, policymaking, planning and allocations.

Based on a systemic approach and economic history of most countries in the world, villages paly an unrivaled and fundamental role in spatial structure and economic development process of any country [3]. One of the most important economic and productive functions of rural areas (in the countries such as Iran) is helping non-oil exports, which finally leads to the country's reduced dependence on oil income [4]. In general, from experts' view, rural community and specially farmers takes advantage of a special status in the process of national growth and development, because they play a fundamental function in the supply of labor and capital, providing food and consumer market of products and goods [5,6]. Despite the importance of rural areas and their function in the country, they have always been faced with the least development and utilization, and there are numerous obstacles to rural development [7,8,9,10].

To explain the causes of such major depression in rural growth and development, numerous obstacles and problems in social, cultural, economic and physical areas can be classified, and what play more fundamental role in this regard is economic challenges faced by rural areas [11,12,13]. In the midst of economic challenges, a lack of capital and poor rural financial market are of significant importance [14]. This is because capital plays a fundamental role in promoting the development of rural economy and increase in farmers' income [15], but its lack and deficiency caused many rural activities in recent decades to suffer a severe decline, thus an increase in unemployment rate in the rural areas, and the departure of young and well-educated people from rural community [16,17,18,19]. Hence, despite presence of a variety of physical, human and natural capital in rural areas and regions, there is a constant investment [20] by governments for rural and regional development, and in this regard, some governments rely heavily on selling natural resources to meet financial and capital needs of settlements including both urban and rural ones. In other words, despite the fact that some sectors of the economy such as industry has a high ability to produce wealth (wealth generation up to \$ 6 trillion less than 20 recent years [21], some countries such as Iran, Algeria, Egypt, Libya, Saudi Arabia, Iraq, Peru, Ghana and Kuwait have founded the basis for wealth generation in their economy on the sale and export of mineral resources.

Among the countries that their economic cycle is built upon natural resources, there are countries whose economy is driven by fossil fuels [22] and the wealth obtained from the sale and export of oil is the biggest source of the country's revenue [23]. In oil exporting countries, heavy dependence upon oil is much higher than the rest of the world [24].

Published: 12 Sept 2016

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Iran as one of oil exporting countries, since 1951 and oil nationalization has been increasingly dependent upon oil revenues. Since that date, to finance the costs for implementing tasks and to achieve the economic goals such as economic growth, increasing employment, equitable distribution of income, maintain general price levels, economic stability, and improved levels of statements, Iran have heavily relied upon oil revenues [25]. In fact, due to the supply of needed energy for economic development programs and also currency requirements of these programs, Iranian oil is considered to be driving force and key sector of the economy [26,27].

Throughout Iran's oil history and economic dependence on oil revenues, some have considered it as driver of economy, and some as a barrier to development in the country [28]; because, low economic growth in Iran despite billions of dollars of oil revenues represents the implementation of improper investment policies and particularly severe mismanagement and waste of time, materials, facilities, machinery, energy and raw materials in the country [32]. In total, weak and inefficient planning and economic instability due to the influence of trans-boundary factors and developments [33], increase in monetary quantity [34,35], inflation, lack of efficiency, extreme consumerism [36], agricultural stagnation, widening gap between urban and rural areas, reducing the production of food and agricultural products and growth of rural people's migration to urban areas [37], inequality in the area of social dimensions [38] and spatial dimensions [39] and also Rantierism and create a rent state [40] are some of the problems faced by the countries with reliance upon on oil economy such as Iran [41,42].

In this regard, the fundamental question is this: "why states with oil revenues, or, more generally, the countries with valuable mineral resources have not been fully developed despite the considerable value of such revenues which at first glance are an important factor for resource mobilization? Regarding many of these countries, including Iran, it is argued that oil revenues have not been well managed and allocated [43]. In Iran, for rural settlement development, there is too much dependence upon the wealth and capital obtained from oil sales, and on the other hand, due to the mismanagement of oil wealth, these sources have not yet played an ideal role in spatial development, particularly the development of Iran's economy. Thus, using an analytical and in-depth approach and to help learn more about the effects and consequences of oil wealth in economic cycle, the current article seeks to respond to two questions: a) oil rent distribution model on a regional scale, or allocation priority of oil wealth to different regions by Iranian government within 10 recent years, b) the effects and consequences of oil wealth distribution model on the economy of the rural areas in the regions (including the impact on traditional activities of the rural economy and human-local capitals)?

The area under study is Birjand in South Khorasan. The region has been chosen for two reasons: first, it can be divided in the category of areas with a high proportion of people in rural settlements and high density of rural settlements in Iran, and also in the category of the least developed areas in Iran. The necessity and significance of this study is that, based on the history of the research performed on oil-rich countries, local and regional impacts of oil wealth have been less analyzed. Therefore, the current research adopts a relatively new approach.

Theoretical Foundations

Economic development as a dynamic process [3] can be realized followed by fundamental changes in the economy and increasing production capacities including physical, human and social ones. Economic growth is limited mainly due to a lack of capital [44]. In this regard, the issue of resources, particularly natural resources and minerals (both quantitative and qualitative) and resource management, due to its capital-oriented role, has a fundamental place, and the issue whether natural resource abundance is good for the economy or bad, has a longevity as old as economy itself [45]; because natural resources can effectively impact political, economic and social areas [46].

One surprising result of the past research and experience has been that the economy with poor mineral resources has had a performance much better for economic growth than resource-rich economies [47] and people like Lederman and Maloney (2003), Stijns (2005) and Brunnschweiler (2008) in their study concluded that natural resource abundance does not have an effect on economic growth [48,49,50]; in some cases the results have shown that if the abundance of resources leads to economic growth, the growth is temporary [45]. Thus, the evidence suggests that wealth derived from natural sources, or in other words, resource abundance can relatively change the share of value-added sectors in favor of service, economic and political inefficiency, poverty and inequality of economic development, tyranny, corruption and violent conflicts [51,52].

In other words, there is a relationship between the dependence of a country's economy on minerals and natural resources with the indicators including growth, poverty, conflict and democracy [53]. Thus, since the growth rate of countries that have natural resources, due to the above mentioned reasons, is less than other countries that do not have these resources, the term "Resource Curse" is used for these countries [54].

The views held by researchers and theorists in the area of explaining the role and effects of the wealth arising from sale and export of minerals on the economy can be divided into three general trends. According

to the arguments proposed by some thinkers such as Viner (1952), Lewis (1955) and Rostow (1960), mineral resources can be a foundation for economic development [55,56,57]; while some people like Prebisch (1950), Singer (1950), Baran (1957), Hirschman (1958), Seers (1964) and Gylfason (2001) argues that dependence on the wealth obtained from resources is a serious impediment to growth and development [58,59,60,61,62,63]. Accordingly, based on the analysis made by Atkinson and Hamilton (2003), there is a significant negative relationship between natural resource abundance and economic growth [64]. In the meantime, some scholars such as Kronenberg (2004) also believe that in the economy of countries with rich natural resources, economic growth follows with a slow pace [65].

Oil revenues as a capital asset, which Harvey considers it as the lifeblood of all communities [66], and is a source that has the features of capital and accumulation at the same time [37], with its own political economy could have significant impacts on spatial and regional organs as a part of macro and national structure, because nowadays modern capitalism and its political and social support structure have been interlinked to oil and economy from many aspects. Existence and availability of oil capital is a geographic factor that level of difference in development of a country can be explained with it [67]. Hence, the use of oil as the driver of balanced growth engine is not proper, because it does not create a widespread domestic market for consumer goods nor an incentive for local production of capital and intermediate goods [24]. In a country like Nigeria, unlike the objectives underlying development goals and national prosperity, oil has led to the perpetuity of the poverty and reminds us of the motto "Oil Curse" [68]. In general, one of the features enumerated for the countries dependent on oil wealth is that "oil-based states are passionately involved in oil exporting" [24]. Another fact is that whether indulgence in spending funds in oil-rich countries is for all territorial and spatial units or only for extravagance centers?

It is assumed that the budget communication as a blessing in oil-producing countries can neutralize oil's harmful effects on the economy, and based on the past experiences, this has inhibited the development of agriculture and industry. In fact, easy access to giant rents generated by oil is a type of structural bias against agriculture and industrial activities, and any type of activity carried out in this area is heavily dependent upon subsidy [24]. Accordingly, oil operates as an engine of growth for oil-producing countries but has harmful effects at the same time. In the tradition of the theorists proposed on essential goods, Hirschman (1977) has argued, "the relation made by a commodity with the rest of economy reveal that whether it is helpful for the country's future development process or not". In this regard, there is little likelihood that mineral resources are the lucky goods that can lead to opportunities for productive economic activity. Mineral economies can create consumption and especially budget relations that Hirschman (1977) defines them as the government's ability to collect revenue flow relevant to essential goods, yet they perform such function at the price of weakening more productive relations [69]. In fact, budget-based relations are practically a hurdle to manufacturing relations, especially when the rents are enormous, because use of this income flow provides necessary currency for purchase from outside the country, and eliminate motives to make domestic production. Under ideal conditions, economic development can be based on basic commodities that encourage co-existence between consumer, budget, and production relations. However, under mineral source condition, a type of relationship is established only at the expense of another relation [24].

Sound management of natural resources, both natural and financial, is the requirement for development objectives at any country [44]. In addition, there is not any particular commodity that alone play positive or negative role in the development, and its ultimate impact depends on how the product can interact to pre-existing institutions in order to create new institutions [24]. Therefore, the lack of impact of natural resource abundance on economic growth of societies depends on two factors: technology and planning priorities [54]. Palazuelos (2016) reinstates that underdevelopment in oil-producing countries is not the result of the existence and utilization of oil, but it is influenced by some factors such as duality between production and exports, political and institutional weaknesses and fragility, and the weaknesses of these countries before the spread of rents in these countries [23]. Hence, how to manage and allocate resources is one fundamental cause of the inefficiency of natural resources in the countries dependent upon mineral-based economies; in other words, resource curse is the result of the mismanagement of resources and its distribution. For example, although the two countries, Botswana and Sierra Leone, export diamond, Botswana after independence in 1966, by managing the flow of revenues from its natural resources, paved the way for further economic growth, to the extent that this country experienced the highest GDP per capita growth rate between the years 1965 and 1996. While Sierra Leone is deeply mired in poverty, and according to World Bank statistics, the country is among the poorest countries in the world [70]. Accordingly, it can be said that effective development is planned management of utilization of available resources to achieve social and economic benefits [71]. New research suggests that there is a specific form of resource curse at the local level [72,73]. Accordingly, the oil revenues in the countries with unipolar and oil-producing economies has multiple impacts on economic sectors and also the center of geographical space and spatial relations, especially within the urban and rural settlements, and these consequences have direct or indirect, and increasing functions.

There are two broad views about the effects of oil wealth on production in the agricultural sector: a) dependence theorists with an analysis entitled "Oil Syndrome" express that with increasing oil wealth, agriculture face stagnation, because with the increase in oil wealth and increasing food imports, urban

people's taste gradually changes toward foreign food products, and finally leads to the stagnation of production in the domestic agricultural sector; and b) in contrast, the classical economists reinstate that, unlike dependency theorists, increased oil wealth is a cause to an increase in food production. They argue that rising oil wealth can lead to an increase in purchasing power of urban consumers, and this can increase farmers' incentives to produce more food for supply on the market [74].

Gbor research (1990) in Nigeria showed that with the growth in oil wealth and the management of its distribution by government, some events has been gradually happened including growing population, increased demand for agricultural products and even expand food exports, restoring wetlands and agricultural lands, increase farmers' income, improve the economic and social situation of farmers and ultimately reduce inequality between urban and rural residents. How to manage oil wealth within Nigeria's society has led to the creation of a paradigm known as Babangida Paradigm. Hence, the lack of sufficient attention to agriculture and consider it not as significant as industry and services sectors causes some negative aftermaths including negative impacts on economic well-being of workers in agriculture, threatening the quality of human life, and fear of food shortages, and can cause serious gaps in the process of rural development [75]. Accordingly, government's improved performance towards rural areas is necessary to achieve development of rural communities and economy [76], and in this regard, some efforts should be made to coordinate urban and rural development, enhance ownership system of rural lands, deepen and reform rural financial system, improve rural policies, and establish technical tools in the area of rural planning.

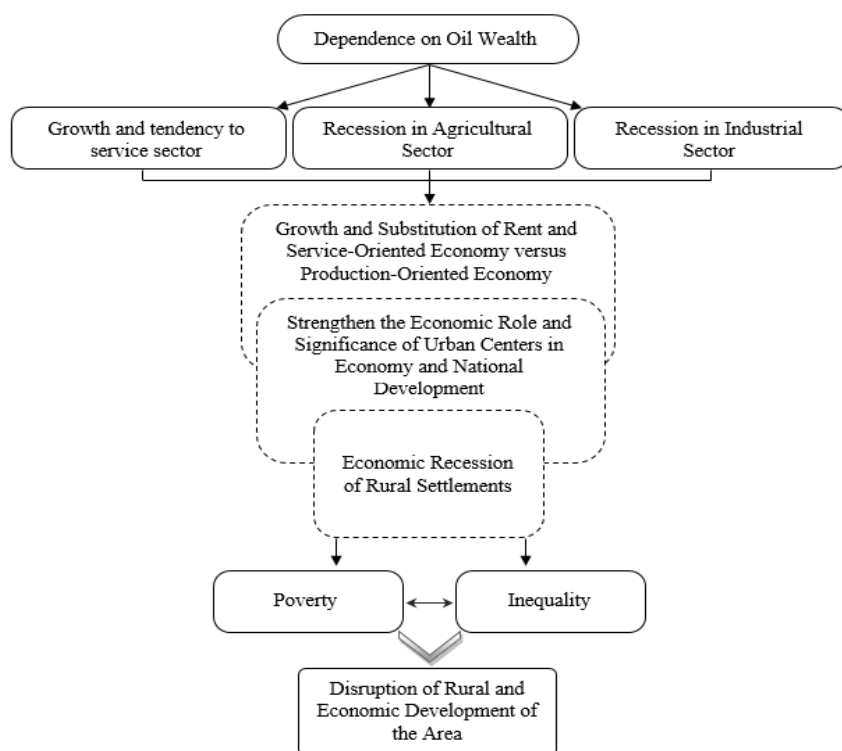


Fig. 1: Conceptual model of dependence on oil wealth

MATERIALS AND METHODS

Exploration of the reality in the current research was in line with the objective and approach adopted by basic and applied research, and in this regard, to gather information, documentary and field methods were used. The theoretical discussions were made through document studies, and the findings were obtained through field survey and econometric research. Field investigations were performed using questionnaire and on two levels: households and villages. The validity of the research instrument was measured, and its reliability was calculated by Cronbach's alpha to be 89%.

The oil wealth rent distribution model among rural settlements in Birjand has been identified on nine macro levels. In addition, through combining the index for evaluating the rural people's point of view on cost and revenue changes in the traditional sectors of the rural economy (cultivation, horticulture and animal husbandry) in the recent years with econometric estimates of agriculture and livestock activities in the

villages under study in Birjand, a composite index was devised known as “the ability to produce wealth in traditional sector of every village”. In this regard, first, by dividing any number by its column average, the difference between the two indices was determined, and then, with the assumption of the weight and importance of the indices, and their algebraic sum, capacity index of value creation in traditional sector of economy for each village was determined. To estimate “spatial flow index of rural-human capitals, the migration rate of each household at each village under study during 20 recent years was extracted using field studies, and finally, the migration of each village in Birjand was estimated. Statistical analysis of data using descriptive statistics indices (mean and percentage) and inferential statistics (Pearson Correlation) were performed using SPSS software.

The statistical community and geographical environment under study is Birjand County in South Khorasan Province as one of the areas in the East of Iran. In terms of political division, Birjand County has a central district and six dehestan (Alghourat, Shakhenât, Fasharud, Kahshang, Shakhen and Bagheran). According to the census made in 2011, the total number of inhabited villages and the ones that have over three households in 17 counties of Birjand County is 247 villages with a population of 52040 populations in 15863 households [77]. For sampling, multi-stage cluster sampling method was used, such that at any county, 25% of the total villages were selected, then using the proportional ratio, the sample villages were determined based on District and dehestan.

At the next step, to determine the volume of the sample households in the villages under study, firstly, using the Cochran formula, the total volume of sample households in each County was recorded, and then, using an optimum rate in each county, district and dehestan, the households in the sample were determined. The total number of the sample villages was 62, and the total number of the households in the sample was 262, and they were interviewed randomly. [Table 1] presents the number of the sample household at each district.

Table. 1: Distribution of the sample villages and household in the rural areas of Birjand County

Dehestan	Number of villages	Number of Household	Number of Sample Villages	Number of Sample Household
Alghourat	52	3865	13	65
Bagheran	109	7390	27	123
Shakhen	13	1587	3	27
Shakhenât	12	983	3	16
Fasharud	24	778	6	13
Kahshang	37	1080	9	18
Total	247	15683	62	162

RESULTS

Allocation of oil wealth between the villages of Birjand County

An analysis of credit pattern and capital allocations to the villages under study in Birjand County during 2006-2015 [Table 2] shows that the average annual amount equal to 5,339,656,524 Rials is annually allocated to each rural settlement under nine credit titles. The largest share of the credits allocated to the rural areas is the credit attributed to the county's Governor and mainly to provide rural management costs (the village's Islamic councils and associations). In the next stage, the cash subsidy granted to the households' members living in the villages under study has the highest percentage share of the budget and annual credit relevant to villages in recent decades.

In terms of the plans carried out in the rural areas and the capital that is spent in this regard, the findings showed that prosperity-infrastructure projects such as road construction, electricity and water supply, and telephone were considered at the third stage of the annual credit allocated to the rural areas. In the next stage, rural physical projects (including rural guide projects), economic-manufacturing projects (such as well construction, layer removal and aqueduct construction), plans related to treatment and health sector (repair and construction of health houses), administrative-communication projects (building of ICT offices), educational projects (construction and repair of schools), and finally, cultural-religious projects (construction and repair of mosques and religious places and construction of libraries) have received annual credit allocated to rural settlements within the last ten years.

Accordingly, it can be concluded, over the past decade, the major part of credit and assignment of wealth to the rural areas in Birjand County was in the areas where return on profit is generated by doing investment immediately after the construction and commissioning it in rural areas. In other words, oil capital that found its way to the villages in Birjand County (rather than being spent on the sectors beneficial to rural people) was transferred to the areas that the resultant profits were delivered to the

sectors external to rural area, especially to the bureaucracy system components located in urban spaces. Even in some cases, according to local society, this tendency pattern of national capital in rural areas lead to the further transfer of wealth and capital out of the country in favor of cities and more economic weakening of rural households.

Table. 2: Average annual credit and capital received by each village in Birjand in the years 2006-2015

Credit Title	Rials	Percent	Priority
Budget and credit allocated by Department of State (Rural Management Sector).	3020169636	56.6	1
The annual cash subsidy obtained from Subsidy Objective Scheme	1365000000	25.6	2
Welfare-infrastructure plans	500967213	9.4	3
Physical plans	161655738	3.0	4
Economic-manufacturing schemes	85360658	1.6	5
Health and treatment schemes	78290164	1.5	6
Administrative and communicative schemes	53836066	1.0	7
Educational schemes	48180328	0.9	8
Religions-cultural schemes	26196721	0.5	9
Total	5339656524	100	-

*Except for the case 1 that was directly received from Birjand Governor in 2015, and also the case 2 that was 455000 Rials, an adjustment for inflation was made in the estimation of other figures using goods and service price index in 2011/ Source: research findings, 2016.

Economic sector's utilization of national wealth and capital which in Iran primarily includes oil revenues can be divided in the category of facility provision system and expenditure credits with the relevant plans and projects. The research performed on the situation of the rural households' utilization of facilities and credits [Table 3] in Birjand County during the past decade showed that only a small part of the population studied in Birjand, i.e. about 32.1 percent, have been able to take advantage of financial and credit system profits.

Table: 3. The rural households' utilization of rural facilities and credits in Birjand County

Grant Credits and Facilities	Frequency	Percent
No	178	67.9
Yes	84	32.1
Total	262	100

Source: Research Findings, 2016

Despite the fact that agriculture and animal husbandry as the traditional sectors of the economy in rural areas are some of most expansive and significant current economic activities in these settlements, the investigations indicated that, among 84 households receiving credits in Birjand County [Table 4] only 11.8 percent of total loans and credit received were in the field of activities related to agriculture and animal husbandry such as purchase of agricultural implements, construction of greenhouses, construction and purchase of livestock. In addition, out of 63 villages under study in Birjand County, the residents of 16 villages took advantage of these credits. In other words, only 26% of rural settlements in Birjand County received the share of oil for the traditional sectors of rural economy. The total amount of credits and wealth that has been allocated to the villages over the recent decades was around 10180 million rials by applying inflation rate in a period of ten years. The average value of each credit item assigned to the rural people was estimated to be about 330 million Rials.

Table: 4. the agriculture and animal husbandry credits assigned to the rural people under study in Birjand during 1996-2015

Index	Value
Percent of the villagers utilizing agricultural and livestock credit	11.8
Total number of the loans granted (item)	31
The number of the villages that received agricultural and livestock credit	16
The total amount of loans granted (£)	10180000000
The average amount of loans granted (£)	330000000

Source: Research Findings, 2016

Employment characteristics of rural population in Birjand County

According to the employment status of the rural people in Birjand, 9.5% of household heads were unemployed, and 90.5% of them were employed over the past year (2014-15). Among the rural employed heads, 46.9% were involved in part-time and seasonal employment activities, and 43.5% had full-time employment. In terms of job composition and frequency of each head of the household, the studies indicated that each person was engaged on average in two job positions. In responding to the question that what is the main job of household heads in the villages under study in Birjand, the research indicate that the main jobs include horticulture, animal husbandry and cultivation, respectively. A small percentage of people were also workers. The main job of about 14 percent of the households surveyed was defined with the term 'other', i.e. activities such as repair, construction, bakery, freight and passenger transportation [Fig. 2]. Accordingly, it can be seen that human and economic life of Birjand's people especially in the rural areas is closely interlinked with activities taken in the sectors of agriculture and animal husbandry.

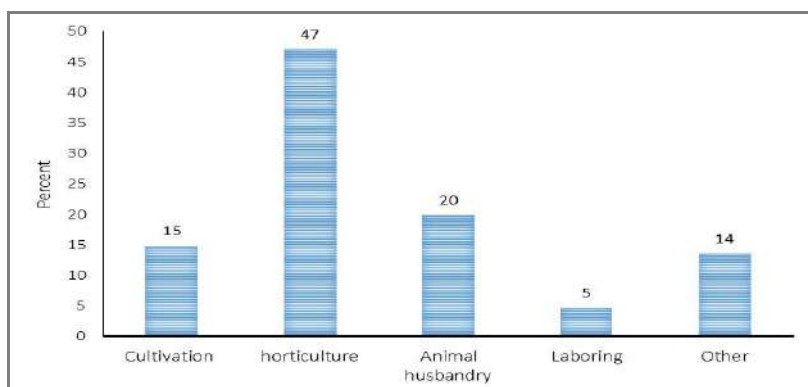


Fig. 2: Frequency distribution of the percent of the main labor of the people surveyed in the villages of Birjand County

Changes of traditional parts of rural economy (agriculture and Animal husbandry) in Birjand County

Cultivation, horticulture and animal husbandry are three common and traditional activities in Birjand. The surveys indicated that in Birjand [Fig. 3], in agriculture sector, the percent of users of horticulture activities is higher than that of main horticultural products in the study area, and two of main garden products in the area include barberry and jujube. Among field crops cultivation, wheat and then barely have the highest percentage of utilization in every village of Birjand county.

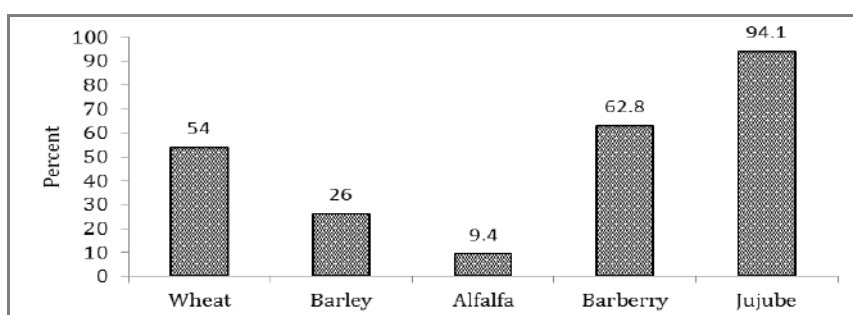


Fig. 3: The diagram for the comparison of the mean percentage of utilizers of major farming and gardening products in each of the villages in Birjand (2014-2015)¹

In terms of added value of agricultural products [Table 5], it was indicated that among the major crop products, average cultivation acreage of wheat in every village is higher than other crops, and then average cultivation acreage of barley was 1.4 ha and barely was 0.054 ha per village. Because wheat production is consumed mainly for self-consumption, and also according to farmers' traditional belief that wheat production increases agriculture's blessing, thus there is more tendency to cultivate wheat. Considering the

production of value added of each agricultural crop in the villages under study in Birjand, it can be found that the production of none of these products has economic efficiency and profit. In response to the question of why despite the lack of the economic benefit from the production of crops such as wheat, barley and alfalfa, farmers continue to cultivate these products, there are two reasons: first, wheat is cultivated due to self-consumption value and fulfilling household's needs and barley and hay due to fulfilling household livestock need (cattle and sheep). Secondly, as the labor force underlying production of the three products are mainly supplied through household's manpower, and agricultural beneficiaries do not pay manufacturing workers' wages, rural utilizers wrongly think that worker costs are free, thus the unprofitability of cultivating agricultural crop does not show itself, and is not tangible. In addition, some factors including low level of experience and skill for planting other crops (innovation in cultivation), the presence of fertile lands and water for agricultural cultivation, low diversification of rural economic activities and consequently relatively high spare time of the household labor force causes rural people to do cultivation even if it has no profit for them.

Among main garden products, jujube product had highest cultivation level compared to barberry, because in terms of climate, in all the agricultural land area in Birjand, there is possibility of planting jujube fruit. However, barberry is faced with significant restrictions and is mainly planted in the north eastern lands of Birjand County. Economically, the calculations showed that both crops have a significant added value, so that they are considered strategic products of agriculture in Birjand and South Khorasan Province.

Table: 5. the status of value added of the major agricultural products in the sample villages in Birjand County (2014-2015)

Agricultural Products		Cultivation acreage per village (ha)	Production yield (kg per ha)	Production cost per ha (Rials)	Gross income (per ha)	Value added of per ha (Rials)
Farming	Wheat	2.1	1195	16586849	13802250	-2784599
	Barley	1.4	1076	15679886	9899200	5780686-
	Alfafa	0.045	500	20158581	4181500	15977081-
Horticulture	Barberry	0.9	1434	13315861	20076000	187444139
	Jujube	6.3	1553	4723922	12424000	119516078

Source: Research Findings, 2016

Based on the survey, it was found that in every village, on average, 62.2 percent of the local population is engaged in animal husbandry. The average number of light-weight livestock per village (both traditional and industrial) was 461 heads and the average number of heavy-weight livestock per village head was 27 [Table 6]. Hence, on average, every exploiter had 14 heads of light-weight cattle and 0.8% heavy-weight cattle. In Birjand County, the exploitation of livestock is done mainly on light livestock such as sheep and goats. Economic efficiency of livestock (traditional and industrial) in Birjand area indicated [Table 7] that the production of added value of one head of light-weight livestock is between 3952500 to 4488500 Rials, and added value of cattle and calves rising in the villages of Birjand is almost 50205000. Despite the heavy-weight livestock has greater economic efficiency than light-weight livestock; light-weight livestock rising is more preferred. This is because of three reasons. Firstly, purchase of the initial capital for the purchase and maintenance of light-weight livestock less than heavy livestock. Secondly, the capacity of the natural environment, especially pastures for heavy livestock is less. Thirdly, given that meat and dairy consumption market in Birjand and even South Khorasan has low number of consumers, and the market is distant from main sources of domestic consumption and food factories in some cities such as Tehran, Mashhad and Isfahan (as the main centers for heavy-weight livestock meat consumption), then sale of heavy-weight livestock is done slower than light livestock.

Table. 6: The average number of the exploiter and livestock in the sample villages in Birjand County (2014-2015)

Number of exploiter per village	Number of light-weight livestock per village	Number of heavy-weight livestock of each exploiter
32	461	27

Source: Research Findings, 2016

Table: 7. Average value added of per light- and heavy-weight livestock in the villages of Birjand (2014-2015)

Indicator	Sheep		Cattle and Calves
	Ewe	Goat	
Total cost for maintaining the livestock (Rials)	5560000	5560000	53110000
Total gross income obtained from livestock (Rials)	10048500	9512500	103315000
Add Value of per head of livestock (Rials)	4488500	3952500	50205000

Source: Research Findings, 2016

Considering the efficiency of production in each of agricultural and animal husbandry sectors as two economic traditional sectors in Birjand, the research made a local survey to reply to this question: "how much change has been happened in the expenses and income obtained from agricultural and animal husbandry activities in rural areas of Birjand over the past decade? And the comments presented by the rural people indicated that the expenses increased at three sectors including cultivation, horticulture and animal husbandry [Fig. 4], such that in the cultivation sector, 50% of the respondents indicated that the expenses were increased to some extent, and 26.7% of increase in the expenses was very high. In the horticulture sector, 56.5% of the rural population reported increase in expenses to be to some extent and 26.7 percent reported it to be too much. In addition, in animal husbandry sector, they assessed the changes in production costs to be high and very high. To compare these three sectors, it should be said that increase in production expenses for livestock activities was lesser than that of cultivation and horticulture, such that 43.1% of the changes in production expense in the livestock sector were reported to be unchanged, because as local people stated animal husbandry depends less on state decisions and service compared to cultivation and horticulture, and is mainly dependent upon pasture and natural environment. Accordingly, it can be said that the economic losses caused by the poor performance of Iranian government (dominant rent-oil political economy) is higher on production activity and spending in rural economy sector in comparison with the phenomenon named drought that it has afflicted Iran, especially East and the area of interest, for nearly two decades.

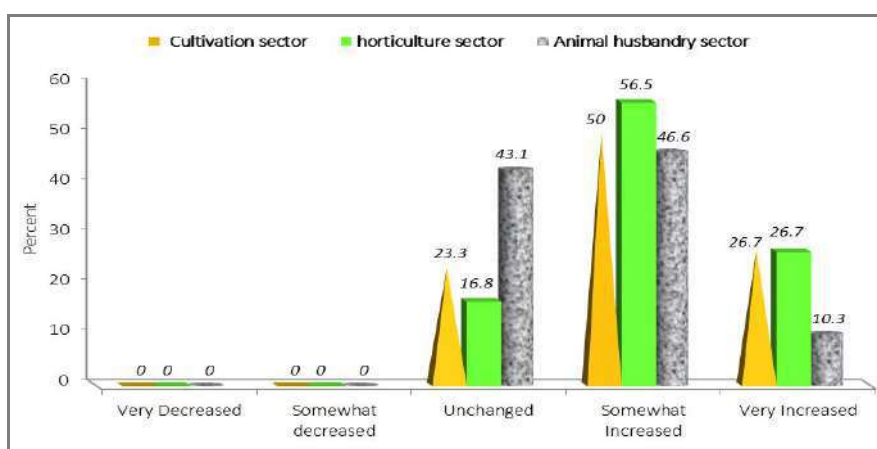


Fig: 4. the graph of the trend of the change in production costs in the traditional activities of rural economy (cultivation, horticulture and animal husbandry) during the decade 2006-2015 from the perspective of the local community in Birjand County

In terms of revenue, in the past decade (2003-2015), production and activity rate in all three sectors including animal husbandry, cultivation and horticulture has fallen, such that according to the local community, income increase has not occurred at any sector. Among the traditional activities of rural economy, production in horticulture sector in the rural areas in Birjand has faced with a more decrease in income compared to two sectors namely animal husbandry and cultivation [Fig.5]. This issue is caused by severe drought impact on horticultural crops such as barberry within the past decade, and also strong inefficiency in warehousing the barberry after production at cultivation season, and these have led to farmers' financial problems and also wastage and damage of the product before presenting to the market. The final result of this process is reduced revenue from horticultural activities.

Villagers and farmers as a pillar of target society, programs and spatial policymaking in the area of political development and economy, are the most important evaluators of functional system and underlying procedures. Accordingly, a review of the views held by the local community of Birjand's rural areas showed that [Fig. 6] the government's attention to the villages, especially in terms of traditional activities of rural economy has not been changed, and dominant tendency is toward reduced attention paid to the rural economy. However, within the last two decades, one of the most obvious obstacles and threats facing the traditional rural economy in Birjand has been the incidence of severe drought, and despite rural people's urgent need to the government fiscal and program supports, we have witnessed lack of sufficient supervision over such problem.

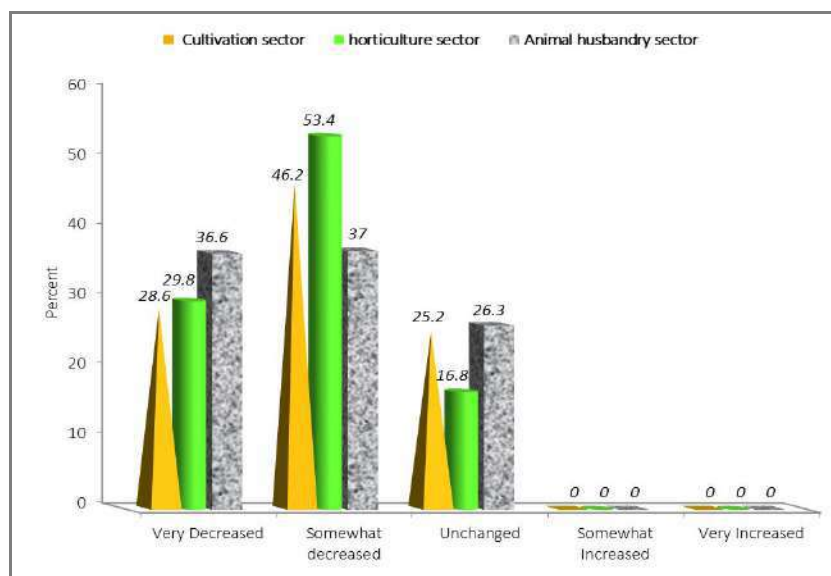


Fig: 5. The graph of the trend of the change in the income obtained from the traditional activities of rural economy (cultivation, horticulture and animal husbandry) during the decade 2006-2015 from the perspective of the local community in Birjand County.

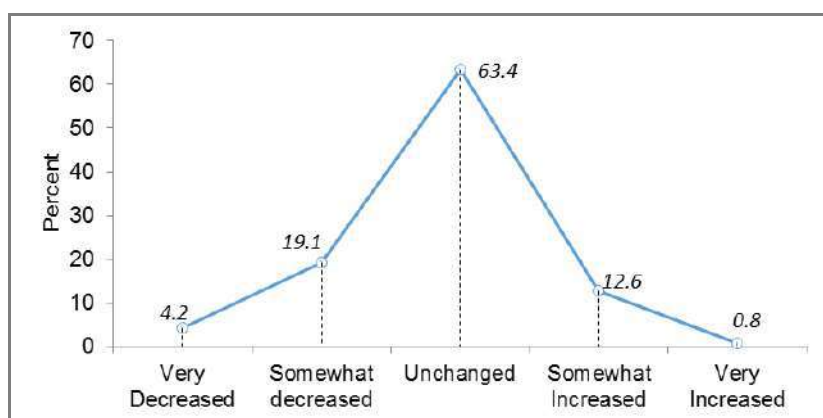


Fig: 6. The trend of the change in the government's attention paid to the traditional activities of rural economy (agriculture, horticulture and animal husbandry) during the decade 2006-2015 from the perspective of the local community in Birjand County

Spatial mobility of rural-human capitals in Birjand County

As one major consequence of the continued recession in economic activity in a place is the loss of active population and potential manpower under the title of labor migration for the benefit of absorbent settlements such as cities, population movement is one of the factors affecting economic growth in a place. A review of opportunity migration of the villages surveyed at Birjand during 1999-2015 showed that [Fig.7] the changes have followed a growing momentum, and within the past 10 years, rural migrations have significantly increased. Thus, it can be said that escape from villages in the study area is rapidly growing.

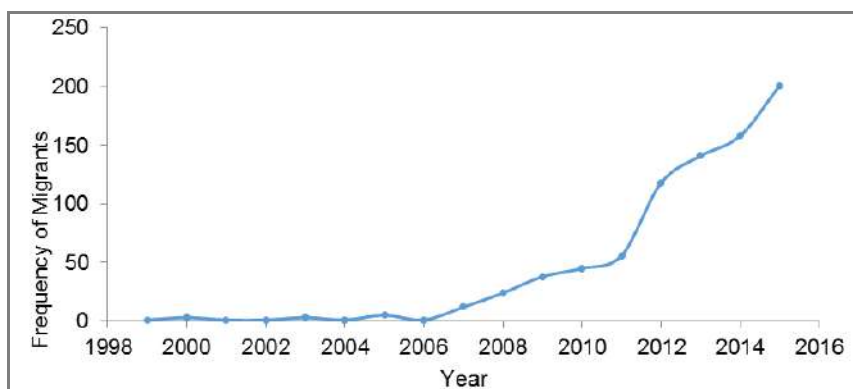


Fig: 7. The trend of rural migrations in the rural settlements under study in Birjand during the years 1999-2016

In response to the question why the intensity of migration from rural areas of Birjand county increases day by day, an analysis of the reasons for the migrations occurred in this region indicates that [Fig. 8] major motivation underlying this process is escape from unemployment. Secondary factors include education, marriage and military service. In this process, gender bias and discrimination prevailing on the rural areas have caused a situation in which men have more opportunities to migrate from the countryside than women, such that in terms of gender distribution of immigrants from the villages under study in Birjand County, 75% were men and 25 % were women.

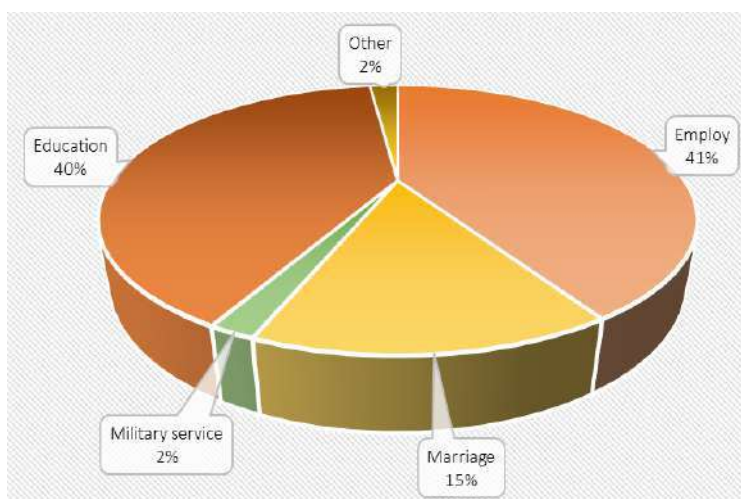


Fig: 8. the graph of the major reasons for the immigration form the villages under study in Birjand County during the years 1999-2016.

Impacts of oil rents allocation on traditional parts of rural economy in Birjand County

Significance test of the oil rent distribution model in the sample villages in Birjand indicated [Table 8] that among the nine dimensions of the model in the villages, the dimensions namely credit and budget allocation to productive-economic projects, the purposeful plan proposed by the incumbent presidency, infrastructure-welfare plans, physical plans, rural management credits, and link-administrative plans have a significant positive relationship with the capability of generating wealth in traditional rural economy.

Table: 8. the results obtained from correlation test between the dimensions of oil rent distribution model in the villages with the potential to generate wealth at the traditional economic sector per village

Variables		Pearson Correlation Coefficient	Sig. (2-tailed)
Rural management sector's credits	Potential to generate wealth in traditional economic sector per village	0.253*	0.002
Purposeful subsidy plan		0.516**	0.000
Infrastructure-amenities plan budget		0.442*	0.030
Physical plan budget		0.281*	0.005
Productive-economic plan budget		0.603**	0.000
Health and treatment sector budget		0.744	0.192
Administrative-communication plan budgets		0.198*	0.010
Training plan budget		0.691	0.058
Religious-cultural plan budget		0.304	0.101

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

A study of significant relationship between the dimensions of the oil rent distribution model at the villages in Birjand with the spatial flows of rural-human capital indicate that [Table 9], among the nine relevant dimensions, the dimension namely productive-economic projects with a negative association have the highest correlation in comparison with the dimensions of spatial flow of rural-human capitals. In addition, the credits granted in the form of the purposeful plan and educational projects such as school construction negatively impacted spatial flows of rural-human capitals.

Table: 9. the results obtained from correlation test between the dimensions of oil rent distribution model in the villages with the spatial flows of rural-human capitals

Variable		Pearson Correlation Test	Sig. (2-tailed)
Rural management sector's credits	The spatial flows of rural-human capitals	0.755	0.122
Purposeful subsidy plan		-0.270*	0.035
Infrastructure –amenities plan budget		0.400	0.68
Physical plan budget		0.237	0.209
Productive-economic plan budget		-0.494**	0.001
Health and treatment sector budget		0.352	0.059
Administrative-communication plan budgets		0.419	0.191
Training plan budget		-0.313*	0.014
Religious-cultural plan budget		0.388	0.063

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

CONCLUSION

Depending upon the extent of dependency and how to manage its distribution, Oil resource as a natural wealth has some effects on the development of the countries at different geographic levels. In fact, the performance of governing political economy system that its main directors are government and bureaucratic system determines whether or not oil can contribute to the realization of economic and spatial development (with its most important function: to strengthen the process of capital accumulation) or it may have anti-development impacts? This is because most views on economic development agree on the point that capital accumulation is a necessary condition for the development of modern economies, and as Alexander Greshengor has stated, three factors including economic enterprise, banks, and states can contribute to capital accumulation or gain the capital in different countries [78]. Accordingly, the present article attempted to present a review and critical analysis of the oil rent distribution between villages in Birjand County which is under the authority of the government and bureaucracy, and then to analyze and interpret economic consequences of the relevant model on the rural economy.

Confirming Douglas's view, the research results show that: "in state economic structure, resource allocation is not primarily optimal" [79], i.e. the distribution of oil rents by the government at geographic areas predominantly aims to advocate and strengthen state revenues and bureaucratic systems rather than providing benefit for rural and local community. In other words, the main priority of management and distribution of oil rents in relation to rural areas has been the sectors and projects whose profit and economic yield shortly after exploitation are transferred to the Treasury and government accounts through paying salaries, paying bills, or rent assigned to the contracts for the implementation of projects, were considered more and more significant. Thus, some Iranian economists believe that since Iran's oil revenues

are a tool used by the government to perform its affairs and meet its needs, it is not utilized for promoting universal development [43].

In an area like Birjand County where agriculture and animal husbandry as the pillars of traditional rural economy are regarded as the most traditional economic sectors in rural economy system, the current oil rent distribution model among rural settlements has not operated very effectively; and improper use of oil wealth to modernize and strengthen capacity to produce value-added relevant to the traditional sectors of the rural economy (cultivation and animal husbandry) and also contribution to the extensive implementation of economic activities as the complement to traditional sectors in villages has had two consequences: an increase in the pressure exerted on traditional sectors of the rural economy despite the exploitation recession in some sectors such as cultivation in order to compensate finance and capital required for the life of rural people and villages. Second, the reduction in income and financial power of the household as a result of economic downturn in traditional sectors of rural economy and also priority of implementation of costly projects for households such as water and electricity supply, implementation of guide projects by planners and authorities involved in wealth source distribution, are two major factors that have led to the imposition of severe financial pressure on the rural people. Based on the relevant trend, the spatial displacement of the rural people has been exacerbated in favor of urban centers or other involved settlements in the form of the phenomenon namely "escape from village", and this can lead to exit of human capitals (manpower and thinking) and intensification of capital in a place rather than village. Accordingly, it could be concluded that, by disrupting spatial wealth accumulation, the current intra-rural oil rent model is in conflict to the interests of rural associations, and follows a direction rather than development, especially economic development.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The authors are thankful to Hon'ble Dean and Management

FINANCIAL DISCLOSURE

None.

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ARTICLE

RELATIONSHIPS BETWEEN SPIRITUAL WELL-BEING AND QUALITY OF LIFE IN HIGHER EDUCATION

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ABSTRACT

The present study was conducted in higher education of Iran to the relationship between spiritual well-being and quality of life. The Statistical population included all students of Qom universities during 2015-2016 academic year from which a sample of 310 was selected from 2200 students of 2 universities through stratified random sampling. For this purpose, questionnaires were prepared and surveys of different universities were conducted to gather quantitative data. The results showed that two subscales of spiritual well-being mean such as existential well-being was lower than mid-level but level of religious well-being was higher than mid-level. It is also observed that the quality of life such as social relationship was less than average level but level of physical health and psychological health was higher than mid-level and environment was at average level. It was found a direct and significant relationship between scores of subscales of spiritual well-being and quality of life. The results showed that there was significant multiple correlation between spiritual well-being and quality of life. Beta coefficients among spiritual well-being and quality of life were significant and no autocorrelation existed and regression model was significant. Significant differences were also observed regarding demographic variables. This paper shows to the importance of analyzing spiritual well-being and quality of life in Iranian universities. It offers practical help to universities to develop motivation and health activity so students' health avoid challenging situations and persist in the face of difficulties.

KEY WORDS

Spiritual well-being;
Quality of life; Higher
Education

INTRODUCTION

Spirituality is frequently described as an individual's quest to find meaning in life and in his or her experiences. It is usually seen as related to some formal religion but is progressively viewed as independent of any planned religion [1]. Therefore, the spiritual well-being can be defined as a sense of communicating by the others, having meaning and goal in life and having belief and relation with a high power [2]. Ellison (1983) states that spiritual well-being contains a psychosocial in addition a religious element. Religious well-being which is a religious element specifies a relation with a superior power i.e. God. Existential well-being is a psychosocial element and shows feeling of a person of who he/she is, what he/she does and why and where he/she belongs to [3]. Both religious and existential well-being contains sublimit and effort beyond self. There are several researchers in supporting this theory that spiritual well-being can strengthen psychological function and adaptation [4]. The National Interfaith Coalition on Aging (1975) recommended that spiritual well-being is the affirmation of life in a correlation with oneself (personal), others (communal), nature (environment), and God (or transcendental other) [5]. Integrating these perceptions together, spiritual well-being can be defined in terms of a state of being reflecting progressive feelings, behaviors, and cognitions of relationships with oneself, others, the transcendent and nature, that in turn provide the individual with a sense of identity, wholeness, satisfaction, joy, contentment, beauty, love, respect, positive attitudes, inner peace and harmony, and purpose and direction in life [6]. In this situation, spiritual well-being is conceptualized as a two-dimensional construct. On the one hand, religious well-being describes on a vertical dimension our well-being for example it relates to God or even to a transcendent dimension. Instead, existential well-being addresses on a horizontal dimension our well-being as it relates to a sense of life purpose and life satisfaction, without any specific reference to a higher power [7].

On the other hand, spirituality is a significant element in the quality of life of humans. Spirituality may be defined in terms of a meaning for living and peace of mind or a relationship with a transcendent being [8]. In 1995, the World Health Organization workgroup on quality of life (QOL) defined QOL as an individual's perception of their situation in life in the context of the culture and value systems where they live in relation to their expectations, goals, standards and concerns [9]. QOL has been defined in a number of methods, and many measures exist for assessing this construct [10]. Most definitions clearly state that the assessment of QOL should take into account patients' subjective sights of their life circumstances [11]. This contains perceptions of social relationships, physical health, functioning in daily activities and labor, economic status, and a general sense of well-being [12]. Evidence is accumulating that anxiety and affective disorders are related with substantial impairments in quality of life and functioning. Individuals with major depressive disorder [13], and panic disorder [14] have substantially poorer QOL than community comparison cohorts. QOL refers to a person's overall sense of well-being, with all aspects contributing to his/her subjective satisfaction [15]. These aspects include health, family, work, the social network, and the residential environment [16]. According to Colver (2009), QOL can be defined in broad ways that incorporate objective and subjective accounts of personal feelings, social relationships, local environment, societal values, political institutions, economic conditions, and international relations [17]. But, a subjective and multidimensional approach, including physical and psychological health and social relations, is needed for QOL assessment [18].

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Published: 12 Sept 2016

In a recent review of the probable association between religious and spiritual factors and health outcomes, it was concluded that religious and spiritual factors appeared to be associated with whole physical health, and the recommendation was made for attention to spirituality and spiritual interventions in future studies [1]. The significant correlations have been stated between of spiritual well-being and variables for example religious deeds [19], depression, self-esteem and internal religious orientation [20] emotional well-being and life satisfaction [21] emotional instability and mood disorders [22] and stress [23]. Few studies have assessed QOL in persons with social anxiety [24, 25], showing a marked impairment in the physical, social and psychosocial domains. In a study of patients with social phobia, these patients supposed their QOL to be relatively poor. Furthermore, QOL in that study was inversely linked to the severity of social phobia [26]. In another study, Antony et al. (1998) found that 49 patients with social phobia described considerable interference with their daily functioning in several domains [27]. Leisa et al. (2008) with the title of "Perceived stress and QOL" on students of medicine established that these students described high levels of stress and low levels of QOL. High levels of stress were negatively correlated with physical and psychological health and QOL. Students with high level of stress had low levels of physical and psychological health and these levels of stress in women were meaningfully more than men. These various stresses were predictors of negative life styles and in turn these negative life styles were predictors of low QOL [28].

The present study was aimed to investigate the relationship between spiritual well-being and quality of life in Iranian higher education. The effects could pave the way to increase the quality of education services and improve the higher education performance. It will offer the managers with knowledge of spiritual well-being dimensions and quality of life indicators while they try to remove the possible defects and prepare the higher education for performing successful changes and aggregate providing better services.

MATERIALS AND METHODS

The present study employs a questionnaire survey approach to collect data for testing and research Question. Variables in the questionnaire comprise background information, spiritual well-being and QOL in higher education. The population for the study is 2200 students of 2 universities comprise Qom University and Qom University of medical Sciences. This study uses a stratified random sampling method to select 310 students. The authors distribute 310 questionnaires and ask for the questionnaires to be completed by faculty members. Of the 300 returned questionnaires, 10 are incomplete. The residual 300 valid and complete questionnaires are intended for the quantitative analysis. Data were composed by one questionnaire:

Following the distinction of previous researches [3], the present study adopts two Spiritual Well-Being Scale (SWB) including Religious Well-Being (RWB) and Existential Well-Being (EWB) of Spiritual Well-Being subscales with development of a twenty-item scale Questionnaire. All variables require five-point Likert style responses ranging from "strongly disagree" to "strongly agree". The Cronbach's alphas, calculated for the subscales and total scale: RWB alpha = 0.86 and EWB alpha = 0.90 and SWB=0.89.

Drawing upon prior researches [29], this study adapts WHOQOL-BREF is a 26-item subset from the WHOQOL-100 that assesses the individual's perception of quality of life and health in a Likert scale ranging from 1 to 5. The first two items measure the overall quality of life, and the individual's satisfaction with health, respectively. The remaining items can be grouped into four dimensions of QOL, namely: Physical Health (7 items), Psychological Health (6 items), Social Relationship (3 items), and Environment (8 items). Higher scores in all scales indicate a higher quality of life. Reliability coefficient of questionnaires were estimated through Cronach's alpha coefficient in healthy individuals assumed acceptable values (0.84 for Physical Health, 0.89 for Psychological Health, 0.85 for Social relationships, and 0.87 for Environmental).

To verify the questionnaires validity face and content method and authority opinions were utilized. To show the differences in Spiritual Well-Being and QOL among universities types, t-test, Fisher test, ANOVA, Multiple regressions were employed. A multiple comparison post hoc test with least significant difference (LSD) was used to determine which universities types were significantly different from the others.

RESULTS

Most respondents (85.3%) aged 19 to 22 years; the participants included 60.7% female and 39.3% male. The number of medical Sciences students was 62% and those whose domain was Social Sciences were 38%. The number of the students studying at the first grade was 37% and those studying at the fourth grade was 63%.

Table 1. Spiritual Well-Being subscales mean, standard deviation Qom University and Qom University of medical Sciences (M= 3, df= 299)

Indicators (SWB) subscales	M	S	SK	d	tob	P
Religious Well-Being (RWB)	3.45	0.78	0.060	0.52	7.68	0.000
Existential Well-Being (EWB)	2.55	0.58	0.034	0.28	2.83	0.001
Total	3.05	0.60	0.063	0.33	3.03	0.000

Table [1] shows that the means two subscales of Spiritual Well-Being universities the highest mean Religious Well-Being (RWB) (M=3.45), while the lowest mean is related to Existential Well-Being (EWB) (M=2.55).

Table 2. QOL dimensions mean, standard deviation Qom University and Qom University of medical Sciences (M= 3, df= 299)

Indicators QOL(dimensions)	M	S	SK	d	tob	P
Physical Health	3.25	0.81	0.06	0.27	3.45	0.003
Psychological Health	3.17	0.84	0.05	0.29	3.53	0.001
Social Relationship	2.57	0.53	0.04	-0.09	-1.35	0.005
Environment	3.04	0.79	0.07	0.25	3.63	0.002
Total	3.00	0.89	0.04	0.34	5.57	0.000

Table [2] regarding the four dimensions of QOL universities the highest mean Physical Health (M=3.25), while the lowest mean is related to Social Relationship (M=2.57).

Table 3. Multiple regression between spiritual well-being and QOL

Indicators Source	ss	df	ms	R	R ²	F _{ob}	P
Regression	13.32	2	8.36	0.680	0.462	41.56	0.000
Residual	32.60	298	0.186				
Total	45.92	300					

[Table 3] presents the results of multiple regression analysis regarding the effects of spiritual well-being on QOL (p=0.000). Multiple correlation coefficients are 0.68 and modified determination coefficient is 0.462. So 46.2 percent of response variable can be explained by a combination of spiritual well-being.

Table 4. Correlation between spiritual well-being and QOL

Indicators spiritual well-being	β	Beta	Vif	tob	P
Constant	1.865	-	-	7.049	0.001
Religious Well-Being (RWB)	0.942	0.761	1.23	6.189	0.000
Existential Well-Being (EWB)	0.870	0.459	1.06	5.696	0.007

[Table 4] shows the results of coefficients of Religious Well-Being (RWB) and QOL are positive and significant. Coefficient of Existential Well-Being (EWB) and QOL are negative and significant (p=0.000). This study uses variance inflation factors (VIFs) to examine the effect of multi co linearity. The values of the VIF associated with the predictors show a range from 1.06 to 1.23 which shows that there is no autocorrelation among them. So regression model is significant and predictive model can be showed as follow:

$$Y = 1.865 + 0.942x_1 + 0.870x_2$$

According to finding of multivariate analysis (MANOVA) showed that observed F at confidence level of p ≤ 0.05 for Spiritual Well-Being and QOL according to demographic characteristics is significant. Etas square for age, Sciences domain are not significant. But Eta square for university type, sex and grade is significant [Table 5].

According to finding of Table-5, LSD test results identified that Existential Well-Being (EWB) and Environment in Qom University of medical Sciences was more than Qom University. LSD test results identified that Social Relationship according to sex students with male were more than those with female and so, Psychological Health according to grade students with first grade were more than those with fourth grade.

Table 5. Paired comparison of Mean Differences and standard deviation of spiritual well-being and QOL

Variables	Demographic Variables		Mean Differences	Sig
Existential Well-Being (EWB)	University Type	Qom University of medical Sciences and Qom University	0.9653	0.000
Environment		Qom University of medical Sciences and Qom University	0.6848	0.036
Social Relationship	Sex	male and female	0.5467	0.025
Psychological Health	grade	first grade and fourth grade	0.4273	0.017

DISCUSSION

The greatest aspect of spiritual well-being is being able to give oneself strengths in various aspects of life. Spirituality is one element of faith development. It is one dimension of how one lives realistically in this world [30]. It lead to from a process of deep understanding of one's purpose of life, through religious practices and guidance from God.

Research results showed that two subscales of Spiritual Well-Being mean such as Existential Well-Being was lower than mid-level but level of Religious Well-Being was higher than mid-level and so the dimensions of QOL such as Social Relationship was less than average level but level of Physical Health and Psychological Health was higher than mid-level and Environment was at average level. Finally, significant differences were observed between Spiritual Well-Being and Quality of Life regarding demographic variables. Results of this study are almost compatible with a study that showed that spiritual well-being is the affirmation of life in a relationship with oneself (personal), others (communal), nature (environment), and God (or transcendental other) [6]. On the other hand, a study showed students reported high levels of stress and low levels of QOL. High levels of stress were negatively correlated with physical and psychological health and QOL. Students with high level of stress had low levels of physical and psychological health and these levels of stress in women were significantly more than men. These various stresses were predictors of negative life styles and in turn these negative life styles were predictors of low QOL [28]. In general, there is significant multiple correlation between the Spiritual Well-Being subscales including religious well-being and existential well-being and QOL in the studied universities. The beta coefficients have been as 0.761 between Religious Well-Being and QOL, 0.459 existential well-being and QOL all of which are statistically significant. The variance inflation factor for explanatory variables has been at least 1.06 to 1.23, which shows that there is no conformity between them. Results of this study are almost compatible with a study that examined how the possible association between religious and spiritual factors and health outcomes, it was concluded that religious and spiritual factors appeared to be associated with overall physical health, and the recommendation was made for attention to spirituality and spiritual interventions in future studies [1]. The significant correlations have been reported between of spiritual well-being and variables such as religious deeds [19], depression, self-esteem and internal religious orientation [20] emotional well-being and life satisfaction [21] emotional instability and mood disorders [22] and stress [23].

CONCLUSION

Our findings indicated that students' spiritual well-being should be regarded as an important value and belief system that can affect their QOL. According to the importance of spiritual well-being role in consolidating physical, mental and social aspects of individual, intervention and training is considered a necessary issue in this field and can have an important key role for students.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The authors are thankful to Hon'ble Dean and Management

FINANCIAL DISCLOSURE

The work is not supported by any funding agency.

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ARTICLE

ANALYZING COMPANY'S STOCK PRICE MOVEMENT USING PUBLIC SENTIMENT IN TWITTER DATA

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ABSTRACT

Recently some efforts have been made to use data from social media for prediction in various domains. Some studies also suggest public emotions in tweets may correlate with market trend. Using studies observations, public sentiments from social media helps to predict stock price of a particular company. The system can be effectively used to predict stock price movement of particular company or not. However, the current systems use to predict the overall market trend instead of predicting for individual company. Also, the public sentiment is not only the single factor which can affect the stock market so, there is need of combination of market and public sentiment to predict the stock price of the company. The system firstly mine the tweets of a particular company from different sources such as Twitter and Yahoo finance and news related to finance are also considered. The data is preprocessed to counter the noisy and missing data and sentiment of the public data of company is calculated using the natural language processing techniques. Financial data values of company will be fetched from yahoo finance. Some classifiers techniques such as SVM, Naïve Bayes and Maximum Entropy are also tested to find the best outcome. The public sentiment and market are sentiments are combined to obtain the desired outcome. The correlation between public's sentiment and company's stock price movements is observed. Granger causality test is used to determine whether sentiment polarity is able to predict the stock price in advance for a company.

INTRODUCTION

KEY WORDS

Social web mining; Data mining; Sentiment analysis; Natural language processing; Market prediction.

Twitter is platform for social interaction. It is an online application for sharing and gathering small messages. These messages can represent everything from a person's opinion of shoes, to the latest changes in the financial market or pictures from Olympics games. The gist of the Twitter is the tweets [1]. The Tweet is a message limited to the 140 character. Tweets let us interact with other people, share photos with people and post any relevant or non-relevant type of information. The small size of the tweets are not a barrier for the flow of information. The fast and rapidly gained worldwide popularity of Twitter, with more than 100 million users posting 340 million tweets a day in 2012 [2]. The service also handled on an average 1.6 billion search queries every day. In 2013, Twitter was one of the ten most-visited websites and has been described as "the SMS of the Internet"[3]. As of May 2015, Twitter acquired little more than 500 million users, 332 million users are frequently visitor of the service.

Economic growth plays a vital role in any country, as it increases job opportunities and income and in turn increases revenue. For the economic development of a country, it is necessary that the investments are in the right direction which yields high return. The capital market provides economic growth, it is made up of mechanism that encourages the formation of savings and are easily accessible to those wishing to invest. The stock market is good channel for the productive activities. However, the pricing of a share on the stock exchange has very dynamic behavior, driven often by the law of supply and demand for action. This dynamism attracts the attention of investors because it provides huge profits when investment is made in the best way at the right time. The objective in share market is to sell shares when price is high and buy shares when price is low. This is the way to generate profits and reduce risk and losses. The technique can also be referred to as prediction; can enhance the profitability of investments.

As the advancement in technologies take there had been developed an enabling environment for widespread use of social networks. Social network is a place where individual can freely express their desires, feelings and preferences, thus making the result of this process, more natural and close to reality. The use of individual may be the basis for establishing, certain preferences and calculating the mood for prediction. Twitter, one of the most popular social media, with over 200 million users who share their opinion through tweets.

Keeping in mind the large amount of available information, resulting from Twitter, the content of messages about certain company in order to establish a relationship between the collective mood of publications and their influence on the price of an asset in the financial market can be analyzed.

RELATED WORK

The generation of huge amount of online documents and text generated by user has led to a growth in research in the area of sentiment analysis and its association with financial segments. A broad analysis of some of the machine learning techniques used in sentiment analysis is described by B.Pang et al. [4]. There, authors presented methods in determining whether movie reviews are positive or negative and investigate some challenges in sentiment analysis. An overview of Support Vector Machine, Maximum Entropy, and Naive Bayes classification techniques in the movie review domain is provided.

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Published: 12 Sept 2016

Pak A. et al. [5] discusses the need of Twitter especially as a corpus for sentiment analysis. They confer the methods of gathering tweets and then processing tweets. The authors use specific emoticons to form a training set for sentiment classification, this technique helps in reducing manual tweet tagging. The training set was split into positive and negative samples on the basis of happy and sad emoticons. Additionally, a few accuracy improvement methods were analyzed.

Similarly, Albert B. et al. [6] also presented a discussion of streaming mining Tweet and sentiment extraction, while facilitating the discussion to include opinion mining. Bollen J. et al. [7] proposed one of the first hints that there might be a correlation between Twitter sentiment and the stock market. In their work, a sentiment value is correlated with the DJIA and then provided to a neural network to predict market movements. Opinion Finder tool was used by authors to track mood and to classify mood in 6 dimensions (Kind, Sure, Happy, Calm, Alert and Vital). Then, correlated the mood time series with DJIA closing values by using a Self-Organizing Fuzzy Neural Network. Their techniques measured an improvement on DJIA prediction accuracy.

A few other works in the area have been proposed. Eric Brown [8] suggests a method in which tweets are extracted according to stock symbols and then sentiment is gathered using Naive Bayes over a dataset already existing. Deng S. et al. [9] combines sentiment gathered from news with technical features of stock data. Sentiment is analyzed using SentiWordNet 3.0, a lexical resource used in opinion mining. The data was scraped from Engadget rather than Twitter. Multiple kernel learning is tested to find the best coefficients for the different parameters in their system for prediction of stock. The authors concluded that training a model based on more technical stock factors improved stock prediction performance.

Ronen Feldman [10] experimented 3 methods of sentiment analysis on tweets: aspect-based, sentence-level, and document-level. They found that aspect-based analysis, which finds the sentiment of context and also determine the aspect it refers to, is the fine-grained technique for the problem. Additionally, they provided various challenges of sentiment analysis on tweets.

Mittal A. et al. [11] achieves a 75% accurate prediction rate using Self Organizing Fuzzy Neural Networks on Twitter data and DJIA closing values. In their research, they created a custom dataset with words to calculate sentiment value for their tweets.

On a side note, E. Hurwitz [12] discusses some common issues associated in many of the works presented above. These include, but are not limited to: data not sufficient always, measures of performance are inaccurate and inappropriate scaling.

Go and L. Huang [13] implemented a sentiment analyzer for twitter data. For training data the tweets with emoticons were considered and able to divide tweets into two sections either positive or negative. Applied SVM, Naïve Bayes, and Max entropy techniques on the data.

Table 1. Study of different sentiment classifier techniques and stock market prediction

Authors	Description	Pros	Cons
Alexander Pak, Patrick Paroubek (2010) [5]	Automatic collection of a corpus that can be used to train a Sentiment classifier. Used TreeTagger for POS tagging and observed the difference in distributions among positive, negative and neutral sets. The classifier used the multinomial Naive Bayes classifier that uses N-gram and POS-tags as features.	Classifier was able to determine positive, negative and neutral sentiments of documents.	Collected only datasets having emoticons. Not applicable for multilingual sentiment classifier. Limited dataset.
Go, Bhayani and L.Huang (2009)[13]	used emoticons as noisy labels for training data to perform distant supervised learning. Machine learning algorithms (Naive Bayes, maximum entropy classification, and support vector machines) method were used. Twitter messages have unique characteristics compared to other corpora, machine learning algorithms	Accuracy improved for Naive Bayes (81.3% from to 82.7%) and Max-Entropy (from 80.5 to 82.7) for using combination of Unigrams and Bigrams.	A set of 177 negative tweets and 182 positive tweets were manually marked. Not all the test data has emoticons. Semantics not considered in classifying tweets.

	are shown to classify tweet sentiment with similar performance		
Apoorv Agarwal, Boyi Xie, Ilia Vovsha, Owen Rambow and Rebecca Passonneau (2011) [14]	Used POS-specific prior polarity features and use of a tree kernel to obviate the need for tedious feature engineering. Tree kernel and feature based models were used.	An overall gain of over 4% for two classification tasks: a binary, positive versus negative and a 3-way positive versus negative versus neutral. POS-specific prior polarity features and tree kernel outperform the Naïve base.	Linguistic analysis, for example, parsing, semantic analysis and topic modeling were not considered. Feature based model applied with less data.
Paolo Fornaciari, Monica Mordonini and Michele Tomaiuolo (2014) [15]	Variations of Naive Bayes classifiers for detecting polarity of English tweets. Two different variants of Naive Bayes classifiers were built namely Baseline (trained to classify tweets as positive, negative and neutral), and Binary (makes use of a polarity lexicon and classifies as positive and negative. Neutral tweets neglected.	Inclusion of new features for classifier such as Lemmas (nouns, verbs, adjectives and adverbs), Polarity Lexicons, and Multiword from different sources and Valence Shifters.	Highlighted the typical problems of Sentiment Analysis (irony, sarcasm, lack of information, etc.). some peculiar problems of the considered channel were also detected
Luciano Barbosa and Junlan Feng (2010) [16]	A two phase automatic sentiment analysis method for classifying tweets. Classified tweets as objective or subjective and then in second phase, the subjective tweets were classified as positive or negative.	The new features used were retweets, hashtags, link, punctuation and exclamation marks in conjunction with features like prior polarity of words and POS. Creates a more abstract representation of tweets.	Failed to deal with the cases of sentences that contain antagonistic sentiments. Not able to perform a more fine grained analysis of sentences in order to identify its main focus.
Albert Bifet and Eibe Frank (2010)[6]	Used Twitter streaming data provided by Firehouse API, which gave all messages from every user which are publicly available in real-time. Experimented multinomial naive Bayes, stochastic gradient descent, and the Hoeffding tree.	Introduced SGD which provides an efficient means to learn some classifiers even if they are based on non-differentiable loss functions, such as the hinge loss used in support vector machines. SGD-based model, when used with an appropriate learning rate provides better result.	Not able to use methods in real time and not considered other features available in Twitter data streams, such as geographical place, the number of followers or the number of friends.
Dmitry Davidov, Ari Rappoport and Oren Tsur (2010) [23]	Proposed an approach to utilize Twitter user-defined hashtags in tweets as a classification of sentiment type using punctuation, single words, n-grams and patterns as different feature types, which are then combined into a single feature vector for sentiment classification. Used of K-Nearest Neighbor strategy to assign sentiment labels by constructing a feature vector for each example in the training and test set.	The framework successfully identifies sentiment types of untagged sentences. The quality of the sentiment identification was also confirmed by human judges. Also dependencies and overlap between different sentiment types represented by smileys and Twitter hashtags were explored.	Predefined tags and smileys were used for the classification of tweets. Not enough dataset to apply over large scale. Not applicable for other domains.
Po-Wei Liang and Bi-Ru Dai (2013) [22]	Used Twitter API to collect twitter data. The training data falls in three different categories (camera, movie , mobile). The data is labeled as positive, negative and non-opinions. Unigram Naive Bayes model was implemented and the Naive Bayes simplifying independence assumption was employed. Finally, the orientation of an tweet is predicted. i.e. positive or negative.	Tweets containing opinions were filtered. Eliminated useless features by using the Mutual Information and Chi square feature extraction method. Machine learning performed well in the classification of sentiments in tweets with good accuracy.	Not able to handle issues such as semantics of tweet, also not able to address issues regarding domain-specific tweets and the neutral tweets.
Peter D. Turney (2002)[21]	Used bag-of-words method for sentiment analysis in which the relationships between words was not at all considered and a document is represented as just a collection of words. To determine the sentiment for the whole document, sentiments of	The algorithm attains an average accuracy of 74%. For banks and automobiles, it seems that the whole is the sum of the parts, and the accuracy is 80% to 84%. Travel reviews	Only able to give recommendation whether it is considerable or not. The time required for queries was more and, for some applications, the level of accuracy that was

	every word was determined and those values are united with some aggregation functions.	are an intermediate case. For movie reviews accuracy is around 60%.	achieved was not good as compared to others.
Rui Xia, Chengqing Zong and Shoushan Li (2011)[20]	Used an ensemble framework for Sentiment Classification which is obtained by combining various feature sets and classification techniques. Used two types of feature sets (Part-of-speech information and Word-relations) and three base classifiers (Naive Bayes, Maximum Entropy and Support Vector Machines) Applied ensemble approaches like fixed combination, weighted combination and Meta-classifier combination for sentiment classification and obtained better accuracy.	Integrated different feature sets and classification algorithms to boost the overall performance. Also pursued hybrid generative/discriminative models that are suitable for sentiment classification.	Computational cost is increased. Also the computational time for the method is slightly higher than the baseline methods.
Zhiang Hu, Jian Jiao, Jialu Zhu (2014)[19]	Found the relationship between tweets of one important Twitter user and the corresponding one stock price behavior. The tweets of Elon Musk, who is the CEO of Tesla, and the change of Tesla stock price are used as data. They tried different sets of features using SVM model.	The accuracy and the confusion matrix of this set of features and labeling are reasonable. Around 60% accuracy can be reached if we leave 10% data to be testing set.	Limited to a single user. Also the method is not able to give up the overall scenario of the market.
Anshul Mittal and Arpit Goel (2011)[11]	Applied sentiment analysis and machine learning principles to find the correlation between "public sentiment" and "market sentiment". Used twitter data to predict public mood and use the predicted mood and previous days' DJIA values to predict the stock market movements	Concluded that public mood can indeed be captured from the large-scale Twitter feeds by means of simple natural language processing techniques, as indicated by the responses towards a variety of socio-cultural events during the year. a Self Organizing Fuzzy Neural Network performs very good in predicting the actual DJIA values when trained on the feature set consisting of the DJIA values, Calm mood values and Happiness dimension	Dataset doesn't really map the real public sentiment, it only considers the twitter using, English speaking people. Not able to obtain high percentage result of 87%, but obtained 75.56% result using k-fold sequential cross validation.
LI Bing, Keith C.C. Chan and Carol OU (2014)[18]	Proposed extracting ambiguous textual tweet data through NLP techniques to define public sentiment, then make use of a data mining technique to discover patterns between public sentiment and real stock price movements.	The proposed algorithms have a better prediction performance in some certain industries such as IT and media. On the other hand, our study indicates the proposed algorithms have a better performance in using current tweets sentiment to predict the stock price of three days later.	Considered the daily or weekly closing values of the stock price only. The dataset used is the Twitter data. Most Twitter messages are very short and some of them are actually meaningless so not able to give clear picture.
Tushar rao and Saket Srivastava (2012)[17]	Worked upon identifying relationships between Twitter based sentiment analysis of a particular company/index and its short-term market performance using large scale collection of tweet data.	Individual company stocks gave strong correlation values (upto 0.88 for returns) with twitter sentiment Features of that company. It is no surprise that this approach is far more robust and gives far better results (upto 91% directional accuracy) than any previous work.	Discussion based tracking of Twitter sentiments which may be biased or misleading. Also more data is required to make good predictions.

From the study of different works it is evident that there is need of a system which can predict and analyze the company's stock price. The study shows that the current systems can predict the overall market trend using the public sentiment. So, the system proposed should be such that it should be based on the individual company. There is a need of system which is capable of mining the company specific tweets from Twitter. The systems which take individual company data and apply all the classifier techniques and find out which one is more suitable is required. But the

technique used by the system must be fast and the accuracy of the technique should be high. The system should also be able to clearly distinguish between the positive, negative and neutral sentiments. The intended user of the system can be any one from stock analysts to company who want to use this as source of improvement. The system must be simple yet elegant and easily adaptable and easy to operate by mass group. Combination of the market and public sentiment must be taken into account as it can help in analyzing better.

PROPOSED FRAMEWORK

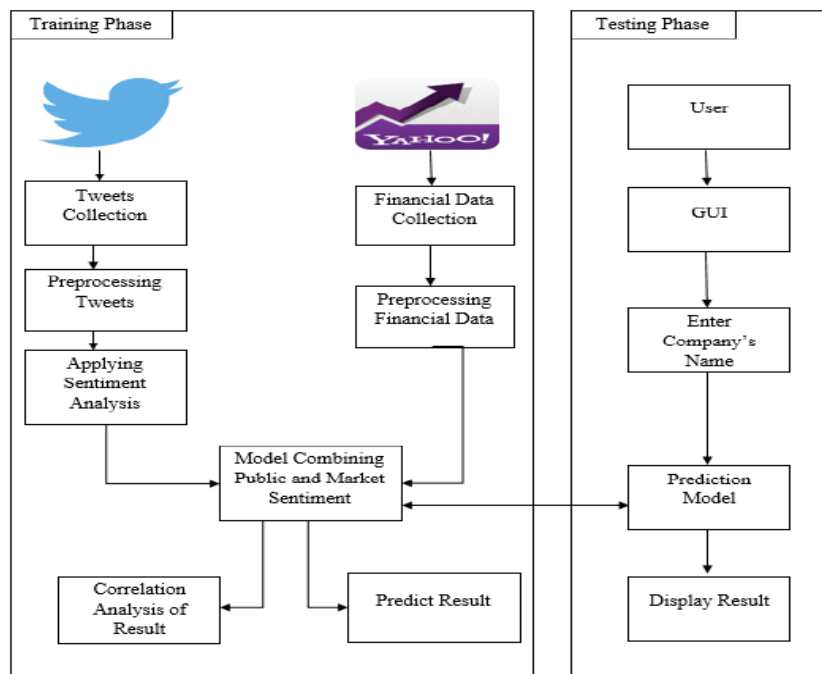


Fig. 1: Schematic view of developed system

In this system, first data is collected i.e. tweets from Twitter with the help of twitter API of Python and financial news and messages from Yahoo from Yahoo API of Python. Then preprocessing of collected data by removing noisy data, redundancy and other unwanted data. Then sentiment analysis is performed using natural language processing technique which first calculate polarity of individual word and then combine them to get polarity of whole sentence. This polarity value of each sentence is the averaged to get the whole sentiment value of the Tweet. The system then combines both sentiments of Twitter and Market. And as a consequence, the predicted value of the stock price of a particular company which the user has queried to the system is obtained. For the better visualization of system a smooth graph is drawn. To analyze the system and find the accuracy of the system correlation, regression, granger causality tests are performed. Also, the accuracy of the system is calculated and obtained the value of 89.4%. The design of the system and different requirements are explained below:

Dataset Collection

To train the system collects the dataset of tweets and make corpus of them. Also, the dictionary of words are needed which will be used to find the polarity of a given word.

So, the tweets on the basis of three different categories positive, negative or neutral were gathered. SentiWordNet will be used for the word corpus. It contains roughly around 8221 words with their polarity values according to the context of the word used. Thus this can be used for calculating the sentiment of the text provided.

Twitter API

For the collection of the tweet, Twitter contributes a rather powerful API. There are two ways to collect tweets: the Search API is a part of REST API which allows user to request the specific queries for getting tweets. REST, simply uses HTTP methods to access the tweets.

Another one is Streaming API which allows user to obtain real time tweets just by entering the specific query. It can be done by establishing the connection between user and the Twitter to gain the stream of tweets. The rate limit is also not limited in Streaming API which is the case in Search API.

The requested tweets are returned in the JSON object format and contain tweets and the metadata associated with them. For our purpose we will store the time, location and the message part of tweet.

The Streaming API can be accessed by entering the unique API key and once it is authenticated the user can interact with Twitter and extract the required tweets.

Tweets Preprocessing

The text part of the tweet can contain many additional words which will not contribute to the sentiment of the tweet. They may contain URLs, retweets, other user's tags or symbols with no sense. To get the exact sentiment of the tweet we need to filter the noise from the original text.

The steps involved in the preprocessing are: -

- **Tokenization:** The first step is to form the collection of words from the text by splitting the text by spaces. The collection of words will be called as bags of word and used for future purpose.
- **Removing stop words:** Next step is to filter out the stop words. This can be done using the python library which has the list of stop words and each word is tested against it and if it is matched then removed from the text. These words will not contribute to the sentiment of the text.
- **Twitter symbols:** The final step is to symbols in tweets. The word immediately following @ will be removed as it will be username and have no sentiment value. The word after # will be considered as they can be used in filtering purpose. The URLs will also be removed from the text with the help of the regex.

Yahoo Finance

Yahoo finance which can be used to obtain every information about the finance. Historical data for the company's share can be obtained from it. The current stock price for company can also be extracted from this. Also, it is the great source for obtaining finance news and major developments going around in financial world. Yahoo finance board can also be used for the prediction of the stock price.

Ystockquote

It is used for obtaining the stock values of the company. It also provides options for giving the historical data.

Classifier Used

Naïve Bayes

A Naïve Bayes classifier is based on Bayes Rule and is type of probabilistic classifier and is one of the simplest form of the Bayesian Network. The classifier is very easy to implement and have wide applications. The underlying naïve assumption based on which classifier operates is conditional independence of each feature from its feature set.

The classifier is a classical application of Bayes Rule:

According to our view, we want a class "c" so we need to find the most probable class with given features "F". The value $P(F)$ can be treated as constant and it will be independent of c and values provided by us. Now we need to calculate the value of $P(F|c)$ and we can assume that a given class "c_j" the features are conditionally independent from each other. Therefore, From this we can find the label c* with maximum posterior decision rule which will take the most probable label from all label of C.

Sentiment Calculator

The sentiment for each and every tweet obtained will be done through this. The sentiment calculator is to identify the tweets in three type positive, negative or neutral tweets. The sentiment calculates the sentiment of each and every word and then it will move to the tweet level and finally the overall sentiment of company is obtained.

Prediction Model

The model is to combine the public and market sentiment. It will be used to merge the data obtained from the yahoo finance and the sentiment calculated of the tweets of a particular

company. The model will give the prediction of the stock price of a company using twitter data and historical financial data.

RESULTS

Different tests were performed to evaluate the efficiency and performance of the system. Correlation test to find out whether the system predicted value and actual value are strongly related or not. Regression test was performed to find the relationship between the actual and predicted stock values.

To analyze result the confusion matrix is taken into account and discussed in Table 2. The confusion matrix is denoted by:

Table 2. Confusion Matrix

		Predicted Value	
		Positive	Negative
Actual Value	Positive	TP	FP
	Negative	FN	TN

Where TP is true positive, FP is false positive, FN is false negative and TN is true negative. The accuracy of the same is discussed in Table 3.

Table 3. Confusion Matrix with experimented value

		Predicted Value	
		Up	Down
Actual Value	Up	268	31
	Down	22	179

On applying the confusion matrix on the experiment performed, and applying the accuracy obtained is 89.4

The above data is obtained for the 500 sample points. The samples are the stock price of a particular company on a single day. The assumptions for calculating the accuracy is that if the stock price is moving up and the system predicts the upward movement then it is considered as true positive. Similarly, if the movement is downward and the system also predicts downward movement then it is true negative. If the movement is upward but prediction is downward then it is considered as false positive and in reverse case false negative is obtained.

The above values are obtained by analyzing the several companies over period of days shown in Figure 2 to Figure 7.

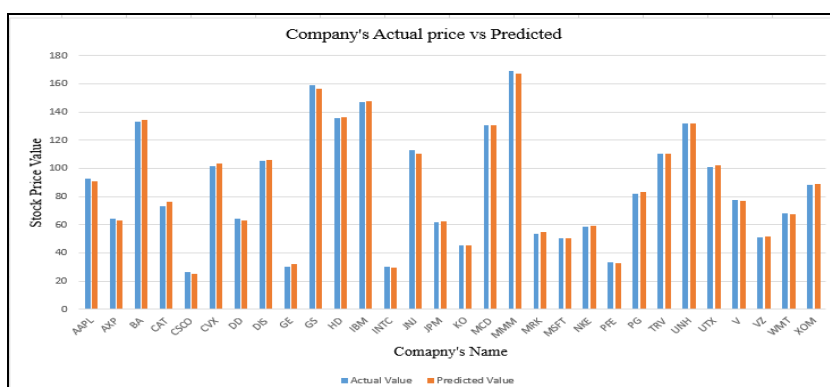


Fig. 2: Actual Vs Predicted price of different company's 1-day stock

The above graph depicts the stock price values of several companies. The graph contains the actual stock price value and also the previously predicted values of different companies.

Also, the more analysis is done with few companies.



Fig. 3: Actual Vs Predicted price for Apple stock over 20 days

The above graph is obtained is showing the movement of Apple stock price over 20 days and the actual value of stock along with the predicted stock value is shown. The movement is captured and actual vs predicted values are displayed over span of days.

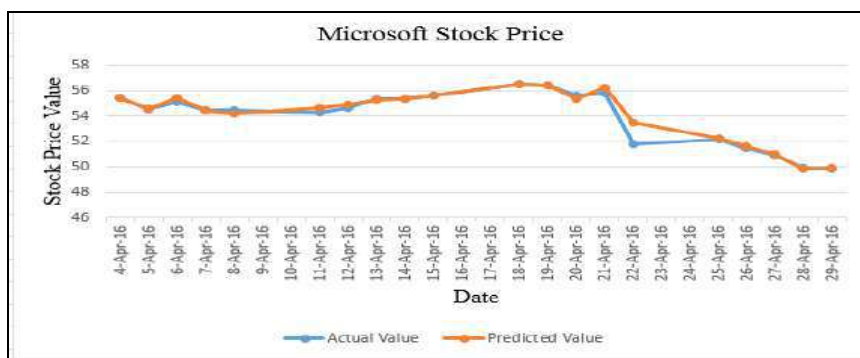


Fig.4: Actual Vs Predicted price for Microsoft stock over 20 days

The above graph is obtained is showing the movement of Microsoft stock price over 20 days and the actual value of stock along with the predicted stock value is shown. The movement is captured and actual vs predicted values are displayed over span of days.

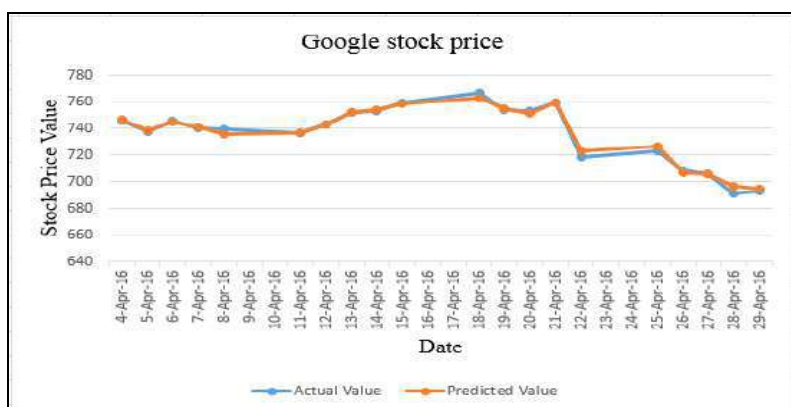


Fig. 5: Actual Vs Predicted price for Google stock over 20 days

The above graph is obtained is showing the movement of Google stock price over 20 days and the actual value of stock along with the predicted stock value is shown. The movement is captured and actual vs predicted values are displayed over span of days.



Fig. 6: Actual Vs Predicted price for Walmart stock over 20 days

The above graph is obtained is showing the movement of Walmart stock price over 20 days and the actual value of stock along with the predicted stock value is shown. The movement is captured and actual vs predicted values are displayed over span of days.

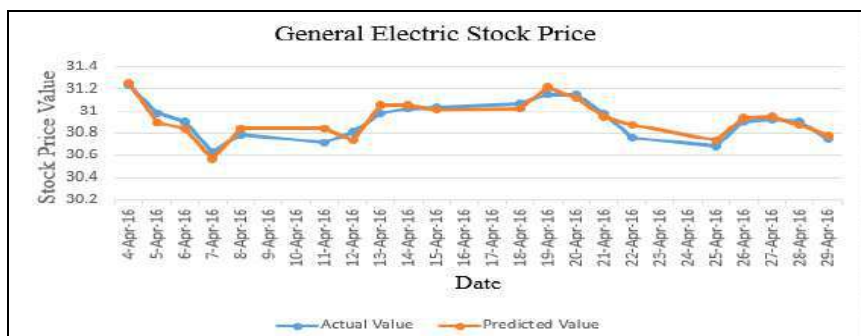


Fig. 7: Actual Vs Predicted price for General Electric stock over 20 days

The above graph is obtained is showing the movement of General Electric stock price over 20 days and the actual value of stock along with the predicted stock value is shown. The movement is captured and actual vs predicted values are displayed over span of days.

CONCLUSION

Camel The main essence of the project was sentiment analysis and applying on the public data obtained from Twitter and other financial news sources and combining with the market values to obtain the future price of the market. The Streaming API and mining of the tweets looks like a challenge at first, but after few initial try's tweets were obtained from the source efficiently. The data obtained from this is good for the analysis but it can be improved.

The use of Naïve Bayes classifier and other had produced better than the baseline methods and had very good accuracy and performed well with the data. The sentiment analysis of the text was a tedious job but was performed efficiently and time required was also less. The usage of the corpus with the polarity value helped a lot in calculating the overall sentiment value of the text. Combining the market and public sentiment to obtain the future price was used. The method was in many ways successful but the method can be improved in many ways for getting the better results. Thus, we were successful in analyzing stock price movement of company's stock and predict the future value.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The authors are thankful to Hon'ble Dean and Management

FINANCIAL DISCLOSURE

No financial support was received to carry out this project..

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ARTICLE

DESIGN AND IMPLEMENTATION OF PIPELINED RADIX-2 SDF-SDC FFT USING MODIFIED CARRY SELECT ADDER

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ABSTRACT

This paper presents the design of power efficient structures of Radix-2 Decimation in Frequency (DIF) pipelined butterflies, aiming the implementation of high speed and low power Fast Fourier Transform (FFT) using modified carry select adder. In the traditional method of FFT, the processing speed is low and large power consumption. So, the pipelined SDF-SDC FFT using carry select adder has been designed. Compared to traditional method, the pipelined SDF-SDC using carry select adder is used to reduce the power consumption. The main goal of this paper is to reduce the hardware slices, LUTs, delay and power consumption. In this paper, we modified the carry select adder by reducing the full adder structure to reduce the hardware slices, delay and power consumption. "Pipelined radix-2 SDF-SDC FFT using modified carry select adder" has been proposed in this paper. The Full adder circuit is shrunk down by reducing number of gates. Finally, the modified carry select adder circuit is integrated into SDF-SDC FFT processor. When compared to traditional equivalents, the proposed architecture which is used to improve the high processing speed and high performances of FFT processor. By using modified carry select adder the FFT processing time is reduced and also the speed can be improved. Simulation of proposed Radix-2 SDF-SDC FFT using modified CSLA architectures are evaluated by using ModelSim 6.3C and performances are validated by using Xilinx ISE10.1 design tool.

INTRODUCTION

Fast Fourier Transform (FFT) is the largely implementation of the Discrete Fourier Transform (DFT) used in some communication systems PHY layer and DSP. This algorithm performs the calculation of complex terms, which involves the multiplication of input data by appropriate coefficients. The FFT algorithm, started a new era in digital signal processing by reducing the orders of complexity of DFT multiplications compared to a normal DFT. Since multipliers and adders are very power hungry elements in VLSI designs they result in consequent power consumption. The basic principle of FFT is that to find mechanism of time saving. The Fast Fourier Transform analysis is to convert the original signal to frequency domain signal and vice versa.

We need to perform N multiplications and $N-1$ additions for an N -point DFT. Therefore, there will be complex multiplications of N^2 and complex additions of $N(N-1)$. Different platforms such as computer chips and general purpose processors are implemented by the Fast Fourier Transform (FFT). FFT uses a divide and conquer methodology for its computation process. This divides the N co-efficient into smaller blocks in different stages.

Adders are mostly used in electronic applications. Digital adder is an important specification in advanced digital processors for faster computation. The speed of addition is limited by the time needed for a carry to propagate through the adder, in digital adder circuits. Adders in circuits acquire extremely large area and consume large power as large additions are finished in advanced systems. Adder is one of the important blocks in ALU and DSP systems. An adder plays a significant role include convolution, digital filtering like DFT, FFT, digital communications and spectral analysis.

In the traditional FFT which uses the adder structure is not suitable due to its low processing speed and large power consumption. Here, the traditional adder is replaced with proposed carry select adder. In this paper, pipelined radix-2 SDF-SDC FFT using modified carry select adder is used to high processing speed and high performances of FFT processor.

LITERATURE SURVEY

[1] Explained the design of pipelined structure from Radix-2 FFT with DIT algorithm using efficient adder compressors. The different and dedicated structures for the 16 bit-width pipelined radix-2 DIT butterfly running at 100MHZ are implemented. The main goal of this paper is to minimize the number of real multipliers of the architectures. This is done by varying the structure of the complex multipliers and applying them into the butterflies. The adder compressors structures are widely used in fast and low power multiplier architectures. Parallel FFT processor has more disadvantages in hardware utilization and speed of processing. In order to overcome the problem of parallel FFT, Pipelined FFT processor such as R2SDF and R2MDC FFT structures has been introduced in [2]. In [2], Pipelined Radix-2k FFT structures have been developed with the help of Feed forward structures. Feed forward structure provides 26ns for performing 8-point FFT.

KEY WORDS

Single path Delay Commutator, Carry Select adder, Decimation in Frequency, Fast Fourier Transform, Single path Delay Feedback, Look Up Tables

Received: 25 Aug 2016
Accepted: 2 Sept 2016
Published: 12 Sept 2016

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[3] Explained the FFT processor using radix-24 feed forward pipeline architecture, which has low latency, high throughput and lesser area. In FFT computation, there are number of complex multiplication and addition operations. In VLSI implementation of FFT, multipliers takes large time in calculation, therefore it increases the delay of FFT processor.[4] Described the efficient combined single-path delay commutator-feedback (SDC-SDF) radix-2 pipelined FFT architecture, which includes N number of sdc stages and 1 SDF stage. The combined SDC-SDF pipelined FFT architecture which provides the output data in the normal order. The SDC processing engine is to achieve 100% utilization. The proposed SDC PE reduces 50% complex multipliers, compared with other radix-2 FFT.

[5] Explained the CS operation is scheduled before the computation of final-sum, which is different from the traditional approach. Carry words identical to input-carry '0' and '1' generated by the CSLA based on specific bit pattern, which is used for logic optimization of the CS unit. For logic optimization, fixed input bits of the CG unit are also used. An optimized design for CS and CG units are obtained. An efficient design is obtained for the CSLA, by using these optimized logic units. CSLA design involves less area and delay than the BEC based CSLA.[6] described the new design of LPPL FFT processor and its two basic building blocks, butterfly in pipeline and address generator.[7]-[9] explained an efficient adder design essentially improves the performance of a complex DSP system.[8]-[10] presented the low-cost VLSI implementation of a pipeline fast fourier transform capable of supporting from 1k to 32k FFT sizes.

RADIX-2 FFT STRUCTURES

Radix-2 FFT algorithm retaining to divides the N-point DFT into two N/2 point DFTs and a complex multiplication in between. The DFT of N-point time domain signal is represented by

$$X_k = \sum_{n=0}^{N-1} x_n W_N^{nk}$$

$0 \leq k \leq N-1$

Where, X_k is the DFT (frequency) representation of discrete signal x_n , W_N^{nk} denotes the twiddle factor and N represents the Number of points.

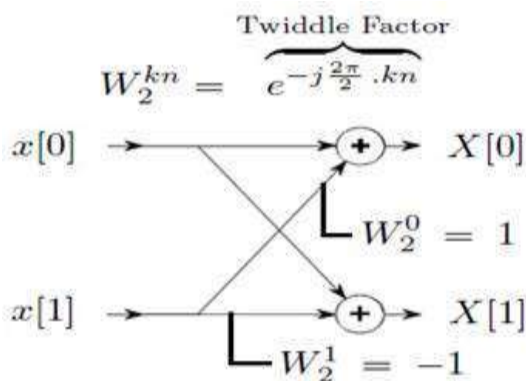


Fig. 1: Structure of Radix-2 FFT

Radix-2 FFT algorithm calculates the FFT in following three levels a) Decompose an N-point time domain signal into N number of separate signals such that each consists of a single point. It is a multistage interlaced decomposition where odd indices and even indices get separated. b) Calculate the N frequency spectra corresponding to N time domain signals. c) Synthesize the resulting N number of spectra into a single frequency spectrum. Radix-2 FFT consists of two types, one is Decimation in Time (DIT) FFT and next one is Decimation in Frequency (DIF) FFT. Input bits are given in reversing order and output is obtained as normal order, in DIT FFT. But in DIF FFT, input is given to normal order and the output is obtained as bit reversing order.

EXISTING METHOD

Single path Delay Feedback - Single path Delay Commutator (SDF-SDC) FFT

The SDF FFT is a serial processor which provides high speed operation. In R2SDF, the inputs are given into serial manner. In R2SDF FFT, N/2 point input data is sequentially controlled with the help of Flip-Flop circuit. This FFT structure consumes more number of hardware utilization and power consumption due to

utilizing or storing bulk of unwanted intermediate processing signals. Hence, large power consumption is one of the main disadvantages of R2SDF FFT. Single Path delay Commutator FFT has more number of single delay commutators within one stage. But in case of SDF FFT, single number of large delay feedbacks is used to implement the functions of FFT. Both SDF and SDC architectures are used in the proposed design. In the place of multiplier unit, Bit Parallel Multiplier is used for multiply the subtracted data into corresponding twiddle factor values. Complex input data is considered to perform the FFT function. In every step, there is single delay commuting function has been used to process the appropriate data points. The Multiplexer units have been used to provide control signals for performing Commutator functions. Further signed addition and signed subtraction units are used to perform accumulation and subtraction functions. When compared to SDF structure, SDC architecture has more computational paths to perform FFT function. Hence, to improve the architectural performances of FFT combined Single-path Delay Feedback (SDF) – Single-path Delay Commutator (SDC) FFT architecture has been designed in this paper. This achievement can be obtained due to sharing or utilizing 50% of same hardware resources for computing multiple functions. The architecture of 16 point SDF-SDC FFT is illustrated in [Fig. 2].

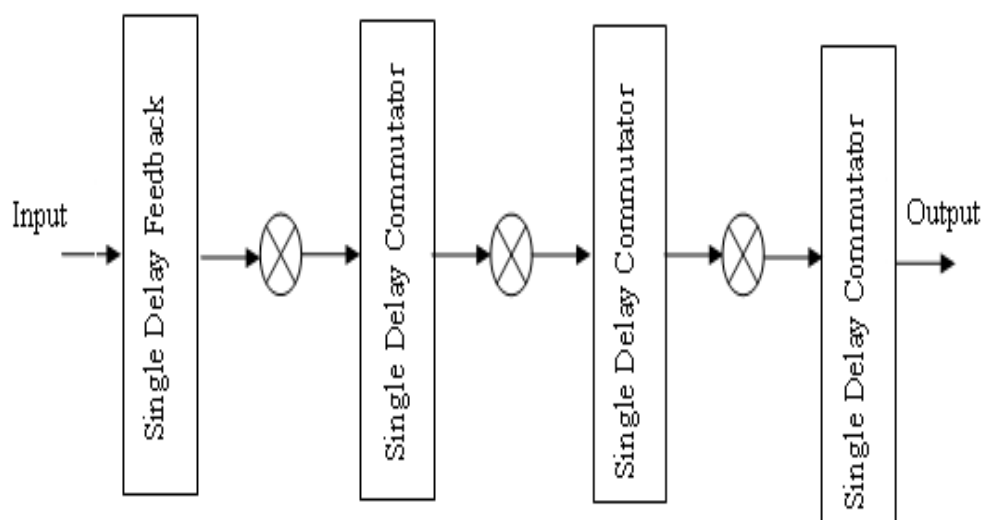


Fig. 2: Architecture of 16 point SDF-SDC FFT

Carry Select Adder

A carry select adder is a combinational logic of arithmetic circuit, which adds the binary value of 2 N-bit numbers and outputs their N-bit binary sum and a 1-bit carry. Carry select adder comes in the group of conditional sum adder. Sum and carry are computed by assuming input carry as 1 and 0 prior the input carry comes.

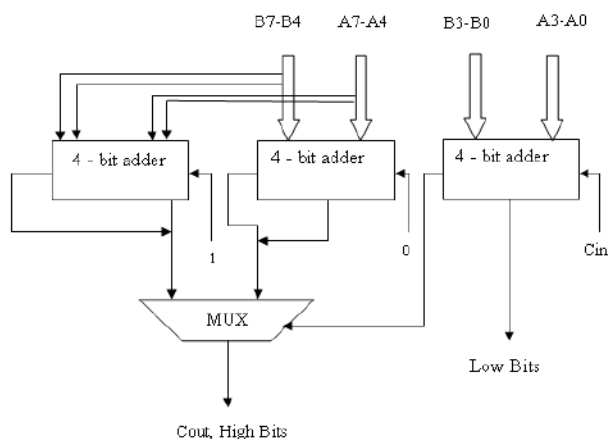


Fig.3: Architecture of Carry Select Adder

When the input value of carry arrives, the actual calculated values of sum and carry are selected using a multiplexer. In the FFT processor, the computational procedure includes vast number of multiplications and additions. To implement the addition operation in the FFT processor, carry select adder has been used. In the existing method of SDF-SDC FFT using carry select adder, which is used to reduce the power consumption of the FFT processor. The architecture of Carry select adder is illustrated in [Fig.3].

PROPOSED METHOD

Modified Carry Select Adder

In the carry select adder circuit, full adder circuit is reduced to improve the performances of the structure. Full adder is the important block of CSLA circuit. The carry select adder circuit consists of 4-bit adder (4 Full adders) and multiplexer. The reduced full adder design has been illustrated in this section.

Reduced Full Adder

Full Adder circuit has been realized and redundant functions are eliminated to improve the architectural performances. The generalized Full Adder circuit block is illustrated in [Fig. 4]. FA circuit consists of two XOR gate, two AND gate and a single OR gate to perform the 3-bit addition operation. Reduced Full Adder (RFA) circuit has been designed by using minimal number of logic gates. Also Multiplexer (MUX) based RFA circuit has been designed in this paper to further alleviates the performances of digital adder circuits.

Gate Count of Full Adder is determined as follows,

Gate Count of FA = Gate Count [(2*XOR) + (2*AND) + (1*OR)]

Gate Count of FA = [(2*5) + (2*1) + (1*1)] = 10+2+1 = 13

Gate Count of Reduced Full Adder = Gate Count [(2*AND) + (1*OR) + (2* NOT) + (1*MUX)]

Gate Count of Reduced Full Adder = [(2*1) + (1*1) + (2*1) + (1*4)] = 2+1+2+4 = 9

The structure of Reduced Full Adder (RFA) is illustrated in [Fig.5].

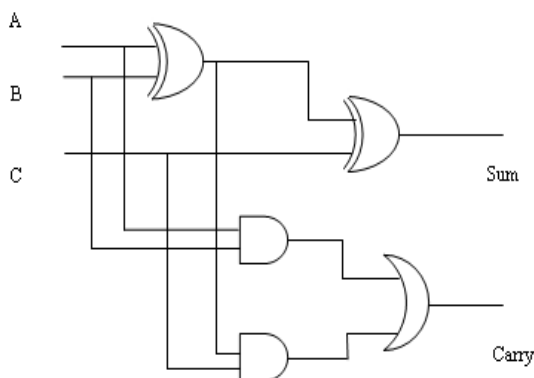


Fig. 4: Full Adder Circuit

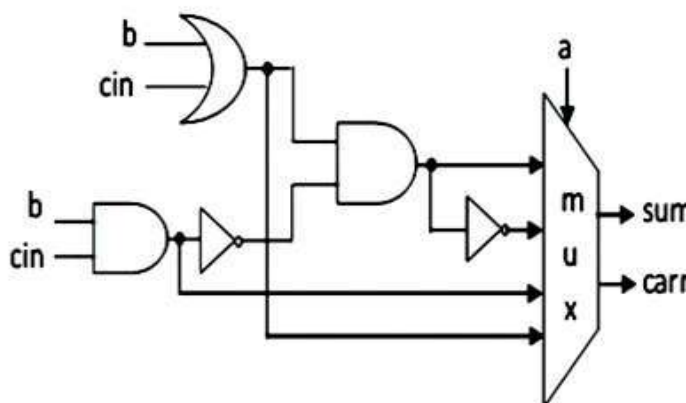


Fig.5: Reduced Full Adder Circuit

Pipelined Radix-2 SDF-SDC FFT using Modified Carry Select Adder

In this paper, the pipelined Radix-2 SDF-SDC FFT using modified Carry Select Adder has been proposed. In the existing method of FFT, the power consumption is large and also the processing speed is low. The proposed architecture of pipelined 16 point SDF-SDC FFT using Modified CSLA has been illustrated in [Fig. 6].

The pipelined SDF-SDC FFT using carry select adder has been designed, that is used to reduce the power consumption but increasing the hardware slices. So, we modified the carry select adder circuit, which is to reduce the hardware slices, LUTs, delay and also power consumption. In the modified carry select adder, the full adder circuit is reduced. In the full adder circuit, the number of logic gates is reduced. Finally, the modified carry select adder circuit is integrated into Radix-2 SDF-SDC FFT processor. The main goal of this paper is to improve the processing speed and performances of the FFT processor.

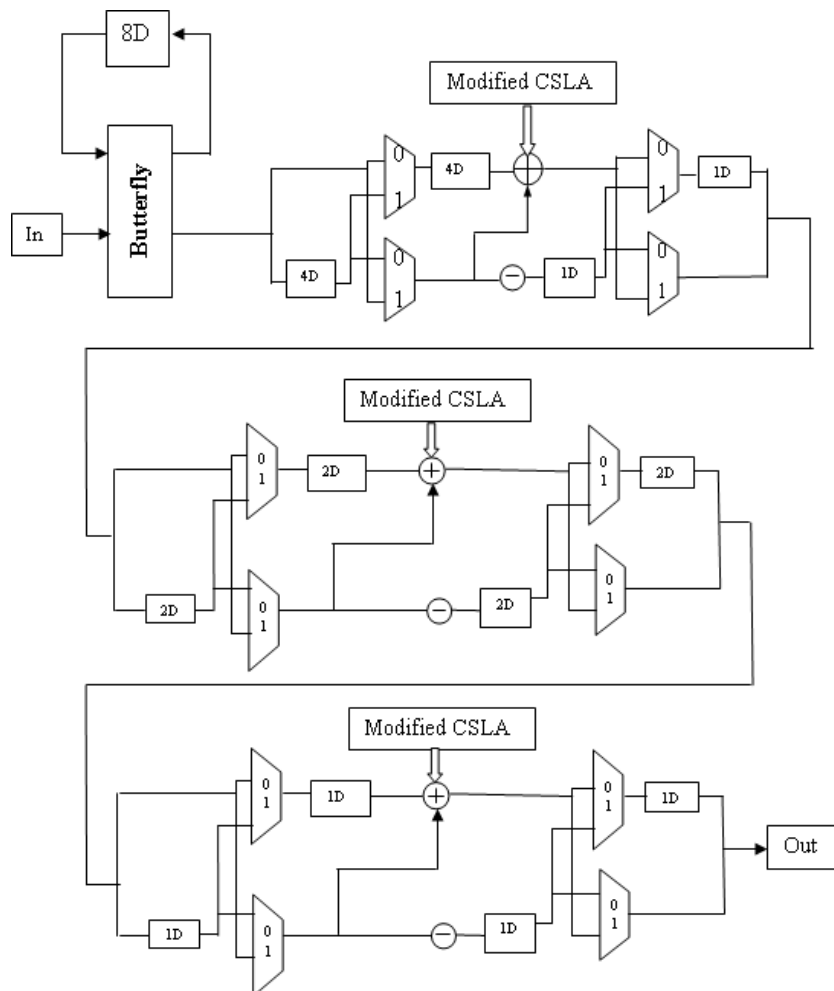


Fig. 6: Proposed architecture of pipelined 16 point SDF-SDC FFT using Modified CSLA

RESULTS

The proposed design of pipelined Radix-2 SDF-SDC FFT using Modified CSLA has been made by using Verilog Hardware Description Language (Verilog HDL). The simulation results has been evaluated by using ModelSim 6.3c and Synthesis Performances are estimated by using Xilinx 10.1i (Package: pq208, Family: Spartan-3, Device: Xc3s200) design tool. The simulation result of proposed pipelined Radix-2 SDF-SDC FFT using Modified CSLA is illustrated in [Fig.7].

The performance evaluation of existing Radix-2 SDF-SDC FFT using carry select adder and proposed Radix-2 SDF-SDC FFT using modified carry select adder are analyzed and compared in Table 1. Also the performance evaluations are graphically illustrated in [Fig. 8].

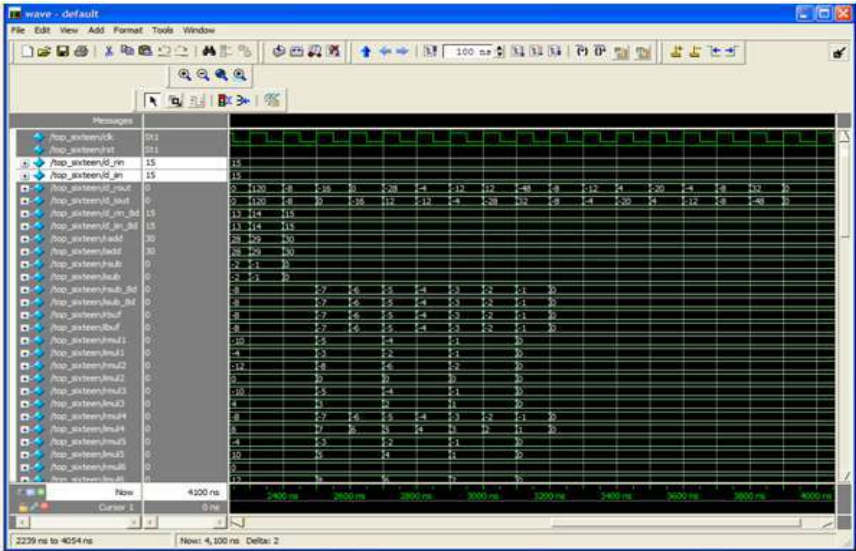


Fig. 7: Proposed pipelined Radix-2 SDF-SDC FFT using Modified CSLA

Table 1: Comparison of existing Radix-2 SDF-SDC FFT using carry select adder and proposed Radix-2 SDF-SDC FFT using modified carry select adder

Types/VLSI Concerns	Number of Occupied Slices	Total Number of LUTs	Delay (ns)	Power(W)
Existing Radix-2 SDF-SDC FFT using carry select adder	984	1714	43.760	3.778
Proposed Radix-2 SDF-SDC FFT using modified carry select adder	945	1679	41.456	1.370
Percentage Reduction	3.96%	2.04%	5.26%	63.7%

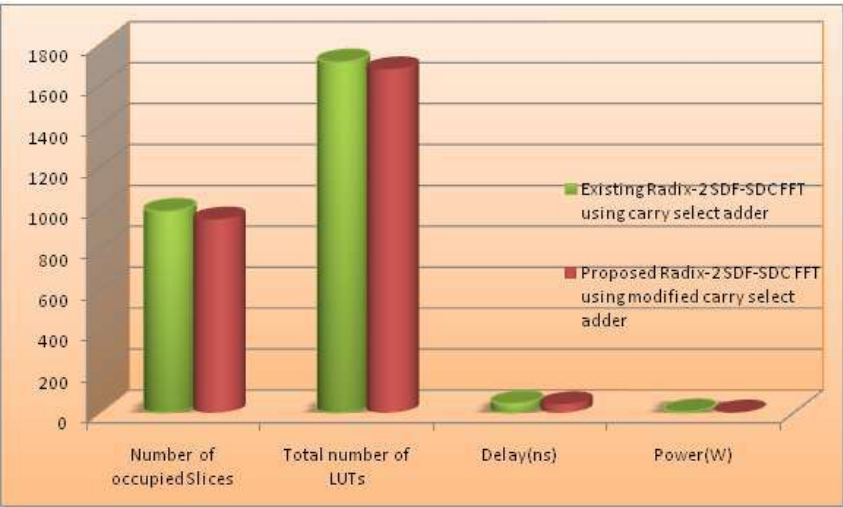


Fig. 8: Performance evaluation of existing Radix-2 SDF-SDC FFT using carry select adder and proposed Radix-2 SDF-SDC FFT using modified carry select adder

From [Table 1], it is clear that proposed pipelined Radix-2 SDF-SDC FFT offers 3.96% reduction in hardware slices, 2.04% reduction in number of LUTs, 5.26% reduction in delay and 63.79% reduction in power consumption than the existing Radix-2 SDF-SDC FFT. When compared to existing method, the numbers of occupied slices are 984 which is reduced to 945, the total number of LUTs are 1714 which is reduced to 1679, the delay value is 43.760ns which is reduced to 41.456ns, the power value is 3.778w which is reduced to 1.370w, than the proposed method. When compared to existing method, the proposed method gives better performance of the FFT processor.

CONCLUSION

Pipelined Radix-2 Single path Delay Feedback (SDF) – Single path Delay Commutator (SDC) FFT using Modified Carry Select Adder has been proposed through Very Large Scale Integration (VLSI) System design environment. Reduced full adder is designed using less number of gates compared to conventional Full adder. These reduced adders are applied in the carry select adder to analyze and improve the performance. The modified carry select adder is incorporated into Radix-2 SDF-SDC FFT processor. The main goal of this paper is to reduce the processing time and improve the speed of the FFT processor. The proposed method is used to reduce the slices, LUTs, delay and power consumption. The proposed pipelined Radix-2 SDF-SDC FFT offers 3.96% reduction in hardware slices, 2.04% reduction in number of LUTs, and 5.26% reduction in delay and 63.79% reduction in power consumption than the existing Radix-2 SDF-SDC FFT. In future, the proposed architecture will be absolutely useful in OFDM based digital communication to perform the function of frequency transformation and to analyze the spectrum characteristics of digital inputs.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None.

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ARTICLE

SECRET DATA HIDING WITH IMAGES USING DATA COMPRESSION AND EMBEDDING ALGORITHM

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ABSTRACT

Objective: The objective of this paper is to embed secret data with enhanced and compressed embedding scheme to maintain tight security and efficient data transmission in un-trusted networks. There are several literature work done in steganography to hide secret from legitimate user with many kinds of embedding scheme namely: Least Significant Bit, Discrete Cosine Transformation, Lempel-Ziv-Welch (LZW), Integer Haar Wavelet Transform(IHWT), Bacterial Foraging Optimization (BFO), Multiple encryption (ME), and MKB etc. However, these approaches failed to maintained tight privacy and data compression during efficient data transmission in un-trusted networks. These approaches are unable to fulfill current requirements completely. Neither they solve compression issues nor secure data embedding and are unable to compress the original size of data during embedding. It also does not maintain efficient encryption scheme to encrypt and decrypt the data. **Method:** To alleviate these issues, proposed framework developed a data compression and embedding algorithm. This approach performs the embedding with two cover file namely master file and output file with secret data file. Hence, it asks to source to reduce the data size based on requirement. After selection of two cover, once file content swaps with another cover file to maintain the privacy. **Finding:** Its supports various formats of secret data file. It provides complete information about embedding to destination like name, formats, compression level in percentage. **Improvement:** Based on experimental results, it realized that proposed systems performs well compared to existing approaches in terms of root mean squared error (RMSE), peak signal noise ratio (PSNR), and structural similarity index measurement (SSIM). It reduces RMSE 0.17 and increase PSNR 3.54db and SSI 0.30.

INTRODUCTION

KEY WORDS

Data hiding, data cover file, data compression and embedding algorithm, root mean squared error, similarity index measurement, and peak signal noise

Nowadays, data embedding scheme is popular to share the secret data from one host to another hosts. It keeps secrecy of original data and easily transfers to concerned hosts. This approach is divided into two parts namely: Data hiding which covers the secret message or data with cover file to maintain the privacy. Cryptography approach which assists to data hiding approach to encode and decode the original data. Generally, cryptography approach is used to provide additional privacy for original data. The main objective of this approach is to transmit the original file or message to desired destination with tight privacy and reduced data size for efficient data transmission.

In existing, digital steganography, electronic communications include steganography coding under transport layer, like a document file, image file, media file program which can hide confidential data (i.e. secret files) through embedding methods. However, there is no privacy guarantee, if embed file is comprised with attacker. A new steganography method designed based on gray-level modification for true color images using multiple encryption(ME) algorithms (bit XOR operation, bits shuffling, and stego key-based encryption) to hide the secret text in images cover files[1]. It maintains the good privacy. However, this method produces high level of error rate during data extraction. It also takes long time to extracts secret data from cover file. Lempel-Ziv-Welch compression technique is worked to hide and compressed the image data by using modified kekre's algorithm. It's capable for large volume of data without incurring perceptual distortion [2]. However, this technique is only applicable for image data embedding. Integer Haar Wavelet Transform (IHWT) approach is designed through a lifting scheme to work on frequency of image [3]. It converts integer pixel values of an image into the integer wavelet coefficients and vice versa. However, this approach works based on some preconditioning methods and this approach has high complexity. Bacterial Foraging Optimization (BFO) approach developed for watermarking digital image to maintain the privacy. This method works based on bacterial movement [4]. However, this method produce high volume of error during extraction of data and embedding process is quite slow.

To overcome these issues, Data Compression and Embedding Algorithm are implemented to maintain tight privacy secret data file from malicious or external threat. This approach's objective is to design efficient data embedding framework to transmit the secure data to destination without revealing data privacy and without affecting the quality of cover file. This approach does not only consider on privacy in steganography but it also considers the size of original data for reliable data transmission to source. It works on both sides of source and destination. In detail, it assists data covering with encoding process to embed the original data with two cover files namely master file and output file to build the secure embedding process. Once, file selection is completed then it performs the file compression methods to reduce the original size of file. Hence, it proceeds for data encoding process with AES algorithms. Finally, it embeds the original data with cover files. After successful data covering process, master file content replace with output file content to conflict the unauthorized users. The paper contribution is as follows:

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Received: 16 Aug 2016
Accepted: 2 Sept 2016
Published: 12 Sept 2016

1. To build efficient embedding framework for contributing secure data to source without compromising the quality of cover file
2. Combine the compression approach with embedding frame work to maintain data privacy of original data and reliable data transmission in un-trusted networks.
3. Make strong embedding framework capabilities to supports various types of cover file and secure data file to utilize embedding framework.
4. Improve the Root Mean Squared Error (RMSE), Peak Signal Noise Ratio (PSNR) and Structural Similarity Index Measurement (SSIM) of proposed algorithm when compared to existing approaches

The organization of rest of paper is as follows: Section 2 introduces the relevant or closest work to proposed algorithm. Section 3 elaborates the system methodology, implemented framework details with mathematical derivation. Section 4 expresses details about implemented algorithm with performance. Finally, section 5 summarizes the overall work with future enhancements.

RELATED WORK

The [5] developed a novel multicarrier/ signature iterative generalized least-squares (M-IGLS) methods to find out unknown data hidden in hosts via multicarrier spread-spectrum embedding. [6] Designed blindly extraction technique is considered to the host signal, via multicarrier embedding. The hidden data is extracted from media like audio, video or image. In [7] introduced a new high bit rate LSB Picture information concealing system. The fundamental concept of the LSB computation is information installing which causes negligible implanting contortion of the host picture. [8] Developed reduced distortion algorithm for LSB image steganography. The main concept of this technique is data hiding bit embedding that causes minimal embedding distortion of the host image. [9] implemented Direct Sequence Spread Spectrum method for steganography with audio data. This method can be applied to embed messages in audio data. The information to be embedded must first modulated using the pseudo- random key sequence to increase the security and robustness of the system.

The [10] introduced Multicarrier Least Square (MLS) algorithm to extract unknown data hiding in image via multicarrier SS embedding. The data is covered in the image via DCT multicarrier DSSS (Direct Sequence Spread Spectrum). In [11] worked on spread spectrum (SS) image watermarking schemes using discrete wavelet transform (DWT), bio-orthogonal DWT and M-band wavelets coupled with various modulations, multiplexing and signaling methods for performance improvement in spread spectrum image watermarking. In [12] developed Half-Tone Pixel Swapping approach from carrier stego image to enhance the privacy as well as the image embedding capability. In [13] implemented H264 /AVC, video encryption, data embedding, data extraction. In[14] designed efficient data hiding method using audio steganography to convey safely in a totally imperceptible way and to abstain from attracting suspicion to the transmission of data.

In [15] focused on the data security approach which combined with encryption and steganographic techniques for secret communication by hiding inside the multimedia files. The files composed of insignificant bits which can be used for overwriting of other data. In [16] introduced advanced image visual cryptography by multilevel decomposition to maintain privacy and certainty of pictures. A content owner encrypts the original image by using an encoding key, and an information-hider can embed data into encrypted image. With an encrypted image, a receiver could initially decode with the encoding key, then extract the embedded information and recover the original image. In[17] designed difference expansion algorithm to embed data into the host image without causing overflow /underflow and distortion problems. In[18] studied about steganography and their applied technique. This paper also studied data hiding in audio signals and utilized LSP method for audio data hiding. In [19] introduced new steganography technique for audio data hiding. This approach embeds secret data into image hence image is embedded into the audio.

In [20] focused on new reversible data hiding method through serving room before encryption with a traditional Reversible Data Hiding algorithm. It used which enables to reversibly embed data in the encrypted image. In[21] developed a new technique for sending secret messages securely, using steganographic technique. This system worked for multiple level of security for data hiding. In [22] developed versatile audio steganographic methods to obtain secure and robust high rate of secret data. It also worked on digital audio steganography, which has emerged as a prominent source of data hiding across novel telecommunication technologies. In[23] reviewed the literature of digital audio steganographic techniques. It also explored their potentials and limitations to ensure secure communication. In[24] investigated analyzed various kinds of existing methods of steganography along with some common standards and guidelines drawn from the literature.

In [25] introduced TIMG algorithm to achieve the different goals of privacy for secure transmission of data. In [26] implemented Byte Rotation Algorithm which contains two techniques; one is random key generation technique & parallel encryption and decryption technique to perform encryption and decryption with minimal time. In [27] developed random scan algorithm to make the data more secure encryption before

data embedding. In [28] designed Efficient and secure cloud data migration (ESCDM) algorithm to migrate owner data from one cloud to another cloud. It migrate the data from one cloud to another after the confirmation from data owner side. In [29] introduced video steganography with digital watermarking techniques for data protection. This system hides large volume of data within a video but it has limitation in perceivable distortion during processing. In [30] worked a data hiding method using pixel value difference (PVD) steganography for digital image steganography to achieve more edges and to enhance the capacity of PVD. In [31] designed Pixel Value Ordering (PVO) method based embedding for image based Reversible Data Hiding (RDH) to plant secret data in minimal and maximum pixel values of each block of image.

SYSTEM DESIGN AND IMPLEMENTATION

This section expresses the brief knowledge about system design and implementation of proposed methodology. In details, proposed methodology works both side namely as source and destination. Here, source will select and secret file along with two cover data to embed the content with tight privacy. This system does not only maintain privacy but it also reduce the original size of data to enhance the embedding scheme. The workflow of proposed system is explained [Fig. 1] in details. The proposed system is divided into following module namely: Source, Data Covering and Encoding, Destination, Data Extraction & Decoding and data compression and embedding algorithm.

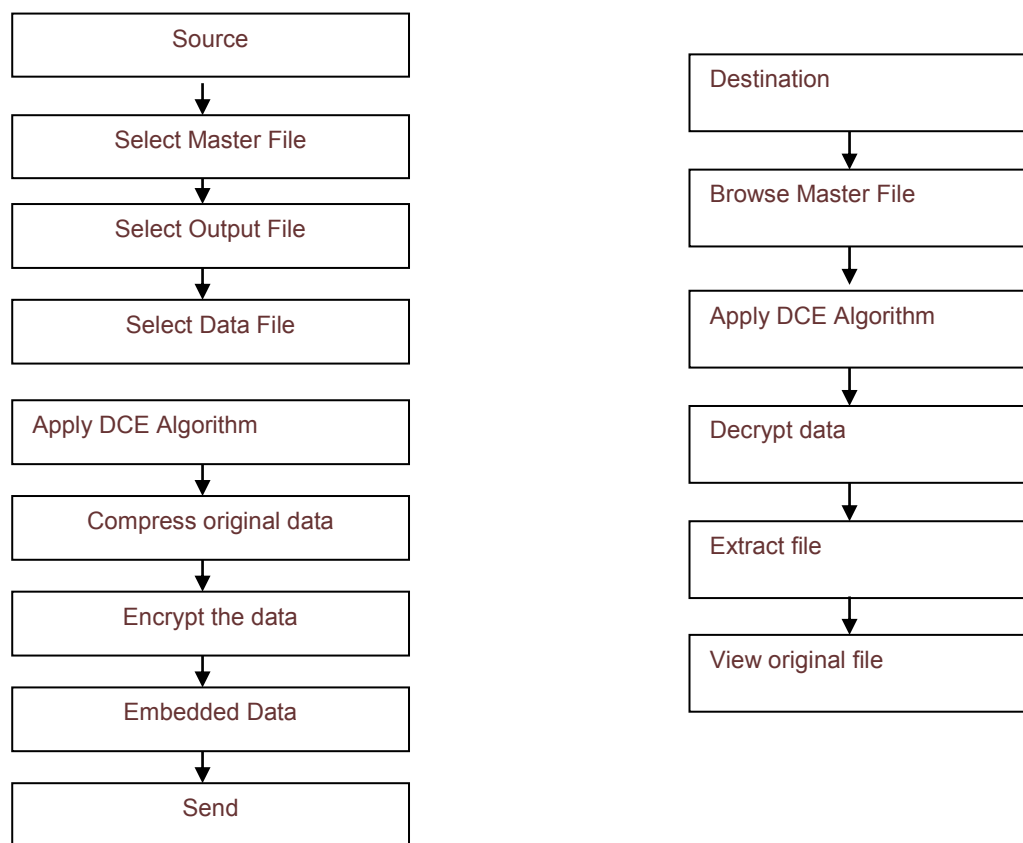


Fig.1: Workflow diagram for Data Compression and Embedding Algorithm

Here, source acts like a data owner who has large volume of secret data. Source wants to share the secret data with embedding format to maintain tight security in efficient way with minimal cost. Source can send secret message and as well secret file.

Data Covering and Encoding

Data covering is a hiding process to cover the secret file to enhance the embedding scheme. This scheme supports many types of data formats for covering and extraction in secure and efficient manner. This system select three file during embedding namely: master file, output file and secret data file. After selection of file, it reduced the size by using compression techniques. Hence, it encodes data using AES algorithm and cover the data to transmit to desired destination.

Destination

Destination extracts and decodes the original data with valid key from receive data covering file. In details, proposed algorithm works extract the error free data and explore in original size.

Data Extraction & Decoding

Data extraction is process to extract the secret data from cover file and after decoding process. This process main objective is to extract the secret data along with original size without affecting quality covering file. Here, AES algorithm is utilized for decoding the data. It extracts many types of data in various formats like audio, video and Document, PDF, Text etc.

Data Compression and Embedding Algorithm

Data Compression and Embedding Algorithm is implemented to maintain tight privacy secret data file from malicious or external threat. This approach's objective is to design efficient data embedding framework to transmit the secure data to destination without revealing data privacy and without affecting the quality of cover file or data. This approach does not only consider privacy in steganography but it also considers the size of original data for reliable data transmission to source in un-trusted. It works on both sides as well source and destination. In details, it assists data covering with encoding process to embed the original data with two cover file namely as master file and output file to build the secure embedding process. Once, file selection is completed then it performs file compression methods to reduce the original size of file. Hence, it proceeds for data encoding process with AES algorithms. Finally, it embeds the original data with cover files. After successful of data covering process, master file content replace with output file content to conflict the unauthorized users. This system always tries to avoid data file privacy revealing. Destination side, this approach co-operates to extract the cover file with original size without affecting the quality of cover file. After extraction of cover file, it performs decoding process with valid key using AES algorithm. This algorithm also displays the compression data percentage (%) along with cover file details.

This algorithm contains two process namely as a data covering & encoding and Data extraction & decoding process which are explained in details in above modules. The mathematical expression of proposed algorithm is described below in details.

Pseudo code: Data covering and Encoding

Input: Select Master File MF, Output File OPF, and Secret Data File SDF

Output: Get Data Cover File DCF

Procedure:

```

Start;
Browse MF, OPF and SDF;
Validate MF and OPF;
If MF does not contains any SDF already
Replace OPF content with MF content;
Encode the SDF;
Complete the embedding process;
Else
Display the message MF have already some other SDF;
Interrupt the embedding process;
End;
  
```

Pseudo code: Data Extraction and Decoding

Input: Select DCF

Output: View MF and SDF

Procedure:

```

Start;
Select MF;
Verify the MF;
If MF contains SDF
Display the complete cover file information with compression level;
Decode the SDF with Valid Key;
If Key is validated;
Decode & Display SDF;
Else
Display message to enter valid key;
Else
Display message there is no contents in this MF;
End;
  
```

RESULTS AND DISCUSSION

Implementation Setup

In order to compare proposed mechanism with existing algorithm. The experiment is conducted on a laptop with Intel Dual Core processor (1.836 Hz), 2GB memory, and Window 7 Ultimate system. Here, this method implemented in JAVA with JDK 1.8 and NetBeans 8.0.

Performance Evaluation Parameter

In this phase, proposed scheme represent mathematical model to enhance privacy of secret data. In this scheme, security model work between data sender and data receiver. Even though, server is not trusted then also data sender secret message will be in safe during data transmissions. It displays following model separately such as Root Mean Squared Error (MSE), Peak Signal Noise Ratio (PSNR) and Structural Similarity Index Measurement (SSIM).

Root Mean Square Error (RMSE)

Root Mean Square Error (RMSE) is computed by getting the square root of the mean square error (MSE). The RMSE can be calculated as follows.

$$RMSE = \sqrt{MSE} \quad (1)$$

Peak Signal Noise Ratio (PSNR)

In this phase PSNR represents the mathematic model to perform the noise ratio of embedding images of secret during data embedding. The mathematical equation is expressed in equation (2).

$$PSNR = 10 \log_{10} \frac{L^2}{MSE} \quad (2)$$

Where, PSNR is peak signal noise ratio of embedding, L is peak signal level for a grey scale of image frame it is taken as 255.

Structural Similarity Index Measurement (SSIM)

The SSIM metric is used to compute the similarity between two images. It designs for modeling of any image distortion as a combination of three factors that are loss of correlation, luminance distortion and contrast distortion. Mathematically, the SSIM is calculated in equation (3).

$$SSIM(x, y) = l(x, y) \cdot c(x, y) \cdot s(x, y) \quad (3)$$

$$l(x, y) = \frac{2\mu_x\mu_y + C1}{\mu_x^2 + \mu_y^2 + C1}$$

$$c(x, y) = \frac{2\sigma_x\sigma_y + C2}{\sigma_x^2 + \sigma_y^2 + C2}$$

$$s(x, y) = \frac{\sigma_{xy} + C3}{\sigma_x\sigma_y + C3}$$

Where μ_x, μ_y is average value of x and y σ_x^2, σ_y^2 is variance x and y and σ_{xy} is the co-variance of x and y. l is dynamic range of pixel value and c contains three variable c1, c2, and c3 to stabilize division of weak denominator. X and y holds two windows size of images and varied pixel value.

[Table 1] expressed root means square error(RMSE), peak signal noise ratio(PSNR), and structural similarity index measurement(SSIM) for JPEG, PNG and BMP image formats with existing algorithms namely BFO[4], IHWT[3], LZW[2] and ME[1] approaches to evaluate the proposed algorithm.

Table 1. RMSE, PSNR and SSIM for JPEG, PNG and BMP formats Image Datasets

Learning Algorithm	Jpg			.png			.bmp		
	RMSE	PSNR	SSIM	RMSE	PSNR	SSIM	MSE	PSNR	SSIM
BFO	7.01	31.22	0.47	5.52	33.30	0.68	5.41	33.28	0.59
IHWT	1.78	51.37	1.00	1.45	47.89	0.99	1.21	51.44	1.00
LZW	1.72	43.50	0.99	1.69	43.58	0.97	0.04	43.47	0.97
ME	0.67	58.06	1.00	0.67	58.04	0.91	0.67	58.04	1.00
DCE	0.50	62.05	1.00	0.50	62.03	1.00	0.51	62.03	1.00

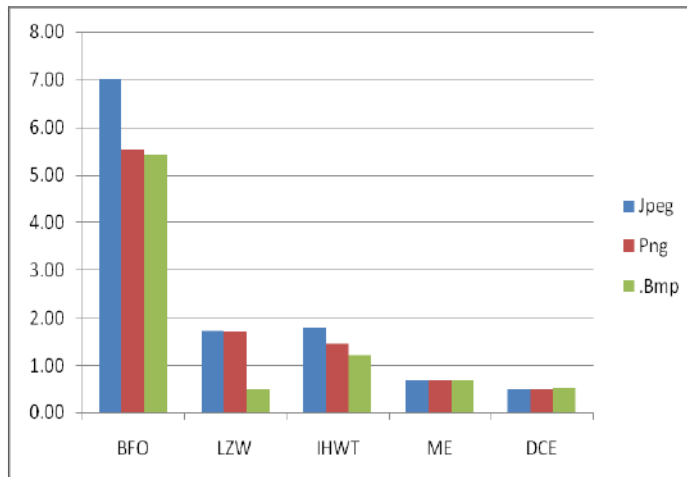


Fig. 2: Root Mean Square Error for .Jpeg, .Png and .Bmp Datasets

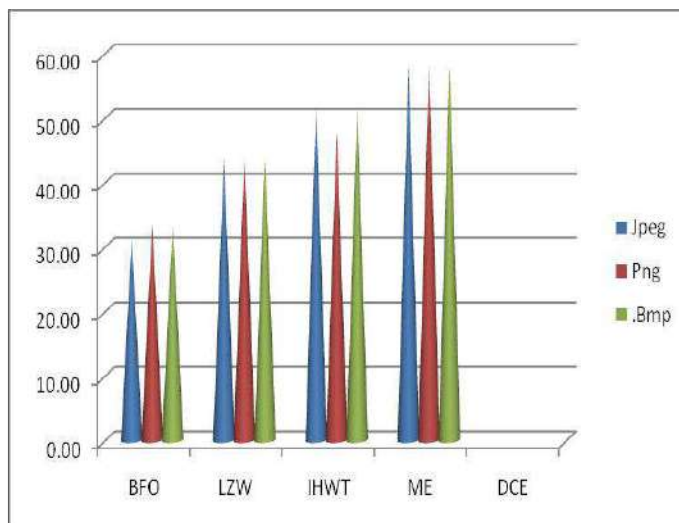


Fig. 3: Peak Signal Noise Ration for .Jpeg, .Png and .Bmp Datasets



Fig. 4: Structural Similarity Index Measurement .Jpeg, .Png and .Bmp Dataset.

Based on [Fig. 2 to 4] result performance respect of root mean square error, peak signal noise ratio and Structural Similarity Index Measurement for overall images dataset, it realized that proposed approach performs well. In details, ME algorithm is closest approach to proposed method with respect of RMSE, PSNR and SSIM. However, ME algorithm performance is low compare than proposed DCE algorithm. DCE approach reduces RMS 0.17, increase PSNR 3.54 and SSIM 0.30 compare then ME algorithms. Hence, this paper states that proposed DCE algorithm is best approach on overall datasets.

CONCLUSION

This paper presents Data Compression and Embedding Algorithm to maintain tight privacy of secret data file from malicious or external threat. This approach's objective is to design efficient data embedding framework to transmit the secure data to destination without revealing data privacy and without affecting the quality of cover file. This approach does not only consider on privacy in steganography but it also considers the size of original data for reliable data transmission to source. It works on both sides as well source and destination. In details, it assists data covering with encoding process to embed the original data with two cover file namely as master file and output file to build the secure embedding process. Once, file selection is completed then it performs the file compression methods to reduce the original size of file. Hence, it proceeds for data encoding process with AES algorithms. Finally, it embeds the original data with cover files. After successful of data covering process, master file content replace with output file content to conflict the unauthorized users. Its supports various formats secret data file. Based on experimental result, it realized that proposed systems performs well compare than existing approaches in the terms of root mean squared error (RMSE), PSNR and SSIM. It enhances the RMSE 0.17 PSNR 3.54db and SSI 0.30. In future, this paper can be extended with vehicular ad-hoc network to establish reliable transmission between sources to destination.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None.

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ARTICLE

AN EFFICIENT APPROACH FOR PRIVACY PRESERVING AND DETECTION OF SELECTIVE PACKET DROPPING ATTACKS IN WIRELESS AD HOC NETWORKS

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ABSTRACT

Security plays the most important issue that has gained attention by a lot of research and development effort in past few years. In multi-hop wireless ad hoc networks link error and malicious packet dropping are two sources for packet losses which results in denial of service. The main objective of this work is to develop an accurate algorithm for detecting selective packet drops made by insider attackers and to improve the detection accuracy, to differentiate whether packet loss is caused due to link error or activity of the attacker by exploiting the correlations between lost packet and to detect packet dropping attacks in mobile environment. The proposed system observes a sequence of packet losses in the network and interested in determining whether the losses are caused by link errors only or by the combined effect of link errors and malicious drop. It specially considers about the insider attack case, whereby malicious nodes that are part of the route use their knowledge of the communication context to selectively drop small amount of packets critical to the transmission. The existing algorithms that are based on detecting the packet loss rate cannot achieve satisfactory detection accuracy while the packets are dropped selectively and also in frequently changing topology. Hence to improve the detection accuracy, the correlations between the bitmap generated are calculated and lost packets are identified. The public auditing architecture is developed that detects and verifies the truthfulness of the packet loss information reported by nodes. In case of mobile nodes, mobility is also one of the reasons for packet loss. Hence, the proposed detection scheme is attack resilient to different kinds of network environments such as static and mobile network. After running the simulation, we observe that the proposed mechanism achieves better detection accuracy, lower computation complexity and overcomes communication overhead.

INTRODUCTION

A wireless ad hoc network is known as a type of decentralized wireless network. The network is ad hoc because it is structure less. As it is structure less it does not have a defined pre existing infrastructure, such as routers in wired networks or access points in managed wireless networks. In spite, all nodes participate in routing by forwarding data for other nodes, so the determination of which nodes forward data is identified on the basis of network connectivity.

Security is the vital problem in the wireless ad hoc network. Wireless ad hoc network can be affected by various types of attacks [1]. It may contain node which is a part of a route, itself as an attacker. Wireless links in wireless ad hoc network are more prone to active attacks, passive attacks and message distortion. There are different types of attacks such as greyhole attack, blackhole attack, sinkhole attack etc. In this work, we detect the occurrence of greyhole attack which is also known as selective packet dropping attack. In this type of attack, the malicious node drops the packets selectively and also intentionally sometimes. A malicious node which is the part of the route with the knowledge about the network protocol can degrade the performance by launching an insider attack [2]. Specifically, the malicious node may evaluate the importance of various packets, and then drop the small amount of selected packets that are known to be highly critical to the operation of the network. By targeting these highly critical packets, intermittent insider attackers can cause significant damage to the network with low probability of being caught.

[Fig.1] shows the system architecture of Wireless Ad Hoc Network. It shows one source node, one destination node, many intermediate nodes and few auditor nodes. The auditor node is an external node which is not the part of a routing path. As shown in [Fig.1], when the packets are transmitted from the source node to the destination node through the intermediate nodes, there may be packet loss. This packet loss may be due to link error or malicious node. Hence, the auditor node is used to detect the reason for packet loss.

In this work, the destination node calculates the packet loss and if the packet loss rate is beyond the threshold level then the destination node sends request to the intermediate nodes randomly and verifies the reply produced by those nodes. Based on the packets received at those intermediate nodes, the destination node creates a suspect list and sends it to the Auditor node along with the Attack Detection Request (ADR). We develop an accurate algorithm for detecting selective packet drops made by insider attackers in Wireless Ad Hoc Networks which is an improved version of the approach discussed in [2]. Our algorithm also provides a truthful and accurately verifiable decision as a proof to support the detection decision. The high detection accuracy is achieved by calculating the correlations between the positions of lost packets, as calculated from the Auto-Correlation Function (ACF) of the bitmap generated by each node—a bitmap describing the lost/received status of each packet in a sequence of consecutive packet transmissions [2]. Here we propose the extension of our previous work [3] to detect the selective packet dropping attacks with implementation and performance analysis. Here, we face another challenge of detecting the truthfulness of bitmap reported

KEY WORDS

Wireless ad hoc network,
Privacy, Selective
Packet Dropping,
Auditing, Attack
Detection

Received: 13 August 2016
Accepted: 18 August 2016
Published: 12 Sept 2016

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by each node. This is solved by auditing method which is carried out by the auditor node. The auditor node should not be the part of the route used to carry the packet from source node to destination node.

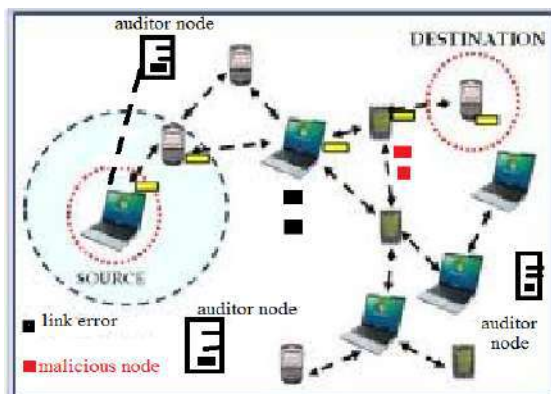


Fig.1: System Architecture of Wireless Ad Hoc Network

The major contributions of this work are as follows: 1) An Extended Homomorphic Linear Authenticator (HLA) approach is proposed for preserving privacy during auditing process and also for securely collecting the information from nodes. 2) An improved auditing method for wireless ad hoc networks is proposed to minimize communication overhead. 3) A new algorithm for verification of packet loss is proposed to create suspected node list which can be used for auditing. 4) To improve attack detection accuracy, multiple auditor nodes are maintained and implementation is done. 5) An attack detection process is designed to detect selective packet dropping attacks during dynamic mobile environment. The remainder of the paper is described as follows, Section 2 discusses about the related works, in Section 3, we discuss about the proposed system, Section 4 explains about the analysis made on security and communication overhead, in Section 5 we discuss about the performance evaluation and the conclusion in Section 6.

MATERIALS AND METHODS

Preserving privacy and providing security against internal attacks are evolving challenges in wireless ad hoc network. Researchers have worked on these areas and proposed many solutions to address the above issues. However addressing selective packet dropping attack which is a serious threat caused by internal malicious nodes and preserving privacy in wireless ad hoc networks have been given little attention only. In this section, the existing mechanisms for preserving privacy and providing security in wireless networks are discussed.

In [2] & [4], it is considered that packet loss is caused by link error and also by packet dropping. By comparing the number of packets sent and number of packets received, packet loss is detected. Detection algorithm is used to compare the traffic rate with source traffic rate and estimated traffic rate and decide the reason whether packet loss is caused due to link error or malicious packet dropping. All the nodes which are interested to be a part of route should be fully cooperative. But some nodes behave selfishly and get only their benefits and do not share the data with other nodes. Due to continuous mobility of the node, the performance of network gets affected and leads to denial of service. To detect such node which degrades the performance by dropping packets acknowledgement method is used [4]. In [5] & [6], new Intrusion Detection System (IDS) based on Mobile Agents has been designed. This approach uses a set of Mobile Agents (MA) that can move from one node to another node within a network. This method takes much time to detect the malicious nodes. It leads to complexity in calculating the mobile agent.

In [7] & [8] the authors have designed the solution to overcome the problem of selective jamming attacks in wireless networks and examine the cryptographic primitives and neutralizes the inside knowledge of the attackers. In this work, only external attackers are detected and fail to find insider attacks. In [9] & [10], the authors have used trust evaluation method based on the feedbacks collected from neighbour nodes. Hence, these feedbacks are not efficient for detecting selective dropping attacks. In [11] & [12], the authors have classified attack detection system into two categories based on the detection algorithm. The first category considers that packet loss is caused mostly by malicious dropping. The first category is further divided into four sub-categories based on their methods used to detect malicious node. The first sub-category considers end-to-end or hop-to-hop acknowledgements to directly locate the hops where packets are lost. A hop which has high packet loss will be removed from the route. The fourth sub-category considers the methods used in cryptography, for example bloom filter. But by these methods, selective packet dropping attacks are hard to identify.

The second sub-category uses the credit system discussed in [13] & [14]. A node receives credit by transmitting large number of packets to other nodes and uses that credit to send its own packets even if it is a malicious node. The node gains good credit by transmitting large number of packets and so it is hard to detect a malicious node if it makes a selective packet dropping. The second sub-category is the reputation system discussed in [15]. A reputation system depends on neighbor nodes to monitor and

identify misbehaving nodes. A node which highly drops the packet is given a bad reputation by its neighbor nodes. This information based on the reputation is sent periodically throughout the network and is used as an important factor in selecting routes which does not have malicious node. This method will be suitable only to detect blackhole attacks but not suitable to detect other types of attack. In [16], the author proposed an anomaly-based IDS system on an enhanced windowing method to carry out the collection and analysis of selective drop attack. This method leads to some miss calculation and detection accuracy. A Record and Trust-Based Detection (RTBD) technique was proposed in [17] which lead to low performance evaluation when the trust is created based on credit system. In [18] the author proposed an intrusion detection system which removes the fake nodes but does not contain any authentication method for privacy purpose. In [19], an approach that deals with routing misbehavior is discussed. The proposed approach can be integrated with any source routing protocol and detects malicious node based on sending acknowledgement packets and counting the number of data packets of active path. This method fails to detect the truthfulness of the node and lack of privacy.

After reviewing the above works, it is observed that some of the issues are not yet completely addressed. In existing systems, attack detection is limited to static or quasi-static wireless ad hoc networks. The existing credit based mechanism for the detection of selective packet dropping attacks may fail to detect the malicious nodes accurately. Reputation based approach is not so efficient in finding malicious nodes which drops the packets selectively and also truthfulness of the nodes are not detected. Hence, we propose an extended HLA signature approach to address the above issues and also for privacy preserving during auditing. We also enhance our work by increasing the auditor nodes to increase the detection accuracy. A new algorithm for creating the suspected node list is proposed to reduce the communication overhead.

Network model

In a wireless ad hoc network shown in Fig.1, consider a path P_{SD} , where S is the source node and D is the destination node. Consider nodes $n_1, \dots, n_k$ as the intermediate nodes. Therefore n_i is considered as the upstream node for n_{i+1} . If Dynamic Source Routing (DSR) protocol is used then it is considered that the source node is aware about the path P_{SD} or else trace route operation is used to identify the neighbour nodes being involved in the path. The symbols and their description that are used in the proposed scheme are given in [Table 1].

Table1: Symbols and Notations

Symbols	Description
S	Source node
D	Destination node
P_{SD}	Path from source to destination node
n_i	Numbers assigned to the nodes
H	Hash values
S_{ij}	Signature generated to the intermediate nodes
b_{ij}	Bitmap generated by each node
$r^{(i)}$	Linear combination
$S^{(i)}$	Signature combination
T_{ij}	Computed homomorphic linear authenticated key
P_D	Probability of packets received at destination node
T_{PL}	Packet loss threshold value
A_d	Auditor node
E	Equality testing
Y_j	Autocorrelation function calculated at auditor node

The wireless channel alternates between good and bad state at each hop for each random process. When the transmission of packet is successful then it considered to be good state [19]. If there is any loss in the packet transmission then it is in bad state. The sequences of packet transmission at each state is considered and based on that sequence autocorrelation function is used to detect the packet loss. The receiver observes the transmission and obtains the realization of the channel state ($a_1, \dots, a_M$), where $a_j \in \{0,1\}$ for $j=1, \dots, M$. Here "1" states that packet was received successfully and "0" states that packet was dropped. There is another node which acts as an independent auditor A_d in the network. The auditor node is not a part of the path P_{SD} . It does not have any knowledge about the key and also about the content inside the transmitted packet.

[Fig.2] shows the overall process of the proposed system. The process is split into four phases. In the first phase, the process of key distribution is carried out. The packets are transmitted securely in the second phase. The auditing based on bitmap generated and detection of attack is carried out in third and fourth phase respectively. The source node distributes the symmetric keys to all nodes along with hash function. According to our proposed scheme, the packets are transmitted along with the signature for privacy preserving purpose. Hence the path is secured and privacy preserved. The packet transmission status is stored at the database of each node which is further used to generate a bitmap. The destination detects the occurrence of packet loss and intimates the source node. The source node verifies the intermediate nodes randomly and creates the suspect list. Then the source node sends the attack detection request to

the nearest auditor node. The auditor node verifies the bitmap of the suspected nodes and then calculates the autocorrelation function and detects the malicious node.

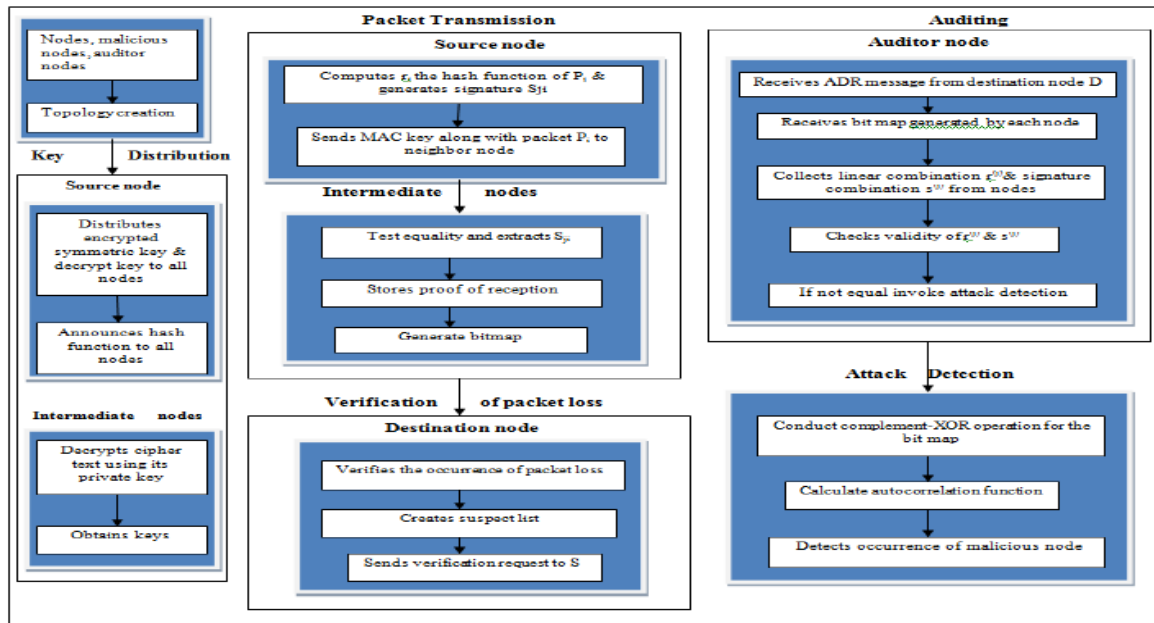


Fig.2: Functional Architecture

Key distribution

As we are using DSR routing protocol, we assume the path from source to destination as P_{SD} . The source node S makes decision on a symmetric-key crypto-system ($encrypt_{key}$, $decrypt_{key}$) and K symmetric keys $key_1, \dots, key_k$. The source node distributes the decrypt key and a symmetric key key_j to its neighbor nodes n_j which exists in the path. RSA is used for key distribution. Using the public key of the intermediate nodes n_j where $j=1$ to k , the source node encrypts and sends the cipher text to n_j . After receiving the packet, the intermediate nodes decrypt the cipher text using its private key and extract the decrypt key and symmetric key key_j . The source node also announces two hash functions to all nodes in the path which can be used for authentication purpose.

Packet transmission

Source node S transmits the packet after the distribution of keys. S selects the packet P_i to be sent, where “ i ” is the sequence number assigned to packets to identify them uniquely. S computes r_i , the hash function of the packet P_i . The hash function of P_i is computed such as $r_i = H_1(P_i)$. S then generates an extended HLA signature for node n_j as shown in equation (1).

$$S_{ji} = [H_2(i || j)u^n]^x, \text{ for } j=1, \dots, k, \quad (1)$$

Here a one way chained encryption is used, it prevents an upstream node from deciphering the signature send to downstream nodes. By using this one way encryption, the S_{ji} is sent along with P_i . S also iteratively computes the following parameters as in equation (2).

$$\begin{aligned} \tilde{S}_{Ki} &= encrypt_{keyK}(S_{Ki}), \\ T_{Ki} &= \tilde{S}_{Ki} || MAC_{keyK}(\tilde{S}_{Ki}), \end{aligned} \quad (2)$$

$$\begin{aligned} &\vdots \\ &\vdots \\ T_{ji} &= \tilde{S}_{ji} || MAC_{keyj}(\tilde{S}_{ji}), \end{aligned}$$

Where Message Authentication Code (MAC) is computed according to the hash function H_{keyj}^{MAC} . S puts P_i and T_{1i} in one packet and sends it to node n_1 . n_1 receives the packet from S and extracts P_i and T_i . Then n_1 verifies the integrity of $\tilde{S}_{1i}$ by testing the equality as shown in equation (3)

$$MAC_{key1}(\tilde{S}_{1i}) = H_{key1}^{MAC}(\tilde{S}_{1i}). \quad (3)$$

If the result of the test is true, then n_1 decrypts $\tilde{S}_{1i}$ as shown in equation (4).

$$Decrypt_{key1}(\tilde{S}_{1i}) = S_{1i} || T_{2i}. \quad (4)$$

If the test of equality fails, then n_1 stores loss of P_i in the proof of reception database. Once if the test is proved to be true then n_1 stores r_i and S_{1i} in its proof of reception database. Each node after receiving the packet stores the data of reception in the database maintained by each node individually. The data is stored as FIFO manner. This proof is used for auditing later. Then n_1 puts P_i and T_{2i} in one packet and transmitted to n_2 . The above process is repeated at every intermediate node n_j . The last intermediate node n_k , only forwards P_i to the destination D .

Verification of Packet Loss

Here, we propose an algorithm for the verification of packet loss and for creating suspected node list. The destination node identifies that the actual number of packets it received from its previous hop node is less than the number of packets the source node sends and then sends packet loss message to source node. Then S starts the suspected node discovery process. First it sends a request to the intermediate nodes randomly. The intermediate nodes after receiving the request, send the number of packets they received and forwarded to the node S. Based on this count, the source node verifies at which node there is a change in the number of packets. The node which has varying number of packets received and its neighbor node is added to the suspected list. After creating the suspected list, the source node sends the attack detection request to the nearest auditor node [13].

We denote the number of packets forwarded by source node S to destination node D in a block be N_s . Let nodes $a_0, a_1, a_2, a_3, \dots, a_n$ represent the source route or data forwarding route between source node S and destination node D. When the destination node receives the data packets from the source, it starts a counter and keeps count of number of data packets it receives in a block. Let N_D denotes the packets received at the destination node, and then the probability of packets received at the destination node is calculated as follows: $P_D = \frac{N_D}{N_s}$. If $P_D > T_{PL}$, then the destination node starts the process of detecting whether any malicious node is present in the route as shown in [Fig.3]. If not, then the destination node sends the positive acknowledgement back to the source node. Here T_{PL} represents the packet loss threshold value and takes values between 0 and 0.2. In our approach, the destination node starts the gray hole detection process, when the data packet loss exceed 20% of the total packets sent by the source node.

Algorithm:

```

if source node
Intimate to the destination, the count of data packets in a block of data
Send one block of data through the path selected through route discovery process
else if destination node
Compare the data packets received with the data count intimated by the source.
Calculate the probability of packets received at the destination node as  $P_D$ .
if  $P_D < T_{PL}$  (the value of  $T_{PL}$  is between 0 and 0.2)
Send positive acknowledgement back to source node.
Else
Creates the suspected node list
Initiate Attack Discovery Process
end if
  
```

Fig.3: Pseudo code for verification of packet loss

Auditing method

In this section, an improved auditing method is discussed to enhance the attack detection accuracy. The source node sends the Attack Detection Request (ADR) message to a public auditor. This message contains the id of the nodes in the path P_{SD} . The identities are listed in the order of downstream direction. The auditor node is also provided with the information about sequence number of the packets sent from source node and also the sequence number of the subset of these packets that were received by destination node. Here, we use multiple auditing nodes. One auditing node is added to each two hops. Hence, auditing is done in an efficient way. All the auditing nodes precede the process in the same manner as follows. The auditor node submits a random challenge vector to each node in the path. At each node the sequence number of the packet received is stored in the database. Based on this proof of reception stored in the database, the bit map b_j is generated by node n_j . Here the $\vec{b}_j = (b_{j1}, \dots, b_{jM})$ where $b_{ji}=1$ if the packet is received at that particular node and $b_{ji}=0$ if the packet is not received at the particular node. The linear combination $r^{(j)}$ and an extended HLA signature combination $s^{(j)}$ is calculated at node n_j , as in equation (5).

$$r^{(j)} = \sum_{i=1}^M b_{ji} \neq 0 c_{ji} r_i, \quad s^{(j)} = \prod_{i=1}^M b_{ji} \neq 0 s_{ji}^{c_{ji}}. \quad (5)$$

After calculating n_j submits $\vec{b}_j$, $r^{(j)}$ & $s^{(j)}$ to A_d . Then A_d checks the validity of $r^{(j)}$ & $s^{(j)}$ by testing the equality as in equation (6).

$$e(s^{(j)}, g) = e(\prod_{i=1}^M b_{ji} \neq 0 H_2(i||j))^{c_{ji}} u^{r^{(j)}}, v) \quad (6)$$

If the result of testing is true, then A_d accepts that node n_j received the packets as reflected in $\vec{b}_j$. If the testing results in false then A_d rejects $\vec{b}_j$ and judges that not all packets claimed in $\vec{b}_j$ are actually received by n_j . The above mechanism only guarantees that a node cannot understate its packet loss, i.e., it cannot claim the reception of a packet that it actually did not receive. This mechanism cannot prevent a node from overly stating its packet loss by claiming that it did not receive a packet that it actually received. This latter case is prevented by next phase called attack detection.

Attack detection

After receiving bit map and the auditing process, the auditor A_d enters the detection phase. A_d detects if there is any overstatement of packet loss at each node by constructing a packet loss bitmap for each hop. A_d checks the consistency of the bitmaps for any possible overstatement of packet losses. If there is no overstatement of packet loss, then the set of packets received at node $j+1$ should be a subset of the packets received at node j . A normal node always truthfully reports its packet reception bitmap. A malicious node will not truthfully report its packet reception bitmap. Hence bitmap of a malicious node will contradict with the bitmap of a normal downstream node. There will always be at least one downstream node i.e. destination node. So A_d only sequentially scans bitmap reported by intermediate node and the report from D to identify nodes that are overstating their packet losses. After checking for the consistency of bitmaps, A_d starts constructing the per-hop packet-loss bitmap $\vec{m}_j$ from $\vec{b}_{j-1}$ and $\vec{b}_j$. This is done sequentially, starting from the first hop from S . In each step, only packets that are lost in the current hop will be accounted for in m_j . The packets that were not received by the upstream node will be marked as “not lost” for the underlying hop. Denoting the “lost” packet by 0 and “not lost” by 1, $\vec{m}_j$ can be easily constructed by conducting a bit-wise complement-XOR operation of $\vec{b}_{j-1}$ and $\vec{b}_j$.

Next the auditor calculates the autocorrelation function y_j for each sequence $\vec{m}_j = (m_{j1}, \dots, m_{jM})$, $j=1, \dots, K$, as shown in equation (7):

$$y_j(i) = \frac{\sum_{k=i}^{M-i} m_{jk} m_{j,k+1}}{M-i} \quad (7)$$

After calculating the auto correlation function for each sequence the auditor calculates the relative difference between y_j and the ACF of the wireless channel f_c as shown in equation (8).

$$E_j = \sum_{i=0}^{M-1} \frac{|y_j(i) - f_c(i)|}{f_c(i)} \quad (8)$$

The relative difference is then used as the decision statistic to decide whether or not the packet loss over the j th hop is caused by malicious drops. In particular, if $E_j \geq E_{th}$, where E_{th} is an error threshold, then A_d decides that there is malicious packet drop over the hop. Here we use the overhearing technique and trust based value evaluation to detect the malicious node in mobile nodes. By using the trust based method, the auditor node calculates the trust value for each node based on the packets it has transmitted. If the trust value goes above the threshold value then the auditor node decides that the node is a reason for malicious drop.

RESULTS

Security and overhead analysis

Our construction essentially follows the BLS-signature-based HLA construction for a given node n_j , as described in [2]. Under the implicitly assumed condition of no collusion between attackers, the authors in [2] proved that the construction is secure, i.e., here only the node which knows about an extended HLA signature can respond to the challenge. There is no possibility for the occurrence of forgery. So here even if there occurs the collusion between malicious nodes, the node does not give the attacker more information about the an extended HLA signature of the packets. We consider some properties of HLA signature to prove this,

1) For a packet P_i , an extended HLA signature is given as s_{ji} , here (i) is the sequence number assigned to the packet and (j) is the unique identity given to the node. This means that for the same packet, each hop on P_{SD} is given a different HLA signature. The verification scheme accounts for both i and j . In case there is no occurrence of collision, the security of the proposed scheme can be proved by concatenation of $(i || j)$ as a Meta packet sequence number.

2) As we are using the one way chained encryption the upstream node cannot get an extended HLA signature intended to the downstream node. As the one way encryption is used the upstream node cannot decrypt the packet send to downstream node. The downstream node can decrypt and get its extended HLA signature and send it to upstream node through a covert channel, if it is a malicious node. If the upstream node drops the packet then the downstream node has no other way to get its HLA signature. So if there is no collision, then more information about HLA cannot be exchanged by the covert channel.

Communication overhead

The communication overhead for the key distribution phase is a one-time cost that incurred when the routing path P_{SD} is established. Here we mainly focus on the cost during the packet transmission and auditing phases (there is no communication overhead in the detection phase). In the packet transmission phase, S sends one encrypted HLA signature and one MAC key along with the each packet it transmits. An extended HLA signature s_{ji} is of 160-bit long. The encryption process is of 192 bits in length. The hash function is of 160 bits. So each hop of packet transmitted is of 352 bits. In our proposed system, we create a suspect list and auditor node verifies only those nodes. Hence the communication overhead is reduced in our proposed system as shown in [Fig: 4].

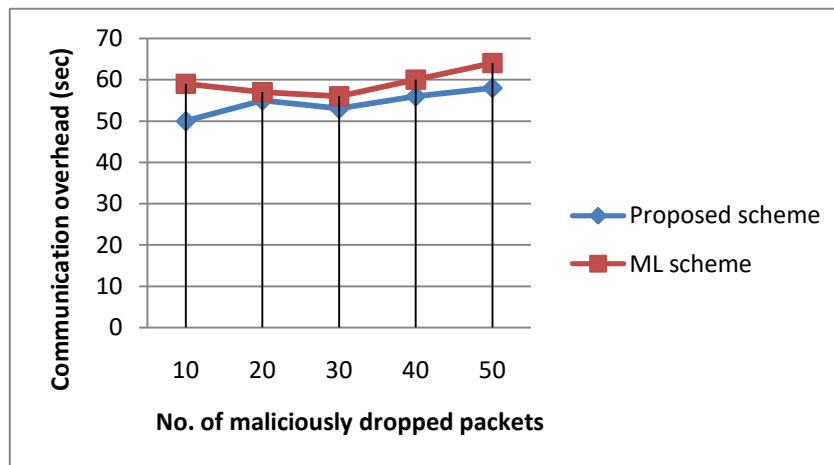


Fig.4: Communication overhead

Simulation setup

The proposed model is simulated using Network Simulator (NS) with its version 2.35. The required system parameters are configured using the TCL. The following [Table 2] represents the parameters used in the simulated environment. The proposed model is carried out with the simulation time 120s.

All the given parameters have to be set first. The nodes are placed at a position initially. Since client nodes are mobile they move in different direction. Due to this mobility of client routes will be changed frequently. To attain the MAC characteristics, here the 802.11 MAC protocol is used. The initial step of nodes displayed in NAM file is shown in [Table 2].

In this work, we compare the detection accuracy achieved by the proposed algorithm with the optimal maximum likelihood algorithm, which only utilizes the distribution of the number of lost packets. For given packet-loss bitmaps, the detection on different hops is conducted separately. So, we simulate the detection of one hop to evaluate the performance of a given algorithm. We also assume that packets are transmitted continuously over this hop, i.e., a saturated traffic environment. We assume channel fluctuations for this hop follow the Gilbert-Elliot model, with the transition probabilities from good to bad and from bad to good given by P_{GB} and P_{BG} , respectively [19]. We consider a selective dropping attack.

Table 2: Simulation parameters

Parameters	Value
Simulator	Network Simulator 2
Topology	Random
Interface type	Phy / wirelessPhy
MAC type	802.11
Queue type	Drop Tail/Priority Queue
Queue length	100 Packets
Antenna type	Omni Antenna
Propagation type	Two Ray Ground
Routing protocol	DSR
Application agent	Security
Network area	600*600
Number of nodes	70
Simulation time	120 seconds

As shown in the [Fig.5], the overall detection error is less in the proposed system when compared to the earlier scheme known as Maximum Likelihood scheme (ML scheme) [20]. In the selective dropping attack, the packets dropped are of certain sequence numbers. During analysis, this is done by dropping the middle N of the M most recently received packets. In this work, we have considered in following three performance metrics: probability of false alarm (P_{fa}), probability of miss detection (P_{md}), and the overall detection-error probability (P_{error}). We collect these statistics as follows. In each run, we first simulate some independently generated packet-loss bitmaps for the hop, where packet losses are caused by link errors only. We execute our detection algorithm over these packet-loss bitmaps and collect the number of cases where the algorithm decides that an attacker is present. Let this number be I_{fa} . The probability of the false alarm of this run is calculated as false alarm of link error divided by the number of bitmaps generated. We then simulate another set of independently generated packet-loss bitmaps, where losses are now caused

by both link errors and malicious drops. Let the number of cases where the detection algorithm rules that an attacker is not present.

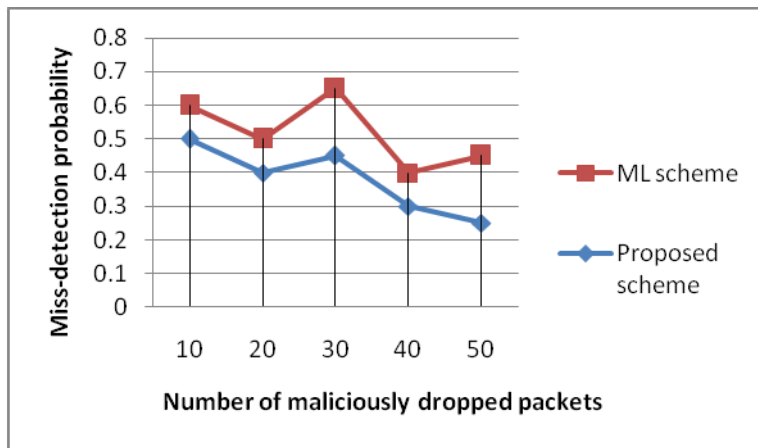


Fig.5: Miss-detection Probability

$$\text{Probability of miss-detection } (P_{md}) = \frac{\text{verification of attackers not present } (I_{md})}{\text{number of bitmaps generated}}$$

[Fig.5] shows the probability of miss-detection by comparing the proposed scheme with the maximum-likelihood scheme. Sometimes it is considered that packet loss is caused due to malicious node and link error is not considered. Hence this leads to miss-detection. Consider the simulation of 70 independently generated packet-loss bitmaps, where losses are now caused by both link errors and malicious drops. Let the number of cases where the detection algorithm verifies that an attacker is not present be I_{md} . P_{md} of the underlying run is given by $P_{md} = I_{md}/70$ [2].

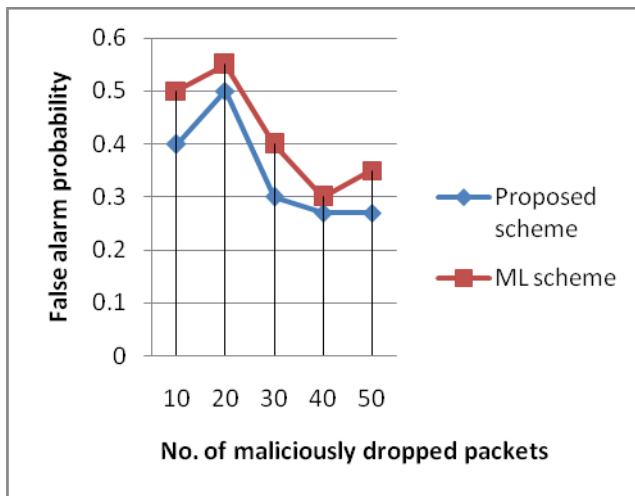


Fig.6: False-alarm Probability

$$\text{Probability of false alarm } (P_{fa}) = \frac{\text{input false alarm } (I_{fa})}{\text{number of packets sent}}$$

The probability of false alarm is that if any node which is assigned as attack node but not actually the attack node and hence the proposed scheme indicates the false alarm. [Fig.6] shows the probability of false alarm for increase in number of maliciously dropped packets by comparing the proposed scheme with the ML scheme. In each run, the simulation of 10 independently generated packet-loss bitmaps for the hop, where packet losses are caused by link errors only [19]. We execute our detection algorithm over these packet-loss bitmaps and collect the number of cases where the algorithm decides that an attacker is present. Let this number be I_{fa} . P_{fa} of this run is calculated as $P_{fa} = I_{fa}/100$.

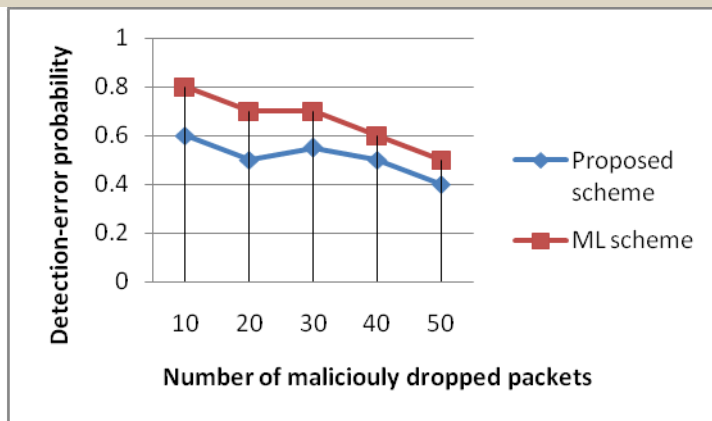


Fig.7: Overall detection-error probability

[Fig.7] shows the overall detection-error probability by comparing proposed scheme to the existing scheme. P_{error} is given by $P_{\text{error}} = I_{\text{fa}} + I_{\text{md}}/200$ [2]. The above simulation is repeated 30 times, and the mean and 95 percent confidence interval are computed for the various performance metrics.

CONCLUSION

In this work, the design and implementation of an efficient approach for privacy preserving and detection of selective packet dropping attacks in wireless ad hoc networks is discussed. The proposed scheme well preserves privacy during auditing by designing an extended HLA signature approach. An improved auditing method is designed to minimize communication overhead by increasing the number of auditor nodes and also to detect the truthfulness of the nodes. An algorithm for verification of packet loss is proposed for creating suspected node list which reduces the communication overhead. Selective packet dropping attack detection process for dynamic mobile environment is also discussed. The proposed design architecture is collusion proof, requires relatively high computational capacity at the source node, but incurs low communication and storage overheads over the route. The proposed mechanism also provides an increased accuracy in detection of malicious nodes and also shows low miss detection. The performance of the proposed system with respect to existing system is analysed and observed that there is increase in the detection accuracy based on the following metrics such as miss-detection probability, overall detection error and communication overhead.

In future, the detection mechanism can be carried out while the source and destination nodes are malicious nodes. The detection mechanism can be tested in various protocols and network environment to compare their performance. As a first step, this analysis mainly emphasize the fundamental features of the problem, such as the untruthfulness nature of the attackers, the privacy-preserving requirement for the auditing process, and the randomness of packet losses, but ignore the particular behavior of various protocols that may be used at different layers of the protocol stack. The implementation and optimization of the proposed mechanism under various particular protocols will be considered in our future studies.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

None.

FINANCIAL DISCLOSURE

None

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ARTICLE

VERNACULAR ARCHITECTURE COMPATIBLE WITH ENVIRONMENT OF STEPPED VILLAGES; CASE STUDY: PALANGAN VILLAGE, IRAN

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ABSTRACT

Background: Sustainable architecture is one of the up to date issues of architecture and has a direct effect on the global policy making. Iranian traditional architecture, because of huge geographical extent and its old age as human settlement, is a valuable resource of study in this field. Rural, environment and traditional houses of Iran contains important and valuable matters and points that must be considered. Stepped villages like Palangan in Kurdistan, are patterns, compatible with mountainous climate, full of thoughts. **Materials and Methods:** For instance economizing energy, native materials, coordination with topography and earth tissue, residential spaces work full of coordination with environment and ecosystem are examples of their characteristics. The aim of this research is to study the problems related to sustainability in difficult condition, construction and materials, energy and its economization in rural architecture. And in the case study, in stepped village of Palangan as prominent historical rural housing, is to consider the feedback of these rural settlements to various energy sustainability factors in library study method and field studies of these villages' dominant characteristics. **Results and Conclusions:** The final step is to categorize the positive points of rural stair houses in terms of energy sustainability and architecture of the village are the matters that have been discussed in the following parts of this paper.

INTRODUCTION

As a result of lack of renewable energy resources, pollution of environment and resources such as nature and life environment it is important to have sustainable designs in residential units. One of the researches, with the purpose of widening the extent of information, is the researches over rural houses. Iran is a valuable case to study because it is geographically extended and is known as an old human settlement so in rural areas and villages has special points to be considered.

Although the villages located in the mountainsides of Zagros are unique and special, they have been less considered by researchers. Current research aims to study some kinds of villages located in Zagros as stepped villages and case study of Palangan² village and help to make its climatic and biological characteristics of this valuable village known. Main questions of this study are:

1. What are the characteristics of stepped villages in the mountainous areas? 2. How considering the environment can lead us to have a successful climatic design? 3. What are the construction methods in unique areas with difficult conditions? 4. How long villages could response to the biological needs of environment and people and how they have been able to last for such a long time?

MATERIALS AND METHODS

The aim of current study is to investigate the sustainable architecture, local and rural settlements and describe their importance according to their sustainable design and in the final step to study the historical stepped village of Palangan. Most of the general information for the study has been extracted from library and previous researches in the same subjects. Other information and their analysis is gathered through field visits and generating reports from the study area using the methods such as visiting, taking photographs, sketching, surveying, areal images, information from experts of rural residential and Cultural Heritage Administration of Sanandaj³ and also local people of Palangan.

Sustainable Architecture

Sustainable architecture has wide range of definitions and its scope is so wide. These definitions range from problems related to human life, environment and earth to socio-cultural problems; consequently providing a definition which is flexible and comprehensive enough is difficult. But a general definition which can be; suitable for this study, is this : "Eco-housing, green development, sustainable design, environmentally sound housing has as many names as it has definitions, but the Rocky Mountain Institute, in its "Primer on Sustainable Building", flexibly describes this new kind of architecture as taking less from the Earth and giving more to people. In practice, Green housing varies widely. It can range from being energy efficient and using nontoxic interior finishes to being constructed of recycled materials and completely powered by the sun [1].

KEY WORDS

Iranian Architecture,
Vernacular Architecture,
Sustainable
Architecture, Rural
Housing, Stepped
Village, Palangan.

Received: 26 Aug 2016
Accepted: 14 Sept 2016
Published: 19 Sept 2016

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From sustainability and energy saving point of view, architecture is very important, because lack of attention to the climatic problems and designs, including design of form of structure, orientation, cover and appropriate materials, may result in high energy consumption and damages to environment and nonrenewable resources [2].

Homogeneous design with environment, has to obey the frameworks and conditions of sustainable development; rural design has to be in conformity with principles and conditions of eco-system as much as the rural planning has to obey the environmental conditions for sustainable development of villages. Experiences, globally or nationally, provides principles that using them can help to develop the quality and quantity of local knowledge and can be useful for professional designers and even the villagers [3].

Rural housing, inspiring to sustainable design

Many believe that house is a place to mean the life and acquire identity and define it using the sense of possession. "Residence represents the meaningful link between human and the environment. Such link originates from identity and belonging to a place. So human finds the identity when finds a house and as a result, their existence is established in the world. He chooses his own place and in this way a kind of reliable empathy with the other man too" [4]. Rural housing is the finest method to contact these aspects of the settlement, which makes it so important.

Rural housing has experienced least changes during the ages .It is important because of having indicators harmony with the environment and context, climate, using canvas binding materials with the least encroachment to the environment around, considering issues related to energy and also because of being in special climatic conditions. Study of how the local and rural housing deals in different areas can give the best and most financial answers in that climate and area. Following parts will discuss about the rural housing and their sustainable design.

Rural housing and Vernacular architecture

Energies, imageries, impressions and life styles are being reflected directly in the family. Consequently differences in the shape of houses comes from life style distinctions and categories like ideas of ideal life, social organization, concept of territory, methods of meeting basic needs and relation between housing and pattern of settlement. Every place that people live in should be shaped based on real events and responding patterns. To reach a good architecture, nature, needs, major and minor issues must be considered. Unlike the common architectures and modern designs, architecture of rural housings are full of plan, thought and using the capabilities of environment and proportionate with the needs of users [5]. Houses compatible with the climatic conditions and comforts as a suitable pattern of architecture has been repeated during the ages by traditional architects. Such time sequence of accepted patterns has led the local architecture to have its own special shape, texture, volume and logical materials compatible with climate and atmospheric conditions [6].

Settlements, from construction materials, shape and forming point of view, are being affected by geographical conditions of their environment and as a result of this effect they have geographical, biological and method of construction importance. Houses that best match with the geographic environment and reflect the effects of environment well and are compatible with the climate, environment and earth are rural houses [7]. Most of rural houses have a deep relation with the environment and depend on it and it is the secret of this housings resistance. As the house is a concept beyond the framework of the home, settling has a meaning beyond a simple house and needs and represents a meaningful link between man and the environment [8].

Rural man, designs and builds his house considering the natural, social and cultural environment and with knowledge to existence and nature [9]. Local architecture is the most pure and obvious introducer of architecture cultures and is the presenter of best dependency of man to natural environment [10]. Rural housing is affected by both climate and condition of natural environment and has a relation with life pattern of families. Mostly rural families use the materials found in the environment around to build their houses [11]. Villages as a result of traditional society, resists against the changes [12].

Parameters that affect the general appearance of village firstly and architecture of rural housing in the next step are: geography of place, economy, culture and political and social factors [13]. The village is one of the oldest residential areas of stable and highly collaborative settlements [14], so it has lots of key and valuable points in the field of principle of sustainable design that must be extracted and used.

ARCHITECTURE OF MOUNTAINOUS VILLAGES

Establishment and texture

Villages in the mountainous area are classified in 3 classes topographically:

- 1) mountainous class with steep slopes;
- 2) mountainous class with average slopes;
- 3) mountainous class with moderate slopes;

In mountainous and foothill classes, such as Palangan village, most of the villages are located on the sides of low width valley with different slopes. Direction of most of the buildings is to the south and south-east to use the sun energy as much as possible. Spread of villages is from hillside to nearby of the high summits [6].

Stepped villages

Stepped village is a kind of architecture in the mountainous areas that the distribution of buildings are in a stepped or terraced form and can be applied to the architectural structure of this area, because the architecture of these mountainous areas as a result of texture, spread and establishment in the mountain are built like step.

Morphologically, the architecture of these villages is completely compatible with the natural environment and has the least encroachment to the environment around. In the following parts dominant characteristics of these villages, Palangan as a study case in particular, and resistant aspects and energy usage of them will be discussed.

Village of Palangan

Appellation of this village according to the ideas of its people is the existence of Leopard in this area, and the other idea can be name which means a place in the slope of hillside that has obstacles and it is because of the structure of the village that is like steps and the fact that every house is an obstacle that does not let sliding of the upper house.

This village is valuable and historical and is known as one of the important centers of Kurdistan⁴ province in the Seljuk⁵ era. The age of this village comes back to Samanian⁶ era because of remaining of mosques, cemeteries and old houses, old gardens, Palangan castle and also Tangivar⁶ inscription [15]. [Fig. 1]

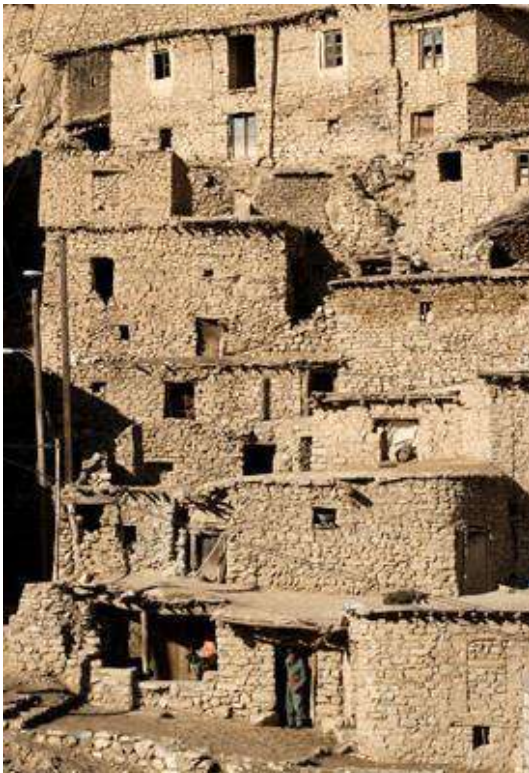


Fig. 1: Palangan, a stepped village (Authors)

Morphology and structure of the houses in Palangan is complex, block and step shaped and mostly the roof of a house is the yard of another. In the villages of Hawraman⁷, the place where the study area is located in, because of being mountainous the houses are built on the fold of sheep, in a way that barn, stock and haystack are beside each other in a collection that builds a semi field position on two bases

[16], which will be discussed more about the energy aspects of this architecture in the following parts. [Table 1]

Table 1: Adaptive comparison of Palangan and Hawraman takht villages (Authors)

Originality	Population	Direction of the village's development	Paths	General slope of the village	Density architecture	Color of the openings	Materials	Stepped village
The villages is old and original in a way that it has kept its structure for centuries.	Low, most of them have been migrated or come from Kamyaran for work.	To the north and main road, mostly the development of the village is in the direction of river for economic uses.	Are vertical, and horizontal paths are rare.	Too high	Compact houses and high density	Blue and Turquoise	Native, including wood and stone using the method of rigid connection.	Palangan
In addition to village's structure, ceremonies and costumes are good reason for its originality.	Because of good facilities migration is low.	East to west and mostly residential	Horizontal paths are found, perpendicular to the slope direction.	high	Because of big environment village is less compact and density is low.	Because of religious beliefs and availability of pigments, green is used too.	Same as Palangan, but woods are different in some areas because of availability.	Hawraman takht

The main and historic core of village whereas its climate issues, faces river. Although the houses receive sufficient light during the day time, one of the main reasons of destruction in the old part of village, in addition to being far from main roads of village and high slope of the hill, is wrong orientation. The identification of the central core of the village has been like this: 1. Existence of base and ancient mosque in the southern hill, 2. Old age of houses in this area, 3. Security issues of this area in comparison with northern parts, because behind this area there is a castle and also the river is preserver in front of dangers and higher slope of this hill could be a reason to build the central core in the discussed area., 4. Existence of cemetery in the hillside of northern hill, because in the past the cemeteries were built far from the village. In addition to the mentioned cases direction of wind can be an effective factor in the formation of central core of the village.

Eastern part of the village and along the *Sirvan River*, there are many gardens. Extension of the village is from north direction and to the asphalted road of the village and from west, beside the river, because of the consumption for fish farming and tourism and in the path of tourists to the village.

Geographic location

Palangan village is located in the northwest of Kamyaran⁸ city which is environs of Kurdistan province and is contained within the limits of 46°36' E, 35°4' N.

Topographic situation and slope

This village has 2 parts, in the northern part slope is from north to south and in the southern part is vice versa and both of the slopes are very steep and between 35 to 40 degrees. Such steep slope has resulted in the appearance of a unique stepped village and has made it different from other special villages like Hawraman takht⁸, Masouleh⁹, Gelin¹⁰, Tangivar¹¹ and others with same structure. The slopes of both hills of village ends in Sirvan River and houses are built on the natural slope. The mentioned river is the only river within the limits of the village and the average water volume of it is 3m³/s. The reason of formation of this village, like other settlements, is the access to water and the future extension of the village was along the river. The mentioned river is the source of income for most of the villages' people in a way that most of the residents are working in fish farming and selling the products and being a source of income, it is a Tourist attraction for it.

Texture and building of the village is in full coordination with the slope of hills without any manipulation of nature, so the placing of buildings in parallel lines and narrowband pathways, width of 80-120 cm, and the thicker is 2m, is in the direction of slope and is from up to down and unlike other similar villages like Howraman takht, Masouleh and Gelin there exist few horizontal pathways. Its reason is steep slope of hill and compact neighborliness of houses that makes it difficult to have any horizontal pathway. In the older parts of the village pathways are in their primary forms and there exists canals, but in the northern and more steeply parts the pathways are like steps and ease of commuting is important.

Unlike the flat and low slope villages, in stepped village of Palangan, there is not a center of the village that be a place for public meeting, like front of mosque, because the pathways are impassable and village has no vertical elongation and public meetings are in the narrowed pathways that are in the old entrance of village in the west of village.

Climatic situation

Palangan has moderate and hot climate with the annual average temperature of -5.5 to 42°C. Average annual rainfall of the village is 500mm and dominant winds usually are from south, south-east and south-west direction of village. [Fig. 2]

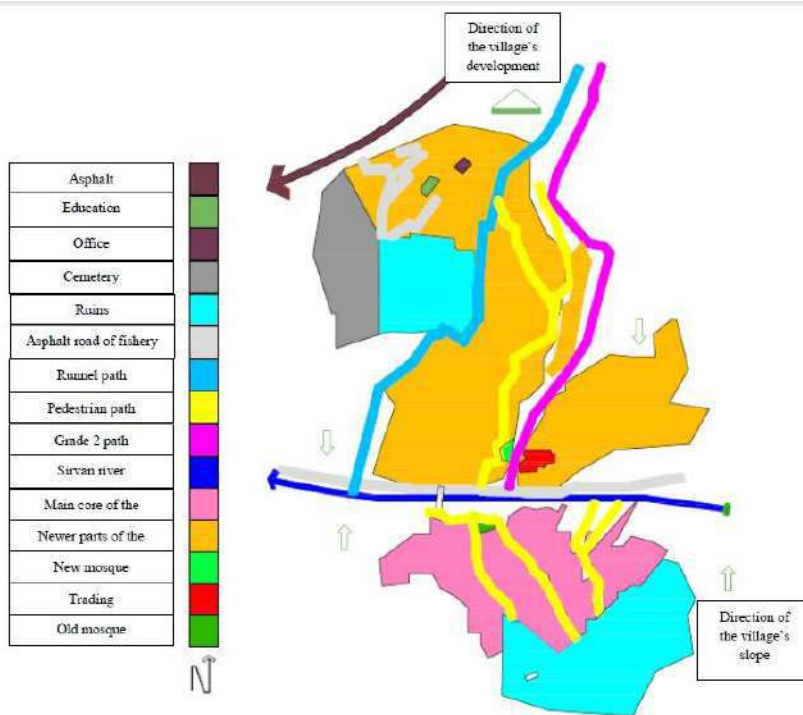


Fig. 2: Analysis of Palangan's maps (Authors)

ARCHITECTURE OF PALANGAN VILLAGE

Materials and structure

Walls of the houses are built using the method of rigid connection by putting the stones on each other without using any mortar between them. All of the material used in the building of the houses are native and are dug by the residents from mountains around and are carried to the village by different animals. To build the houses, after determining the location of house, considering the neighborhoods, direction of shining of sun, direction of wind and path of floodwater from mountains, first they dig the house limits to the depth of 0.5m which is called "Bine Ret". Then the foundation is filled with stones up to 2 to 3 meters higher than foundation such walls are locally called "*Diwar Menin*". [Fig. 3] When the built walls height reached to 3/5 of the main wall height, in the distance of two parts of wall, up and down wall, the woods from Sycamore, Mulberry or Walnut tree are put because their resistant is high and are native of the area and they are locked to two sides of walls and called "*Dimek*". Dimek reduces the pressure of walls to the piles of foundation and distributes the entry power equally in the foundation. After building the walls, up to an appropriate height, the roofs are usually short because of area's climate; wooden Sycamore piles are positioned in the width of walls with the distance of 1-1.5m and then covered them with wooden board. So the woods are cut in special sizes and then installed on the piles. In some houses it is usual to use straw or "*Çirpi*" which is foliage and even sack instead of wood to build a solid roof. After this, covered Çirpis with "*Shefte*", that's kind of native and traditional concrete, it called "*Here Ban*".

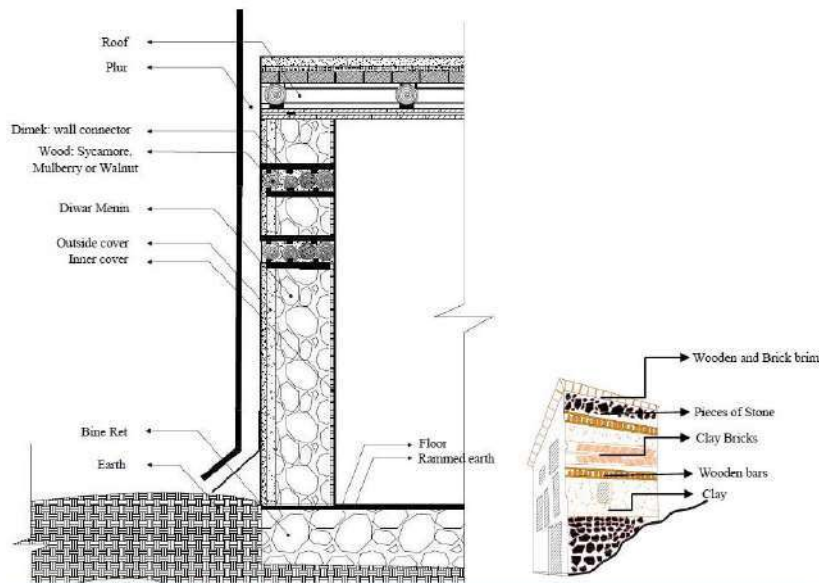


Fig. 3: Wall section details and Materials (Authors)

To avoid the leak of poured mud, before pouring the concrete, woods must be covered by sack and grit. Then using a roller which is called “Ban Tler” or “Ban Kler” surface of roof is being leveled. In the final step haystack is poured on the roof and roll it again. To control the water on the roof in a corner of roof by making a suitable slope to guide the water a pipe made up of mulberry tree’s wood called “Plur” is place. [Fig. 4]

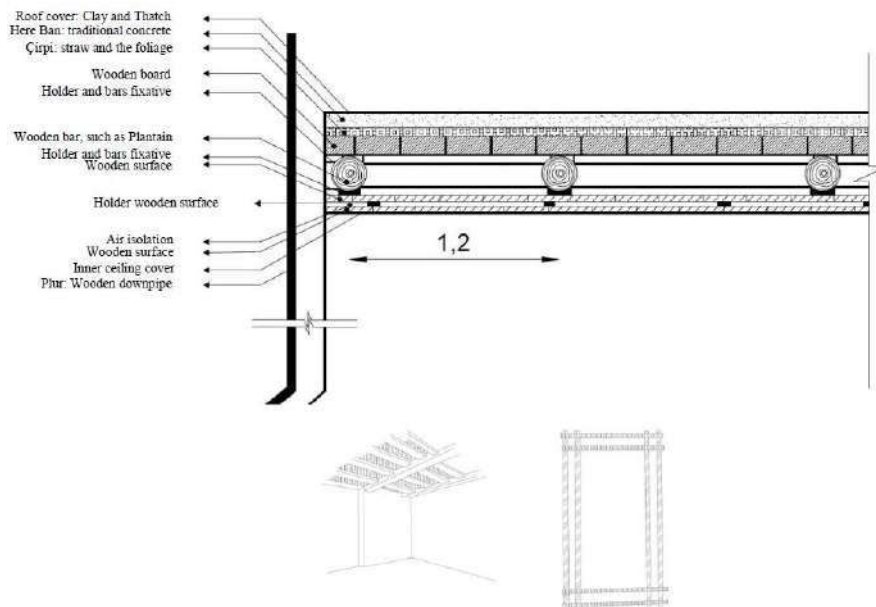


Fig. 4: Details of ceiling (Authors)

As mentioned before all of the materials are extracted from natural environment around and have the least environmental pollution and most of the materials from thermal capacity point of view are good and economical in the village climate. On the roof of the sitting room and baking room there exists a hole called “Roçn” which is for ventilation and light-up.

In Palangan village mud (“Here”) and hey (“Simr”) was used in the past to covered wall’s surface. Whitewashing the internal wall is done using a white soil called “Çermo” this process is called “Suax” locally. The needed soil to do this is provided from mountains around. It is clear that the materials for adornment and joinery of the buildings are natural and can be extracted from environment area. One another structures that has helped the stability of buildings, in such special ground, is “Koleke”. Kolekes are 2-3 wooden piles in the middle of big rooms and stable that transfers the pressure of roof to the

ground. [Fig. 5] In this village some of the houses are attached to the mountain and mostly some parts of mountain are the rear wall of the houses which is important from energy consumption point of view.

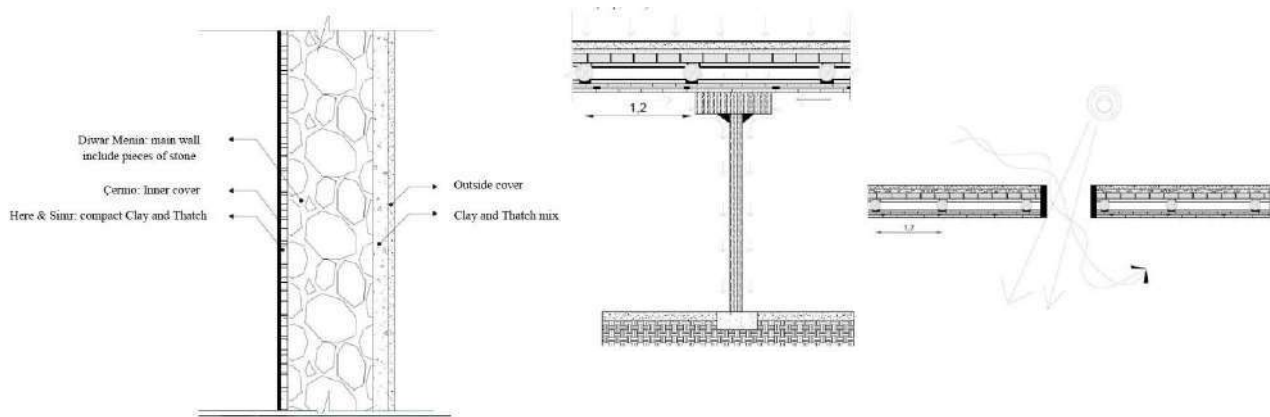


Fig. 5: From left to right: Wall cover; Koke structure and Force diagram; Roçen, the hole of ventilation and lighting (Authors).

Spaces and their applications

Usually the bottom floors are used as stable and place to keep livestock and also feedstuff and agriculture instruments and such application can be entrance filter for energy saving, this space is called “Çer Xan”. On the walls of livestock keeping place, “Gewer”, there are square shaped holes called “Wele” that are used for light supply and air conditioning of “Gewer”. The spaces of stable and storage, are as partitions and also as a source to generate heat for upper floors which are living rooms.

Residence halls and baking rooms and kitchens are mostly in the upstairs, because of ventilation and sufficient light and also energy saving matters, this is called “Seru” or “Sere Xan” locally. To control the temperature of inner spaces in summer, a place, “Ser Tenür”, is made beside the houses or inside the covered yard for cooking and baking (oven). Sometimes in the restroom (“Yane”) an oven is made that is used for both cooking and heating the room in winter and for ventilation purposes a hole is made in the ceiling of room called “Roçen” or “Kwnawance” or “Kwlance”. [Fig. 5] Naming of spaces in the local language illustrates the fact that spaces and framework of rural houses, which are among the primary human settlements after caveman era are created premonitory and for special purposes and then modified which proves the importance of spatial definition in rural housing.

Balcony, terrace and semi-open in most houses are like dents or bumps on the roof of downer houses, the application of this space is as a place for the meeting of neighbors; so most of the houses being introverted because of areas without border characteristic with the neighbors, is the presenter of an extroverted architecture with free walls and this shows the special architecture of the village which comes from culture and beliefs of villages people. [Fig. 6]

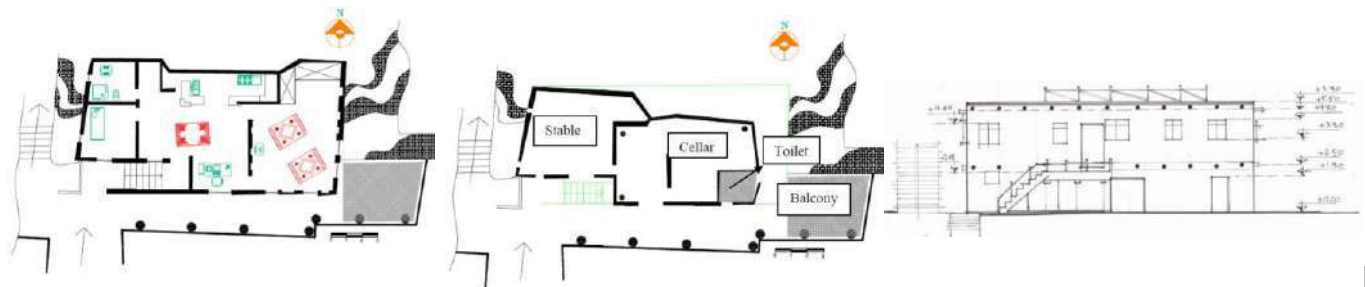


Fig. 6: Plan of ground floor and first floor, and section of a selected house from Palangan village; left to right: Ground floor, First floor, Section (Authors)

Openings

Windows and doors of old houses are made of wood and most of them are colored blue or green; wooden materials are suitable in terms of availability and being thermal insulation [17] and the reason behind selection of blue, green and blue-green colors is firstly people’s religious and symbolic belief and secondly the availability of natural pigments. Consequently the local people use natural available material to reflect their customs in colors to create a shield. The direction and size of windows have direct relation with the climate of area.

Importance of improvements in Palangan village

Based on the definitions and solutions, it is important to have improvements in Palangan, because such villages are important in terms of history, tourism and architectural attraction and rate of migration from these villages is worrying. Improvements of Palangan can help in revival of the village and can help the village to show its capabilities, but surely giving effective solutions in this field needs another time.

RESULTS AND DISCUSSION

Rural houses as a sample of traditional architecture, have original characteristics and factors in the field of stability, which is the main reason of their durability. Obvious aspect in these buildings is the presenter of these buildings response to people's biological need. Palangan village is one of the most extraordinary rural architectures and climatic designs. One the other hand this village like its other counterparts, Masouleh and Howraman, is a valuable heritage that needs considering to its design principles. The points below summarize the sustainable design of study area with principle of climatic design and conclusion in this subject considering scientific principles:

1. The ability of the air flow to cool human body, is ventilation that in the architecture of Palangan shows this with the holes on the wall and roof. To have good ventilation the color of outer view of house must be light like houses of Palangan.
2. Heat transfer plays an important role: 1. Area shell, 2. Thermal resistance of the building shell, 3. Temperature difference. Area shell in buildings of village, is the least possible value and based on the study, sometimes neighborhood of one or two house is mountain.
3. Permeability is entry of cold air from gaps, joints and splits of building. In the mountainous villages and study area in particular, the openings are designed so as to have maximum energy saving.
4. The use of Evaporative cooling of surface and roof, according to the village's structure as every roof is other house's yard, can help to control the temperature of house in warm seasons.
5. The earth is like a temperature discharging dish. Using this capability is clear in the houses of the village, in a way that people use the heat of mountain in the cold seasons and cold of it in the warm seasons.
6. Reduction in the outer surface of walls and roofs in the houses of Palangan, has caused efficient energy saving in the houses of the village.
7. Using the materials, like brick and stone, with high thermal capacity to store the sun energy, it is possible to save the energy during the day to heat it during cold times of night.
8. Design of secondary spaces like store and stable as a central space and using the heating of these spaces.
9. Putting the ground level of houses on the ground to have heat transfer with it.
10. Attention to the direction of openings to have optimum use of sun light and energy from south and south-east.
11. Using native materials with optimum compatibility with the environment around, with high thermal resistance and acceptable thermal capacity.

CONCLUSION

According to mentioned discussions, it can be concluded that rural houses, because of their history of housing and also the fact that during the ages, have been able to response to sustainable, energy and climatic issues and coordination with the environment, although there were difficult environmental factors such as earth, context and material. Extraction of such principles and using them as pattern by designers, can help to have newer and better designs; because it will be wrong expectation from a designer to have an ideal design without paying attention to such thought which comes from long-term occupancy of human.

FUTURE WORKS

According to the extracted principles of this study about the architecture of stepped villages it is suggested to study the success these patterns economically, functionally, coordination with environment and energy issues in design of settlements in the same environments and conditions.

DESCRIPTIONS

1. **Zagros Mountains** form the largest mountain range in Iran and Iraq. This mountain range has a total length of 1,500 km (932 mi). The Zagros mountain range begins in northwestern Iran and roughly corresponds to Iran's western border, and it spans the whole length of the western and southwestern Iranian plateau, ending at the Strait of Hormuz.
2. **Palangan** is a stepped village in Zhavehrud Rural District, in the Central District of Kamyaran Countryside, Kurdistan Province, Iran.
3. **Sanandaj**, also called "Senna" is a city in the Kurdistan Province of Iran. Sanandaj occupies a fertile valley in the Zagros Mountains.
4. **Kurdistan** is a roughly defined geo-cultural region wherein the Kurdish people form a prominent majority population. Contemporary use of Kurdistan refers to large parts of eastern Turkey (Turkish Kurdistan), northern Iraq (Iraqi Kurdistan), northwestern Iran (Iranian

Kurdistan) and northeastern Syria (Syrian Kurdistan) inhabited mainly by Kurds. Kurdistan roughly encompasses the northwestern Zagros and the eastern Taurus mountain ranges.

5. The **Seljuk Empire** was a medieval Turko-Persian empire, originating from the Qynyq branch of Oghuz Turks. The Seljuq Empire controlled a vast area stretching from the Hindu Kush to eastern Anatolia and from Central Asia to the Persian Gulf. The Seljuq Empire was founded by Tughril Beg in 1037 after the efforts by the founder of the Seljuq dynasty, Seljuk Bey, in the first quarter of the 11th century.

6. The **Samanid dynasty** (*Sāmāniyān*), also known as the **Samanid Empire**, or simply **Samanids** (819–999) was a Sunni Persian Empire in Central Asia, named after its founder Saman Khuda, who converted to Islam despite being from Zoroastrian nobility. It was a native Persian dynasty in Greater Iran and Central Asia after the collapse of the Sassanid Persian Empire caused by the Arab conquest.

7. **Hawrāmān** (also Hūrāmān) or **Ōrāmān** or **Avroman** is a mountainous region located within the provinces of Kurdistan and Kermanshah in western Iran and in north-eastern Iraq within Iraq's Kurdistan Region.

8. **Kamyaran** is a city in and capital of Kamyaran County, Kurdistan Province, Iran.

9. **Masuleh** is a stepped village and the capital of Sardar-e Jangal District, in Fuman County side, Gilan Province, Iran.

10. **Gellin** is a stepped village located in Sanandaj and Hawraman region.

11. **Tangivar** is a village in Zhavehrud Rural District, in the Central District of Kamyaran County, Kurdistan Province, Iran.

ACKNOWLEDGEMENTS

The authors would like to thank the experts of "Cultural Heritage Organization of Kurdistan", engineers of "Foundation of Rural Houses rehabilitation, Kurdistan" and people of Palangan village.

CONFLICT OF INTEREST

There is no conflict of interest.

FINANCIAL DISCLOSURE

None.

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HOW TO LEARN: IDENTIFY KEY FACTORS IN LEARNING PROCESS FROM THE PERSPECTIVE OF DIFFERENT INSTRUCTORS AND THEIR LEARNERS

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ABSTRACT

Background: One of the most important fields in Educational Psychology and yet one of the most difficult concepts, the concept of learning. There's a wide range of learning environments academic and non-academic or there. Due to the multifaceted nature of learning and its dependence on various factors, among which can be individual differences (cognitive, emotional) and social noted. This study aimed to assess the key factors, easy to learn instruments and inhibitors was carried out from two perspectives instructors and learners. **Methods:** This qualitative study through interviews and content analysis was performed. In this study, 20 people from various professional instructors and learners, who were working in 2015 that were selected based on purposive sampling and were examined during the 20 interview. **Results:** Using a hand-written analysis resulted in the extraction were 5 themes. The main themes obtained in learning about the key factors are: 1. motivation 2. Social-environmental context, 3. Methods of training, 4. 5. Perseverance and emotional learning. **Results:** The most important key factors, facilitators and inhibitors of learning, according to the extracted categories, in terms of cognitive, emotional, behavioral and social individuals according to their individual differences is very important. **Conclusions:** These results have clear implications for understanding the formation of learning and consequently the use of educational and non-educational considerations appropriate to provide it...

INTRODUCTION

KEY WORDS

learning, motivation,
teaching methods,
perseverance, learning
emotions

Many scientists about the concept of how to facilitate learning and learning have to study and theorizing. Why the importance of this concept can be understood from the fact that individual learning style enables us to predict its behavior appropriately and even our guide [1]. Academic and non-academic learning area is extensive and includes behaviors [2]. Formal education or informal learning environments of life, the good situation for creating started when death is taking place.

Traditionally, most research to respond to questions in the field of learning. When learning history is presented and comments on this concept carefully consider so we find that learning one of the motivating issues of humanity throughout the centuries [3]. The most complete learning effect on life can be found in Persian literature and of course, every line acquaintances who heard it repeatedly sought "be capable of being wise". Meanwhile surprisingly researchers and experts disagree about the definition of acceptable learning. This is probably due to the fact that the definition of the concepts with regard to the scope and complexity of the process and at the same time Lifelong learning, cannot convince all experts[4].

However, a definition that may be mentioned more book learning, and tried to be comprehensive definition of learning it contains three parts: 1. experience, contact with, participate in, and faced with external events within the organism is sensitive to them. 2. learning; all relatively permanent change in behavior potential that arise from experience, but due to fatigue, maturity, drugs, injury or disease are not. 3. Change behavior, actual or potential visible changes after that experience provide us with evidence that learning has occurred [5].

In the current era that is called knowledge era, we witnessed a dynamic and challenging environment we are day by day. Change is an integral part of today's world, namely the fixed component of "change". Today, intangible and intellectual capital is called knowledge which is considered as a critical factor. In this space, people will be very successful in the face of changes and transformations that can improve their knowledge and develop intellectual capital and intangible. It is obvious acquire knowledge without learning is not possible reserves [6]. In relation to the necessity and importance of learning in today's world it could be stated that:

1. Learning as an important technical tool, to achieve a specific goal that is mainly used to increase efficiency and effectiveness.
2. Learning is the most important elements of different people involved in the process which makes the process related to each other.
3. Learning is change of heart, change and improvement of life.

If look deeply into the implications more closely, we will discover its importance in the survival of the organism. Learning process helps the organism to adapt to the changing environment and learn to recognize the positive stimuli and negative incentives to comply, and helps us to understand the causes of our behavior. Also, the mission of higher education in every country, culture and intellectual life of society is specialized for professional office. From this perspective, you learn more about how and under what conditions occur more we know; the better we will be able to assess how the learning process and take steps in order to foster intellectual life.

The aim researcher studying the factors, in the form of advertising and inhibitors facilitate the process of learning from the perspective of instructors and learners, with particular attention and learning theory. Because learning is a process and like any process, has a starting point, the process and the results. In this

study, we tried to have closer and better understanding of learning achieved in non-academic environments and subsequently, holistic view of the complex process of cognitive, emotional and behavioral well.

Research Questions

- What are the key factors in the learning process from perspective of owners and professional learners?
- What elements are facilitator in the process of teaching and learning?
- What elements are dissuasive in the process of teaching and learning?

Theoretical foundation of Research

Over the years, the issue of how learning occurs through the lenses of many disciplines such as physiology, sociology and psychology have been studied. Each of theories of learning has basic stance towards teaching - theoretical and practical learning and different aspects of it. If you look at the origins of theories of learning, early efforts by psychologists to explain the behavior was based on intuition and emotion. Older psychologists like William James and Titchener to study human behavior, relied heavily on introspection. Many origin of psychology as an independent science laboratory established Savion [7]. The reason for this is that Wundt and his followers were trying to check mental concepts such as consciousness, emotion, imagination and perception, more objective methods of use. It can be stated that in the early twentieth century gradually, learning theories were formed. Quality of learning theory depends on extent that it can accept the idea that learning takes place and also how much you can learn about the conditions that occur in them provide better forecasts. By taking this approach, examining the various theories of learning is necessary. With general approach, learning theories can be from 3 perspectives: a) behaviorism: 1. functionalism and 2. Evokes, b) beginning of modern cognitive: 1. evolutionary psychologists, 2. and 3. Cognitive gestalt - Social and c) examined the cognitive theory.

Behaviorism

In the early 1900s, attitudes towards treatment instead of thinking emerged in the United States that eventually became known as behaviorism. This trend mainly led to theories of learning objective events such as benchmarking, answers and rewards were related. These theorists believed that incentives (conditions that are leading to behavior) and replies (actual behavior), the only aspects of behavior that can be observed directly, therefore, they are objective variables that can create to be applied behavioral science.

Functionalism: theories of Thorndike, Skinner and Hull are located in this section

In Thorndike's theory, learning occurs through trial and error or selecting and connecting in steps. In his view, what is status of fulfilling or facilitating learning that seeks to strengthen the call is (punishment has no place in Thorndike's theory) and what inhibitor is a lack of external reinforcement. Including the implications of this theory for learning, taking into account the association status with life issues and avoid creating unnecessary links [8].

Skinner's theory in its environment and amplifiers that are either planned or accidental is very important role in learning. In other words, facilitator of learning, enrichment programs, each in a specific way, amplifier accompanied by learning. In contrast, the deterrent learn or what to turn off delete reinforcement or lack of reinforcement (as Thorndike's theory, the theory of punishment has no place Skinner [9].

What for Hull in determining learning is necessary to explain what learning is what happens immediately after the presentation amplifier and it is nothing less stimulus drive. Hull, exercise facilitator of learning and believes learners learn what they are doing [10]. It should be noted in Hull's theory of educational applications to determine exact purpose of learning, discipline in the classroom, and learning from simple to complex [11].

Associationism: The learning process in terms of laws and theories associated with study Guthrie and Stacy are in this section.

Contiguity is the most important factor in learning process. Guthrie had to practice many believe it is necessary to improve the performance. Guthrie learning principle, the frequency generally rejected as a principle of learning. The other principle in his theory, the principle is delayed for any answer that last of all in the presence of a set of actuators is done, it rebirth actuators, the movement will be carried out.. Motivational factor in Guthrie theory is stimulus holder that maintains the organism to achieve the goal[11].

Stace, like Guthrie, learning based on principle of proximity explains. But Guthrie's theory underlying the new and changed more cognitive. The Stace serves to strengthen the learning necessary for learning to performance. In other words strengthening although it is not necessary to learn but it can be seen as facilitator as it turns learning into practice. In fact, strengthen role of information or news for organism. Deterrent to learn would be forgotten interference [12].

The Beginning of Modern Understanding

1. Gestalt and 2. Cognitive and social are in this category.

1. Gestalt: the followers of Gestalt learn about an insight that occurs suddenly, not gradually. Insight occurs when a person suddenly find out how you can solve the problem. Motivational force that is conducive to

learning cognitive imbalance. Gestalt followers motivating factor, namely cognitive imbalance knew motivational factor that makes learning in cognitive balance and reduce ambiguity. Since the followers of Gestalt emphasis on understanding methods such as rote memorization and logic-based methods and rules prescribed to prevent understand and learn deterrent know [12].

Social-Cognitive

Bandura's social learning theory, believes learning new behaviors more directly and classical learning, the modeling of the behavior no longer occurs. Bandura also like ongoing learning process, but he believes it is necessary to transform learning into performance reinforcement or motivation. Bandura is the facilitator of learning as something of a model for example to be learned before pattern should be considered [10].

In the field of education, factors such as specifying the material, and the applicability of and interest on the amount of attention they affect learners. Regardless of whether we pay attention to behavior that we see how well, or how to do them, we will not do them without motivational processes. If incentives are available, see the action becomes faster. Bandura's theory, the irritatingly positive and negative consequences of behavior are factors, not factors causing learning [12].

Cognitive theory

This paradigm, ontology learning should be emphasized. Learning theories includes Piaget, Azobel and processing information.

In Piaget's theory major concepts of intelligence, schemas, assimilation, adaptation, localization and internalization is balance. In his view, learning experiences must be based on the learner's cognitive structure. Piaget also like followers of Gestalt cognitive disequilibrium motivating factor for learning and cognitive equilibrium knew amplifier. Piaget education that fits the individual's cognitive structure of the learner is learning facilitator [12].

Meaningful learning is important for Azobel which depends on the learner's cognitive structure. In principle this theory to justify and explain the issues concerning verbal learning course has been developed. He especially concept of pre-paid organizer that teachers can use to help learners absorb new information. In his view similar catalyst learn more about cognitive learning by making so that the content can be absorbed in cognitive structure (in this process, including states) in contrast, inhibitory learning, dissimilarity between entry and non-cognitive structure that leads to meaningful learning. Depends on appropriate incentives attract and educational materials [12].

In processing information, people receive news or information from environment, process it in different ways and then act on it. Norman knows one of theorists of this approach, learning the ability to perform a task expertly. Norman's strong emphasis on memory and his view of facilitating learning, or memory is to remember because to him the materials are first remembered and then entered the cognitive structure. In addition to memory, the learner's cognitive structure is an important factor in learning. Requires complex learning, find the most suitable available and apply it in new position that provides sense of new position [11].

MATERIALS AND METHODS

For purpose of this study is qualitative research method was chosen. Attitudes recognition for quality in our society with tools such as interviews or observation, it is possible because people without having time to think and stereotyped answer, your feedback will lay out more clearly [13]. So this study was conducted with a qualitative approach. Qualitative research "set of activities (such as observation, interviews, and enterprise-wide management activities) that somehow realized first-hand information on research topics assist." [14]. According the quality of special features that includes: 1. the goal is hypothesis testing; therefore, we have not before and not during study, no default has been structured into we do not mind. As a result, we have made assumptions in mind that some issues raised in the form of expression. 2. Qualitative method does not consider a large population and 3. Tests and questionnaires not interest Bordeaux and, finally, 4. Look for the test or implement particular theory, not in the environment. Of course, in qualitative research such as this study, after collecting information for understanding and explaining results of theories we have used and stated in the theoretical framework.

Today almost all fields of humanities and social sciences, including psychology and works related with the symbols, meanings and messages are related. In recent years with the emergence of the information society, text, backgrounds, images, relationships and most importantly information widely reviewed [15]. A description of any text is content analysis method. "Content analysis is a research technique for reproducible and valid inferences from texts or other significant materials, or areas that are used in context." In other words, content analysis analytical approach based on the determination of the categories of indication of the content in text, both elements of verbal and visual elements, and the relationship is between these categories. This means that a special meaning can be repeated elements, whether they are verbal or visual, to be allocated, and thus can be embedded in text messages but received basic.

This study population consisted of all those who are somehow involved in the teaching-learning process. Members of the samples were purposive sampling method, and were placed in two categories. The first group includes instructors (10) and the second group of learners professionals ($n = 10$) had a total of 20 people were in the sample.

Tools and procedures for data collection

In this study, semi-structured interviews were used to collect the data. That is the question of pre-designed with the aim of information from the interviewee is deep, but any questions, respondents were asked a number of questions pursued and give more explanation of your answers, to obtain a clearer understanding of the phenomenon under study. First some questions as proposed questions was elected and then do two interviews were completed test this question in questionnaire was modified. Consultation questionnaire's face validity was confirmed by three university professors in psychology and given the quality of research and the results should not be generalized discussion of reliability is not raised [13].

Interviews were done after providing explanations about the purpose of the research and the satisfaction of the interviewees [Table 1]. Location of the interview was interviewed at work. All interviews were recorded after obtaining consent from the interviewees and the exact shape were implemented. Content analysis was used to analyze the data. In this study, we studied the text first, and then a general comment about the text and its relationship with all the questions we did. In the third phase, we began detailed analysis of each call separately. For this purpose, the key words of the text were identified as participants in their cognitive text search.

Table 1: Information on Interviewees

Code of interviewees	Job	Time of the interview
1	Coach Bakery and cooking	30 minutes and 30 seconds
2	Master paintings	15 minutes and 8 seconds
3	Pastry and culinary student	17 minutes and 39 seconds
4	Professor of ethnography	18 minutes and 24 seconds
5	Professor of Economics	23 minutes and 17 seconds
6	the mechanic	25 minutes.
7	English language student	35 minutes and 10 seconds
8	Sculptor	18 minutes and 43 seconds
9	Carpenter	17 minutes.
10	Panegyrist	40 minutes and 15 seconds
11	Physics student	15 minutes and 3 seconds
12	Student paintings	12 minutes and 8 seconds
13	Sewing student	16 minutes and 5 seconds
14	Student Ethnography	13 minutes and 45 seconds
15	Math teacher	24 minutes and 40 seconds
16	Lawyer	20 minutes.
17	Accountants	22 minutes and 10 seconds
18	Music student	15 minutes.
19	Apprentice goldsmith	14 minutes and 15 seconds
20	Architect	20 minutes and 30 seconds

RESULTS

This in present study we wanted to examine the factors influencing learning. For this purpose, no prior assumptions and interviews were deep in search of factors that business owners and learners neglect of the disruptive behaviors commodity. An important characteristic of quality, lack of structured hypothesis is consistent and clear. This does not mean that a qualitative researcher doing research, no hypothesis. On the contrary, the qualitative researcher with very detailed information entered evenly research. So, who knows what is to follow, but his theory is not structured. Professional instructors and learners, according to what is obtained, based on their stress levels, which is indicative of the importance that each of these factors is listed. In this research, professional instructors and learners on five major factors that affect stressed in the learning process, which includes: "Motivation, Environment, teacher training methods, perseverance and emotional learning". Results are shown in [Table 2].

Table 2: Factors affecting learning

Factor	Frequency (percent)
Motivation	20 patients (100%)
Environment	18 patients (90%)
Teacher training methods	16 patients (80%)
Perseverance	15 patients (75%)
excitement of learning	10 patients (50%)

Remember that according to the quality of research and the small number of sample, generalization of the results is not considered to instructors' society, but also a deep understanding of the factors involved in learning a select group of professional instructors and learners of the target population.

Motivation

The first and most important factor that every 20 instructors and learners, and noted that they had an interest and motivation is internal. "I think the most important motivation factor that is I got love... I love the motivation that comes after the catch ... you the inheritance you do not play much or too little color "(coded 1 pastry and culinary instructor).

"The motivation depends on what the goal is? For example, if the goal was intended to show the economy is a kind of collision or other kind of power is a treat ticks all these various functions... Again, just be mature person is different in every way.... For example, Maslow's pyramid considers these and all the way to the end cannot be together "(code 19 goldsmith's apprentice). Motivation is as one of the most important factors in human activity. Loss of or reduction in individual motivation affect all high performances and caused negative effects will be affected. A sort of inner motivation for conscious or unconscious person to satisfy their physiological and psychological needs leads specific behavior [16].

Experts believe that motivation can interfere with the person's feelings and behaviors cause problems and provide basic pessimism, anxiety, depression and psychological problems, as well as significant reduction in the performance of individual, social and occupational. Lack of decent work by entering a serious blow to the confidence causes depression and behavioral consequences resulting from it. Different studies show that the performance of work associated with motivation and they have been successful motivation and education that will follow naturally its job satisfaction [17].

"Motivation is very important to know what you are calling for usability and know what it means to What for Would know for what learn this course knowing, for example, in the first class of brainstorming, I used to hear, because stereotypes have not met with comments... I want to create a new window for him to do and I add to choose.... Active learning since the first issue was the second brush is attractive due to the age profile teaches... People generally strongest records should be kept, but not them and age-emphasis on abstract only example I am using video in our education. "(Code 4 professor of ethnography)

Speaking to explain the basic code (4), in respect of the application of lessons, and sync it with real-life situations, can be used Guthrie theory. The code (4) further states that, if the maturity-based training, in terms of content and in terms of how education can be very helpful. Open training and its effectiveness requires understanding the process of training talents in the actualization of awareness of modern methods of its implementation. The ways which learners use vast amount of information facilitate its application in all areas of life. In recent years supported the view that knowledge is constructed by learners is effective and transferable to other learning situations [18].

Environment

The second factor influencing the process of learning from the perspective of participants (n = 18), the conditions and it was as a facilitator or inhibitor. For example (code 18) refers to family problems and the extent to which the goals and improve the lives of people can play a role. "For example, if the family is strained from early childhood when the child should be the goal of his hand, perhaps he was busy with the family's seizures or let's say a family party you So, okay, it out so it is you challenge and all life on the ground is that to get to the school was forced to fight with others the reflection of sunlight, the way you get different future ... After the individual in a society that wants to progress in it broke all they can to create friction for progress Maslow's pyramid of needs must be met"(code 18 student of music).

Much of the research on the relationship between perception and efficiency of the learning environment and learning outcomes were assessed that it was found that the perception of learning environment can have profound effects on efficiency and learning outcomes of students [2].

Terms teaching - learning and teaching environment of the crucial elements in any job skills and capabilities, and provide a satisfactory condition, the condition is very effective future career. Promoting creativity and

innovation depends on the preparation conditions and the learning environment in the family, school, and work.

The preparation of cells and determine the sources of stress and concerns with the use of supportive teaching and learning, living, stress management and anxiety is possible. Using the theory that the interaction of the individual with the environment has a special concern, such as Bandura's cognitive - social theory can be very effective. However, the separation of personality variables affecting the learning environment is very uncertain, because the personality variables in form and strengthen and environmental variables in turn affect the personality variables [19].

"I told since childhood prayer in the mosque ...slowly I went from childhood Mosque prayer meetings I've read the eulogy I sat mourning all Now I talk about how to find love after a relative died one day I went to help my people help ... I ... I liked you once told me after the game do not crash Mourning Come on ... So we started out ... how wonderful speaker claiming to be the film's reading ...

Family said it was honor for me to encourage me to buy this one ... then you are giving the mosque urging people to say this guy should encourage adults eulogy get ... You have influence).. So we started out ... how wonderful speaker claiming to be the film's reading... Family honor, said it was encouraging me to buy this one for me ... then you are giving the mosque urging people to say this guy should not ... you have to encourage grown Madahi had an impact, ...). More Follow arrest was more interest you have anything ...For example, to keep the poets have always been my practice when a poem was read to the Queen brain became queen go on to the next For example, one of the other colleagues eulogy was not asked, 'Why? I told my family doctor engineer that whenever I am filled with ear making me say these things as honor what you taste is anybody's family said that no ... I cannot sing "(Madah Code 10)

In this example, (Code 10) clearly refers to encouraging theological and social support. Functional theory explains the theory of cognitive strengthens environmental and social - Social support can help to explain. But it is clear that for every complex process of learning has 1. Foreground, including previous knowledge, IQ, family history, personality and the ability, 2. Process, which includes learning approaches of the kind of deep, superficial, success-oriented, motivated and their strategies, 3. Efficiency includes self-goal setting, self-concept and satisfaction [20].

Teaching Methods

The third factor with a frequency of 80% has long been one of the most important factors in the teaching-learning process. Educational activities, according to different views, different ways (for example, education based on individual differences, teaching inquiry-based, network-centric education, teaching sensitive metacognition, etc.), is defined and explained. But, all five of teaching, learning, subject, location and method are unanimous. It is worth noting that according to the vision and approach is that any theory scales in favor of each of the five heavy elements [21].

"In the last few years as a result of the experience gained motivation and how important the environment is important coach training that if I can provide convenient ways I got them If we can we facilitate them an easy way out to interact to form that mind and could not find a harmony together "(code 8 sculptor).

In this case, the master sculptor plays the role of facilitator and guide. The theory of constructivism can be informative to enable that person knows and respect for the coach's role is easy to explain the mechanism used. For example, Bruner and Vygotsky's theories such as have been established on this basis. Constructivism, according to a person's knowledge and through built interaction with environment. In other words, Constructivism is theory about how the learner in a way unmatched knowledge from experience builds [15].

Constructivism in education means that coaches in a holistic way of thinking about learning to believe that something quite different is the direct teaching method. Learning process of the subject learning is more important. The person seeking personal experiences to achieve recognition and at every stage of life experiences makes sense. According to constructivism, learners make their own reality, or at least interpret it based on perception and experience. So the precedents personal knowledge, personal beliefs and structures of the mind are to be used to interpret objects and events. What person knows perception of the physical and social experiences that can be understood by mind rooted?

"We work primarily a theory about what we want to learn what's working.... Next to begin this person should be able to draw a series of lines that if they can kill him any way I could also bring with tools that are in it That must understand that it has to show himself "(Code 9 carpenter).

(Code 9) Clearly, the use of advanced organizers refers. In this style of training, organizers presented by teachers due to fall mind prowling the learners. Before the introduction of concepts of organizational learning at higher level of abstraction, integrity and universality of the message of the training offered so that strong connection between general concepts and details then placed in the message brought create new education [22].

In total, the two organizers help the learner; 1) when learner has not learned from the similar content with new content that is relevant to them something new. 2) When learner data already learned nothing new, but for her the relationship between them and the new subject is not well lit [23].

Diligently

Fourth factor of the 15 interviewees had insisted on practicing, repetition, practice and follow-up. For example speaking (code 1) through the concepts of "training" and "Law of Effect" Thorndike explained in Section theoretical foundation. "Barriers to learning exercises is not ... We now have students try the stage spent together, she was still my problem ... when I look at you I do not work ... I do not want him to remember.... Start point of the eye and is not working with his hands is a problem "(Code 1 coach for confectionery and cooking).

In relation to practical - move work that requires eye-hand coordination skills, the practice (or indented mass) in the acquisition of practical skills - is very effective [24]. Research has shown great deal of learning materials (high frequency) guarantee for the acquisition of motor skill, but also improve memory are subject to processing information on deep level. In the same theory states that processing depth "review the material learned only improves memory and deeply meaningful review, the review cannot be detached, resulting in improved memory" [25]. Groenendijk, Janssen, Rijlaarsdam & van den Bergh [26] showed distributional practice (mass, indented) as one of the methods of planning exercise greater influence in the acquisition of motor skills compared to the practice.

So it seems distributed and organize training in a workout scheduling, a deeper and more meaningful land suitable for processing motor and cognitive concepts provided in person and thereby acquiring practical skills better be good. Research also individual characteristics such as intelligence, motivation, emotional state, reaction time, neuromuscular coordination know effective practical - movement skills [27]. Research also about the effect of interactive planning exercises and homework on acquisition of practical skills - work has been done.

"It seems to me that when one person gets one goal in mind to be nothing ... anything can stop them means you have faith if your goal is perhaps barriers, but he cannot obstacles in the way of you to reach the goal of 100% jump Facilitator diligently gets everything we want ... I had this happen to me "(code 17; accountant).

Speaking to explain (Code 17), Tolman's theory can be used. The theory of learned behavior and is always focused on a goal. In his view, three factors are involved: the act or result of the action. The important work of applying this theory is purpose of the learning behavior to optimize the learning process. One of the most important concepts in the development of cognitive learning, there are particular purpose. People who work according to a specific purpose, usually to learn different species arrive. The aim of the behavior is universality and comprehensiveness. As a result, the targeted person does not feel confusion and ambiguity [28].

Excitement of Learning

The fifth factor which affects the learning process through the eyes of five instructors is inheritance. Perhaps this is the last operating with the lowest frequency is highlighted but it is not less important reason. "While you're excited or motivated to learn one thing, but if you are falling out of the valley, no matter how good your teacher is not possible to learn emotions that must be provided to learn that these emotions may also be motivated from the elements The space where you can see important lesson outdoor For example, if there is an appeal or challenge in space and centralized package is a model for other learning happens "(code 5 is professor of economics). The excitements of learning that are part of the excitement of progress within the framework of "The Theory of control - value - achievement emotions" are explained. Joy, anxiety, shame, relief, hope and despair are emotions that they experience many learners in the learning process. In emphasizing the importance and value of these emotions, Goetz, Pekrun, Hall& Haag [29] stated that "emotional experience directly affects the quality of learning and interpersonal interaction."

In line with this theory of dynamic systems, "thrill as coordinating multi-component process of emotional, cognitive, motivational, affective processes are marked physiological center, emotions are assumed " [30] . This theory has classified the excitement of progress in three dimensions: The outcome of the activity excitement, the thrill of the pleasant (positive) against unpleasant (negative) emotions enable and disable the mechanism. Thrill-based activities underway or are in the process of learning experience and action-based learning activities are a consequence of the outcome. Activation of arousal, energy and excitement refers equipment. The positive and negative emotions with regard to the control and the value of a person are allowed to operate differently.

According to multiple exciting experience in academia and non-academic (learning situations) and their effects on the performance of learners is very important; In research of Hosseinpur and Shokri [31] showed that experience the thrill the negative anger may be associated with frustration or fatigue or experiencing a positive emotion like joy can be combined with pride or hope; according to interact and communicate with each other at the same time so the excitement is of particular importance, may experience one of the other emotions they may recall homogeneous and profound effects on performance or academic career and have learners.

"Sometimes in the middle of a key vague term that I do not understand or that does not explain the true master...You might not realize that I have an interest in that particular topic comes back... Previous interfering with new learning may be a barrier.... Or some singing lessons with the 2 times I just read some not take another 10 minutes so I get bored reading the game and ask myself how nasty these do not

understand...!! Next I got nerves.... I'm confused.... I feel frustrated about abstract topics in a very tangible example does not work because I do not take more but what about the more general topic more tangible and take more quickly "(code 11 student of physics).

To explain the first part of speaking in Code 11 can be the concept of "interference" Stace took advantage theory, and then, from the perspective of Bandura [1997; quoted by 3], which means that, like Conceptual routes determinant of effective self-efficacy beliefs the preferred forms of learning with an emphasis on choice behavior other people in positions three domains thoughts, emotions and actions will be determined. Accordingly, the self-efficacy theory assumes that self-efficacy through positive emotions and facilitate the strengthening of the individual's personal beliefs toward self in successful implementation of a broad group of claims in anticipation of adaptive behaviors plays a role in learning and development opportunities.

DISCUSSION

The aim of our study was to investigate the key factors in the formation of learning from the perspective of instructors and their learners. According to content analysis with a qualitative study of instructors and learners, businesses, key factors were identified in the learning process. In this study, regardless of a particular theory or unique in the field of learning, we have a multifaceted view (mental - emotional, behavioral, cognitive and field) and have taken the key factors involved in the learning process.

After analyzing the content or the main factor achieved in 5 categories that in order of importance and frequency of the repeated statements was made by interviewees that include: 1. Motivation, 2. Environment, 3. Methods of teacher training, 4. perseverance, and 5. Excitement of learning.

Career choice is one of the most important choices of the individual. By choosing a job, one has to spend a lot of cost and time to train profession [32].

Having the right professional for individual can be source to meet the needs of individual and society, respect for self and healthy adjustment. Being favorites does not work causes stress, anxiety and physical illness, mental, social and non-compliance will ultimately wasting material and spiritual assets [16].

Different learning theories can be used in area of training in academic and non-academic environments, depending on the learning situation. Also in the workplace can be behavioral theories used to teach in a pattern of simple to complex. According to cognitive theories of learning to teach how comprehensive is important. The purpose of this theory guide the learners create their own learning and therefore are suitable for classroom instruction and workplace. Social learning theory in addition to role of cognitive processes in learning to respect environment based on theoretical modeling of appropriate methods for educating learners in academic and non-academic environment. Emotions also play a crucial role in identifying people. One of the main objectives of education and training as well as non-academic environment should suffice emotional learners. Emotional informative enough on his attitude toward others, as well as knowledge and skills will be affected. Information received will understand the value and beauty of knowledge and skills will make sense. This ability is called as emotional competency.

Each of learning theories has focused on one aspect of learning and, therefore, each with a particular purpose in education. It is important that teachers (including teachers in the academic and non-academic) education with learning theories and methods of their use are familiar depending on the situation and the experience of students are learning to make optimal use of them. However, given the holistic point of view that was adopted in this study can be one of the most used theories of learning in non-academic environments, the "adult learning theory" applied for use in the learning process. Adult learning theory has been used for more than two decades. The aim of adult learning theory guides the development of skills for learning throughout life. Based on the theory of adult learners should be taught to be applicable to them because, according to this theory, the adult learner learns something can use it.

Adult basic principles of this theory are that when they know why they need to learn some things learn better and are able to guide the use of your learning. This type of learning involves real life situations and learning is internal to the external stimuli [33]. Adult learning principles include: 1. Learn to be active, not passive, 2. must be taken of the need to know, (3) should be on resolving problems in activities of daily living and is associated with learning, 4. Activate previous knowledge and experience, the 5 has self-direction and self-responsibility component, 6. A bridge or support to help learners build the skills of problem solving and provide independent, 7. modes are equal, process of mutual learning between teachers and students is provided occurrence [33]. Another characteristic associated with adult learning environment of acceptance and mutual respect between teacher and learner and between learners. Acceptance is necessary for safe learning environment [34].

CONCLUSION

In the end, it is important to note that this analysis and conclusions drawn from them is limited to 20 instructors and their learners. One limitation of this study and lack of generalizability of the results depends on the circumstances (especially location) that this could be from another perspective by considering the variables behavioral, cultural, psychological - emotional and cognitive research capabilities or at least be considered a feature. According to the studies with a focus on gender differences in the field of education has always been the focus of researchers, it is suggested that the key factors in the learning process in both sexes also be studied.

CONFLICT OF INTEREST

The authors declare that they have no competing interests

ACKNOWLEDGEMENTS

The authors would like to thank patients who kindly collaborated in this project.

FINANCIAL DISCLOSURE

This paper had been done by authors' expenses.

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ARTICLE

IOT APPLIANCE ACCESS STRUCTURE USING ABE BASED OTP TECHNIQUE

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ABSTRACT

Internet of Things refers to the use of standard Internet protocols for the communication of embedded system. Even though certain security techniques are applied like cipher text, Attribute Based Encryption, IoT is less secured which shows need to improve security level. Overcoming with drawbacks in existing security approaches, multiple security approaches are applied to improve security in IoT. Randomized selection logics are applied to select attributes randomly. One time password is generated based on same selected attribute data set. Based on selected data, RSA algorithm is applied to form primary and secondary encrypted keys. IoT appliance access structure is applied with those multiple security approaches to enhance security level.

INTRODUCTION

KEY WORDS

IoT(Internet Of Things), ABE(Attribute Base Encryption), CABE(Current Attribute Based Encryption), R_D(Randomized selection algorithm), OTP (One Time Password)

Received: 7 Sept 2016
Accepted: 28 Sept 2016
Published: 29 Sept 2016

The time is continuously changing so do the internet .With the help of Internet of things now machine can communicate with each other, IOT provides connectivity for everything and everyone, IOT is so much advance that they can actions on their own. But there are many security flaws in IOT so we will use ABE(Attribute based Encryption) to cover as many security flaws . Attribute based Encryption we use it or the log encryption schemes that represent user attributes as a monolithic set in keys instead of encrypting each log file with diff key. To access a particular file we need that specific attribute to decrypt that file .So we can use ABE encryption mostly on the databases , as databases are one of the most important as it contains very sensitive and personal data so to secure this we will use ABE encryption. A first step in addressing this problem of trust is to only store information in encrypted form. However, data access is not static – as employees are hired, fired or promoted so every time we cannot change the credentials of the database but it will be necessary to change the authority who can access the data . SAP HANA is one most used databases now a days by automobile company and they have every personal info about their customer, so if anybody may be able to penetrate the server and bypass authentication by exploiting software vulnerabilities [1]. So the solution to this is Cryptography we can access the control through Attribute based Encryption (ABE). For Instance in the Ubiquitous IoT application such as smart city, data is usually gathered by many people of different domain [2]. The data may be out without the knowledge of the user and transmitting in the plain text , there may be many departments and the data may be transferred inter department that can be accessed by an unauthorized user and can cause serious problem. Our main area of Interest here is to exploit the heterogeneous nature of the IoT to make best possible use of Attribute based Encryption Schema in diff environment.

MATERIALS AND METHODS

Internet of Things: Security Architecture

IoT have some security flaws so here we are going to see the architecture of the Internet of Things. Every Network has same security issues whether its mobile communication network, Internet, Sensor networks etc. The main challenge in IoT security is Data and privacy protection. In IoT our main communication is done through RFID (Radio frequency identification) and WSN (Wireless Sensor Network) so all the data travelling through these communication channels are encrypted in some or the other format [3]. The other end users have to confirm their identity so see the data. There are some issues for the security of the IoT, one of the issues is the related technologies to IoT for constructing and implementation of network function and the other issue is the IoT itself, the main issues with IoT is the compatibility issues between different networks this is prone to security. In the network due to large amount of data transfer any one can create data congestion which can cause of data loss. So we should look into the problem regarding connectivity problem and network redundancy. Internet of Things connects with people daily life, to ensure technology security and to strengthen human awareness [4]. IoT is usually divided into three layers, Application Layer, Transport layer & Perception Layer. Application Layer is subdivided into two sub parts IoT Application & Application support Layer. Transportation layer is subdivided into three sub parts viz. Local area network, Core network & Access network. And Perception Layer is subdivided into two sub parts Perception Network & Perception Nodes. Each technology has some specific role which is not

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irreplaceable by anyone else. Each layer has different security measure every layer secure different networking protocols as perception layer secures RFID security, WSN security, RSN security and many more. Transport Layer secures Internet security, Local Area network security, wi-fi security, GPRS security. Application layer includes application support layer and specific IoT applications. The security in support layer includes middleware technology security, cloud computing platform security. IoT in different industries have different application and different security measure [5].

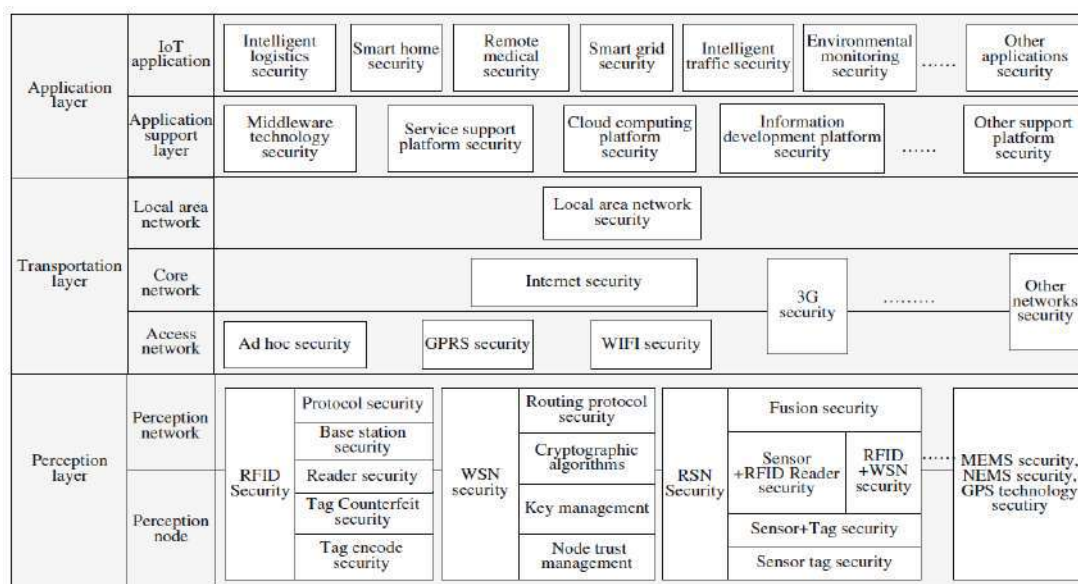


Fig.1: Security Architecture in IoT [4]

Cryptographic Approaches

There are many Cryptographic algorithm are widely available now and some of them are used right now by many company and some of them have been applied to secure the internet protocols. As shown in table we have four type of algorithm available for encryption. For confidentiality data encryption we basically use Advance Encryption Standard (AES), it is basically symmetric encryption data. There's another algorithm its purpose is to generate digital signature and key transport, it is one of the frequently used algorithm know as RSA/ECC [6].

Table 1: Cryptographic Algorithms [6]

ALGORITHM	PURPOSE
AES (Advanced Encryption Standard)	Confidentiality
RSA (Rivest Shamir Adelman) / ECC (Elliptic Curve Cryptography)	Digital signature key transport
DH (Diffie-Hellman)	Key Agreement
SHA (Secure Hash Algorithm)-1/ 256	Integrity

An algorithm is made to generate for the key arrangement know as the Diffie Hellman (DH). The problem for integrity has been solved by the SHA-1 and SHA-256 secure hash algorithms [6]. These algorithms can be applied only if all the required resources are available memory and processor, but the part of implementation is still under research.

Attribute Based Encryption

As most data on the internet is shared by the third party websites, so we need to encrypt the data secure which is kept at the websites. Normally a person is identified by a unique identifying string, but Attribute based Encryption scheme in contrast is a scheme in which a string is identified on the basis of the attributes and some function are used to decrypt this cipher text [7]. In Attribute based Encryption it allows user to set policy describing who should be able to the data. In this solution set of attributes and cipher text is associated with formula over attributes; the other end user will be able to decrypt the cipher text if and only their private key matches attribute which satisfy the formula. It is one of a special case of function encryption as this can be practiced in real life [8].

Cipher text Policy

It is a type of identity based encryption. In cipher text policy attribute based encryption (CP-ABE), every secret key is associated with a set of attributes and every cipher text is associated with an access stricter of attributes [9]. It has one public key and has a master key and it use to make more private keys. However, CP-ABE is much more flexible than plain identity-based encryption, in that it allows complex rules specifying which private keys can decrypt which cipher texts [10]. It is much more secure but it does not have flexibility and new key must be generated for each file this is because many file with same key won't give fine grained access [11].

WORKING APPROACHES IN INTERNET OF THINGS

Centralized Internet of Things

In centralized Internet of things all the devices (i.e. network of things such as mobile phones, radiation sensor, cars, home automation system) which have some computing power and which can be connected to internet to a dedicated central server know as centralized internet of things. Their only task is to provide the data and all this data is retrieved by the single central entity. Now all these data is processed in to information. User won't be able to make use of IoT services until he connects to the Internet provided by the central entity. Centralized entity can be formed by using a server or by cluster of devices forming a cloud [12].

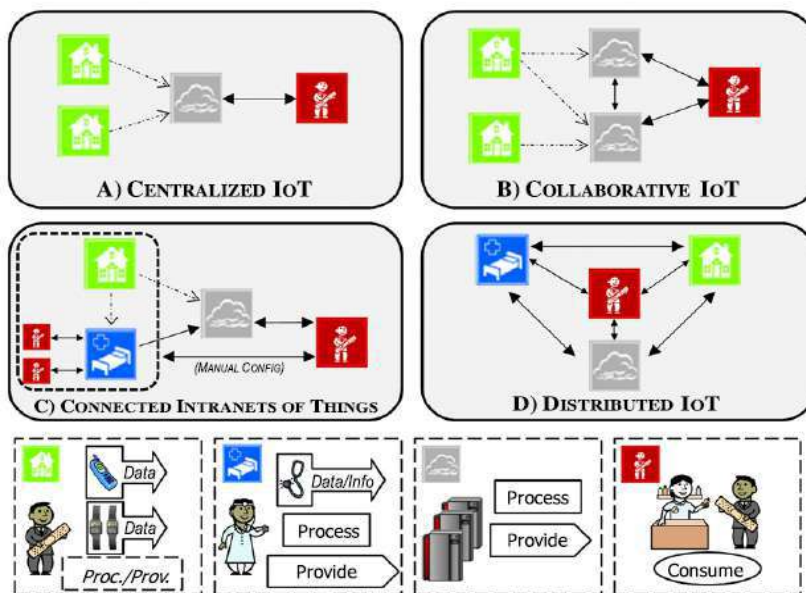


Fig.2: Approaches in Internet of Things [12]

Collaborative Internet of Things

Collaborative Internet of Things is not very different from Centralized Internet of Things as power to take decision is still with central entity. In Collaborative Internet of things there are many central entities instead of one. These all the central entity interacts with each other and they share the data between, different central entities are made up for specific task is performed by each. As a result, various central entities that can exchange data and information with each other for generating new services. For example IoT service provider that analyzes the radiation in atmosphere can now collaborate with diff cities to find the radiation in atmosphere of the whole country [12].

Connected Intranets of Things

In data acquisition (INTRANET OF THINGS) it process local information and shares the data with both central entities and to the local user. There is no relation between the collaboration of entities. The whole data flow from the central entities from where get the complete view of the whole system. This is a big security flaw or we can say a loophole because any local user can access the personal data of anyone [12].

Distributed IoT

The name itself indicates that all the entities can access, retrieve, process, and combine all the information to other entities. As time is evolving so does the Intranet of Things as it is evolved from remote entities to fully functional entities. It can now be collaborated with local entities for the betterment of the society and centralize cloud service. So this is beneficial for the society they can check any service is available right from their home [12].

SECURITY ISSUES IN INTERNET OF THINGS

Security is one of the major aspects of Internet of Things. Because whenever we say internet the first thing that comes in mind is security because as soon as anything gets connected to internet we can say we are connection to the rest of the world through a network and on this planet there is no device which is totally secure so there are some security measure we have to take to secure Internet of Things. If anybody can get unauthorized access to Internet OF Things it can be dangerous as Internet of things have full permission to do anything. So there are some basic measure authentication, authorization, and access control [7].

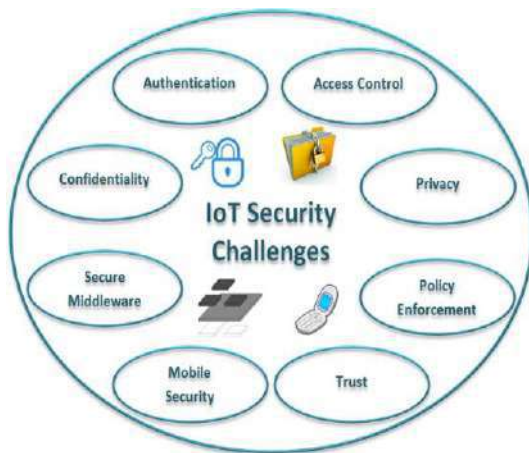


Fig.3: Security Challenges in IoT [7]

In authentication a user is given with a specific user id and the password until and unless he enters that specific credential he won't be allowed to access the data. These credentials are confidential so they should be kept personal and should not be shared with someone else. Authentication makes the use of custom encapsulation mechanism namely intelligent service security Application protocol. It has cross-platform communication with encryption signature and authentication to improve the security. It is based on two-way authentication security scheme and it is placed between transport layer and application layer. Currently authentication is based on RSA Algorithm; these all things provide confidentiality and authenticity. We can check our confidentiality and integrity by analyzing how Key Management System could be applied to the IoT context. There is another approach Object Naming Service (ONS), which helps us to identify security requirement (trustworthy and attack resistance) whether our devices is capable of these types of attacks or not. The key is establish on the basis of Elliptic curve cryptography (ECC), this is another method for the light weight encryption mechanism, this is one of the schemes that define Attribute based access policies managed by attribute authority[7] . By this we can use Authentication and confidentiality.

Access control refers to the access given to a particular user to access the data, the access is given depends upon the authority of the user. This access list is defied at the database which checks every credential of the user and allows the type of access to him. The client subsystem helps in user authorization so no other user can access unauthorized data [7].

RESULTS

One time password is latest cryptographic trend in the sensitive online transactions. Attribute Based Encryption is widely used technique. In proposed approach, both cryptographic techniques are applied simultaneously. Internet of things uses security approach at some extent. Multiple IT appliances are included in internet of things which requires multiple security approaches to enhance its security level.

User credentials

IoT application layer is used as a part of user interface through which user credentials are accepted. Based on accepted user credentials, next procedure is started. User credentials are considered to authorize and identify user [13]. IoT application layer is installed in respective IoT devices which will create common interface to securely access devices. Logical system understands according to authorized user and respective devices.

Attribute selection

Based on IoT device and user credentials identification, attributes are used. Attributes are allocated according to these two entities considered as device used and user credential. While designing setup and synchronizing it with server, attribute allocation is done. For example if printer P is considered and User U is accessing based on IoT, respected attributes will be considered. Attribute set includes all attributes related to considered user and IoT appliance. Particular user has regarding attributes and IoT based appliance has regarding attributes.

Attribute Allocation

Based on user, attribute sets are created. $U_1, U_2, U_3, U_4, \dots, U_n$ are registered user sets which has respective attributes based on user credentials and registered user details [13]. Also devices or appliances which have secure access based on IoT, are registers according to attributes sets and respective attributes. $D_1, D_2, D_3, D_4, D_5, \dots, D_n$ are attribute sets according to IoT appliances.

$$\begin{aligned}
 U_1 &= \{ U_{11}, U_{12}, U_{13}, U_{14}, \dots, U_{1n} \} \\
 U_2 &= \{ U_{21}, U_{22}, U_{23}, U_{24}, \dots, U_{2n} \} \\
 U_3 &= \{ U_{31}, U_{32}, U_{33}, U_{34}, \dots, U_{3n} \} \\
 &\vdots \\
 &\vdots \\
 &\vdots \\
 U_n &= \{ U_{n1}, U_{n2}, U_{n3}, U_{n4}, \dots, U_{nn} \}
 \end{aligned}$$

User attributes are allocated accordingly. User attribute sets are created according to user registration.

$$\begin{aligned}
 D_1 &= \{ D_{11}, D_{12}, D_{13}, D_{14}, \dots, D_{1n} \} \\
 D_2 &= \{ D_{21}, D_{22}, D_{23}, D_{24}, \dots, D_{2n} \} \\
 D_3 &= \{ D_{31}, D_{32}, D_{33}, D_{34}, \dots, D_{3n} \} \\
 &\vdots \\
 &\vdots \\
 &\vdots \\
 D_n &= \{ D_{n1}, D_{n2}, D_{n3}, D_{n4}, \dots, D_{nn} \}
 \end{aligned}$$

Here, attribute sets and attributes are allocated according to registry done in the attribute storage database. Here U_1 may be any user who has some user credentials, and user details. Based on user details, attributes are allocated [14].

$$\begin{aligned}
 U_1 &= \{ \text{'name'}, \text{'mob'}, \text{'city'}, \text{'dob'}, \dots \} \\
 \text{Where 'name'} &= U_{11} \\
 D_2 &= \{ \text{'D\_name'}, \text{'D\_MAC'}, \text{'D\_reg.date'}, \text{'Company'}, \dots \} \\
 \text{Where, 'D\_name'} &= D_{11}.
 \end{aligned}$$

In similar ways rest of the user components are allocated and stored accordingly [14]. If user has entered user details, accordingly user attributes are selected from attribute set. If U_1 is user and respective user attributes are as per attribute sets, these will be selected randomly by using randomized selection algorithm R_d . In this case, attributes selected can be $U_{11}, U_{13}, U_{15}, U_{16}$. There is no any specific logic is applied for attribute selection. Even there is possibility of same attribute selection in next attempt. Even though, in case of device attribute selection same thing is applied. Logic depends on the randomized selection algorithm. Device or appliance attributes can be selected according to applied logic such as for device D_2 , randomly attributes can be selected as $D_{21}, D_{23}, D_{24}, \dots, D_{2n}$.

$$\begin{aligned}
 U_n &\xrightarrow{R_d} U_{nf} \\
 D_n &\xrightarrow{R_d} D_{nf}
 \end{aligned}$$

Based on randomized selection algorithm, finalized sets U_{nf} and D_{nf} are formed which are considered as final attribute sets to apply encryption techniques. Rest of the device attributes are allocated and stored accordingly.

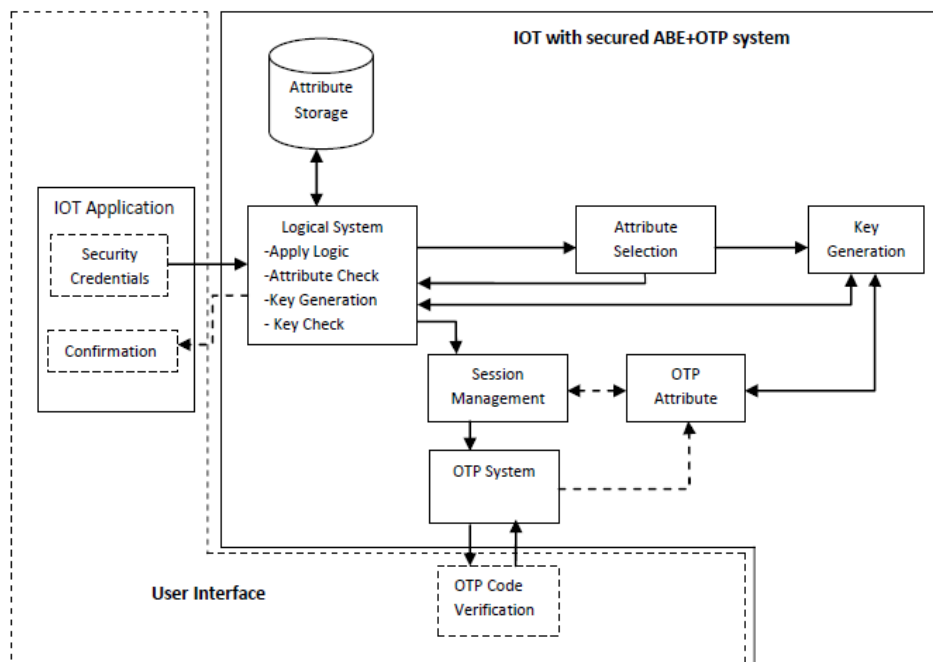


Fig. 4: IoT with Secured ABE+OTP System

Main attribute set formation

After attributes selection, finalized attribute sets are added to form main attribute set. Main attribute set is formed from finalized attribute sets. In this paper, two algorithms are applied. While selecting attributes, randomized sort algorithms is applied. And RSA algorithm is applied to form encrypted data [15]. To provide an access to the IoT based appliance, these encrypted formatted data is verified. At the application layer side, encryption as well as decryption is done. Consider user attributes and devices attributes are selected as $U_{11}, U_{13}, U_{15}, U_{16}$ and $D_{21}, D_{23}, D_{24}, \dots, D_{2n}$ respectively. Attribute sets are combined further to form main attribute set A_n .

$$A_n = U_{nf} + D_{nf}$$

$$A_n = \{U_{11}, U_{13}, U_{15}, U_{16}, D_{21}, D_{23}, D_{24}, \dots, D_{2n}\}$$

RSA algorithm is applied to process formed attribute set [1]. After applying RSA algorithm, main data is encrypted based on which encrypted key is generated [15].

$$A_n \xrightarrow{\text{RSA\_E}} E_{A_n}$$

Here E_{A_n} is an encrypted key. This encrypted key is called as primary key. Important condition to access IoT appliance is, primary key should be equal to the secondary key. Secondary key is generated according to the One Time Password elements set.

OTP approach

Based on selected attribute, One time password is generated. One time password is a combination of numbers, alphabets and special characters. Attribute allocation table is formed while installing IoT application layer. Each attribute is allocated with some special character. According to selected attributes, numbers, alphabets and special characters are allocated and OTP set O_s is formed. For above example, it can be,

$$A_n = O_s \setminus \{U_{11}, U_{13}, U_{15}, U_{16}, D_{21}, D_{23}, D_{24}, \dots, D_{2n}\}$$

$$O_s = \{'1', '9', '7', '3', 'X', 'A', '@', \dots, '\$'\}$$

User has to enter OTP elements to validate him as an authorized user. Based on one time password, encryption key is generated. This encrypted key is called as secondary key.

$$O_s \xrightarrow{\text{RSA\_E}} E_{O_s}$$

Since same encryption algorithm is applied on same attribute set with same attributes sequence, generated key is similar to the primary generated key.

$$E_{A_n} = E_{O_s}$$

To identify the equality between two keys, decryption modules are applied on both sides. IoT application layer has encryption as well as decryption module. In decryption module, encrypted data is decrypted and it will automatically provide access to the requested IoT appliance.

$$E_{A_n} \xrightarrow{\text{RSA\_D}} A_n$$

$$E_{O_s} \xrightarrow{\text{RSA\_D}} O_s$$

$$\text{But } A_n = O_s$$

After attribute based details checking, it is confirmed that both primary and secondary keys are same. Then only IoT based user has access to the requested IoT appliance.

CONCLUSION

In proposed approach user and appliance attributes are used instead of actual data which shows data hidden approach. Selected attributes are used using randomized selection algorithm, shows situation based attribute selection method. One time password is generated based on selected attributes in terms of different ASCII sets. It increases levels in user authorization and validation process. Encryption key is generated using RSA algorithm where proposed approach based data is used. Combining these approaches simultaneously including attribute allocation, selection, applying encryption algorithms and One time password, enhances the security level to access IoT appliances.

CONFLICT OF INTEREST

The authors declare no conflict of interest

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

QUALITY OF AIR AND NOISE LEVEL ASSESSMENT AT CONSTRUCTION SITE

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ABSTRACT

In a world that is fast moving towards intensive infrastructural development to meet the ever changing standards of globalization, the focus from environmental hazards has unfortunately been removed. Construction activities have seen an exponential rise over the years especially in Indian metropolitan cities which has brought along with it increased risks of ambient air pollution and noise pollution that have adverse effects on human life. With respect to the above problem statement, the focus has been to conduct a cohesive and comprehensive study on the effects of construction works with regards to air and noise pollution. The methodology adopted was to carry out the studies on the release of suspended particulate matter as a consequence of dust emission at the construction site using a High Volume Air Sampler. Other data like temperature of the day at site was recorded, wind speed at the site was recorded (from meteorological data) to relate variation of concentration SPM with climatic condition during the study period. The sound levels were also investigated using Sound Meter at the construction site simultaneously during the study period. An attempt has been made to find variation of the noise levels with working hours. The recorded SPM concentration at site was compared with National Ambient Air Quality Standards to assess the pollution level. Similarly the recorded sound levels were compared with National Ambient Air Quality Standards with respect to Noise. An attempt has been made to suggest mitigation measures that can be applied by institutions to counteract the harmful effects of dust emissions and noise pollution due to infrastructure projects that our development needs but also to safeguard our environmental needs.

INTRODUCTION

Emissions of dust to air can occur during the preparation of the land (e.g. demolition, land clearing, and earth moving), and during construction. Emissions can vary substantially from day to day, depending on the level of activity, the specific operations being undertaken, and the weather conditions. In terms of effects, construction sites can give rise to annoyance due to the soiling of surfaces by dust. Very high levels of soiling can also damage plants and affect the diversity of ecosystems. Additionally, there is evidence of major construction sites increasing long term particulate matter (PM₁₀) concentrations and the number of days when PM₁₀ concentrations exceed 100µg/m³ [1], the daily limit value for this pollutant. Exposure to PM₁₀ has long been associated with a range of health effects. Controlling construction noise can pose special problems for contractors. Construction activities often take place outside where they can be affected by weather, wind tunnels, topography, atmosphere and landscaping. Construction noise makers vary considerably in its intensity throughout a work day. High noise levels on construction worksites can be lowered by using commonly accepted engineering and administrative controls. Normally, earplugs and other types of personal protective equipment (PPE) are used to control a worker's exposure to noisy equipment and work areas. According to the center for construction research and training (CPWR) 73% of all construction workers are exposed over the noise recommended exposure limit [2].

METHODS

Dust analysis

- A. Initial Stage Heat the Whitman Glass Fiber filter paper for 15 minutes at the temperature 2°C - 3°C higher than the room temperature and cool it for 15 minutes then take its initial weight [3]. Then place the filter paper in High Volume Air Sampler and keep the sampler in construction site [Fig. 1]. As per to IS : 5182 (Part 14), 2000, the sampler should be placed at the height of 3±0.5 m from the ground level and should never be placed at the corner [Fig. 2] [3]. Now set the time between 4-6 hours and set its flow between 900 lpm to 1200 lpm (liters per minute). Now switch on the machine and keep it running up to its set time.
- B. Final Stage Once the machine is stopped then take the final weight of filter paper in weighing machine and do the calculation for SPM concentration.
- C. Figures:

Noise analysis

- A. Initial Stage Select some points around the construction site and then use the sound meter on each point to note down the noise level in dB (decibel) [Fig. 3]. Place the sound meter at 1.5m height from the ground level and 3m away from the source.
- B. Final Stage At every 1 hour interval note down the sound level from each allocated points. Make the observation table to note down each data's.
- C. Figure:

KEY WORDS

High Volume Air Sampler, National Ambient Air Quality Standards, Sound Meter, Suspended Particulate Matter (SPM).

Published: 29 Sept 2016

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Fig. 1: Inside view of high volume air sampler

Fig. 2: Placing of high volume air sampler on construction site



Fig. 3: Reading displayed in sound meter

Calculation for dust

Below is just a sample calculation to be done for obtaining the value of SPM of that particular day.

Initial weight of filter paper (W1) = 2.7345 grams

Final Weight of filter paper (W2) = 3.3490 grams

Weight of dust collected (W2-W1) = 0.6145 grams

Initial Flow = 900 liters/min = 900/1000 = 0.9 m³/min

Final flow = 900 liters/minute = 900/1000 = 0.9 m³/min

Time = 5 hours = 5*60 = 300 minutes

Solution

Volume of air sampled at 32 degrees Celsius, 690 Hg = 300*.9 = 270 m³

Volume of air sampled at 25 degrees Celsius, 760 Hg = 300*.9 = 239.505 m³

$P_1V_1/T_1 = P_2V_2/T_2$

» $690 \times 270 / (273 + 32) = 760 \times V_2 / (273 + 25)$

» $V_2 = 239.505 \text{ m}^3$

Therefore, Suspended Particulate Matter (SPM) = $(W_2 - W_1) \times 106 / V_2$

» $6145 \times 106 / 239.505 = 2565.70 \text{ } \mu\text{g/N-m}^3$.

Units for dust

- The SI unit for weight of filter paper and dust collected is in gms (grams).
- The SI unit for temperature is in K (Kelvin).
- The unit for volume of air sampled is in m³ (cubic meter).
- The SI unit for concentration of SPM is $\mu\text{g/N-m}^3$ (micro gram per normal cubic meter).

Units for noise

- The SI unit for noise is in dB (decibels).

Equation used for dust analysis

$$1. \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$2. \text{Concentration of SPM} = \frac{\text{weight of dust collected} \times 10^6}{V_2}$$

Equation (1) is used for finding the value of V_2 . Once V_2 is known then the concentration of SPM can be known with the help of equation (2).

RESULTS

Dust analysis

Below is the observation table with the highest value of SPM that is found on different locations [Table 1]. The work was conducted for 20 days on each sites and the readings were obtained with respect to it. The meteorological factors i.e. wind speed (in km/hr) and temperature (in °C) was also noted down and graph was plotted to see the relation between meteorological factors and SPM.

Time: 10:00 AM to 03:00 PM

Limit: $100 \mu\text{g}/\text{Nm}^3$ [1]

Table 1: Highest value of SPM readings from different places of Bangalore

Places in Bangalore	Highest SPM readings	Places in Bangalore
Mathikere	2565.702 $\mu\text{g}/\text{Nm}^3$	Mathikere
White Field	2737.723 $\mu\text{g}/\text{Nm}^3$	White Field
Electronic City	2015.124 $\mu\text{g}/\text{Nm}^3$	Electronic City
Bannerghatta	1975.482 $\mu\text{g}/\text{Nm}^3$	Bannerghatta



Fig. 4: Graphical representation of SPM vs. days

The graphical representation of SPM Vs Days by considering all the places together [Fig. 4]. The green line indicates the limit as specified by Indian regulations ($100 \mu\text{g}/\text{N-m}^3$).

The graphical representation of SPM vs. temperature by considering all places together [Fig. 5]. As can be seen, the trend shows that SPM increases with increases in temperature. An instance where this trend is not followed is owing to the nature of work at construction. On correlation to preceding graph, one will note that overall SPM emission on these days was low due to reduced activity at site.

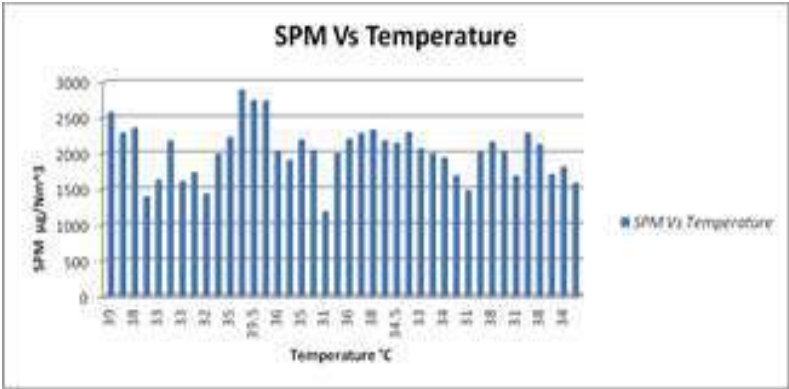


Fig. 5: Graphical representation of SPM vs. temperature

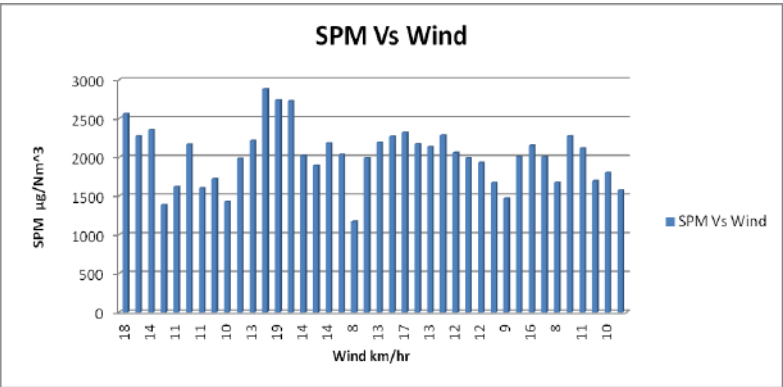


Fig. 6: Graphical representation of SPM vs. wind speed

The graphical representation of SPM Vs Wind speed by considering all places together [Fig. 6]. As can be seen, the trend shows that SPM increases with increases in wind speed. Instances where this trend is not followed is owing to the nature of work at construction. On correlation to preceding graph, one will note that overall SPM emission on these days was low due to reduced activity at site.

Noise analysis

Below is the observation table with the highest value of noise level found on different locations at different points [Table 2]. The readings were taken for 20 days and at each points reading is taken at an interval of 1 hour. Then the graph was plotted by combining all the points to check its effect with respect to time.

Time: 10:00 AM to 03:00 PM
Limit: For Commercial
Area: Day time - 65 dB [4]
Night time- 55 dB [4]

Table 2: Highest value of sound meter readings from different places of Bangalore

Places	Points	
	A	B
Mathikere	70.3 dB	68.5 dB
White Field	74.5 dB	70.4 dB
Electronic City	72.4 dB	68.7 dB

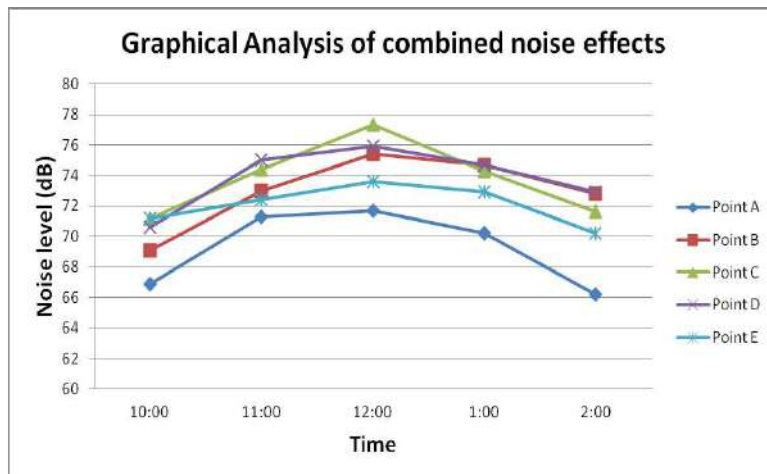


Fig. 7: Graphical representation of Noise level (dB) vs. time

The graphical representation of noise level with respect to time [Fig. 7]. As can be seen, the trend shows that the noise level increases most to the peak time of 12 noon afterwards the noise level gets decreased as the rate of work at construction site gets decreased.

SUGGESTIONS

Administrative measures

1. Develop and implement a stakeholder communications plan that includes community engagement before work commences on site [5].
2. Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The desirable measures should be included as appropriate for the site [5].

Site management

3. Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken [6].
4. Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimized. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes [6].

Monitoring

5. Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary [7].
6. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Preparing and maintaining the site

7. Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible [8].
8. Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period [8].
9. Keep site fencing, barriers and scaffolding clean using wet methods [8].
10. Spray water on the site after every half hour or 1 hour, so that all the dust particles will settle down and there will be less air pollution.
11. Grow more trees around the construction site.

For Noise

Basic controls

1. Construction noise makers, e.g., heavy earth moving equipment, can move from location to location and is likely to vary considerably in its intensity throughout a work day [9].
2. Normally, earplugs and other types of personal protective equipment (PPE) are used to control a worker's exposure to noisy equipment and work areas [9].

Engineering controls

Engineering controls modify the equipment or the work area to make it quieter. Examples of engineering controls are: substituting existing equipment with quieter equipment; retro-fitting existing equipment with damping materials and maintenance. Keep machinery covers and panels closed and well fitted. Bolts/fasteners done up tightly avoid rattles [9].

Administrative controls

These are management decisions on work activities, work rotation and work load to reduce workers' exposure to high noise levels. Typical management decisions that reduce worker exposures to noise are: moving workers away from the noise source; restricting access to areas; rotating workers performing noisy tasks; and shutting down noisy equipment when not needed [10].

CONCLUSION

From the above work it is already found that the construction site leads to emit very heavy concentration of suspended particulate matter (SPM) in the atmosphere and produces high amount of noise level which leads to noise pollution. As the limit provided by Central Pollution Control Board (CPCB) for dust [1] and noise [4] is found to be not at all followed at construction works which slowly affects our atmosphere. The values mentioned here are just for the four locations in the Bangalore, thus we can fairly make an idea that on whole the Bangalore city pollution is on higher scale. Thus we can conclude that the pollution coming from all the cities in India sums up and create a larger pollution and affects our environment adversely. It's a very high time that the mitigation measures are needed to be followed at each and every state's construction sites.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The first author acknowledges the immense help received from the Tanoy Dutta, Bryan Andrew Kharshandi and Nripendu Sharma (students of MSRIT, Bangalore). The author is also grateful to publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

FINANCIAL DISCLOSURE

None.

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ARTICLE

AN APPROACH FOR IRIS SEGMENTATION AND MACULOPATHY DETECTION AND GRADING OF DIABETIC RETINAL IMAGES

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ABSTRACT

Diabetic macular edema (DME) is a common vision threatening complication of diabetic retinopathy which can be assessed by detecting exudates (a type of bright lesion) in fundus images. Diabetic maculopathy is the major cause of irreversible vision loss due to retinopathy and is found in 10% of the world diabetic population (L. Giancardo-2011). Compulsory mass screening will help to identify the maculopathy at early stage and reduce the risk of severe vision loss. Retinal Image Analysis is a key element in detecting retinopathies in patients. It assists in the automatic detection of pathologies such as diabetic retinopathy (DR), macular degeneration, and glaucoma. Optic Disc (OD), macula and retinal vasculature are all important anatomical structures in the retina (Anantha Vidya Sagar-2007). Diabetic retinopathy is one of the retina problems in which a diabetic patient suffers from serious vision loss due to the affected macula region of retina. It affects the vision of the person and causes blindness in most severe cases. In this paper, proposing an automatic system for the iris recognition and grading of diabetic maculopathy that will assist the ophthalmologists in detection of the disease. The proposed work first segments the iris if an image and extracts the macula from digital retinal image using the vascular structure and optic disc location. It creates a binary map for possible exudate regions using filter banks and formulates a detailed feature vector for all regions (Anam Tariq-2013). Iris Recognition is one of the most powerful biometrically based technologies for human identification and verification that utilizes the iris patterns which exhibits uniqueness for every individual. In this manuscript, a new algorithm is proposed for iris recognition on distant images. The novelty of this algorithm includes recognition through iris patterns based on both the left and right eye of an individual so as to improve the recognition accuracy and computational efficiency. In this work, iris of retina image is segmented and from fundus retinal images, exudates are detected and classified as soft and hard exudates for grading of maculopathy.

INTRODUCTION

KEY WORDS

Maculopathy, Fundus images, Retinopathy, Iris recognition, Diabetic macular edema

Published: 29 Sept 2016

Person identification based on iris is becoming a very useful tool rapidly as compared to other biometric security techniques due to its standard epigenetic pattern remains stable. The past development in the field of digital image processing makes it very economical and automated for digital iris images. The classification of spatial iris patterns helps to recognize the individual effectively. The cornea and the eyelid act as a shield for the iris and protect it from adverse environmental effects. These in all inherent properties make iris recognition as the most suitable security solution. The first automated iris recognition concept was given by Flom and Safir in the year 1987 based on the reason that varying the brightness to force pupil to a predetermined size to overcome with the problem of contraction and expansion of pupil. But the image capturing conditions they addressed were not that practical. Then the most widely used methodology was developed by Daugman has used multi-scale quadrature wavelets to extract texture phase features of the iris to generate iris templates and compared the difference between a pair of those by computing their Hamming distance (HD).

The major disease all over the people is diabetes in which the lack of insulin in human body causes high blood sugar in human beings. Long-term diabetes also affects the human retina resulting in a condition known as diabetic retinopathy (DR). This problem damages the retinal blood vessels leading them to leak which finally leads to blindness. DR of any stage develops in nearly all of the patients having diabetes of type 1 and about 60% of the patients with diabetes of type 2. The percentage of diabetes patients is high in almost every region of the world especially in industrialized countries which makes a high chance of DR sufferers. There are many stages of DR such as no proliferative DR (NPDR), proliferative DR (PDR) and maculopathy or macular edema (ME). NPDR is known as background DR, whereas PDR and ME are the advance stages of DR. Diabetic patient can have different signs of retinopathy such as micro aneurysms, hard exudates, hemorrhage and cotton wool spots (CWS) at different stages of DR. Micro aneurysms are weak dark red spots developed on blood vessels that bulge outward. They are the first detectable change in there tin a due to diabetic retinopathy. In this proposed method, iris segmentation, normalized and noise pattern extraction, exudates detection and classification are performed which will assist ophthalmologist for diagnosis of retinal diseases.

PROPOSED WORK

Iris recognition system

The proposed iris recognition system involves below steps:

1. Pre-processing.
2. Normalized pattern extraction.
3. Noise pattern extraction.

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4. Iris segmentation.

Maculopathy detection system

The proposed Maculopathy detection Algorithm involves the following steps:

1. Pre-Processing.
2. Green channel extraction, Contrast enhancement.
3. Segmentation.
4. Optic disk elimination.
5. Retina regions detection.
6. Exudates detection.
7. Exudate classification.
8. Grading.



Fig. 1: Block diagram of iris segmentation

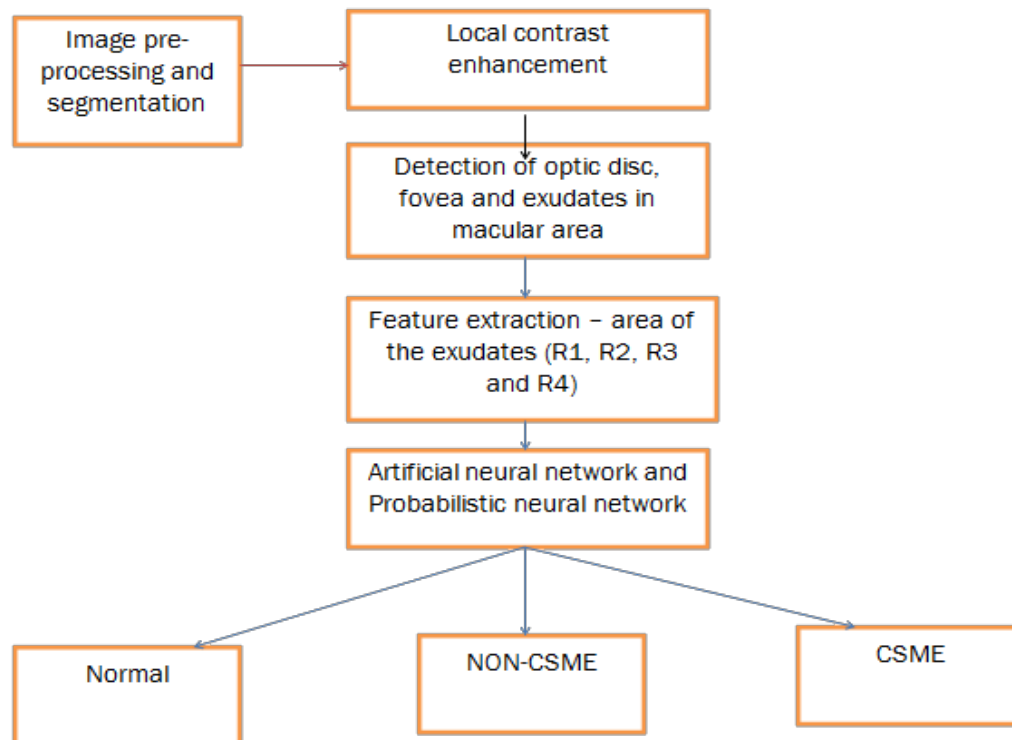


Fig. 2: Block diagram of maculopathy detection

METHODS

Iris Segmentation

The Hough transform is a computer vision algorithm that can be used to find the parameters of simple geometric objects, such as lines and circles, present in an image. The circular Hough transform can be used to deduce the radius of the pupil and iris regions and center coordinates of the pupil and iris regions. An automatic segmentation algorithm based on the circular Hough transform is employed by Wildes. Initially, an edge map is generated by calculating the first derivatives of intensity values in an eye image and then threshold the result. From the edge map, votes are cast in Hough space for the parameters of circles passing through each edge point. These parameters obtained are the Centre coordinates X_c and Y_c , and the radius r , which are able to define any circle according to the equation. A maximum point in the Hough space will correspond to the radius and Centre coordinates of the circle best defined by the edge points. Wildes et al. and Kong and Zhang also make use of the parabolic Hough transform to detect the eyelids, approximating

the upper and lower eyelids with parabolic arcs, which are represented as to performing the preceding edge detection step, Wildes et al. bias the derivatives in the horizontal direction for detecting the eyelids, and in the vertical direction for detecting the outer circular boundary of the iris. The motivation for this is that the eyelids are usually horizontally aligned, and also the eyelid edge map will corrupt the circular iris boundary edge map if using all gradient data. Taking only the vertical gradients for locating the iris boundary will reduce influence of the eyelids when performing circular Hough transform, and not all of the edge pixels defining the circle are required for successful localization. Not only does this make circle localization more accurate, it also makes it more efficient, since there are less edge points to cast votes in the Hough space.

Segment iris

Performs automatic segmentation of the iris region from an eye image. Also isolates noise areas such as occluding eyelids and eyelashes.

Find circle

Returns the coordinates of a circle in an image using the Hough transform and Canny edge detection to create the edge map.

Linecoords

Returns the x y coordinates of positions along a line.

Find line

Returns the coordinates of a line in an image using the linear Hough transform and Canny edge detection to create the edge map.

Hough circle

Takes an edge map image, and performs the Hough transform for finding circles in the image.

Add circle

A circle generator for adding (drawing) weights into a Hough accumulator array. NONMAXUP - Function for performing non-maxima suppression on an image using an orientation image. It is assumed that the orientation image gives feature normal orientation angles in degrees (0-180).

Ajdgamma

Adjust image gamma. Image gamma value in the range 0-1 enhance contrast of bright regions, values > 1 enhance contrast in dark regions. HYSTHRESH - Function performs hysteresis threshold of an image. CANNY - Function to perform canny edge detection.

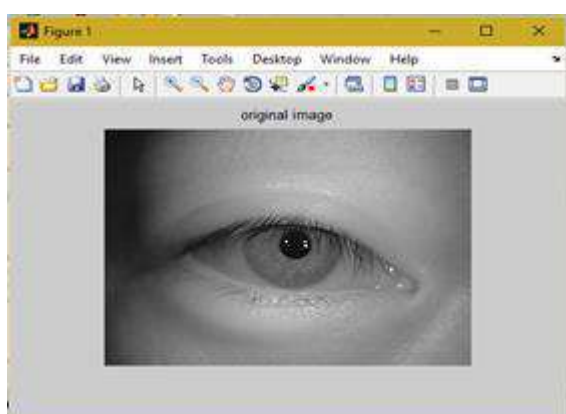
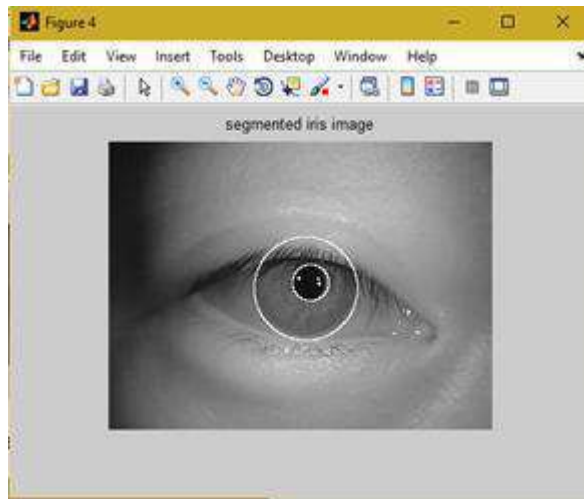
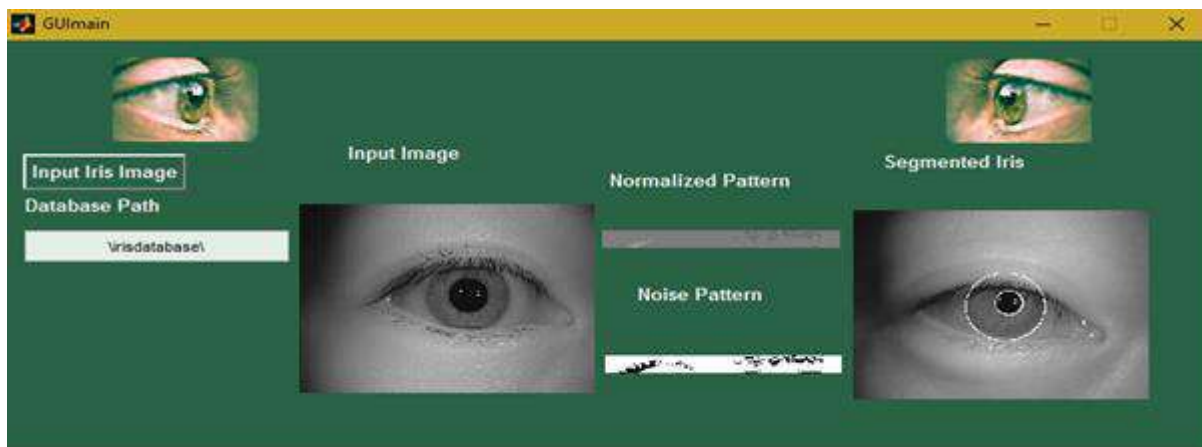


Fig. 3: Original input image



Fig. 4: Normalized Pattern


Fig. 5: Noise pattern

Fig. 6: Segmented Iris

Fig. 7: Iris Segmentation GUI

Maculopathy detection

Image pre-processing

There is dissimilarity in the colour of the fundus images of different patients. This dissimilarity is strongly related to the person's skin pigmentation and iris colour. Other reasons like intrinsic attribute of lesions, decreasing colour dispersion at the lesion periphery and lighting disparity, etc. This may result colour of the lesion of some images to be lighter than the background colour. Under these conditions, there is every possibility that these lesions may erroneously be classified as background colour. Therefore, colour normalization is necessary to be performed.

Pre-processing consists of the following steps

1. The RGB image is converted to a green channel or grayscale image.
2. Adjust the intensity values in the image, using 'imadjust' function.

Below Figures shows (a) the original image (b) the Green channel image after intensity values adjustment.

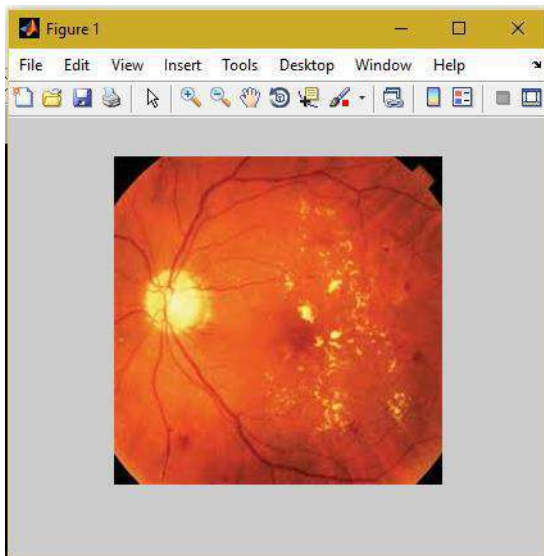
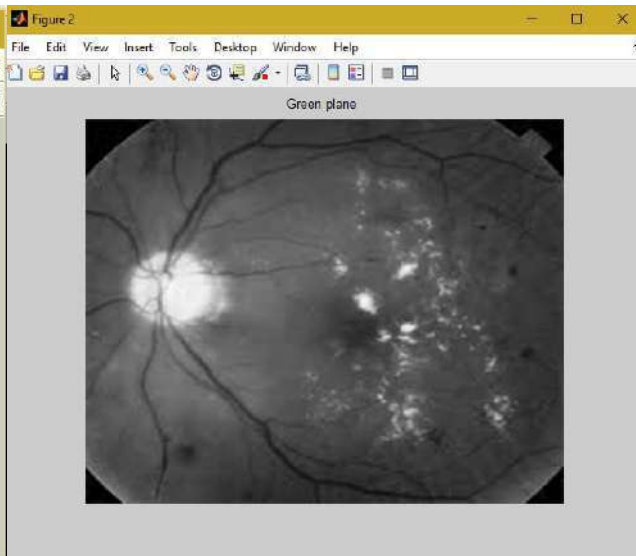
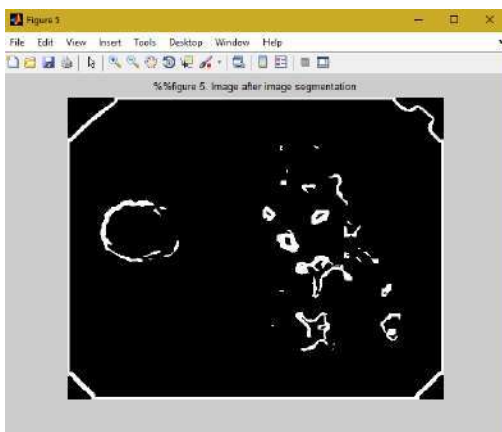

Fig. 8: Original image

Fig. 9: Adjusted Green plane image

Image segmentation

Exudate detection

The exudate identification is done by assigning a score for each exudate candidate. The exudate candidates are selected by running an 8-neighbour connected component analysis. This is implemented in two ways to assign this score, one based on Kirsch's Edges and the other based on Stationary Wavelets. Both methods seek to take advantage of the higher inner and outer edge values of exudates in comparison to non-exudate structures.


Fig.10: Image after Segmentation

Detection of optic disc

In the proposed work there is a need of removing optic disc from eye image to get good results. The optic disc is the exist point of retinal nerve fibers from the eye and the entrance and exist point for the retinal blood vessels. It seems to be similar intensity, colour and contrast to other features on the retinal image. While blood vessels of the retina also appear with very high contrast as the optic disc, the second channel of the input image with morphological erosion operator on the intensity channel will help to eliminate the blood vessels which may remain in the optic disc region. An octagonal structuring element with a fixed radius of fifteen (SE - morphological structuring element) was used.

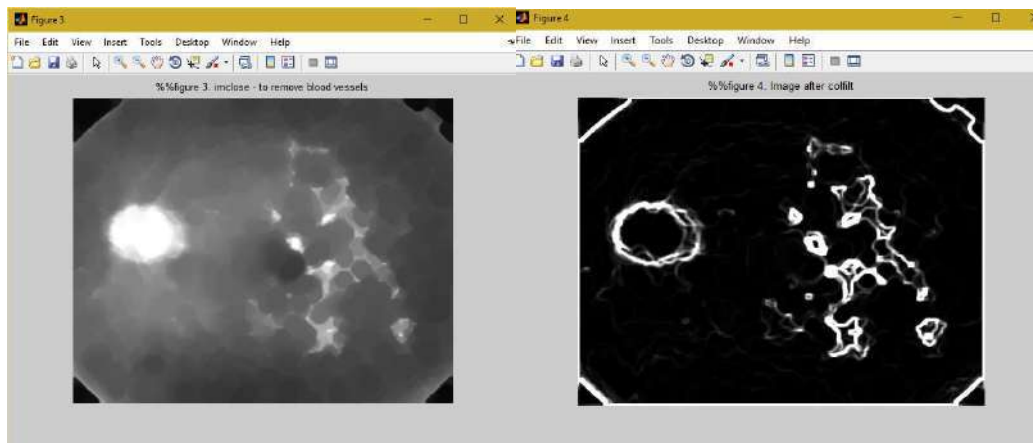


Fig. 11: Image after blood vessel removal **Fig 12:** Image after morphological filtering

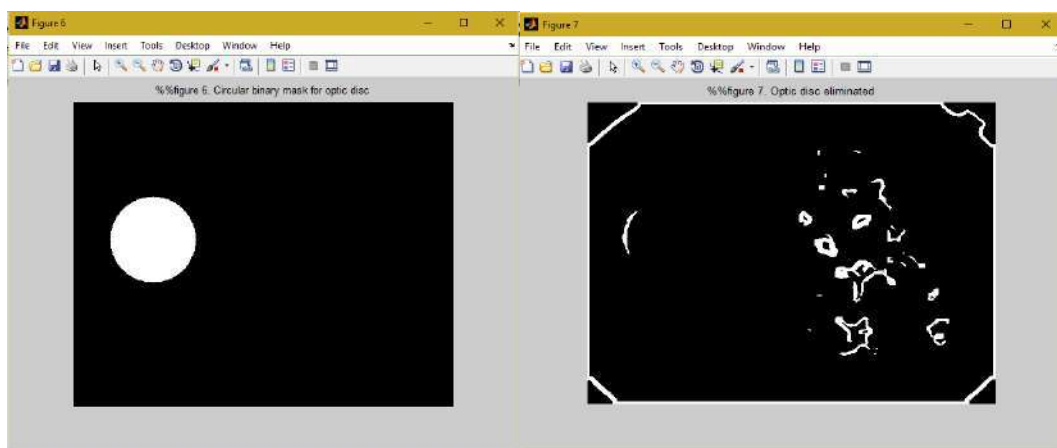


Fig. 13: Circular mask on optic disk

Fig. 14: Optic Disk eliminated image

Detection of fovea

Here is the concept of detecting Fovea in input image. Fovea is close to the Centre of the macula which responsible for our central, sharpest vision. The Centre of the fovea is normally located at a distance of nearly 2.5 times the diameter of the optic disc of retina image, from the Centre of the optic disc. It is the very darkest part of the retina images which some images are not obvious to human eyes due to very high lighting or being covered by lesions.

After detecting the optic disc, the macula region can be determined by setting an area of restriction in the vicinity of the image Centre, as determined by the optic disc Centre. Two circle binary masks from the Centre of the optic disc are draw and the restriction area is set as 478x216 pixels to identify as the macula region. Once the macula region is identified, the location of the minimum of this region was taken as the Centre of the fovea. Below Figure shows the detection of fovea.

Detection of exudates

Retinal exudates are very bright patterns in colour fundus images and they are well contrasted with respect to the background. The shape and size of the exudates vary considerably and their borders are mostly irregular during the progress of the disease. There are other features such as optic disc and blood vessels in the images that cause difficulty to detect exudates. They have high level variation and brightness patterns as compare to the exudates. Morphological image processing techniques are used for detection of exudates. Dilation and erosion are the two fundamental morphological operations. Closing and opening are applied extensively for detecting the exudates. The algorithm developed uses a morphological operation to smooth the background, allowing exudates to be seen clearly. Two types of structuring elements (SE) are used. They

are octagon SE used to remove the vessels from the image and disk-shaped SE used to identify the exudates.

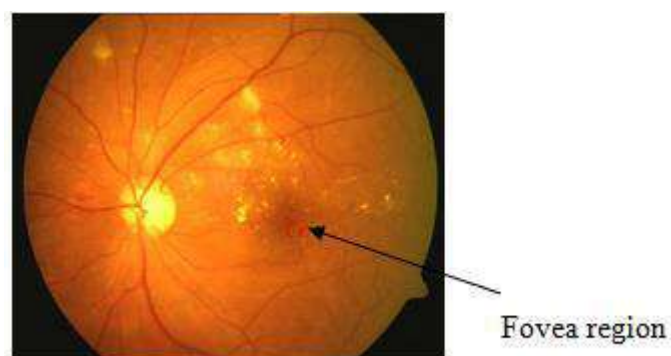


Fig. 15: Detection of Fovea Region

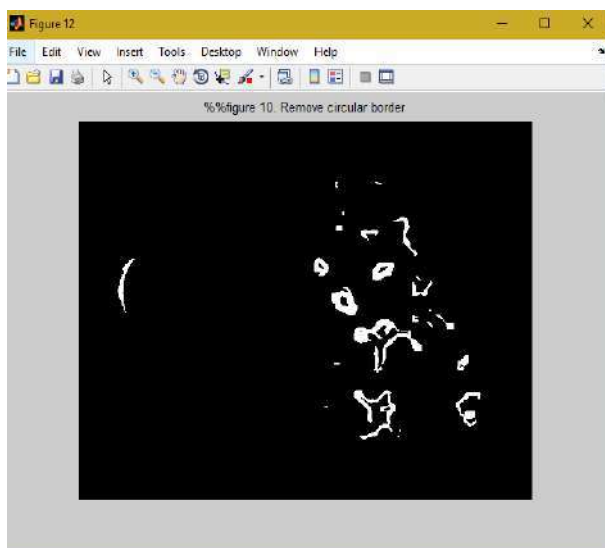


Fig. 16 : Circular boarder removal

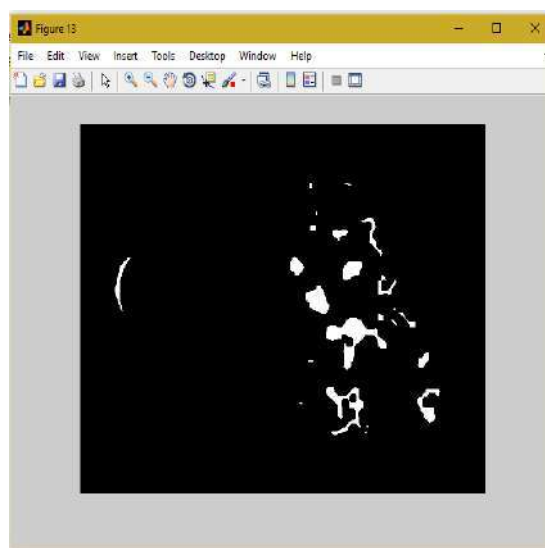


Fig. 17 : Exudates image

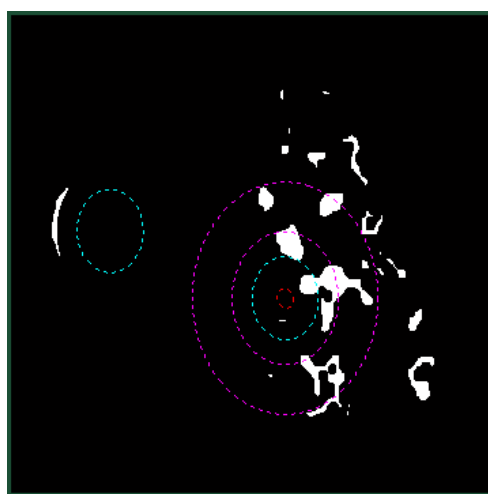


Fig. 18 : Exudates in macula region

Detection of exudates

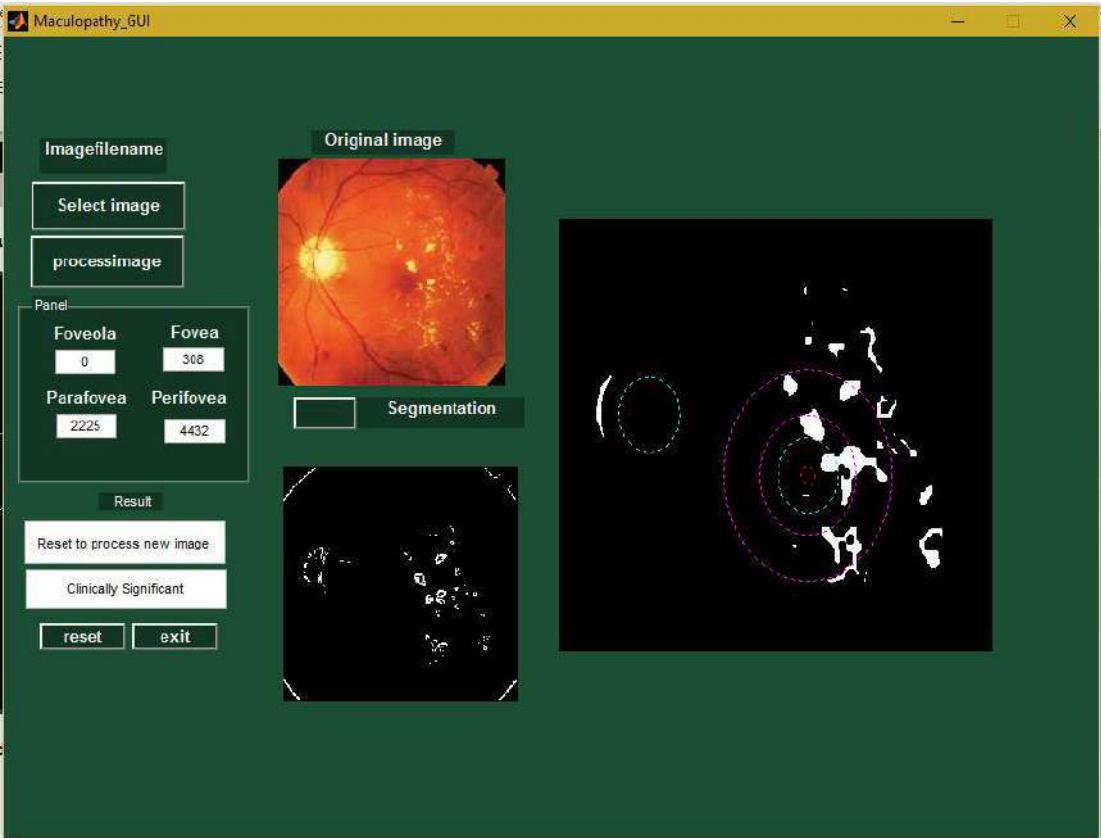


Fig. 19: Maculopathy detection GUI

Images	Normal	Non-CSME	CSME
Original			
Exudates			

Fig. 20: Original images and Exudates results for the three classes

RESULTS

For the proposed work a data base of 50 samples is used for training and testing the classifiers. These samples are divided into 90% training and 10% for testing. The performance measures such as sensitivity, specificity and positive predictive accuracy are used to evaluate the performance of the systems. The terms used to measure the test performance are as follow:

- (TP)- True positive: abnormal subjects with positive test results and are correctly diagnosed.
- (TN)- True negative: normal subjects with negative results and are diagnosed correctly.

(FP)- False positive: normal subjects with negative test results and diagnosed wrongly as abnormal subjects.
 (FN)- False negative: abnormal subjects with positive results and diagnosed wrongly as normal subjects.
 The sensitivity, specificity and positive predictive accuracy are computed as below.
 $\text{Sensitivity} = \text{TP} / (\text{TP} + \text{FN})$
 $\text{Specificity} = \text{TN} / (\text{TN} + \text{FP})$
 $\text{PPA} = \text{TP} / (\text{TP} + \text{FP})$

CONCLUSION

Diabetic maculopathy (DM) is caused from the prolonged diabetes retinopathy and is a leading cause of blindness. It happens when the retinal blood vessels are get damaged and the exudates leakage area increases, deposit very close to the fovea. Hence, an automatic system for identification of normal, Non-CSME and CSME fundus eye image is proposed. For the proposed work iris segmentation and normalized pattern, noise pattern extraction gives more clear information about the iris area and pupil area. Firstly, Iris segmentation is done and then maculopathy detection is performed. The features from the raw images are extracted using image processing techniques, and fed into the feed-forward neural network and probabilistic neural network classifiers for classification. We have concluded that feed-forward neural network classifier perform better than probabilistic neural network classifier with an accuracy of more than 96% of correct classification, sensitivity of more than 96% and specificity of 100%. The accuracy of the system can further be improved using proper input features such as microaneurysms and Hemorrhages, and the size of the training data.

CONFLICT OF INTEREST

The authors declare no conflict of interest

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

A FRAMEWORK FOR AUTOMATIC COLORIZATION OF MEDICAL IMAGING

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ABSTRACT

Background: Good visual quality along with the chromatic information in medical modality significantly improves analysis and diagnosis. This paper presents a novel approach for colorization of medical images preceded by enhancement phase. The heart of proposed framework lies in an efficient enhancement phase, essentially needed for any medical image colorization algorithm. **Methods:** In this proposed framework, the chromatic value is calculated from target reference images on the basis of intensity and then it is assigned to desired source image to achieve the colorization. **Results:** The performance of proposed framework is evaluated on various open source medical images datasets, producing benchmark results. Moreover, quality assurance of resulting colorized images is also carried out by computing chromatic information, measurement of enhancement, structural similarity and signal to noise ratio. On close examination, it was observed that resulting images structurally correspond to source input image with significantly enhanced chromatic and visual information justified by quality parameters. **Conclusions:** The framework can colorize any kind of medical modality which makes it a unique system as compared to other reported algorithms in medical imaging domain. Visual representation statistics and lower time complexity validated its supremacy with other reported methods.

KEY WORDS

Image processing,
medical Images
colorization,
bioinformatics,
enhancement,
chromatic information

INTRODUCTION

The most vital characteristic of materials are colors that contribute in medical image processing for better understanding of biomedical substances. Colorization enhanced the perceptual visibility of grey scale images and videos [1]. Color calibration is one of the essential preprocessing techniques used in computer vision applications. One of the colorization utility known as Black Magic supports users to colorize normal daily life images [2]. On the basis of high quality, colorized medical images assist in different diseases perversion and treatment [3]. Certainly, colorization applications are effectively contributing in entertainment and medical industry.

The proposed algorithm is a novel approach for colorization of medical images that boosts up the treasured information hidden in grey scale images. Visual noise affects the appearance of an image and gives snowy, grainy, textured and speckled form resulting in variation in brightness with no specific pattern. Hence, it is one of the major causes of poor quality in medical imaging [4]. Therefore for the purpose of diagnosis, noise reduction is of fundamental importance [5]. The high contrast of medical modularity also affects accurate diagnosis. Ordinary colorization algorithm for natural images fails to colorize high contrast and noisy medical images. The proposed framework suggests that medical images may get pre-processed through proposed enhancement phase before applying any colorization algorithm, therefore salt and pepper as well as Gaussian noise are removed by a pre-processing phase of colorization.

The main contribution of building proposed framework was to remove all types of noise, restore the medical image and then adopt colorization algorithm to obtain a good quality chromatically improved image. The colorization algorithms are mainly divided into three types, namely automatic coloring, semi-automatic coloring and user coloring methodologies [6].

In 2002, Welsh et al. reported a semi-automatic algorithm for colorization of natural images using $L \alpha \beta$ color space. This algorithm works well only for natural images but the results for medical images were not accurate as one could not differentiate between different types of tissues [7]. Reported studies for colorization of CT images using threshold based pseudo-coloring techniques increases the processing time, memory and maximum power consumption [8, 9]. Brain MRI colorization using voxel classification by matching luminance distance between source and target image is reported [10]. In another technique, modalities with different weights were fused together to produce colorized medical images [11]. Automatic fusion based colorization study contributed in CT and MRI colorization. Reported technique colorized only small infected portion of CT and MRI image [12]. Similarly, Markov random field was used to determine possible chromatic value with prior estimation [13]. Moreover, wavelet packets were utilized to predict pseudo-random code to produce colorized image [14]. Texture information was used to determine the

Published: 29 Sept 2016

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possible chrominance value [15]. Further, video colorization technique to colorize key frame used few color seed and propagated chrominance to remaining pixels. Eventually, remaining similar frames were colorized using generated colorized key frame as reference image [16].

MATERIALS AND METHODS

The proposed framework recommends pre-processing as a key step before applying any colorization process on medical images. The colorization algorithms also differ from other reported studies of colorization of medical images i.e., second and third channels were created in the grey scale image and YCbCr space was used, thus proposed colorization method visually enhances an image. Framework reveals a novel algorithm to colorize any kind of medical modality resulting in a good visual representation and lower time complexity. None of other reported studies uses the second and third channels.

Following pre-processing steps were used for enhancement and noise removal of medical imaging. Initially, noise was removed and contrast of image was adjusted. Edges were highlighted to improve visual understanding. A target color medical image was used as reference to map the chromatic information in input grey scale source image. After mapping, colorized medical image was produced. The quality assessment of resulting colorized medical image was determined by computing quality parameters. An architecture overview of the proposed framework is represented in [Fig. 1].

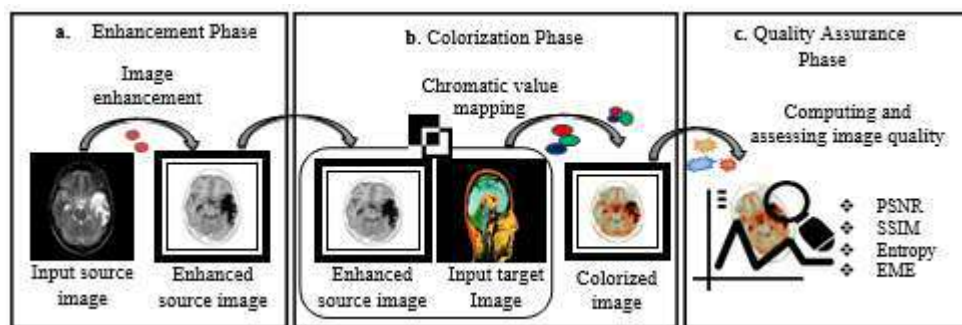


Fig.1: Graphical overview of proposed framework a. enhancing source medical image after preprocessing by enhancement phase b. colorization phase c. quality assurance phase

Image enhancement phase

The grey scale medical images were pre-processed by a series of steps as shown in [Fig. 2]. These enhancement techniques resulted in an improved quality medical image. The source input medical images were acquired of resolution 256×256.

The medical images were converted into process able format and text labels were removed. Noise was removed by weighted averaging filter. Input source image was convolved with weighted kernel of 3×3 pixels neighborhood and resulting pixel under processing with weighted average of its neighboring pixel. Sliding kernel of m×n size was centered at point (x, y) of Image(x, y) where m and n=3.

Considering Zj pixel under processing, whereas, j represents number of pixels ≤9. Rxy denotes an area to compute average of Image(x,y). s and t represent the location of pixel being processed. Following expressions (1-3) represent averaging smoothing process on Image(x, y).

$$\text{Weighted Kernel} = \begin{bmatrix} -1 & -1 & -1 \\ -1 & +12 & -1 \\ -1 & -1 & -1 \end{bmatrix} \quad (1)$$

$$\text{Image}(x,y) = \frac{1}{mn} \sum_{s,t \in R} I(s,t) \quad (2)$$

$$\text{Image}(x,y) = \text{Image}(x,y) * \frac{1}{9} \text{Weighted Kernel} \quad (3)$$

Image(x, y) noise was removed and preceded further for adjusting the contrast to highlight minor details hidden within an image.

After noise removal, image contrast was enhanced and minor details in an image were accentuated. Intensity distribution equalization was used to normalize intensity of Image(x, y). Transformation function (4) represents intensity distribution equalization value.

$$T = \sum_{i=0}^r f_p \cdot \frac{\text{max.intensity img}}{m \times n} \quad (4)$$

Where, f_i was the frequency of intensity value p of number of pixels of an image. Intensity equalization is a transformation function of transferring particular pixel intensity with T intensity value at location i .

Edges of medical images were enhanced by using two 3×3 convolution kernels, K_x and K_y producing horizontal and vertical derivatives as shown in expression (5). It dominates the vertical and horizontal edges of I_x, y to enhance the information. In K_x and K_y , kernels were used to enhance the edge information by subtracting pixels above and below the edge. More weights are assigned to pixels across the edges.

$$K_x = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ +1 & +2 & +1 \end{bmatrix}; K_y = \begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix} \quad (5)$$

Expressions (6-7) represent the edge improvement mathematical formulas.

$$\text{Imgx} = K_x * I(x, y) \quad (6)$$

$$\text{Imgy} = K_y * I(x, y) \quad (7)$$

This makes a noticeable increase in edge intensity and the resulting image became more informative as compared to the original input image. Every pixel value at x, y was being replaced by gradient magnitude at location (x, y) as given in (8).

$$\text{Img}(x, y) = \sqrt{\text{Imgx}^2 + \text{Imgy}^2} \quad (8)$$

The gradient's direction is represented by (9):

$$\angle = \arctan \frac{\text{Imgy}}{\text{Imgx}} \quad (9)$$

The medical image was further processed and its negative was obtained with negative transformation using (10). Negative of image was computed when the dynamic range of image was between $[0 \text{ to } L-1]$ whereas L is maximum intensity and W is pixel intensity under processing respectively.

$$\text{Neg Img}(x, y) = L - W \quad (10)$$

The [Algorithm 1] presents sequences of steps for enhancing medical image.

Algorithm1. Enhancement of medical images

Required: Preprocessed image img when $r \leftarrow$ total number of pixels, where i is pixel under processing

Input: Medical image $\text{Image}(x, y)$

Output: Noise free, sharper edged medical image

Initialization $\text{Image}(x, y)$

Step 1: Resizing $\text{Image}(x, y) \mid \text{rows} \times \text{columns} = 256$

Step 2: Noise removal by weighted averaging filter sliding window of 3×3 convolved with $\text{Image}(x, y)$
while $i \neq r$ do

Noise reduced $\text{Image}(x, y) \cong \text{Image}(x, y)$ convolving Weighted Kernel

end while

Step 3: Contrast improvement by equalizing intensity distribution

while $i \neq r$ do

normalized histogram = $\frac{\text{number of pixels with intensity } p}{\text{total number of pixels}}$

end while

Step 4: Edge improvement by computing absolute gradient and direction.

Step 5: Negative of image when dynamic range of image is between $[0-L-1]$, whereas L is maximum intensity and W is x pixels intensity under processing

while $i \neq r$ do

Neg $\text{Img}(x, y) = \text{maximum intensity} - \text{intensity of pixel under processing}$

end while

Step 6: Return enhanced medical image

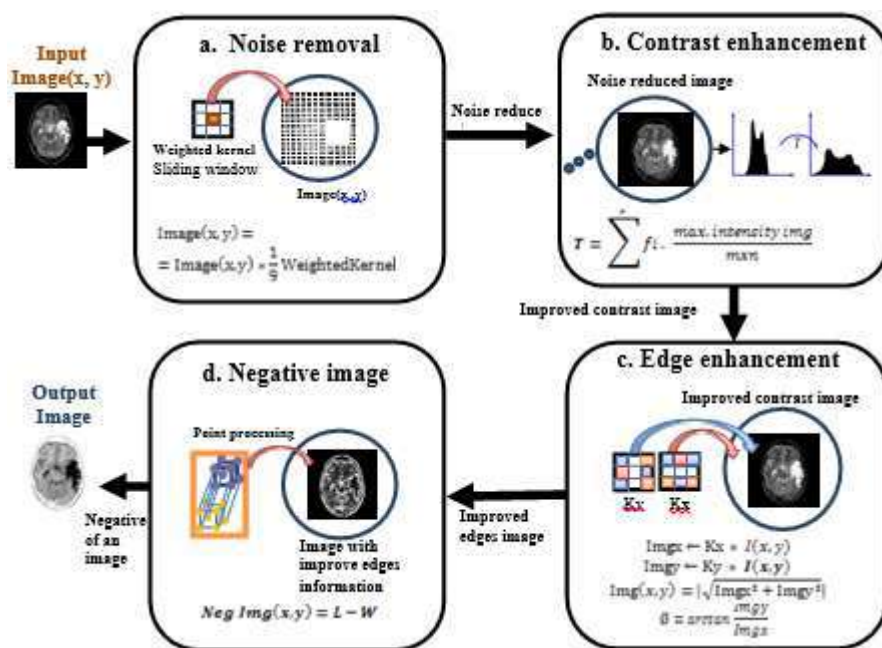


Fig.2: Enhancement phase of proposed methodology a. Noise removal module representing an application of weighted averaging filter on an image b. Contrast enhancement module on an application of transformation function c. Edge enhancement module using K_x , K_y mask convolving with an image and computing gradient with phase d. Negative of an image for better colorization

Colorization Phase

Colorization phase requires input enhanced grey scale source image of 256×256 resolution and target colored medical image of 256×256 resolution to produce a colorized medical image of 256×256 resolution.

The source grey scale medical image has one dimension. In order to convert it into three-dimensional image so that it can hold chromatic information, a second and third channel of size 256×256 was added in it. Initially, a new channel was populated with ones and later these values were updated with the computed chromatic value assigned to the source image. [Fig. 3] depicts the series of steps for colorization of medical images.

Normalization was performed on the input source grey scale image to bring pixels intensity compatible with the target image. In this way, intensity of an image is limited in the specified range. Normalized pixel intensity value N of source image s is shown in (11), where L is maximum intensity value and P is minimum intensity value. The pixel at location x, y was convolved with a maximum value of intensity i.e., 255. The resulting value was divided by $255 - (L - P)$. The intensity of pixel (x, y) was normalized within maximum and minimum intensity range.

$$\text{Normalized pixel value} = \frac{I \times 255}{255 - (L - P)} \quad (11)$$

Then both images i.e., grey scale input source image s and colored target image t was converted into YCbCr color.

Pixels intensity was compared using Y channel of YCbCr of two images and all the source input image pixels were mapped with chromatic value using target image chromatic information. After successful chromatic value assignment, the source image was converted into RGB color space for visualization.

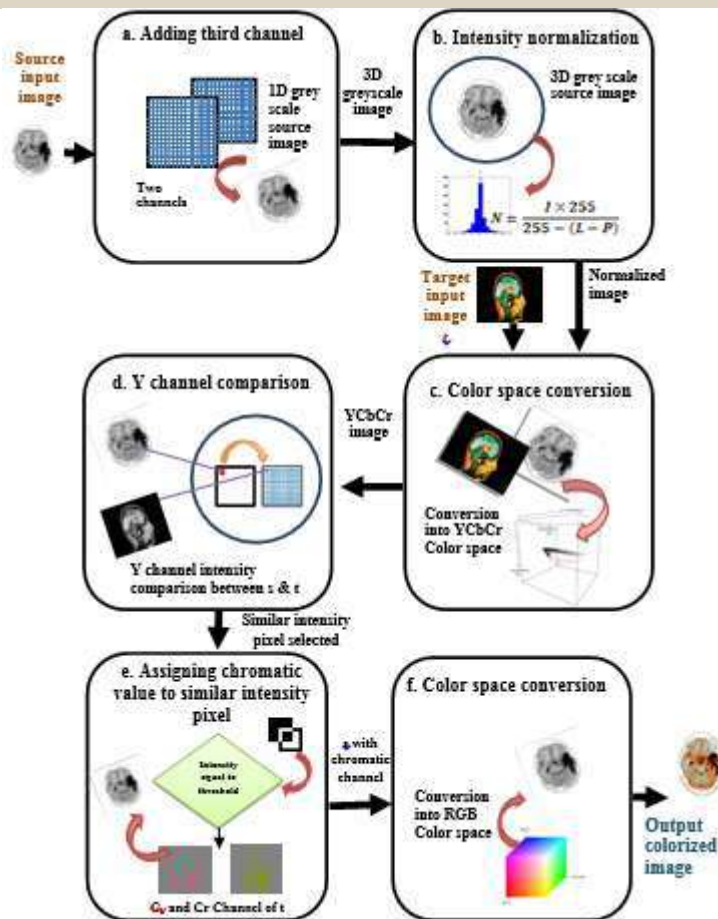


Fig. 3: Colorization phase of proposed methodology **a.** two channels are inserted in 1D grey scale image to form it 3D grey scale image **b.** normalization of grey scale 3D image **c.** converting both target and source image into YCbCr **d.** comparing Y channel pixels intensity **e.** similar intensity value pixels chromatic value C_b C_r of t transferred to the source image. **f.** color space conversion from Y YCbCr to RGB for displaying.

The [Algorithm 2] presents sequences of steps for colorizing medical image.

Algorithm2. Colorization of medical images

Required: Colorized image col_img, when $r \leftarrow$ total number of pixels of source grey scale medical image s , where i is pixel under processing

Input: Pre-processed source grey scale medical image s and target color medical image t

Output: Colorized medical image

Initialization

Step 1: Adding second and third channels in s

Step 2: Normalized intensity value of s , where L is maximum intensity and P is minimum intensity

$$P \leq \text{Normalized pixel intensity} \leq L,$$

$$0 \leq P, L \leq 256, \text{normalized pixel intensity} \leq L$$

Step 3: Converting s and t into YCbCr color space

Step 4: Assigning chromatic value to s

while $i \neq r$ do

Comparing intensity value between s and t

if intensity matched

Transfer the chromatic value from t to s

else

Compare the next pixel

end if

end while

Step 5: Converting s from YCbCr color space to RGB color space

Step 6: Return enhanced colorized medical image col_img

RESULTS

Dataset

The open source dataset's seventy images were utilized for experimental evaluation of proposed framework [18-21].

Results

The proposed algorithm gives a meaningfully better understanding of medical image. On precise observation, various cells, tissues, blood vessels, bones and organs can be significantly examined. Technically it has better efficiency on visual and computation grounds from the reported algorithms [1-16] which show its supremacy as a highly sophisticated medical instrument. The strength of proposed framework is its operational capacity on all types of medical modalities. The average computation time required for colorization was approximately 0.9-1 seconds. The resulting colorized outputs of medical modality validate substantially good visual representation of medical images generated by the proposed algorithm as displayed in [Fig. 4].

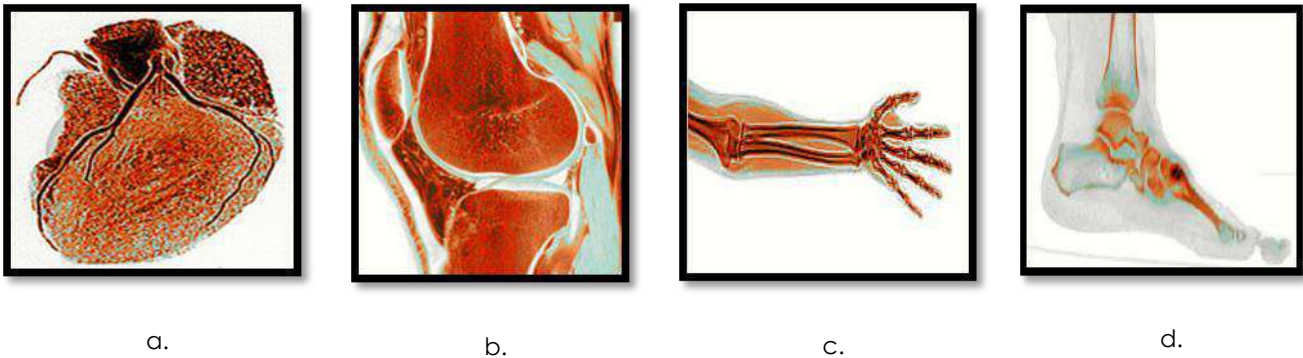


Fig. 4: (a-d): Colorized output of MRI, CT, X-ray and PET images generated by the proposed framework

As all minor details are not fully represented by grey scale medical images, therefore sometimes healthy tissues of similar pixels intensity are considered as infectious by medical experts due to the high contrast of medical modality. Resulting colorized images displayed above justified vivid enhancement methodology rationally contributing in anomalies detection, including cancerous tissues and internal bleeding. Medical images substantially colorized at run time with an average colorization time of 0.6 milliseconds. Colorization utility using proposed algorithm colorized medical images installed at clinical instruments for inspecting human anatomy. Potentially, it supports in real time scenario that leads to faster diagnosis and overall improved patient care as well as increasing the survival rate.

PERFORMANCE EVALUATION

To justify the enhancement in color and information performance, parameters were computed to assure image quality [22-24]. Various statistical performance metrics were calculated to assert the enhanced quality of proposed algorithm resulting colorized images shown in [Table 1]. Quality assurance parameters under considerations are peak signal to noise ratio (PSNR), measure of enhancement (EME), structural similarity index (SSIM) and entropy.

Table 1: Quality parameters of resulting colorized medical images

Medical Modality	PSNR	SSIM	Entropy		EME	
			Input Image	Output Image	Input image	Output Image
CT	80	0.8	0.05	1	10	20
MRI	78	0.9	0.02	3	1	19
Mammogram	70	1	0.04	2	5	39
Nuclear Medicine	65	0.8	0.2	15	1	19
PET	60	0.9	0.1	2	4	15
Ultrasound	70	1	0.01	1	6	19
X-ray	80	1	0.2	2	2	9

The good quality images PSNR value is higher than 20dB [22]. The PSNR value was calculated between resultant colorized medical imaging and input grey scale medical imaging. All the resultant images PSNR values are greater than 50, thus good quality images generated by proposed framework. Ultrasound, X-ray, and PET samples PSNR values strike 99 dB value, depicting zero MSE (mean square error) between input and colorized image.

SSIM was computed to examine luminance, structure and contrast similarity between colorized image c and source image s. Greater the value of entropy, greater the information content present in an image

[23]. The obtained range of SSIM value was between 0.8- 1. Mammogram, ultrasound and X-ray images mean SSIM value is 1 which was highest among all the other types of images. CT images mean value was smaller as compared to other mean values. Overall the proposed colorization algorithm did not degrade the structural contents, contrast or luminance information. Best resulting SSIM values were obtained from Ultrasound and X-ray. The entropy of colorized image was much improved and justified information within the colorized image was enhanced. PET and Nuclear medicine colorized images hold the maximum mean value of entropy. Colorization framework increases the entropy value of subject image.

A higher value of the measure of enhancement EME denotes a higher contrast and information clarity in an image. There should be an optimal value of EME to preserve contrast and local features to enhance image details [24]. Resulting EME value was within an optimal range and cause of good visual quality images.

Comprehensive comparison with state of arts studies

The quantitative comparison of proposed methodology with following state of art colorization algorithms, such as Welsh, et. al. color transfer colorization using $L\alpha\beta$ color space [7], Noda, H., et. al. algorithm [13], Kyung woo, et. al. [14], Lipowezky, et. al. algorithm [15] and Horiuchi, T., et. al. algorithm [16] is shown in [Table 2].

Table 2: Quality comparison of resulting colorized medical images with state of art methodologies

PSNR comparison with reported studies						
Methodology	Image 1	Image 2	Image 3	Image 4	Image 5	Image 6
Proposed algorithm	52	65	71	61	73	99
Noda, H. et. al. algorithm [13]	30	15	27	19	17	26
Welsh et. al. algorithm [7]	21	35	30	29	31	27
kyung woo et. al. algorithm [14]	21	20	20	19	21	18
Lipowezky et. al. algorithm [15]	25	35	31	19	30	25
Horiuchi, T., et. al. algorithm [16]	30	25	29	32	27	30

The parameters of all algorithms were kept optimally same to achieve highest computable PSNR. The proposed algorithm PSNR curve is quite higher than the existing state of art algorithms. The proposed enhancement phase before applying colorization algorithm is significantly one of the factors for highest quality of resulting colorized medical images.

CONCLUSION

The main objective of this medical image enhancement research is to facilitate medical professionals in identification of various biological structures. Hence, possibly medical colorized images supports in accurate and prompt analysis of patients disease along with suitable medication. Quality assurance parameters were computed to support and estimate the improvement in chromatic value, brightness, contrast and perceptual appearance. One of the greatest contributions of proposed methodology was that structural features remained same on the addition of chromatic features. Future research can focus on constructing clinical decision support system using colorized medical imaging for robust diagnosis and precise medical treatment.

CONFLICT OF INTEREST

The authors declare no conflict of interest

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

A HYBIRD MIK SEGMENTATION TECHNIQUE FOR DIAGNOSING ASPIRED FOREIGN BODY ON PEDIATRIC RADIOGRAPHY IMAGES

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ABSTRACT

Background: Radiography plays an important role in medical image processing. At present, different radiographic techniques such as X-ray, Computer Topography (CT), and Magnetic Resonance Imaging (MRI) are commonly used in the field of pediatric health informatics. These techniques are used to analyze the anatomical structures and other regions of the human body. In nature, radiography image contains a lot of noise, irrelevant information, intensity problems and partial volume effect which makes the task of locating and analyzing the suspicious area in such a image is very difficult task. **Methods:** Existing works does not focus more on segmentation corresponding to the aspired foreign body pediatric radiography images. Therefore, this work analyzed eleven image segmentation techniques are discussed in [Table 3] and proposed a hybrid segmentation technique with the combination of Median filtering, Iterative thresholding and K-means clustering which is named as MIK segmentation technique. **Results:** The quantitative metrics such as SNR, PSNR, RMSE and MAE are computed for evaluating the performance of segmentation techniques. **Conclusions:** The performance evaluation results prove that the proposed MIK segmentation technique is the most suitable segmentation technique for foreign body aspired pediatric radiography images.

INTRODUCTION

In medical image processing, the accuracy of the segmentation proves way for early diagnosis in most of the clinical studies and recommends a treatment plan for radiotherapy. Radiography techniques such as X-ray, Computer Topography (CT) and Magnetic Resonance Imaging (MRI) are most commonly used in radiology techniques. It is mandatory for a medical imaging technician to use computers to reduce processing time and improve reliability in case of large data. Existing techniques available for image segmentation are specific to the imaging modality. The segmentation techniques are useful to identify the anatomical structures, region of interest, measure tissue volume in order to measure growth of tumor, help in treatment of radiation therapy, in radiation dose calculation and to distinguish one anatomic structure from the other.

RELATED WORKS

In General, segmentation of medical images is one of the most difficult tasks in image processing. Segmentation sub-divides an image into constitute regions or objects. Segmentation techniques involve edge detection, thresholding and clustering for segmenting the region/boundary or detect the edges from an image. Segmentation accuracy determines the success or failure of computerized analysis procedures. The following [Table 1] contains an exhaustive survey on various existing segmentation techniques used in medical field for interested region segmentation.

Table 1: Existing survey on various segmentation techniques used in X-ray images

S.No	Segmentation Technique used	Observation
1	Adaptive thresholding Technique, Morphological Operator-based Algorithm, Connected Component Labeling algorithm(CCL) ,watershed algorithm as edge-based image Segmentation and Region Growing (RG) algorithm.[1]	A hybrid segmentation technique which is capable to segment liver from abdominal CT and detect hepatic lesions automatically. The experimental results show that 93% of good extraction for liver from abdominal CT.
2	Combination of Direct Thresholding and Adaptive Thresholding.[2]	The accuracy of the detection of regions is improved by applying adaptive thresholding.
3	Mean Shift Segmentation Algorithm And Adaptive Region Merging process.[3]	The proposed segmentation algorithm is highly effective. The computational time of the segmentation is very high.
4	Sobel, Prewitt, Roberts, Laplacian And Canny.[4]	Canny is the best of all for accurate edge detection. Fails to detect flesh and bone separately.
5	Morphological operations, Fuzzy C-Means	Fuzzy C-Means clustering was used to

KEY WORDS
 Medical images, Image Segmentation, Radiography images, Quality Matrices

Published: 2 Oct 2016

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	clustering.[5]	segment the lungs and the morphological operations were used for smoothening the irregular boundary. The algorithm is simple and is effective for lung images only.
6	Hybrid Region Growing Algorithm.[6]	The results observed from proposed hybrid region growing technique are more accurate even when images are blunt. Sometimes the detection results include false region detection along with true regions.
7	Marker Watershed Transform.[7]	The manual intervention and processing time for segmentation process is reduced.
8	Fuzzy C-Means ,k-means, Active contour algorithms and region growing.[8]	Open source software tool "MIASYS" is developed. Image misalignments often occur. The image registrations of local deformations are not handled in the current version of the software.
9	Three generations of segmentation techniques development. [9]	Each generation adds an additional level of algorithmic complexity.
10	K-means clustering algorithm seeded region growing algorithm. [10]	The proposed algorithm performs well in real time though not fully automatic
11	Threshlodng, Region Based Segmentation, Mean Shift, k-means Clustering Algorithm, And Fuzzy C-Means.[11]	This paper suggests that using appropriate image segmentation in quality input images give better results in the identifying the region of interest.
12	Threshlodng, Region Based Segmentation, Mean Shift, k-means Clustering Algorithm, And Fuzzy C-Means.[12]	This paper suggests that using appropriate image segmentation in quality input images give better results in the identifying the region of interest.
13	FCM, Prior-Information-Guided FCM (PIGFCM) algorithm.[13]	The proposed approach improves the accuracy of segmentation process, but it fails to address the intensity variation.
14	Improved Fuzzy C-Means Clustering.[14]	It is suggested that the parameters used for improving the FCM such as entropy, mean square error, peak signal to noise ratio should be improved for better image segmentation.
15	Segmentation techniques like, Edge detection, Thresholding, Skeletonization, Contour and Watershed Transform.[15]	The analyzed segmentation technique successfully helps in segmenting X-ray images. Selection of correct threshold value determines the efficiency of the edge detection
16	Contrast adjustment ,region growing algorithm.[16]	Contrast adjustment causes false positive metallic regions detection.
17	Fuzzy clustering algorithm, alternative FCM(AFCM).[17]	The results of the proposed AFCM algorithm prove better than the standard FCM. FCM does not address the intensity variation during segmentation process.
18	Snakes contouring techniques, histogram analysis, nonlinear anisotropic diffusion and automatic thresholding.[18]	The proposed technique is applicable only for the image containing homogeneities region.
19	Improved FCM Based On Measure Of Medium Truth Degree.[19]	The proposed algorithm is more suitable for images with less noise. FCM is sensitive to noise.
20	Watershed segmentation and Otsu's Thresholding, Discrete Step Algorithm.[20]	X-ray image is prone to noise. Watershed and Otsu's segmentation technique still needs lot of improvements in identifying the image with noise and low intensity for better segmentation with the desired areas in X-ray images.
21	Region growing algorithm, thresholding.[21]	Region growing algorithm is used for organ segmentation. Both over and under segmentation error occur during experimental test. Does not achieve high precision results.
22	Region Growing, Multi-Region Segmentation Based on a Topological.[22]	The accuracy of the proposed approach depends on the accuracy of the extraction of the prior information of topological graph
23	Wavelets Transform And Morphological Operators.[23]	The efficiency of the algorithm is analyzed only based on the segmentation speed.
24	Automated medical image segmentation algorithm.[24]	The novelty of the algorithm is proved by considering the whole MRI data set as a 3D entity. More computation time is needed to process the data set.
25	Modified Watershed Segmentation Algorithm With De-Noising.[25]	This work proves that combining denoising with segmentation techniques perform well in segmenting medical images rather than applying by individual approach.

From the literature survey, it is found that the image segmentation plays a vital role in medical Imaging. This will lead to proper extraction of the interested region for detection and identification. Therefore, identifying the suitable segmentation technique for different modality images such as X-ray, CT and MRI are required. Hence, assessing the performance of various segmentation techniques need to be carried out to identify the suitable segmentation technique for medical images. The detailed survey helps us to identify widely used segmentation technique in the medical field. [Fig. 1] demonstrates the steps involved for identifying suitable segmentation techniques in pediatric foreign body aspirated X-ray images.

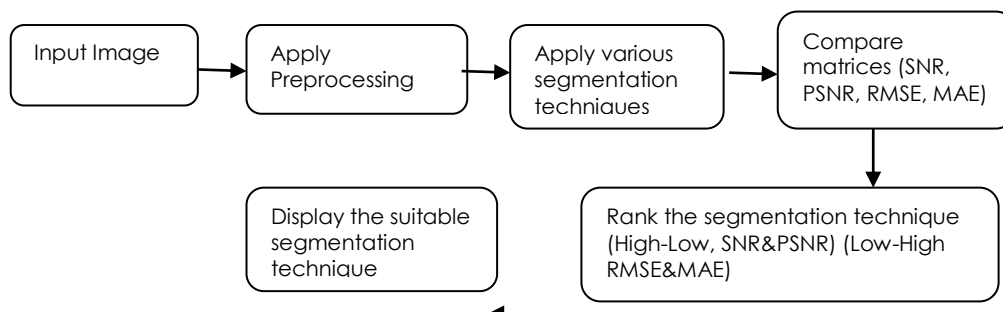


Fig.1: Steps involved for identifying suitable segmentation techniques

METHODS

This section provides an overview of the various segmentation techniques for segmentation of pediatric foreign body aspirated images.

Thresholding based Segmentation Technique

Thresholding is one of the simplest methods of image segmentation. Image thresholding techniques partition an image into a foreground and background. It isolates the objects by converting grayscale image into binary images. Some of the existing thresholding techniques such as Otsu, Huang, Percentile and Adaptive performance are assessed to identify the suitable thresholding technique for pediatric foreign body aspirated X-ray images. Otsu's method separates an image into background and foreground by two classes of pixels and calculates the optimum threshold with combined spread [25]. Huang thresholding utilizes the measure of fuzziness to evaluate the fuzziness of an image to determine the optimal threshold value. It is used as an evaluation criterion to identify the uniformity and measures boundary of an image [12]. The percentile thresholding strategy uses data-driven method for selecting the optimum threshold value. It also improves the recovery performance [10]. Adaptive thresholding calculates the mean of pixels as an initial threshold value and compares with all the pixels of the image. If the pixel value is below the threshold it is set to the background value, otherwise it assumes the foreground value [25].

Edge based Segmentation Technique

Edge based segmentation is performed based on information about edges in the image. Edge is a boundary between two homogeneous regions. Edge detection refers to the process of identifying and locating sharp discontinuities in an image. Detected edges are used to identify the objects present in an image. Some of the existing edge detection techniques such as Canny, Sobel, and Robertcross [20, 21, 7, 5] are assessed to identify the suitable edge detection technique for pediatric foreign body aspirated X-ray images. The Sobel operator calculates gradient of the image based on each pixel position in the image. Roberts cross operator calculates the gradient of an image through discrete differentiation which is achieved by computing the sum of the squares of the differences between diagonally adjacent pixels. Canny edge detection technique detects as many edges as possible in the image with low error rate. It uses different steps such as Gaussian filter, intensity gradients, non-maximum suppression, double threshold and hysteresis to detect edges.

Region based Segmentation Technique

Region based segmentation techniques aim to differentiate the regions of interest (objects) from the background. Some of the existing Region based Segmentation Techniques such as K-means, FCM, watershed and single seed region growing are assessed to identify the region based segmentation technique for pediatric foreign body aspirated X-ray images. K-means is an unsupervised learning algorithm that partitions a group of data points into a small number of clusters in an image. Fuzzy c-means (FCM) clustering algorithm allows one piece of data to belong to two or more

clusters. The watershed segmentation is based on mathematical morphology that segments the image regions into catchment basins as rain flood. Single seed region growing technique takes a single seed point starting in the middle of an object and then growing outward until it meets the object boundaries.

Performance Evaluation of Existing Segmentation Techniques

Performance evaluation carried out gives the impact on the significance of identifying appropriate segmentation techniques for pediatric foreign body aspirated images. There are various quantitative analysis metrics for examining image quality, such as signal-to-noise ratio (SNR), Peak signal-to-noise ratio (PSNR), Mean square error (MSE), Root mean square error (RMSE). The evaluation process assesses the SNR, PSNR, RMSE, and MAE of images according to the definitions of Gonzalez [26] as given below

1. Signal-to-Noise Ratio (SNR) is defined as the ratio of the power of meaningful information and the power of background noise. The better segmentation indicates the higher value of SNR. [26]

$$SNR = 10 \log_{10} \left[\frac{\sum_{x=0}^{n_x-1} \sum_{y=0}^{n_y-1} [r(x, y)]^2}{\sum_{x=0}^{n_x-1} \sum_{y=0}^{n_y-1} [r(x, y) - t(x, y)]^2} \right] \quad r(x, y) \text{ is original image, } t(x, y) \text{ is target image}$$

2. Peak Signal-to-Noise Ratio (PSNR) represents region homogeneity of the final segmentation. The better segmentation indicates the higher value of PSNR [26].

$$PSNR = 10 \log_{10} \left[\frac{\max(r(x, y))^2}{\frac{1}{n_x - n_y} \cdot \sum_{x=0}^{n_x-1} \sum_{y=0}^{n_y-1} [r(x, y) - t(x, y)]^2} \right] \quad r(x, y) \text{ is original image, } t(x, y) \text{ is target image}$$

3. Root Mean Square Error (RMSE) is a measure of each pixel by adding up the squared difference of all the pixels and dividing by the total pixel count. The better segmentation indicates the lowest value of RMSE [26].

$$RMSE = \sqrt{\frac{1}{n_x - n_y} \cdot \sum_{x=0}^{n_x-1} \sum_{y=0}^{n_y-1} [r(x, y) - t(x, y)]^2} \quad , r(x, y) \text{ is original image, } t(x, y) \text{ is target image}$$

4. Mean Absolute Error (MAE) of the image is calculated by subtracting the original image from the target image for all the pixels. The better segmentation indicates the lowest value of MAE [26].

$$MAE = \frac{1}{n_x - n_y} \cdot \sum_{x=0}^{n_x-1} \sum_{y=0}^{n_y-1} [r(x, y) - t(x, y)] \quad r(x, y) \text{ is original image, } t(x, y) \text{ is target image}$$

These metrics are computed based on the fundamental benchmark of the quantitative analysis metrics. The results of quantitative metrics SNR, PSNR, RMSE, and MAE analysis are as given in [Table 3].

RESULTS

The performance estimation of various segmentation techniques such as Otsu thresholding, Haung thresholding, Percentile thresholding, Iterative thresholding, Canny edge detection, Sobel edge detection, Robert cross edge detection K-means Clustering, FCM Clustering, Watershed segmentation, Single Seed Region growing. The results of various segmentation techniques are shown in [Table 2]. Based on the observation and with the results obtained, it is concluded that the clustering based segmentation techniques perform better in pediatric foreign body aspirated images.

Table 2: Implementation results of various segmentation techniques

Segmentation Techniques	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Original Image					
Otsu thresholding					
Haung thresholding					

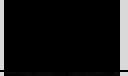
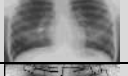
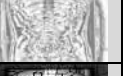
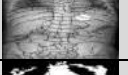
Percentile thresholding					
Iterative thresholding					
Canny edge detection					
Sobel edge detection					
Robert cross edge detection					
K-means Clustering					
FCM Clustering					
Watershed segmentation					
Single Seed Region growing					
MIK Segmentation					

Table 3: Performance evaluation by quality metrics (SNR,PSNR,RMSE,MAE)

Seg.Tech/ Metrics	Samples	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10	ST11
SNR	Sample1	19.21	19.41	19.38	19.20	0.01	0.83	0.24	21.57	28.91	11.62	28.34
	Sample2	15.69	15.42	14.97	15.69	0.22	1.78	0.87	20.80	20.25	11.17	17.25
	Sample3	21.42	13.68	17.50	21.69	0.02	0.91	0.27	25.41	5.68	10.78	5.68
	Sample4	12.18	11.95	11.76	12.18	0.42	1.82	0.55	24.06	30.78	8.70	26.87
	Sample5	22.99	17.16	16.69	16.56	0.01	1.46	0.45	23.83	12.74	8.81	12.74
PSNR	Sample1	22.90	23.14	22.98	22.85	3.97	4.79	4.02	25.48	32.87	15.64	32.29
	Sample2	21.19	21.33	21.03	21.19	8.20	10.20	9.30	28.09	25.09	18.99	5.01
	Sample3	23.81	35.44	21.43	24.06	5.61	6.50	5.86	30.93	30.13	16.16	0.10
	Sample4	21.82	19.25	17.02	21.82	8.17	10.41	9.14	32.65	40.10	17.34	36.19
	Sample5	26.05	20.00	19.71	19.62	7.37	8.82	7.81	28.70	25.98	14.42	5.91
RMSE	Sample1	18.26	17.77	18.09	18.37	34.09	22.08	31.05	11.00	4.83	35.19	5.17
	Sample2	22.23	21.89	21.88	22.23	84.01	66.72	74.08	7.53	12.00	22.70	12.05
	Sample3	16.45	14.31	21.64	15.99	119.56	107.94	16.19	6.41	18.00	34.23	18.01
	Sample4	20.69	27.80	35.04	20.69	64.77	50.06	57.93	3.87	2.81	22.67	2.81
	Sample5	12.71	25.28	26.37	26.63	109.16	92.40	103.77	6.99	12.06	48.29	12.59
MAE	Sample1	11.63	21.56	21.61	21.64	121.56	106.89	117.08	8.92	3.72	9.22	3.84
	Sample2	12.32	12.25	22.23	32.32	59.02	4.72	51.47	4.72	11.01	14.68	8.06
	Sample3	13.18	13.08	2.19	21.25	93.41	82.01	90.15	4.31	6.00	7.87	8.30
	Sample4	2.01	3.58	5.60	2.01	49.01	38.17	44.91	2.56	0.88	6.91	1.45
	Sample5	21.08	32.95	23.02	8.28	93.53	77.06	88.19	6.33	11.00	15.16	11.00

ST1=Otsu thresholding,ST2=Haung thresholding,ST3=Percentile thresholding,ST4=Iterative thresholding, ST5=Canny edge detection,ST6= Sobel edge detection,ST7=Robert cross edge detection,ST8= K-means Clustering,ST9= FCM Clustering,ST10= Watershed segmentation,ST11=Single Seed Region growing

DISCUSSION

As per the results obtained, clustering techniques such as K-means and FCM show higher values than the other segmentation techniques for the quality metrics SNR and PSNR. The clustering techniques K-means and FCM clustering show lower values than the other segmentation techniques for RMSE and MAE. The overall performance results show that the clustering techniques gives better results compared to other techniques. The SNR, PSNR values obtained with the clustering techniques are high for most of the images and smaller values in RMSE and MAE. Hence, it can be concluded that the clustering techniques such as K-means and FCM are best suitable segmentation technique for foreign body aspired pediatric X-ray images. As per the evaluation the K-means segmentation techniques suits better for most of the sample images of pediatric foreign body aspired radiographic images. The overall performance evaluation with the suitable segmentation technique for each sample is given in [Table 4].

Table 4: Identification of suitable segmentation technique by Ranking the Quality metrics evaluation

Sample	Suitable segmentation Technique	SNR	PSNR	RMSE	MAE
Sample 1	FCM	28.91	32.87	4.83	3.72
Sample 2	K-means	20.08	28.09	7.53	4.72
Sample 3	K-means	25.41	30.93	6.41	4.31
Sample 4	FCM	30.78	40.10	2.81	0.88
Sample 5	K-means	23.83	28.70	6.99	6.33

A comparative analysis of each quality metrics such as SNR, PSNR, RMSE and MAE are given in [Fig. 2].

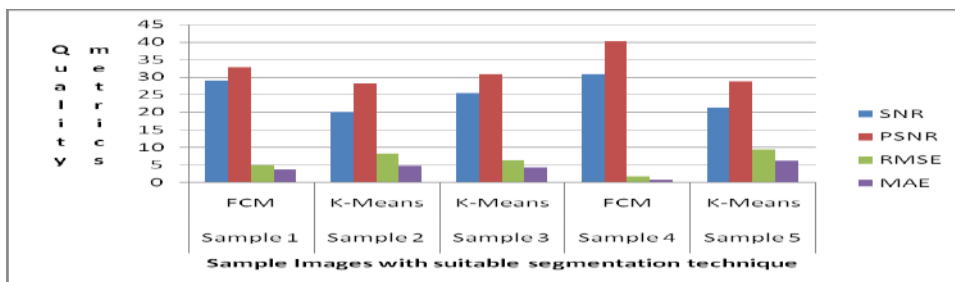


Fig. 2: Performance evaluation with existing segmentation techniques.

MIK Segmentation Technique

A hybrid segmentation technique with the combination of Median filtering, Iterative thresholding and K-means clustering (MIK) is proposed to segment the interested regions in foreign body aspired pediatric radiography images. The proposed work uses the best suitable segmentation technique as per the performance evaluation of the existing segmentation techniques. The performance evaluation of the proposed hybrid MIK segmentation technique is done by the quality metrics as same as the existing segmentation techniques such as SNR, PSNR, RMSE and MAE.

Table 5: MIK segmentation technique (Median filtering + Iterative thresholding + K-means clustering)

Sample	Suitable Segmentation Technique	SNR	PSNR	RMSE	MAE
Sample 1	MIK segmentation	39.710	43.62	1.39	0.82
Sample 2	MIK segmentation	27.33	35.23	3.53	1.99
Sample 3	MIK segmentation	36.11	41.55	1.87	1.02
Sample 4	MIK segmentation	30.69	39.01	1.80	0.82
Sample 5	MIK segmentation	24.72	32.09	6.33	3.13

Performance Evaluation of MIK segmentation technique

The proposed MIK segmentation obtains higher values for SNR, PSNR and lowest value of RMSE and MAE when compared to existing segmentation techniques. The performance evaluation of the proposed hybrid MIK segmentation technique is shown in [Table 5] and [Fig. 3].

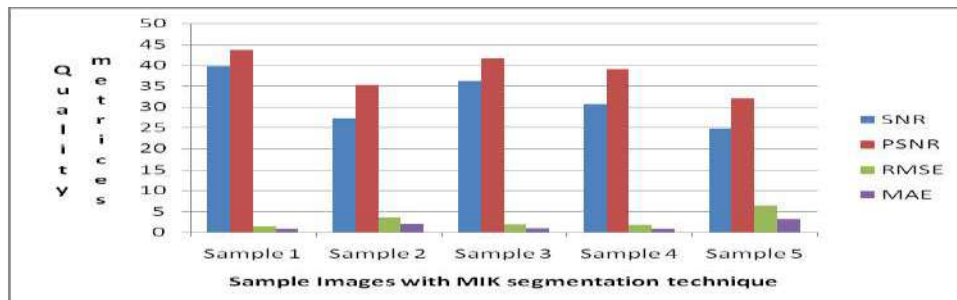


Fig. 3: Performance evaluation with MIK segmentation technique.

CONCLUSION AND FUTUREWORK

This work focuses to identify suitable segmentation techniques in order to segment aspired foreign body in pediatric X-ray images. A detailed survey has been made to list various segmentation techniques used in medical imaging. Widely used segmentation techniques on foreign body aspired pediatric radiographic images are implemented. The quantitative metrics such as SNR, PSNR, RMSE and MAE are computed for evaluating the performance of segmentation techniques. As per the evaluation results, K-means and FCM segmentations techniques are most suitable segmentation technique for foreign body aspired pediatric radiographic images. By the experimental results the proposed hybrid MIK segmentation technique comparatively gives better results than the existing segmentation techniques. As further improvement, this work will be extended to develop a framework for automatic identification of intrude objects in pediatric radiographic images.

CONFLICT OF INTEREST

The authors declare no conflict of interest

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

A REFLECTION ON NULL CURRICULUM

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ABSTRACT

Objective: In this paper we scrutinize the concept of null curriculum critically—what schools do not teach—and two questions were in the focus: 1) what are different kinds of null curriculum? 2) What general factors affect the null curriculum in the Iranian educational system? In each of these questions, particular attention is given in clearly defining this almost ambiguous concept. It also defines two types of null curriculums namely intended and implemented null curriculum and the factors that affect the development of it. **Background:** Curriculum development has always been a matter of concern for educational institutions, and it is one of the most important areas in language teaching and learning. The concept of curriculum can be recognized as a connective link between teacher and student, organized in such a way to achieve goals determined by the teacher already, the learning organization or by the curriculum designers. It must be noted that conception of curriculum plays a significant role in defining the null curriculum, and pointed out that relationship to a given null curriculum can be identified only in relation to what is valued as educationally significant. **Method:** in this study, several studies related to curriculum designing as well as other aspects of curriculum were reviewed. Furthermore, we also searched various scientific sites to obtain related information and required data. Afterwards, theoretical views, problems involved, and related strategies about them were presented. **Conclusion:** The tips and suggestions presented in this article can be applied in certain practical areas of curriculum development and evaluation. Curriculum and syllabus designing is one of the fundamental cornerstones of every educational system. The focus of this paper is on null curriculum, although various variables affect curriculum designing, the most important of all were presented here. It also reviews the role of teachers and the students in designing curriculum and investigates how important are their roles in establishing and implementing curriculum. It seems that there are some determining factors that affect curriculum and syllabus designing in the Iranian educational system and also some tips that syllabus designers and developers must take into consideration to meet the educational needs and purposes.

INTRODUCTION

KEY WORDS
Curriculum, Null
Curriculum, Explicit
Curriculum, Hidden
Curriculum, Syllabus
Design

Curriculum development has always been a matter of concern for educational institutions, and it is one of the most important areas in language teaching and learning. The concept of curriculum can be perceived as a connective link between teacher and student, organized in such a way to achieve goals previously set by the teacher, the learning organization or by the curriculum specialists. The above definition, of course, does not cover all the meanings of curriculum, especially when we think of them in a variety of contexts and situations where different goals and objectives need to be pursued. In certain situations the curriculum is used to diagnose learning problems and restore connections between the teacher and the learner, while in other situations it can be conceived as a framework that provides external settings for the learning process. However, the above definitions fail to incorporate all the aspects related to curriculum designing and its interaction with teaching process and learning community.

Published: 2 Oct 2016

In this perspective, the process of decision-making to update the curriculum should be supported by a platform of shared values, images and beliefs that would be crucial in the process of organizing the intended and planned learning framework. Several scholars have defined curriculum.

According to Tanner and Tanner a curriculum is a plan or program of all experiences which the learner encounters under the direction of a school [1].

Hoover and Patton believe that issues such as strategies, settings, and management should be taken into consideration along with teaching skills and the context [2]. Eisner in his textbook, *The Educational Imagination*, categorized curriculum into three types: [1] explicit (stated), [2] hidden (unofficial, or implied), and [3] null (excluded) [3]. According to Urevbu the explicit curriculum refers to what is laid down as the syllabus or that which is to be learnt by students [4]. It is the officially selected body of knowledge which government, through the Ministry of Education or anybody offering education, wants students to learn [4]. The explicit curriculum is at the same time both the planned content, and the abilities that form the taught lessons [3]. This is usually understood as a document which includes details about goals, objectives, contents, teaching techniques, evaluation, and assessment [5]. The hidden curriculum, on the other hand, is considered as a process for students to be socialized [3, 5]. Apple believes that hidden curriculum encompasses the tacit teaching to students of norms, values, and dispositions that goes on simply by their living in and coping with the institutional expectations and routines of schools [6].

And finally the null curriculum, coined by Eisner, the area which would be elaborated and discussed in this paper, is a program that schools do not teach [7]. It consists of areas in language teaching and learning which

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often have been omitted or removed intentionally, since they are not accepted by sociopolitical conventions, or by the mindset of the students.

The null curriculum explicitly draws us to consider the fact that when we are developing a curriculum, some things are left out. It is a fact that schools cannot teach everything, and thus, all demands of the educational system cannot be met. Eisner argues more generally that what is not taught may be as educationally significant as what is taught: I argue this position because ignorance is not simply a neutral void; it has important effects on the kinds of options one is able to consider, the alternatives one can examine, and the perspectives from which one can view a situation or problem [7].

Developing curriculum

Given the rapid evolution of necessary knowledge, skills and the need to take into account global, national, state, and local cultures, the core curriculum must ensure that students will develop the essential knowledge and proficiency they need to be successful in college, in a career, in their communities, and in life.

The term curriculum is a Latin word meaning the course of a chariot race [8]. Traditionally, the curriculum consisted of two components: content and examination [9]. According to Burton & McDonald, providing a dictionary definition for this concept is difficult, mainly due to its complicated nature [10]. However, it can be defined in terms of a list of topics to be taught at school or in other academic institutions. For a wider view of point, all the experiences that the students undergo while being part of that institution.

Harden et al. points out that a curriculum should not be simply considered as a combination of separate topics and issues, but as a big picture in which the whole is much greater than any individual part [11]. According to Garcia-Barbero, a curriculum is the final product of aggregating a number of factors such as content, strategies, and methods to guarantee the quality in education, but should be a proper combination to ensure efficiency and facilitate learning [12]. Harden elaborating on this concept says, a curriculum is a sophisticated blend of educational strategies, course content, learning outcomes, educational experiences, assessment, educational environment and the individual students' learning style, personal timetable and the program of work [13].

According to Cheong Cheng, to achieve the purposes of planned education and curriculum targets, some relationships must be taken into consideration such as the relationship between curriculum development and teacher competence and attitudes in teaching [14]. Thus, the implementation and development of the curriculum could be followed in three stages: first, at individual level in which a teacher plans or performs it; second, at team level in which the collaboration of teachers is taken into account; and third, at school oriented level in which school authorities' views and attitudes are registered. This research indicates that the importance of materials covered at schools is influenced by different views discussed above [14].

Teacher and student's roles in curriculum designing

The productive involvement of students in curriculum development can lead to greater students' interest in learning and their more satisfaction. Eisner demonstrates the students' role in curriculum development and questions the negative impact of external evaluations upon the teacher's curricular decisions [15]. He asks, What opportunities do students have to formulate their own purposes and to design ways to achieve them? [15].

Recent researches show that the more students are engaged in education, the more successful they are and there is a positive link between the engagement and learning process. For example, Carini, Kuh, and Klein's broad-based, university-level analysis found that student engagement is linked positively to desirable learning outcomes such as critical thinking and grades [16].

On the other hand, teachers have significant roles in designing curriculum. While curriculum specialists, administrators and outside educational companies spend countless hours developing curriculum, it is the teachers who know best what the curriculum should look like. According to Zeiger and Media, in order to create a strong curriculum, teachers must play an integral role in every step of the curriculum development [17].

Planning

Teachers know their students' needs better than others involved in the curriculum process. While state standards often dictate the skills expected from the curriculum, a teacher can provide insight into the types of materials, activities and specific techniques that need to be included. Teachers from multiple grade-levels may collaborate to identify the skills students need at each level, and ensure that the curriculum adequately prepares students to advance to the next grade-level and to meet the standards.

Creation

Because teachers must apply the curriculum, they should have input into its creation. A teacher can gauge whether an activity fits into a specified time frame and whether it engages students in intended activities. If multiple teachers use the curriculum, we should allow as many of them as possible to provide their input during the creation stage. As teachers provide input, they gain their ownership in the final product and feel more confident that the curriculum was built upon their own concerns and according to the needs of their particular students.

Implementation

Teachers must implement the curriculum in their own classrooms, sticking to the plan that has taken so much time, effort, and careful planning. Teacher can make minor changes. In fact, a strong curriculum is designed to allow a teacher to be flexible and to insert a few personalized components or choose from among a selection of activities.

Reflection

Research on teacher participation in curricular decision-making is varied. The literature focuses heavily on the engagement of teachers in the determination of curriculum within their own schools or within their own classrooms. Site-based management efforts over the decades have consistently demonstrated that despite administrative directives for teachers to take an active role in the determination of curricula within their own work settings, the efficacy of such measures is limited [18, 19].

Null curriculum

The concept of the null curriculum points out to the exact analysis of the curriculum that looked for what is left out or neglected, and concentrates on how the curriculum is conceptually designed and implemented. The null curriculum opens new windows for thinking which is not suggested by other curricula to the students and therefore its educational potential and significance have been overlooked. Generally speaking, a null curriculum proposes what is not taught. Meanwhile, excluding some particular idea or sets of ideas may not be merely the results of the curriculum. Other causes would probably be the preferences of educational administrators, teacher's lack of knowledge, or deeply ingrained assumptions and biases of instructors. Teachers and schools may not be willing to teach that Christopher Columbus slaughtered many of the native peoples he encountered during his discovery of the Americas. Similarly, some other teachers are not interested to teach evolution. Eisner first described and defined aspects of null curriculum. He states that:

There is something of a paradox involved in writing about a curriculum that does not exist. Yet, if we are concerned with the consequences of school programs and the role of curriculum in shaping those consequences, then it seems to me that we are well advised to consider not only the explicit and implicit curricula of schools but also what schools do not teach. It is my thesis that what schools do not teach may be as important as what they do teach. I argue this position because ignorance is not simply a neutral void; it has important effects on the kinds of options one is able to consider, the alternatives that one can examine, and the perspectives from which one can view a situation or problems [7].

Aspects of the null curriculum

Null curriculum is generally divided into two broad categories namely the intended, and the implemented null curriculum:

Intended null curriculum

The purpose of the null curriculum is not providing a procedure to be applied by curriculum developers. Instead, the null curriculum could be affected by the policies of every government and dominant parties in general and educational system in specific. For example, in some countries such as, the United States and Britain, religious teachings are banned from teaching programs. In other countries like Iran sexology has been removed from schools and preschools [20]. Another example is the change of authorship in texts that happens in academic years, mainly, for the sake of psychological benefits and interests of a certain party that leads to the change of content and teaching methods and books in Iran.

Implemented null curriculum

Implemented null curriculum removes parts of the curriculum and textbooks through teachers and other authorities to meet the needs and interests of students. Studying the mathematics curriculum in many countries such as, the United States indicates that the US students have more capabilities in this area compared to students of China [21]. This demonstrates that the teachers are highly efficient in the U.S.

Another study shows that teachers in China use the class time more efficiently than teachers in other countries. Further, they use more difficult questions in their classrooms [22]. Conducting a study with the primary school students in China, Yeping shows that there is a relationship between the teachers' knowledge of curriculum and teaching methods in teachers' guide books. The results show that aspects of knowing, understanding and discovery of contents are designed in such a way to influence the methods teachers teach. In another study, the role of history teachers and its impact on presented materials in the class is examined [23]

Factors affecting null curriculum in Iran

There are several factors which affect all curriculum development in both educational environments and learning centers. Before deciding on any kind of curriculum, certain points must be taken into consideration, including learning goals and kinds of knowledge desired. Factors affecting curriculum development comprise government norms and codes, politics, history, administrators or government control, and environmental factors [24]. For a curriculum to be justifiable, some concerns of the nation such as ideology, politics, economy, technology, and so on must be regarded. Below, there are some general factors which may affect the curriculum design in Iranian educational setting:

Gender segregation

There is a long history of single-gender education, in which boys and girls attend separate-schooling. This may be done solely for educational purposes or as a response to clerical demands such as dress codes for the female. For instance, images of the women without proper hair covering are removed. Accordingly, this strict separation at educational settings is led to weak abilities in social relationships and fails to understand the characteristics, nature, and proper interaction with a number of populations. Some disciplines were limited just to females, and male students were not permitted to study them such as certain majors in law. In the same way, male students were not allowed to enter fields such as, midwifery, gynecology, and so on.

Lack of Reliable References for Notions Such As Love and Man-Woman Relationships: Nowadays, the education of children, adolescents and even the youths are affected by issues like love and emotions. Elaborations on such feelings are often considered as taboos and therefore are not appreciated. A study carried out by Tahmasb Zade concerning love affairs in curriculum revealed that both teachers and students regard it as an essential component [25].

One of the most important roles of belief system is seen in the instruction of sexology, where curriculum designing is on the agenda. Sexology instruction is a taboo in many belief-centered systems; hence, no space is allotted to such topics in the school books. Naturally, they would be excluded from preschool and school curriculum in the country [20]. In these cases, students have no chance to learn appropriate ways of behavior towards the opposite gender in their life.

Politics

Politics affect curriculum development in numerous ways. National ideology and philosophy have a tremendous influence on the educational system; it determines and defines the goals, contents, learning experiences, and evaluation strategies in education. Giroux identifies schools as political institutions inextricably linked to the issues of power and control in any given society [26].

Attitudes of programmers, policy and decision makers should not be neglected nonetheless. Textbook designers are always affected by national interests, political parties, and party politics. Consistent with this, policymakers decide what parts to be removed from the contents of the books. Depending on the setting and the dominant party, some historical periods, ideologies or people are excluded from the textbooks. Sometimes this removal makes a big information gap which students may suffer to understand facts in the future. For example, in the U.S., history curricula often fail to cover topics such as, the labor movement, the importance of religion in American life, or the internment of Japanese Americans during World War II. Gehrke, Knapp, and Sirotnik point out that the excluded curriculum is powerful by virtue of its absence [27].

Fundamental developments in humanities

After the 1979 Revolution, disciplines such as economics and law underwent fundamental changes. Economics, which was inspired by western and European ideas was replaced by Islamic economics. Similarly, a law which was affected by, and adopted from western rules experienced substantial changes in its form and contents.

The new policy stressed on the fact that the humanities have been highly influenced by western culture and that they had to be revised. Hence, texts incongruent with new values were banned.

Society and Demands

Since every society has its own expectations, curriculum designers have to consider public demands for the development of their suggested curriculums. Otherwise, the curriculum does not reach its purposes.

Emphasizing social integration and monolingual rather than multilingual and multicultural education

Iran is a multicultural and multiethnic land in which each ethnic community possesses its own culture, attitude, and tradition. Therefore, policymakers and educational planners must take into consideration these issues while designing the curriculum. In this regard, the question is the issue of priority: whether to go for a single-voiced educational content, or to develop the curriculum on the basis of ethnic demands.

Technology

Technology-driven curriculum development is one of the norms of the twenty-first century. Computer technology of this age influences curriculum development at every level of learning. Classrooms and learning centers increasingly provide computers as prerequisite interactional studies among students. This increased progress which has taken place in different areas of science, technology, education, has led curriculum planners and designers, experts and scholars of educational issues update the structure, goals, programs, content and methods of the education system.

Economy

All the government planning in the various communities is often done in cultural, social, political, research and developmental areas which is in harmony with the economic power of that community. This is especially true with educational planning. Poor countries encounter massive problems due to weaknesses of the economy in the areas of training, education, health, unemployment, low productivity, depending on foreigners and population pressures.

Today, countries with strong economic foundations can take basic steps in educational planning. In case the inputs of such planning are appropriate and applied explicitly through an appropriate process, the output will be economically valuable. If investment is carried out in education, but the outputs do not possess enough quality or quantity, it signals that investment in educational system does not have proper output. To express the impacts of economy on education, considering a point is essential: the effect of the overall economy of the society and the average revenue of that country on its educational system is enormous. One of the economic issues associated with education is the development of infrastructures, laboratories and educational facilities, which are almost not accessible in rural areas.

DISCUSSION AND CONCLUSION

Null curriculum often takes the form of the purposeful and deliberate exclusion of the perspectives, issues, and histories of particular populations and cultures. Some parameters are historically and culturally left out in designing Iranian educational curriculum including, philosophers, writers, poets, and scholars of other thoughts, their viewpoints and ideas, western literature and philosophy and so on. Throughout this paper, null curriculum is classified into 5 general categories, which influences planning and codification of the Iranian school curriculum. This classification, however, is general and since they are interrelated, they overlap each other. These five classifications fall within the areas of belief system, politics, society, technology, and economy.

The curriculum takes much the hue of the belief system and male and female students do not receive egalitarian education. It seems that the 'politics', especially in the new political system, has a great influence in choosing the contents of the educational curriculum at schools and universities at the present time. Fundamental changes in education system include the exclusion of western, colonial, imperial, and communist works, individuals, and ideas all under the influence of the new policies.

Society takes the next place in this classification. From such impacts, we could point to societal integration and mono-lingual education rather than multicultural and multi-lingual approaches, and also gender-biased attitudes in the educational curriculum.

Technology as another parameter has its own influence on curriculum development. This aspect of the null curriculum has been imposed because of the lack of educationally appropriate environments and technological equipment for fostering innovation in schools.

Last but not least is Economy. Economy is one of the most fundamental concerns in every country and can directly and indirectly touch the educational system in general and in specific.

Curriculum designing begins with a series of wished purposes or values. It is continued through a developmental process and is terminated in successful learning experiences of students [28]. Curriculum, in its contents, is divided into three types: formal, hidden, and null. Null curriculum is a kind of curriculum in which some aspects are excluded (either intentionally or unintentionally) from classroom instruction. But, as Eisner points out, what we exclude from daily teaching and learning may be just as important as what we include [3]. The null curriculum may explain the lack of adequate progress towards benchmarks or objectives more accurately than the explicit or hidden curriculum alone. Large number of materials, as requested or unwanted are removed from school curriculum and materials for various reasons are excluded. There are several factors affecting all curriculum development in both educational environments and learning centers. Before deciding, designing, and developing any kind of curriculum, certain points must be taken into consideration, including learning goals and kinds of knowledge desired.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None.

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ARTICLE

PHYTOREMEDIATION USING POA PRATENSIS BALIN LAWN AND SLUDGE IN MASHAD INDUSTRIAL TOWN TREATMENT PLANT

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ABSTRACT

We studied four levels of Mashad Industrial town treatment sewage sludge (0,10,15,20) on phytoremediation capacity of metals such as Nickle, Lead on physiological and developmental features of *Poa pratensis* balin lawn in a full random design with four iterations. Results showed meaningful accumulation of Nickle in roots and aerial organs in *Poa* lawn. The highest amount of Nickle accumulation is in *Poa* lawn root with treatment of 15% and 20% (0.23 and .022 mlgr/kg). The lowest amount of accumulation obtained in control treatment (0.15 mlgr/kg). Lead accumulation in *Poa* lawn aerial parts is meaningful at 5% probability which is not observed in roots yet. The value of *Poa* lawn dried and wet weight in aerial parts and roots has meaningfully changed as a result of sludge usage. Measures of general values of chlorophylls and carotenoid have not changed drastically. Sludge usage lead to decrease in relative ratio of wet content and stomatal conductance. The lowest amount of ion leakage is in controlled sample (13.43%) and treatment with 10% sludge weight (24.5%) and 15% (24.83%) sludge weight didn't show any meaningful difference. The highest rate of ion leakage obtained in treatment with 20% *Poa* sludge (28.7%) which proved meaningful change in comparison with other treatment samples. Results demonstrated that lawn can develop in floors containing sludge in Mashad Industrial town treatment plant. It can be introduced as a Nickle purifying of soil but it is not much capable of soil lead absorption.

INTRODUCTION

KEY WORDS

Lead, Phytoremediation, Ion leakage and Nickle

The most important soil pollutants are heavy metals, acid rain and organic substances. Among which recently, heavy metals have attracted much attention for their soil polluting features. Locational changes of heavy metal contents on surface agricultural soil may be under the influence of original soil elements and human sources. In other words, naturally, there are such metals in soil, though they are added to the soil due to human interactions with nature. Actually, human interactions may result in more heavy metal accumulation [1].

Heavy metals are environmental hazardous pollutants for human health and its environment. Such metals can affect agricultural soil qualities which are either poisonous or absorbed by plants and added to human food cycles to cause health and body problem. Besides, they are considered as permanent and lasting pollutants in environment for they are not decomposed nor damaged. They are accumulated in soil and sediments whose high amount of them in sea and on lands may both affect creatures in general or poison human via consumption of food gained in sea or on land [2].

Treatment plants' sludge contains organic substances which are produced along sewage biological purifying processes without any charges. At specified periods, that redundant amount of such sludge must be moved to sludge drying floors to be eliminated from purifying process [3].

In most treatment plants, both sewage and sludge contain components and elements which are useful and needed for plants' development. Also, they have organic components which can help to improve soil structure. At present, the extra produced sludge in treatment plants is a basic strategic problem. After it is collected and stored from sludge drying floors, it is always an obstacle which should be removed from the original environs and eliminated. It imposes a lot of charges on treatment plants' management [4-5]. Ways of elimination and safe burial of such sludge along the expenses are those issues which always occupy treatment plants management' mind. Nowadays, different methods such as burning or safe burial of such sludge are applied to remove the sludge. Yet each method has its own disadvantage. Generally, sludge removal is not an economic and reasonable way for the sludge nutritional potential is ignored [6-7]. Methods such as burial are perhaps moving pollutants and heavy metals to the earth and ground water depth which may lead to environmental damage [8].

Researchers have found that plants have features which can be used as a purifying agent. As a result, a new context such as plant modification, plant purification or plant phytoremediation is introduced [9-10]. This relation between plants and heavy metals are known since medieval ages. For instance, Marker plants were used to discover mines. In late 19th century, *Viola calaminaria* and *Thlaspi caerulescens* were first plant varieties whose capacities in absorbing and storing metals in high volume were proved [2]. Purifying plants are those which inherently or for genetic modifications are used to correct and purify polluted soil [11]. Plant purification is easier in view of management of plants for it is an autotrophic system with large biomass which does not require much feeding. It is able to remove pollutants from soil and accumulate and store them in aerial plant organs. Furthermore, such plants are having protective roles in the face of water wind soil erosion. They also prevent pollutant transmission [3]. Extra accumulation capacity of heavy metals in this method is based on growth fast rate (Biomass production) and heavy metal accumulation (gr of metal per kg plant tissue). Heavy metal elimination by plants is

Published: 2 Oct 2016

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carried out by plants which are called super accumulators. These plants carry out heavy metal accumulation more efficiently than other plants. It is reported that there are super accumulators which are able to collect heavy metals such as Cobalt, Copper, Chrome, Lead, Nickle and Magnesium up to 1000ppm of their dried tissue weight .This proportion is reported up to 1000 ppm for Zinc [12].On the account of the fact that there is no study on purifying capacity of Poa Pratensis balin lawn on Nickle and Lead, we aim to evaluate absorption rate of two heavy metals such as Nickle and Lead from soil via the above lawn. We also study the effect of Mashad industrial town treatment plant sludge usage on developmental and physiological features of the lawn.

MATERIALS AND METHODS

After we sterilized shallowly the lawn seeds of Poa, they were planted in plastic vases with 210 mm diametre by 45 cm height under greenhouse condition. Cultivating environ includes the control sample (natural soil), Soil and dried sludge with ratio of 10%, 15%, and 20% of weight .Thus, in control sample, for instance with 10% of weight, there is 10gr dried sludge in 90gr soil. The used soil in this experiment is the one with loamy structure without any salinity limitations or other agricultural ones. To measure soil and sludge elements, we weighed 25 gr of it in a 250 ml Erlenmeyer plastic flask. Afterwards, we added 50 ml extractor solution who's PH is 7.3, then its lid was closed and we shook it with a circular shaker make G.F.L, shaking 145 rounds per minute. It was filtered with wattman paper 42. Later, we switched on the atomic absorption instrument connected to graphite furnace .There is a specific lamp installed for each element whose element concentration is read after initial adjustment. If the elements concentration in the extract is higher than the standard level, we may dilute the samples by D.T.P.A. Soil tissue is measured by hydrometric method [13].its PH is measured by PH meter (MacClean 1982), and its electric conductance potential in saturated flower extract is measured by conductivity meter instrument [14].

Morphologic features

Features of this study are investigated in two parts. The first part is of sludge effect on with varying levels on the quality of lawn development. In this part, morphologic features of aerial organs length , roots , roots and aerial organs dried weight , roots and aerial organs wet weight, the ratio of wet and dried weight of roots to the aerial organs , lawn leaf width and other morphologic features such as total Chlorophyll a, b, carotenoid rate , relative humidity of water content, ion leakage , stomatal conductance and leaf surface index were measured to investigate the sludge varying levels effect on lawn growth to determine what levels of sludge usage is producing the best growth quality .The height of lawn crown is measured each 14 days before trimming. To do it, we held a ruler tangent to the soil surface, then a piece of paper on which there is a central hole is moving across ruler easily. We placed the paper at three points of each experiment unit along moving the ruler. So we can measure the height. Wet and dried weight of leaves and roots were measured each two weeks. Trimming was carried out at above 4 cm with a scissors, weighed on a scale, put in paper bags and moved to the oven at nearly 72 C for 48 hours. Finally the dried weight of control samples was measured. Roots were also taken out of soil, washed, dried and their wet and dried weight was measured as explained above.

Physiological features

Measures of chlorophyll and carotenoid

Chlorophyll and carotenoid were measured on (Liqten taler 1987) basis. Leaves pigments were extracted by acetone 80% and the rate of control sample absorption was read at wavelength of 663, 645, and 470 nanometer by spectrophotometer .On following formula the amount of Chlorophyll and carotenoid was calculated.

$$b \text{ chlorophyll} = 21.5 .A_{665} - 5.1A_{663}$$

$$a+b \text{ chlorophyll} = 7.15A_{663}+18.71A_{645}$$

$$\text{Carotenoid} = [1000A_{470}-1.82(a \text{ chlorophyll}) - 85.02 (b \text{ chlorophyll})]/198$$

The relative water content of leaves

RWC in fully developed and young leaves measured. It is performed after the initial weighing of leaves , sinking in distilled water for 24 hours and being dried at 75c. It is obtained via following formula (Smart & Bingham 1974).

$$RWC = ((\text{wet weight} - \text{dried weight}) / (\text{turgor weight} - \text{dried weight})) \times 100$$

Ion leakage

Ion leakage is calculated through dividing initial electric conductance by dead cells electric conductance(Demichic and colleagues 2010).

Leaves surface index

Leaves surface index is measured and studied by AcuuPAR (Make Delta T device) after it is separated.

Stomatal Conductance

Stomatal conductance measurement is carried out by Photo synthesis device of a German company Walz make HCM-1000, when leaves are irrigated at saturation level (while leaves are in the device box) , 4-week bushes were used.

Heavy metals measurement

Heavy metal content such as Nickle and Lead were measured in different organs such as leaves and roots 4 months after development. Also, rate of such heavy metals in soil were measured and compared before and after lawn growth. To measure heavy metal rate in plant tissues, we used atomic absorption device equipped with graphite furnace (Varianspectr AA 280) with 1ppb precision. Aerial organs such as leaves and roots were first washed with distilled water .Then It was dried at 80 c in the oven for 48 hours. Afterwards, plant control samples were milled and extracted by Nitric Acid and Hydrogen peroxide. At final step, rate of heavy metals like Nickle and Lead were measured. To evaluate rate of heavy metals, atomic absorption device in science and food tech park in Khorasan Razavi was used.

Statistical calculation

This experiment is carried out at full random design with four iterations .Data organization is performed by Excel SW and their analyses carried out by SPSS version 19.Mean comparison is done via Doncan test at 5% probability.

RESULTS AND DISCUSSION

Used Soil and sludge physiological features shown in [Table 1] and soil structure shown in [Table 2].The Nickle and Lead of the soil used in this experiment was lower than allowed world standard. Amount of metals such as Nickle and Lead in used sludge was higher than soil. Nickle rate in the sludge of Mashad Industrial town was somewhat higher than the standard level reported by different organizations, which is at allowed extreme point of this metal. Although Nickle rate in experimental sludge was two times higher than the one in the soil, it was at standard point [Tables 1 and 2].

Table 1: Physical and chemical features of used soil and sludge

	Pb (mg/kg)	Ni (mg/kg)	Fe (mg/kg)	CO ₃ H (mg/kg)	pH	Clay (%)	Silt (%)	Sand (%)	EC (dS/m)
Soil	42.8	25.4	3.5	953	6.4	30.5	43	26.5	6.6
Sludge	81.5	62.7	4.3	911	7.2	-	-	-	9.1

Table 2: Allowed levels of Nickle and lead in soils in different world standard (mg/kg)

Organization	Pb	Ni
EU ¹	300	50-75
NZWWA ¹	300	60
SEPA ²	350	60
CEPA	300	50
CODEX ³	-	50

Variance analyses result showed that treatment samples using different sludge density in Mashad industrial town treatment plant proved meaningful changes in most morphological , physiological and phytoremediation capacity of the lawn species *Poa pratensis* balin features at 1% and 5% probability levels [Table 3].

NICKLE PLANT PHYTOREMEDIATION

Variance analyses results have shown that sludge usage has meaningfully affected the Nickle rate of absorption in roots at 1% probability. Absorption and accumulation of roots in aerial parts were getting meaningful at 5% probability [Table3]. As demonstrated, Nickle accumulation rate in *Poa* roots are higher than aerial parts. The highest rate of Nickle accumulation in *Poa* roots on using the sludge are in

treatment samples of 20% and 15% (0.23 0.22 mg/kg) .The lowest rate of accumulation in treatment samples (0.15 mg/kg) was obtained [Fig. 1]. In aerial parts, the highest rate of accumulation gained in treatment samples with sludge usage, which showed no meaningful differences at three levels of 10%,15% and 20% of their weight. Though, the lowest rate of Nickle accumulation obtained in treatment samples which showed meaningful difference with other treatment samples at 5% probability [Fig. 2].

Soroosh et al [23] have done a research on heavy metal absorption by some Japanese lawn species (Zoshia Grass) .They came to the conclusion that irrigation with different sewage treatment in various soil tissues ,such tissues have no effect on metal absorption by this kind of lawn, yet sewage usage for irrigation caused heavy metal absorption such as Nickle, Lead, Cadmium and Cobalt to increase. Although sewage irrigation has no effect on Iron and Zinc absorption,

this study result expressed the Japanese lawn absorption ability in decreasing and extracting some metals particularly Nickle and Cadmium from soil. On the account of Al souraii et al [24] the tree Conocarpus lancifolius has high ability to accumulate high levels of Chrome (Cr),Vanadium(V), and Nickle (Ni) in its roots. This tree can also accumulate loads of Alminium(Al), Calsium(Ca), and Iron (Fe) in all parts of its organs. A study has been conducted in Zanjan Lead and Zinc Plant campus to investigate some trees species in absorbing heavy metals .It was done in quite random block designs with three iterations. These trees species' sample leaves, branches and soil were taken off and the content of Lead (pb), Zinc(Zn) , Cadmium (Cd) and Nickle (Ni) was measured by (ICP) device. The result demonstrated that among those species investigated, Poplar trees and Robinia have high absorption ability of Lead, Zinc and Nickle in their branches and Poplar trees are able to highly absorb metals such as Lead, Zinc and Cadmium through their leaves which make them all appropriate to be planted in polluted areas green lands (Moradi).

Table 3: Variance analyses of morphologic features and heavy metal concentration of Lead and Nickle in roots and aerial organs of Poa pratensis balin lawn with sludge treatment of Mashad industrial town treatment plant (Ni-R-Nickle root,Ni-A Nickle aerial organs,Pb-R Lead roots,DW-R dried weight root,DW-A dried weight aerial organs,FW-R wet root weight,FW-A wet aerial organs weight, R/ADW relative dried weight of root to aerial organs, R/AFW relative wet root weight to the aerial organs,LW leaf width)

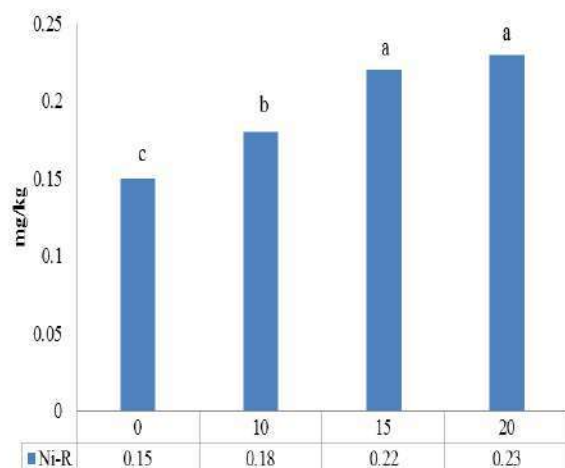
Source		Mean square												
	df	Ni-R	Ni-A	Pb-R	Pb-A	Height	Length-R	DW-R	DW-A	FW-R	FW-A	R/A(DW)	R/A(FW)	LW
Treat	3	0.04**	0.004*	0.757 _{ns}	0.333**	0.25 _{ns}	3951.6	0.067*	0.506**	0.354	1.386 _{**}	0.352**	0.6 _{**}	0.012 _{ns}
Error	12	0.001	0.001	0.26	0.044	0.099	594	0.01	0.028	0.084	0.077	0.01	0.02	0.05
CV		19.2	17.6	16.9	21.07	17.8	22.2	11	16.8	9.5	8.7	12.41	10.9	14

Ns*** is meaningfulness at 1% probability, meaningfulness at 5% probability and non-meaningfulness

Lead phytoremediation

Using varying sludge amount has no meaningful effect on Lead accumulation in Poa lawn root but Lead showed meaningful changes in aerial organs at 5% probability [Table 3]. The highest rate of Lead accumulation obtained in aerial organs in treatment samples of Mashad industrial town treatment plant sludge which had no meaningful difference and the lowest rate of Lead accumulation observed in aerial organs in treatment samples (without sludge usage) with 3.33 mg/kg [Table 3].

Taghi zadeh et al [25] studied and compared Lead heavy metal absorption ability in various concentrations by three kinds of Regrass lawn, Kentucky blue grass and Bermuda grass lawns. It is reported that along Lead concentration increasing rate in soil, generally Lead accumulation rate in aerial organs and roots increased which showed highest absorption in aerial organs in Regrass and lowest absorption in Kentucky blue grass .Besides, in terms of Lead accumulation rate in lawns roots, Bermuda grass showed the lowest and Regrass showed the highest rate of absorption and accumulation.



[Fig.1: The mean comparison of Nickel accumulation in *Poa pratensis* lawn root under the influence of varying amount of sludge in Mashad industrial town treatment plant

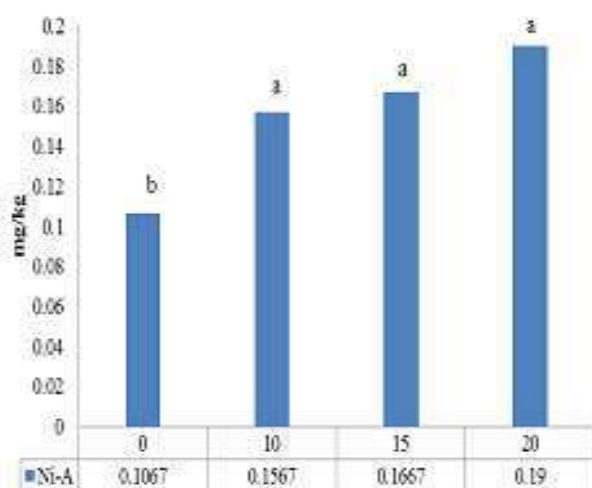


Fig. 2: Mean comparison of Nickel accumulation in aerial organs of *Poa pratensis* lawn under the influence of varying amount of sludge in Mashad industrial town treatment plant

Besalat pour et al [2010] have done studies on several different species. Ultimately, *Festuca arundinacea* and *Agropyron gaertn* species were chosen for final phytoremediation of oil sewage and heavy metal. In Grassca studies [2011], several different plants such as corn and wild tumbleweed were used to purify polluted soil with heavy metals such as Lead, Nickle and Zinc in vase controlled and free environs. In this study, the average rate of Lead absorption in wild tumbleweed plant is higher than others. It is observed that plant *Poa pratensis* balin's ability in absorbing and accumulating Lead in its root is rather low but it is quite able to do so in aerial parts.

Morphologic features

Variance analyses results demonstrate that sludge usage has neither affected *Poa* lawn height rate, nor any meaningful changes have been proved thus far. [Table 3]. Considering heavy elements low accumulation in lawn aerial and agrarian parts, we may conclude that heavy elements have not much affected this lawn for its heights rate has not changed.

The root rate length has meaningfully changed around 5% probability [Table 3]. The highest rate of root length has been resulted in treatment with 20% (504 cm), while treatment of 15% sludge weight comes second (483.5 cm). The lowest rate of root length resulted in typical samples and treated ones holding 10% of sludge are 424.5 and 445 cm respectively (Table 4). High sludge usage EC caused higher rate of land salinity which will end up in dryness tension. Under such stress and dryness which is aggravated by heavy elements, this plant reacted in a way to increase its length. Soroosh and colleagues reported that irrigation with purified sewage of treatment plant in Shahrin Shahr has resulted in meaningful root length in Japanese lawn with 1% probability.

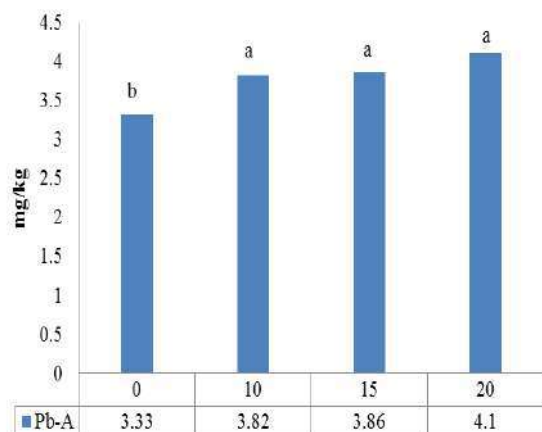


Fig. 3: The mean comparison of Lead accumulation in aerial organs in *Poa pratensis* balin under the effect of varying amount of sludge usage in Mashad Industrial town treatment plant

The rate of root dried weight with 5% probability and *Poa pratensis* balin lawn aerial parts with 1% probability which are treated with sludge usage have demonstrated meaningful changes in comparison with the typical untreated samples (Table 3). The highest rate of dried root weight (2.07 gr in the plant) obtained in treated sample whose sludge usage is 20% and the lowest rate is of the typical sample (1.74 gr in the plant). The highest rate of dried weight of aerial parts in *Poa pratensis* balin lawn obtained in those treated with 20% sludge weight (2.69 gr in the plant), after which those treated with 15% and 10% sludge have proved highest rate of aerial parts dried weight (Table 5). On the account of sludge sample analyses and its high rate of Nickel, Lead and Iron [Table 1], such increase in dried weight of different lawn's organs under studied can be justified.

The ratio of root dried weight to aerial part with 1% probability has become meaningful [Table 3]. Different studies have reported contradicting results in terms of purifying plants organs dried weight changes. Adavy [2008] investigated different varieties of Bermuda Grass purifying rate in petrol hydrocarbons. He reported, considering the detriment impact of petrol hydrocarbons on plants, refinery oil sludge increase to the soil resulted in decrease on lawn aerial parts dried weight. Meanwhile, refinery oil sludge increase to 20% lead to root dried weight increase. While the higher sludge increase resulted in lawn root dried weight decrease. We can conclude that proportion of taken sludge and sewage has affected on plants dried weight organ's changes. Soroosh et al [22] have reported the Japanese lawn different organs dried weight due to irrigation with Industrial town treatment plant sewage. The ratio of root wet weight to the aerial parts became meaningful at 5% probability. The feature of leaf width has not shown any meaningful changes as a result of Mashad Industrial Town sludge usage [Table 3].

Physiological feature

On the basis of results gained from variance analyses of physiological features, leaf surface feature index, total chlorophyll rate, a, b chlorophyll and total carotenoid didn't show any meaningful changes due to sludge usage in cultivating floor [Table 4]. Tartary et al, [2013] reported the 30% decrease in total chlorophyll, b, and photosynthesis capacity in *Poa pratensis* balin took place due to dryness tension. This study didn't result in such a finding. One of the reason could be the dryness tension which the lawn underwent. Consequently, low irrigation levels may be the decreasing factor in chlorophyll rate.

20% decrease in plant water requirement, may lead to chloroplast damage and may end up to eventual cell death (Keiser 1987, Fu and Hung 2001). As anticipated, due to high sludge salinity used, the relative water content of leaves has dropped which showed meaningful difference at 5% probability. The highest relative water content in control samples was 84% and in treatment samples was 10% of sludge weight of 81.5%. The relative lowest wet content obtained in treatment samples with 20% of sludge weight of (77.3%).

Meaningful changes were observed at 1% probability in stomatal conductance features [Table 4]. Consequently, higher sludge concentration caused noticeable decrease in leaves of *Poa pratensis* balin lawn stomatal conductance, in that the highest rate of stomatal conductance (345.9 mc ml per sqm /s) obtained in control samples and the lowest rate reported to relate to treatment samples with 20% sludge weight (255 mc ml /sqm/s) [Table 5]. There are various reasons to explain stomatal conductance decrease. Sometimes, different tensions particularly, salinity and dryness tensions will result in stomatal conductance which ultimately causes decrease in photosynthesis rate. Mohsen zade et al, [2003] reported that they observed decrease in stomatal conductance and photosynthesis rates in wheat irrigated by sewage which will end up in plant tensions.

Meanwhile, *Poa* leaves ion leakage in treatment samples using treatment plant sludge at 5% probability demonstrated meaningful changes (Table 4). The lowest ion leakage reported in control samples (13.43%) while treatment samples of 10% of sludge weight (24.5%) and 15% sludge weight (24.83%) did not demonstrate any meaningful difference. The highest rate of ion leakage observed in treatment samples of 20% sludge weight (28.7%), which showed meaningful difference with other treatment samples [Table 5]. Since most tensions naturally accompanied with the beginning of an oxidative tension, so the production and storing of poisonous groups and destructive substances to free oxygen are also increased. Therefore, electrolyte leakage will rise across tensions [26]. In this study, along sludge usage, ion leakage rate has arisen. Taken into account the high rate of EC in used sludge, this kind of sludge was exposed with salinity tension which led to increase in ion leakage. Non-saturated fatty acids peroxidation available in membrane phospholipids has knowing roles in the increase rate of electrolyte permeability through membrane [13].

Freera and colleagues have done researches on different proportions of sludge cultivated with a combination of *Logominoos* and Grass. They realized that, when they have done four rounds of iterated researches on cultivation, those plots treated with sewage sludge have shown higher and better physical and chemical characteristic in comparison with those which have been treated with just chemical fertilizers. Total rate of Phosphor, available soil absorbing Phosphor in plant CEC, soil water holding capacity, organic Carbon and sewage sludge treatment samples increased in comparison with those receiving the chemical fertilizers.

In India in 1986, they have irrigated more than 150 farms as large as 12000 hectares with at least 500 millions square meter sewage water. Sewage irrigation has rapidly grown since 1985. According to available statistics, nowadays in China, there are nearly 3 million hectares of agricultural lands and farms around small and big cities, cultivated to grow and produce rice, wheat and corn which are all irrigated with sewage [14].

Table 4: Variance analyses of *Poa pratensis* balin lawn Physiological features under the treatment of Mashad industrial town sludge (LAI- leaf surface index, Chol-T total Chlorophyll, RWC leaf relative water content, SC stomatal conductance, EL electrolyte leakage)

Source	df	Mean square							
		LAI	Chlo-T	Chlo-a	Chlo-b	Cartenoid	RWC	SC	EL
Treat	3	0.014 ^{ns}	0.074 ^{ns}	0.052 ^{ns}	0.02 ^{ns}	0.004 ^{ns}	23.25 [*]	4340.5 ^{**}	129.9 [*]
Error	12	0.106	0.019	0.023	0.008	0.003	3.16	204.7	3.9
CV	15	27.1	22.4	23	13.75	16.3	14.8	16	

Ns, *, ** meaningfulness at 1% probability, at 5% probability and non-meaningfulness

Table 5: Mean comparison of studied *Poa pratensis* balin lawn features under the treatment of Mashad industrial town treatment plant (LR root length, DW-R dried weight of root, DW-R Aerial dried weight, FWR dried weight root, FWA dried weight aerial, R/A(DW) relative weight of root to aerial organs, RWC relative water content, SC leaf electric conductance, EL electrolyte leakage in each column, figures with mutual letters have no meaningful difference.

	LR (Cm)	DW-R (g/plant)	DW-A (g/plant)	FW-R (g/plant)	FW-A (g/plant)	R/A(DW)	R/A(FW)	RWC (%)	SC(μm.m ² .s)	LE (%)
0	424.2c	1.74c	3.62a	3.93a	6a	1.27d	1.78a	84a	345.9a	13.43c
%10	445bc	1.83bc	3.22b	3.92a	5.34b	1.49c	1.41ab	81.5ab	301.6b	24.5b
%15	483.5ab	1.99ab	2.87c	3.46ab	4.76c	1.82b	1.22bc	80.29bc	283.8bc	24.83b
%20	504.3a	2.07a	2.69c	3.24b	4.46c	2.04a	1.1c	77.3c	255c	28.7a

CONCLUSION

Using sludge of Mashad industrial town treatment plant has brought about meaningful changes on developmental characteristics of a kind of lawn called *Poa pratensis* balin. This sludge usage in turn caused meaningful increase in dried weight of aerial and ground organs. Our finding showed that this kind of *Poa pratensis* balin has high potential to purify Nickel from soil, even though Lead was accumulated only in aerial organs. Therefore, this kind of *Poa pratensis* balin lawn could be introduced as a suitable phytoremediation kind of plant for lands and soil contaminated with Nickel.

To purify an area contaminated with different pollutants (through phytoremediation), plants should be selected in a way to ensure they have the ability and potential to adjust, grow and develop in contaminated environs. They should also bear, bloom, grow, develop and improve roots under such conditions [2]. However, reported researches on decorative phytoremediation plants in contaminated lands hit by ecological and environmental pollutants such as heavy metals are somehow rare. Yet recognizing and introducing resistant species which could be used as phytoremediation plants in horticultural development, enhancing green areas, landscapes and land improvement are vital.

CONFLICT OF INTEREST

There is no conflict of interest

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

THE RELATIONSHIP BETWEEN USING SUKUK AND ACHIEVING IDEAL CAPITAL STRUCTURE: EVIDENCES FROM LISTED COMPANIES IN IRAN

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ABSTRACT

Sukuk (Islamic bond) is an investment certificate consisting of ownership claims in a pool of assets. In addition to the Islamic countries, there are a growing number of sukuk users from the United States, Europe, and Asia. In this descriptive analytical study the purpose is to assess the relationship between using Sukuk for financing and achieving ideal capital structure in listed companies. The study samples were 17 listed companies in Tehran Stock Exchange in a period from 2006 to 2011. Data were collected from financial statements and annual reports of the study samples. We hypothesized that the use of sukuk bonds is significantly correlated to (a) debt/asset ratio (D/A) and (b) debt/equity ratio (D/E) of listed companies. They were analyzed using panel data method in the form of regression models. Results supported our hypothesis. According to the results, sukuk can significantly predict D/A and D/E ratio of listed companies as 52.2 and 13.7%, respectively ($P < 0.05$). We concluded that by using sukuk bonds as a new financing instrument, listed companies can achieve an optimal capital structure.

INTRODUCTION

KEY WORDS

Sukuk, bonds, capital structure, listed companies, Tehran Stock Exchange

Achieving ideal capital structure in order to gain maximum profitability, value and minimal cost of capital is one of important topics studies by financial experts. Experience has shown that most of companies that are faced with financial distress and bankruptcy often had inadequate capital structure. Capital structure or leverage refers to debt and equity and, and all of their variants which support the assets of a company. For analyzing capital structure, a firm's debt/equity ratio (D/E) is an important factor; a company that has high debt usually has a more aggressive capital structure and therefore poses greater risk to investors. Accurate analysis of capital structure can help a company save on the part of their cost of capital and hence improve profitability for the shareholders. In this regard, several studies have been conducted. Modigliani and Miller [1] suggest that (a) the value of a firm is not related to the capital structure of a firm, and (b) whether a firm is highly leveraged or has lower debt component, it has no effect on its market value (Modigliani & Miller theory). Kraus and Litzenberger [2] suggested that there is an optimal capital structure (D/E ratio) that maximises the firm value which should reach by using the right amount of debt (Trade-off theory). Jensen and Meckling [3] suggesting that the appropriate mix of debt and equity is still effective, argue that the interests of managers and shareholders are different which can result in costs called agency costs that include the instance monitoring costs (Agency theory). Myers and Majluf [4] showed the effect of information asymmetries between the firm's managers and the outside investor on capital structure (Pecking Order Theory). Booth et al. [5] found that the tax benefits vary in developing countries and play no role in the determination of capital structure. Some studies have shown that the determinants of capital structure are country specific and they are different in various countries [6-8]. Choi [9] pointed out that this is because of their institutional differences such as level of transparency and investor protection, besides the bankruptcy and tax laws, so research findings from one country cannot be generalized to other countries. Acedo Ramirez and Ruiz-Cabestre [10] concluded that this difference is because of the type of financial systems of the countries. Many studies have shown positive relationship between tangibility and capital structure [11-13]. Chen and Strange [14] in a study in China found that profitability is negatively related to capital structure; the size and risk of the firms are positively related to the debt ratio – but only in term of market value measures of capital structure; the years of the companies being listed on stock markets are positively related to capital structure; tax is not a factor in influencing debt ratio; and ownership structure has a negative effect on the capital structure. Choi [9] indicated that profitability, tangibility of assets and firm size are significantly positively related to the capital structure of Korean firms. Growth opportunities and tax shield substitutes were significantly but negatively related to the capital structure. Abor [15] indicated that age, size, asset structure, profitability, risk and managerial ownership of the firm are important in influencing the capital structure decisions in Ghana. In another study, Obeid Gharaibeh [16] revealed that firm's age, growth opportunities, liquidity, profitability, firm's size, tangibility, and type of industry are determinants of capital structure of listed companies in Kuwait. Bhaduri [17] in a study in India showed that optimal capital structure choice is influenced by factors such as growth, cash flow, size, product and industry characteristics. His results proposed the existence of restructuring costs in attaining an optimal capital structure. Delcours [18] found that in Central and Eastern European countries neither the trade-off, pecking order, nor agency costs theories explain the capital structure choices and companies follow the modified pecking order. Drobetz and Fix [19] showed that firms with more investment opportunities apply less leverage, which supports

Published: 2 Oct 2016

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both the trade-off model and pecking order model. They showed that Swiss firms tend to maintain target leverage ratios. Noulasa and Genimakis [20] showed significant positive correlations among firm's capital structure and sales, growth rate, tangibility of assets, depreciation, profit volatility and credit rating. Respectively, profitability and firm's age are significantly inversely associated with capital structure, whereas the number of workers as a measure of firm size does not have an effect on capital structure.

Considering the previous researches on achieving optimal capital structure in different countries, in this paper we aim to investigate the effect of using investment sukuk (Islamic bonds) on capital structure of listed companies in Iran where the business is consistent with Islamic law (*Shariah*). Sukuk is very similar to conventional bonds where it provides a fixed income to the investor. It constitutes partial ownership in a debt, asset, project, business, or an investment. Sukuk provides diversified financial resources to develop market and liquidity management of Islamic economic firms. It is basically an investment certificate consisting of ownership claims in a pool of assets. It is a type of financial instrument backed by physical assets of the balance sheet. According to Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) (standard no.17), sukuk are "Certificates of equal value representing undivided shares in ownership of tangible assets, usufructs and services or the assets of particular projects or special investment activity". There are different types of sukuk such as *Murabahah* (issued for financing the purchase of goods), *Ijarah* (issued for using mobilised funds to rent a real estate or the usufruct of the real estate), *Istisna* (issued for mobilising the funds to be used in production of new goods), *Musharakah* (issued for using mobilised funds to establish a new project), and *Mudarabah* (used for enhancing public participation in big investment projects). Curiel and Mardam-Bey [21] in a study called sukuk "an alternative capital structure" and reported that from January 2001 through December 2010, Malaysia topped the list for global Sukuk issuance by volume (59%), followed by the UAE (16%), and Saudi Arabia (8%). Malaysia and the Gulf region are the main hubs for Sukuk issuance; however, Sukuk issuance is not limited to Islamic countries. There are a growing number of issuers from the United States, Europe, and Asia [22]. In Iran, although the first use of Islamic financial instruments dates back to 1994 with the issuance of *Musharakah* sukuk by Tehran Municipality to finance *Navab* project, the enactment of Iran securities market law, and new instruments and financial institutions development law was done respectively in 2005 and 2010 to pave the way for the appliance of such instruments to develop financial system of the country. As of July 2011 and for the first time since the law was passed 3 years ago, Iranian companies such as Mahan Airlines and Saman Bank have respectively issued \$30 million and \$100 million worth of this type of bonds [23]. Cakir and Raei [22] studied the impact of sukuk on the cost and risk structure of investment portfolios. Their analysis showed that secondary market behavior of Eurobonds and Sukuk issued by the same issuer are significantly different to provide gains from diversification. They argue that Sukuk are smaller in size and have shorter maturities compared to Eurobonds issued by the same issuer. So far, no study has been published based on finding the relationship between the use of Sukuk and achieving ideal capital structure in any country. In this regard, in this study we attempted to investigate their association among listed companies. The research questions are:

- Q1. Is the use of sukuk significantly correlated to debt/asset ratio (D/A) of listed companies?
- Q2. Is the use of sukuk significantly correlated to debt/equity ratio (D/E) of listed companies?

MATERIALS AND METHODS

Study samples

Study samples were 17 companies from multiple sectors chosen from a population of 385 companies listed in Tehran stock exchange during the period 2006-2011. They selected based on having released sukuk and the availability of data. The data set used for analysis was collected from financial statements and annual reports of the study samples.

Study hypotheses

The CS is a mixture of long-term debt, short-term debt, common equity and preferred equity; Equity comes in the form of common stock, preferred stock and retained earnings, while debt is classified as bond issues or long term notes payable. In this study dependent variable is "ideal CS", and independent variable is Sukuk. Based on above discussions, we formulated our hypotheses as following:

- H1. There is significant relationship between use of Sukuk and debt/asset ratio of listed companies;
- H2. There is significant relationship between use of Sukuk and debt/equity ratio of listed companies.

Study models

Two different proxies of capital structure (CS) are measured in terms of book value rather than market value, debt to total assets or debt/asset ratio (D/A) and debt/equity ratio (D/E). To measure the

relationships between sukuk with the above-mentioned determinants (debt, asset, and equity) of capital structure, we use the Ordinary Least Squares (OLS) estimation based on the following regression models:

$$y_{it} = \alpha_1 + \beta_1 s + x_{it}$$

$$y_{it} = \frac{X_1}{X_2} \quad (1)$$

$$y_{it}^* = \alpha_1 + \beta_2 s + x_{it}$$

$$y_{it}^* = \frac{X_1}{X_3} \quad (2)$$

where, y represent D/A ratio and y^* is D/E ratio, i denotes each individual Iranian listed company, t is the examined time period, X_1 = book value of total debts, X_2 = book value of total assets, X_3 = book value of equity, S = amount of released sukuk, e_{it} = the random error term, α_1 is the constant term, and β_1 and β_2 are the regression coefficients. The two regressions were estimated by the OLS and the results are analysed in the following section. In addition, since sukuk are fixed parameters and in Iran their amount are announced by the Iranian Central Bank, we used their reported data for measuring sukuk.

RESULTS

Descriptive data of study variables

Descriptive statistics of study variables showed that mean $\pm$ standard deviation (SD) of the use of sukuk by Iranian listed companies was 33.62 ± 10.38 . Also, the results for X_1 , X_2 and X_3 were 26.57 ± 6.2 , 0.53 ± 0.15 , and 27.32 ± 10 , respectively [Table 1].

Table 1: Descriptive statistics of the study variables

	S	X_1	X_2	X_3
Mean	33.6229	26.5746	0.5382	27.3258
Median	30.4000	27.3150	0.5140	39.2154
Mode	29.10	21.10	0.46	31.10
SD	10.38184	6.27101	0.15085	10.00221
Skewness	0.933	-0.247	0.717	1.440
Elongation	0.636	0.087	0.635	4.749

Regression results

For conducting panel data analysis, we first need to check whether the panels contains unit roots or they are stationary. For this purpose we used Dickey-Fuller test. The null hypothesis of the Augmented Dickey-Fuller is that there is a unit root, with the alternative that there is no unit root. P-value for all variables were obtained as 0.0000 which was less than critical value (0.05) then we cannot reject the null hypothesis and there is a unit root. In panel data analysis, there are two common assumptions made about the individual specific effect, the random effects assumption and the fixed effects assumption. The random effects assumption is that the individual specific effects are uncorrelated with the independent variables. The fixed effect assumption is that the individual specific effect is correlated with the independent variables. We use Hausman test to choose random (RE) or fixed effect (FE) method. If the null hypothesis is rejected, we conclude that RE is inconsistent, and the FE model is preferred. Its results reported $\chi^2(1)$ as 10.300, $df = 6$, and $prob. = 0.0126$. Since $prob.$ is less than 0.05, so FE is consistent; therefore the null hypothesis is rejected and FE is preferred.

Regression results for examining the relationship between the use of sukuk and D/A ratio of listed companies are presented in [table 2]. Durbin-Watson statistic (D-W) was used for testing the presence of autocorrelation. Since its value (1.091) is higher than critical value, so the errors are not autocorrelated. R square value indicated that 52.2% of variations in D/A ratio can be predicted by the use of sukuk. The p value associated with this F value is very small (0.0000) (less than 0.05) which shows that sukuk can reliably predict D/A ratio of listed companies. The t-value showed that the coefficient for sukuk (2.853) was significantly different from 0 (p -value < 0.05). Overall we found out that sukuk has significant relationship with D/A ratio of listed companies in Iran. The regression equation can be written as:

$$y = -2 / 290 + 0.137s$$

[Table 3] presents the regression results for examining the relationship between the use of sukuk and D/E ratio of listed companies. D-W value (1.095) was higher than critical value, so the errors are not autocorrelated. R square value indicated that 13.7% of variations in D/E ratio can be predicted by the use of sukuk. The p value associated with this F value (< 0.05) showed that sukuk can also reliably predict D/E ratio of listed companies. The t-value reported that the coefficient for sukuk (2.073) was significantly different from 0 (p -value < 0.05). Overall we found out that sukuk has also significant relationship with D/E ratio of listed companies in Iran. The regression equation can be written as:

$$y^* = -0 / 128 + 0.860s$$

Table 2: Regression coefficient estimation results for testing the relation of sukuk with D/A ratio

Model	Un standardized coefficients		Standardized coefficients	t	Sig. (2-tailed)	D-W
	B	SD	Beta			
Constant	-0.290	0.128		-2.260	0.033	1.901
Sukuk	0.137	0.048	0.419	2.853	0.009	
R square= 0.522 , Adjusted R square= 0.464 , F= 9.093, Sig.=0.000						

Table 3: Regression coefficient estimation results for testing the relation of sukuk with D/E ratio

Model	Unstandadized coefficients		Standardized coefficients	t	Sig. (2-tailed)	D-W
	B	SD	Beta			
Constant	-0.128	0.172		-0.741	0.31	1.095
Sukuk	0.860	0.415	0.370	2.073	0.048	
R square = 0.137, Adjusted R square = 0.105 , F= 4.296, sig.=0.084						

CONCLUSION

Decisions about capital structure which is corporate financing, like other decisions of managers, influence the value of the firm. Managers as representatives of shareholders, always try to set the composition of the company's capital structure such as to increase corporate value, and shareholder wealth; therefore, specifying an optimal capital structure and financing of companies has a special significance. For this reason managers should be aware well of the influence of variables that can affect the company's capital structure. Most of studies conducted on capital structure have focused on its influencing factors which are different in various countries as were mentioned in Introduction section.

In this study our purpose was to investigate the relationship of sukuk use with achieving ideal capital structure as case study conducted in Iran. Samples were 17 companies listed in Tehran stock exchange for five years from 2006 to 2011. we measured capital structure by applying book value rather than market value as most of predictions apply it [24]. Book ratios can better reflect management's target debt ratios [25]. We hypothesized that sukuk has significant relationship with both debt/asset ratio and debt/equity ratio. Using panel data analysis, results supported our hypotheses which indicate that new financing tools like sukuk can affect the capital structure of firms. In this respect, sukuk was able to reliably predict 52.2% of variations in debt/asset ratio and 13.7% of variations in debt/equity ratio ($p < 0.05$). Overall, we concluded that by using sukuk as a new financing tool, listed companies can achieve an optimal capital structure.

Low share of fixed-income securities licensed by the Iranian Exchange Organization and the high proportion of the allocation of investment companies to underwrite fixed income securities with the permission of the Iranian Central Bank have caused these companies to be inclined to the bonds issuance in the market to earn money, so it is recommended that Iranian investment companies, by designing new financing instruments and taking into account the characteristics of firms, pave the way for improvement of business environment for financial institutions.

CONFLICT OF INTEREST

There is no conflict of interest

ACKNOWLEDGEMENTS

This paper was extracted from a master thesis prepared by Maliheh Yonesi in 2015 which was approved by Islamic Azad University of Qeshm Branch in Iran

FINANCIAL DISCLOSURE

None

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ARTICLE

IRANIAN EDUCATIONAL ENVIRONMENTS; ARCHITECTURAL STUDIES OF MADRASEH BUILDING IN AZERBAIJAN-IRAN

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ABSTRACT

Background: Since a long time ago, Iranian people interested in science and they try to learn knowledge and education with taking faith principals and new, contemporary education in different eras and used from every opportunity. Iran, particularly Azerbaijan that have vast geographical area, have various education systems that sometimes were effective and sometimes were unsuccessful. In Iran, education have close relationship with religion and paranormal beliefs, from past eras up to now, large size of education affairs dedicated to belief problems and this subject have deep influence in education contents and concepts and it has also appeared in lesson places. **Methods:** When Iran education history and its bodies are investigated, it is necessary to consider different belief aspects and body attributes of religious environments but the most of physical body of past architectures in Iran are destroyed and researchers only can use written sources and as possible as restore their contents. **Results & Conclusions:** In this paper have attempted to investigate the historical transformation development in Iranian schools and the case study of Azerbaijan schools and education environments around the body and architectural study have done until we attain to prove results and take past experiences in designing of current education spaces. In this direction, it has been tried to obtain the reliable conclusions in traditional architecture of Iran education environments in Azerbaijan zone that it is included library studies –whether architectural or human science scope- and figures, maps, tables and case studies.

KEY WORDS

Educational environment,
Architectural Studies,
Sustainable
Architecture, Madraseh.

INTRODUCTION

Education, in Iran, from the ancient times until now has experienced lots of ups and downs from philosophical, motivational and planning points of view. Teaching war and battle techniques to children and teen in the Median¹ time and before that, teaching the religious beliefs of Mithraism² and Zoroastrianism in Achaemenid⁴ and Sasanian⁵ time were the reasons of booming education from the ancient times. Then after appearance of Islam and this religion's emphasis on learning and knowledge, and outstanding revolution happened. As time passed the Islamic countries of that time were changed to center of education and pole of science and knowledge. Then facilities like Nezamiyyeh, libraries and observatories were built to teach both religious concepts and other fields of science from mathematics, music and astronomy to natural and medical sciences. In the following decades different governments and their policies and also helps of open-minded and brainy people made the schools more popular. In the Safavid⁶ era, glorious schools were built in big cities such as Tabriz and Isfahan and consequently modern education methods were introduced in Iran in a way that most of those methods are used in the current religious schools. Getting closer to recent times as a result of educational migration to Europe, the framework and concept of education in Iran changed and it was the appearance of new season to opening of modern schools in the Pahlavi⁷ era.

In this research the researchers have tried to reach a pattern to historical chronology of Iranian schools, schools of Azerbaijan in particular, based on their history, framework and architecture using the resources such as book, maps, photos, interview, observation and also field works. So comparing the sense of place, as an architectural determinant factor, between classic and modern school, and obvious vision has been provided from these educational places and their characteristics.

Education in Ancient Iran

In the ancient Iran according to the social history of ancient times in Iran, three groups were responsible for education: family, society and government. Most of the concepts were religious specially Zoroastrianism and perhaps were in daily praises and in the family environment: "... oh Ahura Mazda! grant me a perfect child; a child that be in his/her society and do his/her duties well, and do the best for the happiness of family, city and country; a honored child that help the poor, regularly..." [1]. So the importance of education and dedicated environments for this purpose can be seen in the architecture of that era.

Content and form of education in Ancient Iran

Education was being done by a master and in the afternoons and in the free times after work to teach special skills [2]. Primary schools were in the families and in the houses of that time, and in some cases when the discussions were becoming serious a room or special spaces were considered in the house. Before Islam, educational centers were located beside the Palaces and governmental centers or Altar,

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Published: 4 Oct 2016

temples that people worship fire, and far from trade centers [3]. This verse of Ferdowsi⁸ proves this: "In each alley that were school, you could find fire worshipers."

Sasanian Empire

In this era as the result of Zoroaster as the formal religion and being lots of Zoroastrian priests and religious teachers, education became compulsory. Antiquity of this can be found on the epigraphs of that time that contain the word "Depi or Dabir" which means school and also can be found in Shahnameh. However "school" word was used by Daabale Khazayi, Shiee poet and scholar (765-859), in the mid^{2nd} Islamic calendar century in his poem [4].

"Jondi Shapoor", "Beyt Al-hakam of Baghdad", "Jame Al-azhar of Egypt" and "Azodi scientific center and hospital of Baghdad" are the examples of schools of Sasanid that none of them become as famous as known schools and even their plans were completely different from the Nezamiyeh¹⁰ schools [5]. School of "Naseibin" was rebuilt by one of the Iranian bishops of "Barsuma" in the mid^{5th} AD century. The number of students of mentioned school is estimated to be 800 [6]. Educational centers were located beside the Altars [7] and altars like the religious centers of other religions were multi-functional and apart from religious matters were places to educate and judge and also places for secretions.

Early and middle ages of Islam

After accepting Islam by Iranian, contents, forms and frameworks of schools changed and a new kinds of schools appeared that now are called "Madreseh", that means traditional schools; but "Maktab Khaneh", kind of place that were used to educate children in house areas, were used in this time. For instance "Badi Al-Zaman Tabrizi" in 1001 AH in school of his father learned philosophy, wisdom, literature and calligraphy [8].

In the early ages of Islam most of educations were concentrated in the mosques, but because of the mosque's holiness and respect this duty was not suitable for them so Madresehs appeared beside the mosques [9] and in some cases they changed to mosque-school (Masjed-Madraseh).

In this time independent Iranian governments became the reason of Iranian Renaissance. In a way that creation of different rings of science, literature and philosophy and big and valuable libraries expresses this fact. For instance there were libraries in the Shiraz which were like current libraries with the subject classification [10] and even in this library they were geographical maps drawn on the canvas [11]. The completed form of libraries was called "Dar Al-olum" that was paying the education fees of students [12]. According to the appropriate diversity of schools, it was considered by Muslims in building environment and urban design [13]; in a way that in building the environment the purpose was to classify the spaces and facilities based on needs and distribution of residents.

Rising the Seljuks¹¹, lots of "Khanqah" and "Rabat", Darvish's convents, were built for Sufis¹². Gradually and as the power of governments were increasing, the "Rabat" lost their past meaning and usage and became equal with mosque and religious school (Masjed-Madraseh) [14]. Generosity rule is an ethical, religious and mystical way, because it was based on edification and development of moral virtues [15]. One of the principles of Iranian mysticism, was education and building special place for this purpose and respecting to that place.

Marageh observatory

At the age of Ilkhans¹³ different science centers were built. One of them was Marageh observatory, which was the first scientific and research center of Ilkhans with its unique architecture [16]. Marageh library contained 4000 books and with the possibility of group research, which can be seen in European schools of following years, are other characteristics of this observatory.

Shanb Kazan complex

This complex contains buildings such as mosque, school, convent (Khanqah), Dar Al-Shafa (hospital), library, observatory, Beyt Al-Siyadat (lordship house) and Beyt Al-Qanoon (court). Educational centers of this complex were "Shafei" and "Hanafi" Madreseh and children school [17]. Historical written resources prove that building of Shanb Kazan (Sham kazan) is a Dodecagon prism [18] and each side of it was built as a tower and the building of tomb in the middle of other building is glorious with beautiful decorations inside it.

Rabee Rashidi

The important and glorious complex of "Rabee Rashidi" was built by Rashid Eddin fazl Ollah to gather all the scientists, scholars and literate people of that time [19]. This complex was like current campuses and

as a center to exchange and research about the last achievements in science and art. This complex was containing big libraries, school and convent (Khanqah) for Sufis and Dervishes and all of these facilities were managed by the earning of endowments [20].

The architectural framework, form and facilities of this complex were in the following order: 1. "Rabe" including: Roze, Khanqah, Mehman sara (guest lounge), hospital, school of medicine and Dar Al-Masakin (poor people houses); 2. Countryside of "Rashidi" including: big complex of building, mosque, places and welfares instruments for workers, 3. "Rabze Rashidi" Including: special buildings for Rashid Oddin family and his servants and relatives.

Architecture and structures of Rabee Rashidi's scientific-educational units were: a) Beyt Al-Taalim (school), b) High school (college), c) Technical institute, d) Dar Al-Shefa (hospital), e) Dar Al-Qoraan (holly book of Muslims), f) Beyt Al-kotob (library) [19]. Rabee Rashidi beside the mentioned places, had other building like reception hall, poor people houses, guest's room, Seyfi and Shatari mosques [21]. This unique complex that just its ruins are remained can be called the founder of modern education and unique architecture and an inspiration for modern upcoming schools and universities.

Argeh Ali Shah (Ali shah's Castle)

In this time one of cultural complexes, which can be seen now, was built in Tabriz. History has called it "Miyar-Miyar". This building includes a mosque that has a scientific-religious unit in one side, a convent (Khanqah) in south-west part and a "Hamam" (public bathroom) in south-east part [22]. In the following years one of the doctrines that were founded until "Mashrooteh"¹⁴, was a doctrine called "Ark's Dabestan" (castle's school). This "Maktab Khaneh" (children school) was founded in a mosque beside the castle at 1892 [23]. The only building that remains now in Tabriz is "Ark" (castle). This complex was a combination of cultural, educational and artistic spaces in a governmental complex.

Soltaniyeh Complex

One of the other complexes of this time that was built in imitation of "Shanb Kazan" and with the order of "Oljayto" was "Soltaniyeh Complex". This complex included buildings like Dar Al-Shafa (hospital), pharmacy, Khanqah and Dar Al-Seyadat (women houses) [16]. Soltaniyeh tomb looked like Marageh observatory's dome. In Soltaniyeh a school was built in imitation of "Bagdad's Mostansariye School" and many lands were devoted to it. In this school there were 16 teachers. Soltaniyeh mosque is the only remaining of this complex.

Mobile schools

One of Ilkhans initiatives in the field of booming and spreading science and knowledge was founding "Mobile Schools". As a result of Ilkhans customs, who were in travel and war, to avoid stopping to educate, they founded mobile schools. It must be mentioned that although religious trend had direct and positive effect on building and founding schools, in some cases such as "Rabee Rashidi" and many other schools in Khorasan they were ruined because of conflicts between different sects [24]. This proves that fact that schools could affect the rise of conflicts in a way that in conflicts, parties were trying to attack and ruin each other's schools

Other places for making educational circles, in the teachers' houses, were libraries and sometimes palace of kings; e.g. Naser Khosro says about Abou Al-ala mo'erri, 438 AH, that had more than 200 students for learning literature and poem [25]. There the mosques were playing an important rule and spaces like porches and their compatibility with education proves this.

Mosque-School (Masjed-Madraseh)

Mosques are the best example of a place that have both contents and structure of education formed inside. Completing the structure of mosques and adding new places and facilities and considering both education and praying inside it, a new structure called "mosque-school" was created. Considering mosque and school integrated and united, school was the presenter of Islamic nation that had religious and non-religious activities, which was considering and respecting Islamic regulations together, inside it.

Building form of mosque-school

Evolution of mosques in concentrating on educational matters and its effect on the structure of mosques was started from early 3rd century AH. Using four porches instead of one proves this fact because porches were a place to start the education and related discussions. Some examples like mosque-schools in Ardestan, Qazvin, Qolpayegan, Zavare and Esfahan. In fact these places were the schools which were built in the mosque. In this case the porches of second floor around the yard of school were chambers of

students. Rooms behind the porches were completely compatible with such function which confirms this idea but different kinds of social activities could be done in such porches and use the spaces of both floors. These places could be a good choice for social activities of mosques.

Independent schools

In the early 4th century AH, when the country was governed by Seljuks, because of spreading public education and insufficiency of existing multi-functional educational spaces, new independent schools were founded but acceptable schools were founded after 150 years and in mid-5th century AH. Structure of these schools was like a religious complex with the plot of 4 porches (Chahar Eivan). The whole of structure was similar to a temple. Central yard was surrounded from two sides by rooms that could be place for residence of students. In the other two sides there were big porches (Eivan) ending to halls with dome shape covers.

"Nezamiyeh schools" were the start point of state schools in the history of Iran that were completely independent of mosque-school [26]. Schools and science centers, that were built with the order of Khajeh in the eastern parts of Islamic territory and territory of Seljuks, are in two groups: one the schools that were like current primary and high schools that were in the small cities and villages, other was the big schools that were like current modern universities and higher education centers [5] that had useful facilities and because they were related to Nezam Al-Molk, they were called "Nezamiyeh".

From structure point of view porches (Eivans) of schools were the main spaces for speeches, groups of discussion and also saying the prayers and from two opposite porches one was as "Shabestan" (religious indoor covered with columns) for saying prayer and the second one was for education. One of the characteristics of Nezamiyeh schools that had big effect, semantically on the structure of educational spaces, were chair and seat place for teachers [5]; but crowd of students was the reason to make a bigger chair for teachers and the students were in front of teachers and teacher assistants in his sides, a method that could increase the quality and quantity of education. But before that teacher and students were in the form of "Maktab khane" in a level and around a circle. Examples of this time's schools until Safavid in Tabriz are "Sadriyeh", "Majdeh Roomi", "Kazan Khan shool", "school near Ali Shah mosque", "Khalediye", "Soltan Oveis" and "Nasriyeh". Other schools from Mongol¹⁵ until Safavid in the Azerbaijan are "Soltaniyeh Khanqah", "Eltefatiyeh" (in Qazvin city), "Mohiyyeh", "Seyvasi" (in Marageh), and "Moa Al-Din" (including school, Khanqah and hospital in Hamedan city).

Safavi Schools

Education in this time changed considerably from content, plan and appropriate structure points of view. There are different reasons behind the developments of Safavid era. Before them the education was limited to special powerful people and not for public and the limited number of public schools were suffering from lack of facilities and planning. But in Safavid era schools were a place for political-religious legitimation for the government; governors were interested in spreading country's formal religious and Safavi kings were interested in art, for instance Shah Abbas's interest to architecture and Shah Soltan Hossain's interest to education confirms this, are the reasons [Fig. 1].

One of the other methods that accelerated the education was the method of devotion that helped the schools to be independent. In a way that first a "Karvan Sara", such as current hotel the way as the main source of income [27], and then a "Hammam" (public bathroom), "Qahveh Khaneh" (coffe shop), "Bazaar" and "Bagh" (garden) were added to it.

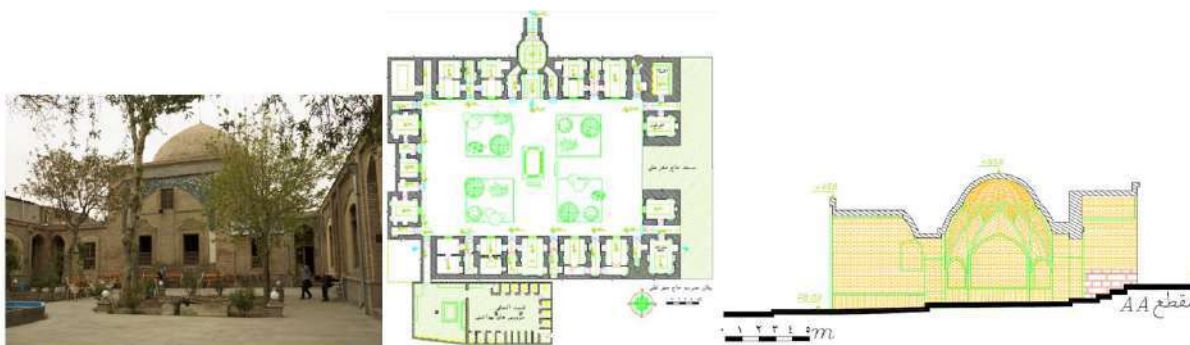


Fig. 1: Image, Plan and Section of "Haj Safar Ali" Safavi School, a traditional school of Tabriz, authors. December, 2013.

Schools founded in Tabriz in Safavid

Masjed Jaameh and Talebieh school: In the place of Masjed Jaameh, main and largest mosque of city, four mosques can be seen including: the oldest one "Alchaq Machid" (short mosque), from Seljuks; second one built in the south of corridor of school and now known as "Ismayil Khalogli" (name of person); third one is the "Jaameh mosque", known as "Mojtahed", that its northern windows are opened to the yard of "Talebiyeh school" and was built in the west of "Ismayil Khalogli" and finally the last mosque which is too old and has experienced several changes is known as "Hojjat Al-Eslam" and is in the west of "Masjed Jaameh" and its northern windows are opened to the yard of mosque. The founder of this complex is likely to be "Mirza Aboo Taleb", one of the Safavi grandees.

Saheb Al-Amr Square, Akbariyyeh School: This building consists of a school for religious science and tomb of "Saheb Al-Amr" and a mosque. This building was built at the age of "Shah Tahmasbeh Avval" (king of Safavid) [Fig. 2].



Fig. 2: "Akbariyyeh" school's Plan and image, "Saheb Al-Amr" square, authors. February, 2014.

Tomb of Seyyed Hamzeh: This Monument is the tomb of one of Imam Musa Kazim's offspring which is located in the south-east part of mosque. Based on marble decorations and remaining tiling, it can be concluded that the mosque once was glorious and beautiful. Existing of rooms for student shows that it was used as school too [Fig. 3].



Fig. 3: Image and plan of "Tomb of Seyyed Hamzeh" masjed-madrasesh, Tabriz, authors. February, 2014.

Sadegiyyeh School: This school was built at the end of northern part of "Sadegiyyeh Bazaar" by Mirza Sadeg Khan. "Sadegiyyeh Bazaar", "Hammam" (public bathroom) and a village were of his devotions and from 14th century RIC after its stagnation, it repaired and rehabilitations.

Mosque- school of Haj Safar Ali: At the mid 13th century AH in the middle of Tabriz Bazaar and with the help of Haj Safar Ali trader was founded.

Mosque-school of Haj Ali Asgar: "Haj Ali Asgar Khaje-ye Mazandarani" built it in the "Haram Khaneh alley" close to his house.

School of Mirza Ali Akbar: The translator of Russian consul, Mirza Ali Akbar Khan founded this school at 1266.

Classical pattern of traditional schools

As the result of slight changes, it can be concluded that classical pattern of traditional schools are the schools of Safavid era. In this kind of architecture the architect tries to consider financial affairs, subject

and application of building, materials, technical aspects and environmental conditions of travelling from exterior into interior [28]. The overall plan with four porches (Chahar Eivani) is the main characteristic of these schools; beside that volume and more special diversity and more use of decorations and tiling is the main difference of these schools with Timurid¹⁶ and Seljuk schools. According to classical pattern central yard is surrounded with open porches and with arc-shaped view in two floors. At the end of these porches there are rooms for students to stay and study. The central porch, a semi open porch with arc arches with better decoration than other parts of building, was used as a place for educational or religious speeches, school or to make rings of decision. Stable and glorious entrance and considering spaces at the corners of school for applications like library or official affairs can be named as the initiatives of schools at this era.

Contemporary schools

Relations with West, by sending student to Europe to study, getting familiar with the up-to-date science, by translating books and articles, and also getting familiar with some European industries [29] and some other reasons affected the education in Iran, consequently lots of changes were made in the planning, purposes and goals of education and content of education which was pure religious.

Emersion of new schools

9.1.1. Dar Al-Fonoon: "Mirza Jabbar Baghcheban" was one of influential people on founding modern schools in Iran and Azerbaijan. The founder of "Ahmadiyyeh School" at 1303 RIC opened first kindergarten in Tabriz. He also considered two classes of that kindergarten for deaf and mute children [22]. The first state school of Azerbaijan was founded by "Mozaffar Al-Din Mirza" at 1300-1313 AH with the name of "Mozaffariyeh" which was called "Dar Al-Fonoon" after its reopening.

Mirza Hasan Roshdiyeh: The name of Mirza Hasan Roshdiyeh comes with modern schools in Iran and has been entitled as the father of modern schools of Iran. Unlike the traditional schools that students were sitting at the sides of teacher around the class, Roshdiyeh placed them on the benches, in front of the teacher. Benches were in rows and in front of teacher to be able to attract the most attention of students [30]. The most important things for Roshdiyeh were placing the school [31] in a location with ease of access and increasing the rate of attention which needs the building to be simple and easy to construct. Sense of place and a mentally suitable environment and students' relation with teachers were the concepts that were considered more about the modern schools. Studying this matter may mean that students like the past, should have space and in an active way should understand it [32]. Islamic architects were believing in making efficient environments and suitable for groups [33] but in the modern schools students consider the architecture unfamiliar and this a sign fake, low value spaces, poor places and educational spaces.

Traditional schools

These schools have been repaired and reopened and they are used as centers with the focus on religious science. The reason behind the life of these schools is the need for experts and specialists in the field of religious science who are needed for educating and subject such as devotion, a way that can be considered as a source of funds for controlling the school independently. For instance in managing "Shokatiyyeh" school, vast donations of Shokati was used in a way that annually tens of students were receiving financial aids and different gifts [34]. According to historical resources there are 12 schools in the field of religious and Islamic science, such as Talebiyyeh, Sadeqiyyeh, Jafariyyeh, Akbariyyeh and Haj Safar Ali in the Tabriz Bazaar.

One of the oldest schools of Tabriz is "Memorial school" known as "Parvin Etesami" high school now, which was built by American ambassador in Tabriz. The name of this school has a close relation with the Mashruteh events [35] and death of this school's teacher, Haward Baskroil.

From architectural point of view, the shape and design of modern schools, was a scape from traditional architecture to rational and functional architecture of west. In a short time after the mentioned chronology functional and structural changes appeared in the structure of building. For instance to get rid of educating technical and industrial skills, based on "Omid Ebtekar" opinion, first technical and industrial schools were founded with the innovation of "Mohammad Ali Tarbiyat" [23]. In the Pahlavi schools a sense of eminence and glory have been reflected in the big and high entrance. This picture shows the "Neo classic" interests same as the Alborz School's entrance. One other characteristic of these schools is simplifying and orienting internal corridor instead of yard. Lack of educational space, laboratory, workshop buildings and facilities [36] were the problems that changed the structure of schools and appeared as the result of new educational systems and policies.

Comparing sense of place as a differentiating attribute of architecture in traditional and modern schools

As mentioned before one of differences between traditional and modern schools is the sense of place. Compares two samples according to factors of special sense, one mosque-school of "Talebiyyeh" (traditional) and the other school of "Amir Khizi" with modern and newer architecture and is discussed in Table 1..

Table 1: Comparing framework, formal and architectural factors of sense of place in traditional and modern schools, authors.

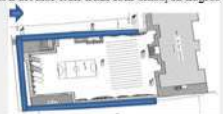
Framework factors of sense of place	Guidance school of "Amir Khizi" in Charndab St. (Modern and Newer)	School of "Talebiyyeh" in the older direction of Tabriz Bazaar. (Traditional)
❖ Size of place	Concentration of class(volume of class/number of student) is low.	New proportions has a kind of opening vision in the places, and the number of student is low so there is lots of space.
❖ Limitation	Building has a divider wall from four sides, so degree of limitation is low. 	Building have spaces in four sides with different application, being in the yard has the sense of being far from other spaces and relaxation. Limitation is complete. 
❖ Human scale	Human scale has been considered.	Human scale has been considered but high elevation of mosque reflects the believes of people. Height of windows shows this.
❖ Color	There is no diversity in color.	Kinds of tiles and bricks has acceptable diversity of colors.
❖ Smell	There is not air flow, because of unsuitable ventilation	Beside the smell of flowers and vegetables, because of yards there is air flow in the school. Ventilation is good.
❖ Sound	Building is in by lane so there is no sound pollution but there is not any good sound too.	Building is in the compressed part of Bazaar but because of entrance plan and... there is no sound pollution, the sound of water can be heard.
❖ Vision diversity	There is not any vision diversity in the building.  	There is good vision diversity. 

Table 2: Historical evolution of schools in Azerbaijan area, authors.

Building	Construction period (AD data)	Images	Architectural documents	Description
• Maragheh observatory	1259, order by "Khajeh Nasir Al-din Toosi"			This building is located in northwest of Maragheh in Azerbaijan, and for managing it there were some donations. School (region) was founded in the place observatory.
• Shahnab Kazan complex	1284, order by "Arghun Khan"			This complex has a big vault in the height of 120 and width of 60 gaz and has buildings like mosque, school, dar al-aytun, dar al-goran, dar al-seyyadat, bath, observatory, university and hospital.
• Arghun Ali Shah	1316-1335, by "Taj Al-din Al-shahne Tabrizi"			This historical complex mosque, school and temple (Khankah) that was used materials like Sarooj and other endurable materials. Destructive earthquake of Tabriz in 10 th century destroyed most parts of this complex.
• Rabee Rashidi	About 1400, order by "Khajeh Rashid Al-din Fazlallah Hamedani"			Big university complex of Rab'e Rashidi has 3 parts: rab'e rashidi (main part), municipality (residential complex and side facilities), Rabzeh Rashidi (residential part for grandees); that will be explained inside the article.
• Soltaniyeh Complex	1302-1311, order by "Soltan Mohammad Khoda Bende"			From age point of view, Soltaniyeh is the oldest two-layer Vaults of world. Thickness of vault is 160cm and space between the two vaults is 60cm. One of reasons of durability of vault is having 2 layers that have saved the building from earthquakes until now.
• Safavid Schools	1501-1722, Safavi era			Base of current traditional schools and top of Iranian art of school building and the mosque-schools are come from this era.
• Current schools	1760-1930, Qajarziyyah & Pahlavi era	"Dastkhast" school, First Pahlavi era Modern school, Tabriz. 		Contain vast diversity of traditional and modern schools with different framework and sense of places.

Table 3: Historical evolution of schools point of view architecture, form, movement, accessibility and Privacy; Graphics explain on Plan, authors.

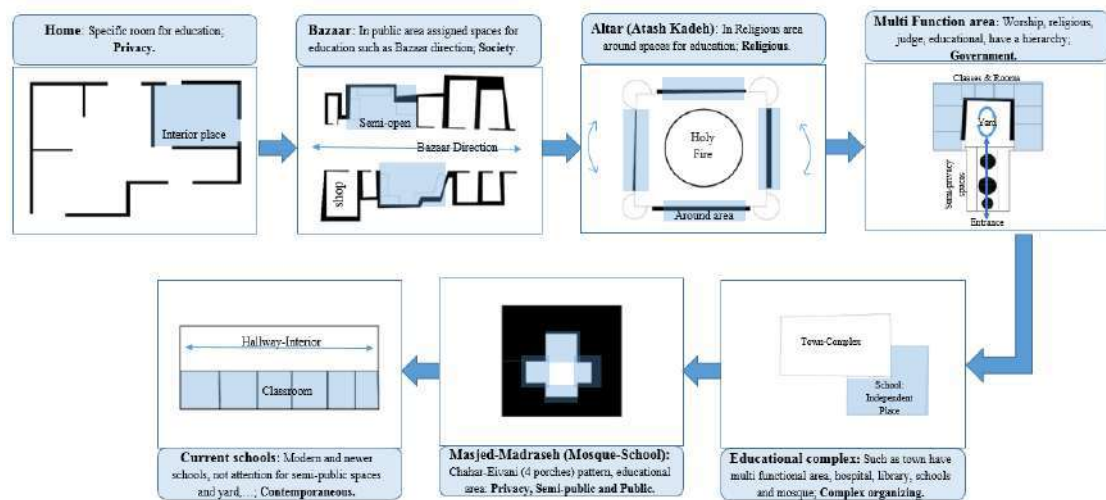
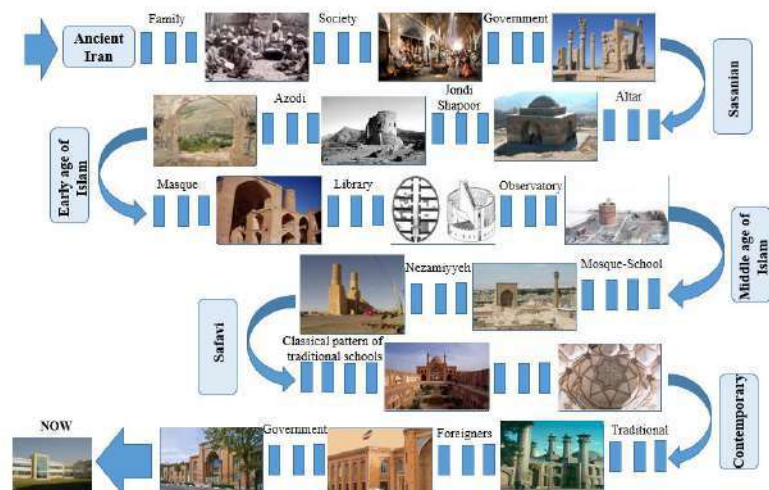


Table 4: Chronology of Iranian schools with architectural approach, authors.



CONCLUSION

Considering the shape and design of current schools of Iran, we notice that they have had slight changes in their form and function. So studying characteristics of new schools can make us to have clear understanding about current condition of our schools: 1. Increasing the scale of schools as the result of more needs and tendency for neoclassical traditionalism and motivating the sense of nostalgic which needs the buildings to be higher and bigger; 2. Tendency for nationalism and elements of pre Islamic architecture such as porches and piles of Sasanian and Achaemenian and Reza Shah's interests in this matter and then showing the characteristics of modern architecture in plans and views of further times; 3. Attention to functionality of spaces and disregarding the sense of space, which was in the modern architecture, and designing functional and soulless spaces without paying attention to the morality of users unlike traditional architecture. 4. Change of application of yards in traditional buildings as a main characteristic and heart of building to a useless intermediate space in new schools. 5. Most important point is the fact that current education spaces are not designed for users considering their age, sex, morality and special and temporal needs. This matter becomes important when we know that education unbelievably is related to the location of learning. [Table 2].

Another matter in comparing old and new schools is "Sense of Place" and the both architectures' response to it. Generally quality of environment is combination of activity, characteristics of framework and concepts that any of these need sensational, emotional and spiritual experiences from life environment. These experiences can be obtained through intimate interactions and a kind of place attachment with

environment of life. This means sense of place, so importance of place making is considered as the main purpose of architecture in the schools [Table 3 and Table 4].

CONFLICT OF INTEREST

There is no conflict of interest

ACKNOWLEDGEMENT

Authors consider it important to thank the great people that their kind guides and helps were effective, Dr. Ahad Nejhad Ebrahimi (Assistant professor of university of Islamic art of Tabriz), Mr. Javad Sarabi (history and literature expert), Miss Humay Majidzadeh (photographer) and experts of East-Azerbaijan "Cultural Heritage" organization.

FINANCIAL DISCLOSURE

None

Notes and Descriptions

1. The **Medes** were an ancient Iranian people who lived in an area known as Media (North-western Iran and south-east Turkey) and who spoke a northwestern Iranian language referred to as the Median language. Their arrival to the region is associated with the first wave of migrating Iranic Aryans tribes into Ancient Iran from the late 2nd millennium BCE (circa 1000 BC) (the Bronze Age collapse) through the beginning of the 1st millennium BCE (circa 900 BC).
2. The **Mithraism Mysteries** were a mystery religion practiced in the Roman Empire from about the 1st to 4th centuries AD. The name of the Persian god Mithra (proto-Indo-Iranian Mithra), adapted into Greek as Mithras, was linked to a new and distinctive imagery.
3. **Zoroastrianism** also called Zarthustranism, Mazdaism and Magianism, is an ancient monotheistic Iranian religion and a religious philosophy. It was once the state religion of the Achaemenid, Parthian, and Sasanian empires.
4. The **Achaemenid Empire** (550–330 BC), or First Persian Empire, was an empire based in Western Asia in Iran, founded in the 6th century BC by Cyrus the Great.
5. The **Sasanian Empire** known to its inhabitants as Ērānshahr and Ērān in Middle Persian, was the last Iranian empire before the rise of Islam, ruled by the Sasanian dynasty from 224 CE to 651 CE.
6. The **Safavid dynasty** was one of the most significant ruling dynasties of Persia (modern Iran), and "is often considered the beginning of modern Persian history". They ruled one of the greatest Persian empires after the Muslim conquest of Persia and established the Twelver school of Shi'a Islam as the official religion of their empire, marking one of the most important turning points in Muslim history. The Safavids ruled from 1501 to 1722 (experiencing a brief restoration from 1729 to 1736) and, at their height, they controlled all of modern Iran, Azerbaijan, Bahrain and Armenia, most of Georgia, the North Caucasus, Iraq, Kuwait and Afghanistan, as well as parts of Turkey, Syria, Pakistan, Turkmenistan and Uzbekistan.
7. The **Pahlavi dynasty** was founded by Reza Shah Pahlavi in 1925, whose reign lasted until 1941 when he was forced to abdicate by the Allies after the Anglo-Soviet invasion. He was succeeded by his son, Mohammad Reza Shah Pahlavi, the last Shah of Iran (1925 until 1979).
8. Hakim Abu 'l-Qasim Ferdowsi Tusi (940–1020 CE), or **Firdawsī** was a highly revered Persian poet and the author of the epic of **Shahnameh** - the Persian "Book of Kings" - which is the world's longest epic poetry created by a single poet.
9. Mohammad Karim **Pirnia** (1923 -1998) was a prominent architectural historian and architect; born in Naeen, Iran. He studied at what came to be Tehran University School of Fine Arts.
10. The **Nezamiyeh** are a group of the medieval institutions of higher education established by Khwaja Nizam al-Mulk in the eleventh Islamic calendar century in Iran.
11. The **Seljuk Empire** was a medieval Turko-Persian empire, originating from the Qynyq branch of Oghuz Turks. The Seljuq Empire controlled a vast area stretching from the Hindu Kush to eastern Anatolia and from Central Asia to the Persian Gulf. From their homelands near the Aral sea, the Seljuqs advanced first into Khorasan and then into mainland Persia before eventually conquering eastern Anatolia.
12. **Sufism** is a concept in Islam, defined by scholars as the inner, mystical dimension of Islam; others contend that it is a perennial philosophy of existence that pre-dates religion, the expression of which flowered within the Islamic religion.
13. The **Ilkhanate**, also spelled Il-khanate was a breakaway state of the Mongol Empire, which was ruled by the Mongol House of Hulagu. It was established in the 13th century and was based primarily in Iran as well as neighboring territories, such as present-day Azerbaijan, the central and eastern parts of present-day Turkey. The Ilkhanate was based, originally, on Genghis Khan's campaigns in the Khwarazmian Empire in 1219–1224, and was founded by Genghis's grandson, Hulagu Khan. In its fullest extent, the state expanded into territories which today comprise most of Iran, Iraq, Turkmenistan, Armenia, Azerbaijan, Georgia, Turkey, western Afghanistan and southwestern Pakistan. The Ilkhanate initially embraced many religions, but was particularly sympathetic to Buddhism and Christianity. Later Ilkhanate rulers, beginning with Ghazan in 1295, embraced Islam.
14. **Mashrooteh**: The Persian Constitutional Revolution or Iranian Constitutional Revolution, also known as the Constitutional Revolution of Iran, took place between 1905 and 1907. The revolution led to the establishment of a parliament in Persia (Iran).
15. The Mongol Empire which existed during the 13th and 14th centuries, was the largest contiguous land empire in history. Originating in the steppes of Central Asia, the Mongol Empire eventually stretched from Central Europe to the Sea of Japan, extending northwards into Siberia, eastwards and southwards into the Indian subcontinent, Indochina, and the Iranian plateau, and westwards as far as the Levant and Arabia.
16. The **Timurid dynasty** was a Sunni Muslim Persian ate dynasty of Turco-Mongol lineage that ruled over an empire comprising modern-day Iran, the Caucasus, Mesopotamia, Afghanistan, much of Central Asia, as well as parts of contemporary Pakistan, Syria, India, Anatolia. The dynasty descended from the warlord Timur (also known as Tamerlane), who established the empire between 1370 and his death in 1405.

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ARTICLE

PERFORMANCE STUDY OF ROUTING AND ENERGY EFFICIENT TECHNIQUES ON WIRELESS BODY AREA NETWORK

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ABSTRACT

Wireless body area network (WBAN) is a network consists of heterogeneous wearable and personal computing radio devices with various functionalities and resources. Every network contains network coordinator or hub which is responsible to establish and synchronize the network. In WBANs, sensor nodes are used to enlarge the human physiological data and addressed to the sink node. The sensor in WBANs has three classifications such as implant nodes, body surface nodes and external nodes based on the position of sensor nodes with respect to human body. Routing plays a major role in WBAN to collect the sensed data and route through relay nodes to reach the destined nodes with minimal usage of energy. During the routing process in WBAN, energy consumption and routing time are major concern in the performance of wireless body area network. The study helps to evaluate the energy efficiency and routing time overheads for effective WBAN communication. The energy efficient approach provides better connectivity between nodes in body area network.

INTRODUCTION

KEY WORDS

Wireless Body Area Network (WBAN);
Routing Time; Energy Consumption

Wireless Body Area Network (WBAN) is employed for increasing as one of most advanced communication networks. The objective of WBANs develops speed, accuracy and reliability of communication of sensors in direct proximity of human body. The challenges of huge capacity is connected with the advantage of WBANs contains several publications. For enhancing the network lifetime, routing models are planned. But the majority of routing models are aimed on coverage distance and residual energy of sensor nodes. WBANs assure unobtrusive ambulatory health monitoring for extensive periods of time and presents real-time restore of patient's status to physician. WBANs are extensively employed for many application such as ubiquitous healthcare, entertainment and military applications.

A body area network (BAN) is termed as wireless body area network (WBAN) or body sensor network (BSN). BANs are used to transform the capture, processing, and communication of significant data for healthcare systems that present new forms of hospitalization and quality health care. BAN method allows the continuous, computerized and remote monitoring of physiological signs to maintain the medical applications. The applications of BANs are mainly in healthcare domain for monitoring and logging parameters in patient knowledge the chronic diseases namely diabetes, asthma and heart attacks. BAN technology maintains the additional personalized applications like sports, gaming, entertainment and military operations.

WBAN is the wireless network from wearable computing devices. BAN devices are inserted and surface-mounted on body in fixed position wearable technology. The growth of WBAN technology with wireless personal area network (WPAN) technologies employs communications inside or outside the human body. BAN denotes the systems where communication is inside the proximity of human body. A WBAN system utilizes WPAN wireless technologies because the gateways are in longer ranges. A medical professionals access the patient data online by internet of patient location.

This paper is organized as follows: Section II discusses wireless body area network. Section III describes the existing wireless body area network method, Section IV identifies the possible comparison between them and Section V concludes the paper, research work is given as to decrease the routing time and power utilization with better efficient.

The main contributions of this existing work including the following methods are,

- To perform adaptive routing protocol for developing lesser energy cost per bit of information
- To present Multi Agent System method monitors the Body temperature, blood pressure, pulse rate and respiratory rate for accumulating and collecting the data in database.
- To design Bayes Node Energy and Polynomial Distribution method minimize routing problem.

The main contribution of this research work evaluates the efficient energy using wireless body area network. The main aim of the proposed work namely,

- To reduce the utilization of power for efficient WBAN technique.
- To decrease the energy drain rate and routing time for avoiding practical issues.
- To improve number of nodes, the network easily shares the data with other network.

Wireless body area network is emerging technology at health service ability due to wide range of services and essential role to increase the human health. The WBANs are applied in healthcare domain, mainly for continuous monitoring and classifying important parameters of patients enduring from chronic diseases

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like diabetes, asthma and attacks. For example, if the patient suffer some health problem. With the help of sensor, the doctor finds the problem in home itself by using wireless body area network. In addition,

- A BAN network is used to monitor the patient in the hospital; previously they contain a heart attack by evaluating the changes in their vital symptoms.
- A BAN network on a diabetic patient preserves auto injects insulin through a pump and immediately their insulin level gets refused.

LITERATURE REVIEW

Novel medical supervision system architecture [1] is based on distributed wireless body area network. Since several sensors transmit their messages at same time slot for common channel. However, significant problem is not formulate the system more comfortable, simply portable and android application is fixed into Smartphone performs essentially. The topological issues for WBAN [2] are addressed for both cost and energy using effective energy of optimal design and cost effective WBAN. Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) [3]. Adaptive routing protocol is designed for developing and evaluating the reduced energy cost per bit of information. However, the utilization of energy is high. An optimal network control algorithm is planned for distributed network systems of ultrasonic waves in [4]. It is utilized to transmit improved radio-frequency electromagnetic waves in aqueous media like human tissues. However, these results still continue from low-speed of sound in under-utilization of channel and thus throughput gets minimized.

Medium Access Control and Rate Adaptation for Ultrasonic Intrabody Sensor Networks (UsWB) in [5] are based on the idea of transmitting bits of information bits. However, clear channel assessment techniques are not used since it is difficult to detect UWB pulses because of very low power spectral density. WSN technique in [6] is ability to handle the sensor for accumulating and collecting data in database, a Multi Agent System (MAS) is utilized. However, the storage requirement is low with use of data reduction method. Cross Technology Interference (CTI) technique in [7] is analyzed by the utilization of different transmission technologies that distributes identical radio spectrum. However, the computation of CTI method is high. Wireless sensor network is designed for energy sensitive routing in [8] using Bayes Node Energy and Polynomial Distribution (BNEPD) method. In BNEPD method, the node consumes minimum energy rate and provides fairness between different users for decreasing communication overhead. Though, the BNEPD technique is not addressed both energy consumption and routing technique.

The QoS aware energy management in [9] is measured in terms of delay, throughput and packet loss. Though, in such situation, the difficulty of energy shortage is further disturbing due to set of small energy by human motion. The QoS management depend on biometrical WSN in [10] is to enhance the new application and patient monitoring service. However, due to the simplified channel models and protocols, simulations are not actually described. WBANs for medical application in [11]. Though, the bandwidth is not maintaining both the video and voice transmissions. Alternative approach is based on producing the Intrabody opto-ultrasonic communications between nanorobots in [12]. Opto-ultrasonic communications are used to support consequence of opto-acoustic that concedes the acoustic waves of very large frequency. BAN in [13] is based on recent principles and publications. However, the design of body shape and human tissue are more complicated a path loss model for WBANs and low power utilization is not simply modelled. Mobility maintenance through WBAN in [14] is employed to produce better results. While the power in system life time of WBAN communication through power game approach is enhanced, it effectively reduces the interference issue. Mahalanobis -Taguchi System with ECG Arrhythmia Classification during Body Area Network Environment in [15] to categorize different arrhythmic beats by decreasing set of relevant-only ECG features. Though, it is not performed to supply higher robust and optimized by incorporating any dynamic threshold selection mechanism. An efficient next hop selection algorithm in [16] is used in multi-hop BANs. However, the utilization of power and end to end delay is enlarged. High data rate shows the initial time of Ultrasonic OFDM communication method in [17] has large ultrasonic communications of data for Intrabody networks. Though, the more transmission of power is required. The medical application of WBAN is described in [18]. However, these descriptions of prolonged the health monitoring is limited.

The QoS aware energy management contains the problem of energy shortage is more disturbing due to small set of energy by human motion. The bandwidth of WBANs for medical application is not preserving both the video and voice transmissions. In body area network, the shape of body and human tissue structure are more difficult. Ultrasonic OFDM communication method is to demonstrate the primary time of high data rate requires more transmission power. ECG features is not performed for high robust and optimized by integrating some method of dynamic threshold selection. Due to the simplified channel models and protocols in the management of QoS, simulations are not described essentially based on biometrical WSN. An optimal network control algorithm is still continuing from the low-speed of sound in under-utilization of channel and reduced throughput. UsWB method is complicated to identify UWB pulses because of its very small power spectral density. Efficient next hop selection algorithm has maximum

utilization of energy and end to end delay. In order to overcome the above mentioned problem, the wireless body area network provides very less energy efficiency and routing time in an efficient manner.

WIRELESS BODY AREA NETWORK

Wireless Body Area Networks (WBANs) in has received wide attention for continuous monitoring of patients. The fast development in low power circuits and wireless communication allowed the new generation of wireless sensor networks termed as body area networks (BANs). WBANs provide wide range of applications such as healthcare, personal entertainment, advance sports training, live events, aviation, natural disasters and user electronic devices. The WBANs sensor is employed for defining physiological parameters of human body including sugar level, temperature and heartbeat and forwards the disturbed authorities by internet facility. These varieties of continuous monitoring are essential in critical circumstances like workers in coal mines and patients with serious medical conditions. The performance of WBAN is compared against with three existing methods namely Multi Agent System (MAS), Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) and Bayes Node Energy Polynomial Distribution (BNEPD) methods.

Agent based health monitoring of elderly people in indoor environments using wireless sensor networks

Wireless sensor networks (WSN) is employed for designing the health care monitoring system in which the ability of collecting, retrieving, storing and analyzing the essential signs of patient. Body temperature, blood pressure, pulse rate and respiratory rate are the important symbols are monitored. Due to handle these sensors and for accumulating and collecting the data in database a Multi Agent System (MAS) is utilized. In WSN, the cause of dynamic nature and mobility of agents are suitable for preserving these sensors.

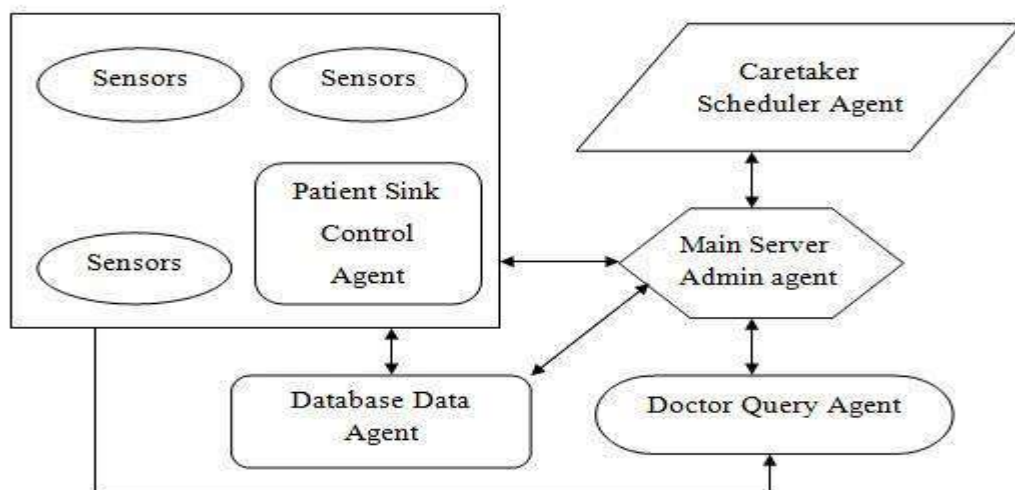


Fig. 1: Block diagram of Agent Architecture

[Fig.1] represents the block diagram of agent architecture. The MAS method contains four agents such as Admin agent, Control agent, Query agent and Data agent. Admin agent plays major role of terminating the other agents. Control agent is subjected to accumulate the data sensed by sensors into the database. Data agent is used for executing the reduction of data which is accomplished by Epsilon approximation. The objectives of data agent scheme are to decrease the data traffic and requirement of secondary storage space. Query agent is addressed for producing GUI for doctors to analyze the patient's essential sign details. The agent system is known as multi agent system. Each agent has an exact purpose and controlled by admin agent. By assigning specific function to each agent, it becomes easy to modify the system and control the changes. Even if there is an error with one of the agents, it does not affect the whole system because each agent is not depends on other. Finally, the performance of agent system demonstrates the reduced set of values near the original set and minimum amount of data is used to store.

Adaptive Routing For Dynamic On-Body Wireless Sensor Networks

In wireless body area network, the energy is limited during mobile computing devices including wearable and implantable devices. An adaptive routing protocol is designed for developing and evaluating lesser energy cost per bit of information by using channel information to choose the best route data approach. The source node is employed to determine the switch between the direct and relayed communication

based on quality of link. Using single relay, channel quality is smaller than the threshold. An adaptive cross layer protocol is initiated to increase the channel information at transmitter side to choose the routing strategy. The transmitter achieves the channel information through feedback and decides whether to utilize an alternate relay channel to generate redundancy.

An analytical model is improved for transmitting energy cost per bit of information. While supporting the Markov chain of process and the model is validated through simulations. ARP model provides more power efficient and performance of protocol in terms of energy efficiency and evaluates the outage. Moreover, the standard in system level through mathematical analysis and simulations is calculated. The arithmetic model for received energy in dynamic body area network is produced during real-time and time domain measurements.

The cost of energy is addressed for transmitting a bit of information during dynamic human body location. The fundamental idea of ARDO-WSN is adaptively used for modifying the routing approach occupies the quality of channel. The adaptive protocol is arithmetically estimated based on intermediate access measures of IEEE 802.15.6 standard and the analytical model is validated. Channel measurements is a dynamic human body, the advantages of adaptive routing strategy in conserving on-body sensors energy is verified.

Bayes Node Energy Polynomial Distribution to improve Routing in wireless Sensor Network

Wireless Sensor Network monitors and manages the physical world through large number of low-priced sensor nodes. Wireless Sensor Network (WSN) is obtainable for sensing the data through continuous selection of data resulting in higher delay and energy utilization. In order to overcome the routing issue and minimize energy drain rate, Bayes Node Energy and Polynomial Distribution (BNEPD) technique is designed for energy aware routing in the WSN. The BNEPD technique assigns the sensor nodes that identify an object similar to particular regions with application of Bayes rule.

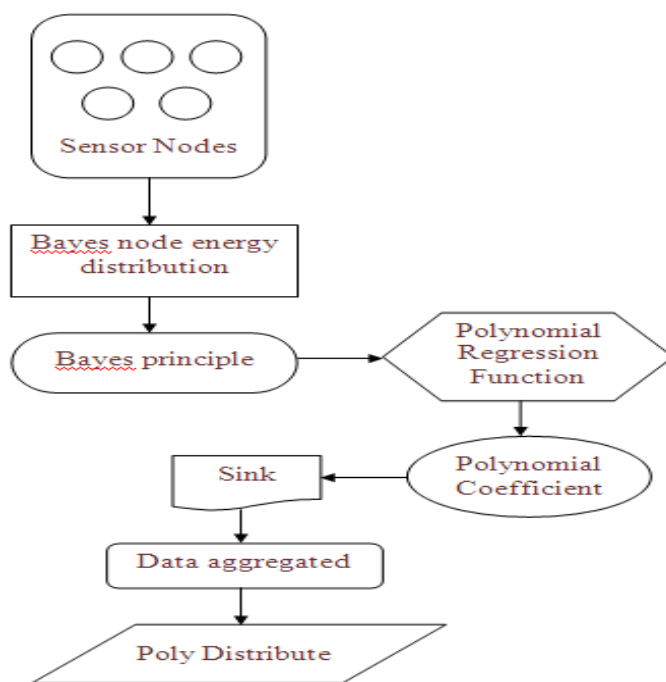


Fig. 2: Bayes Node Energy Polynomial Distribution Framework

[Fig. 2] describes the framework of bayes node energy polynomial distribution for WSN. The structure of BNEPD technique is separated for implementing the Polynomial Regression Function for data aggregation and function of Poly Distribute algorithm. The framework starts with construction of BNEPD that applies Bayes rule during sensor nodes detect the target object is parallel to its frequency to decrease the energy utilization. The Polynomial Regression Function is employed to target object of identical events for connecting various sensors. There are mainly depends upon the measure of smallest and highest object and sent to the sink node. Poly Distribute algorithm distributes the sensor nodes in an efficient manner. The aggregation of data is produced with sensor nodes aroused for generating a polynomial regression function that minimizes the rate of drained power. As an ultimate result demonstrates the limitation of distribution algorithm decreases the node energy drain rate and provides fairness between various users for reducing communication overhead. The experimental evaluation using Wireless Body Area Network (WBAN) technique is conducted on various factors namely security, energy consumption and routing time.

COMPARISON OF WIRELESS BODY AREA NETWORK USING DIFFERENT TECHNIQUES AND SUGGESTIONS

In order to compare the wireless body area network method using different techniques, number of nodes is taken to perform this experiment. Various parameters are used for wireless body area network techniques.

Security

Security measures the number of nodes that are secured. The security is defined as the rate at which the packet sent to receiving end without any inclusion. Security is measured in terms of percentage (%). When the security level is higher, the method is said to be more efficient.

Table 1: Tabulation of Security

Number of Nodes	Security (%)		
	MAS	ARDO-WSN	BNEPD
10	56	70	62
20	58	73	64
30	59	76	65
40	63	78	69
50	66	80	73
60	69	82	75
70	72	85	77

[Table 1] describes the security versus different number of nodes in the range of 10 to 70. The security comparison takes place on existing Multi Agent System (MAS), Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) and Bayes Node Energy Polynomial Distribution (BNEPD) methods.

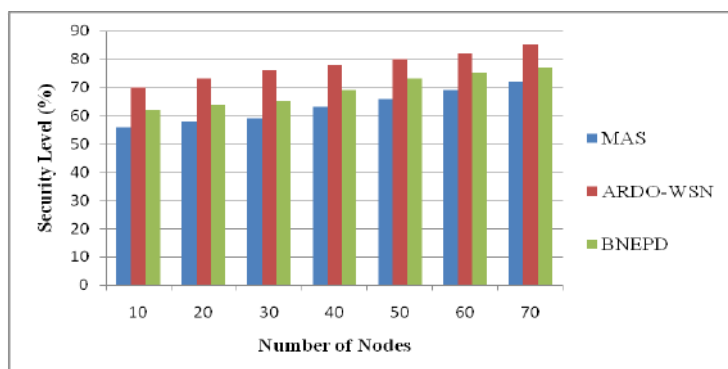


Fig. 3: Measurement of Security Level

[Fig. 3] measures the security of existing techniques. Security of Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) technique [3] is comparatively higher than that of Multi Agent System (MAS) [6] and Bayes Node Energy Polynomial Distribution (BNEPD) [8] methods. Research in Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) method has 11% higher security than Bayes Node Energy Polynomial Distribution (BNEPD) method and 19% higher security than Multi Agent System (MAS) method.

Energy Consumption

Energy consumption (EC) technique measures the energy required in every node for evaluating the different number of nodes. Energy consumption is measured in terms of Joules (J) and mathematically formulated as below,

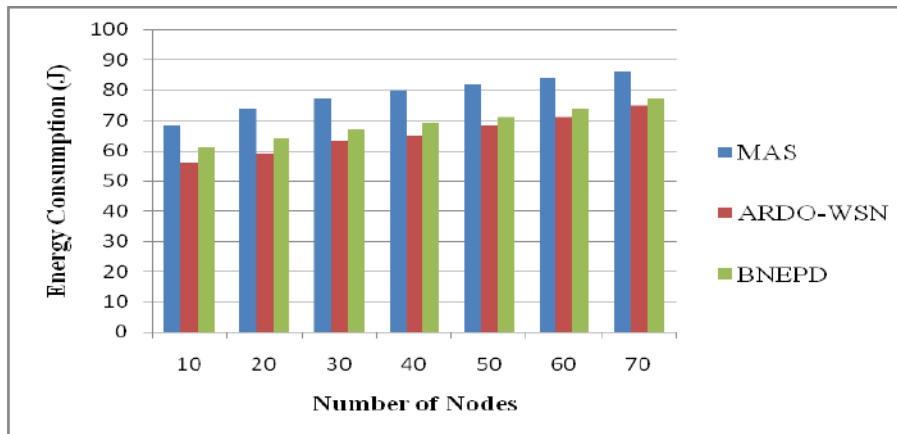
$$EC = \frac{\text{Average energy consumes for every node}}{\text{Total number of energy consumed}}$$

When energy consumption gets decreased, the method is said to be more efficient.

Table 2: Tabulation of Energy Consumption

Number of Nodes	Energy Consumption (J)		
	MAS	ARDO-WSN	BNEPD
10	68	56	61
20	74	59	64
30	77	63	67
40	80	65	69
50	82	68	71
60	84	71	74
70	86	75	77

[Table 2] explains the energy consumption versus different number of nodes in the range of 10 to 70. The energy consumption comparison takes place on existing Multi Agent System (MAS), Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) and Bayes Node Energy Polynomial Distribution (BNEPD) methods.

**Fig. 4:** Measurement of Energy Consumption

[Fig. 4] measures the energy consumption of existing techniques. Energy consumption of Multi Agent System (MAS) technique [6] is comparatively higher than that of Bayes Node Energy Polynomial Distribution (BNEPD) [8] and Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) [3] methods. Research in Multi Agent System (MAS) technique consumes 17% lesser energy than Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) method and 12% lesser energy consumption than Bayes Node Energy Polynomial Distribution (BNEPD) method.

Response Time

Response time defines the difference between the starting time and ending time for responding the number of nodes taken. Response time is measured in terms of milliseconds (ms) and mathematically formulated as below,

$$\text{Response time (ms)} = \text{Ending time} - \text{Starting time for routing the information}$$

When the response time is lower, the method is said to be more efficient.

Table 3: Tabulation of Response Time

Number of Nodes	Response Time (ms)		
	MAS	ARDO-WSN	BNEPD
10	36	45	29
20	38	47	32
30	41	50	34
40	42	53	37
50	44	56	39
60	47	58	40
70	50	60	43

[Table 4.3] describes the response time versus different number of nodes in the range of 10 to 70. The response time comparison takes place on existing Multi Agent System (MAS), Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) and Bayes Node Energy Polynomial Distribution (BNEPD) method.

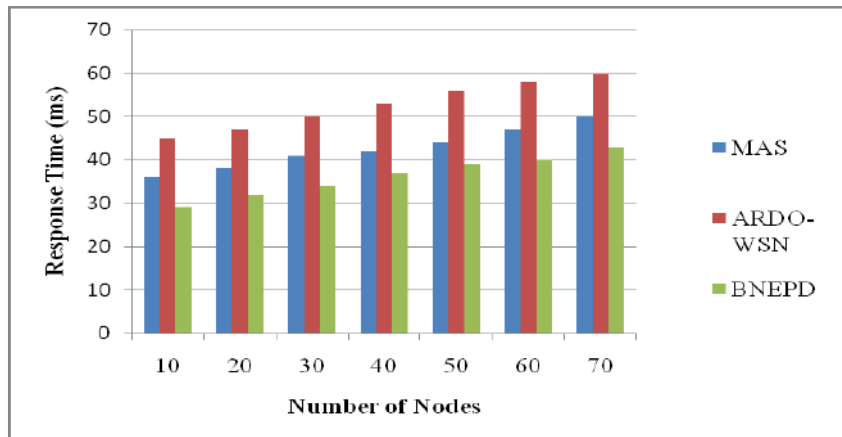


Fig. 5: Measurement of Response Time

[Fig.5] measures the response time of existing techniques. Response time of Bayes Node Energy Polynomial Distribution (BNEPD) technique [8] is comparatively lesser than that of Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) [3] and Multi Agent System (MAS) [6] methods. Research in Bayes Node Energy Polynomial Distribution (BNEPD) technique consumes 46% lesser response time than Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) method and 18% lesser response time than Multi Agent System (MAS) method.

DISCUSSION AND LIMITATION OF WIRELESS BODY AREA NETWORK USING DIFFERENT TECHNIQUES

An Adaptive Routing for Dynamic On-Body Wireless Sensor Networks (ARDO-WSN) [3] protocol is intended for developing and determining the reduced power cost per bit of information. While using the channel information to choose most excellent route data approaches. The large number of nodes is not deal with effect of network. Hence the network does not share the medium with other user BAN, because the number of nodes is small. But, the utilization of power is increased.

In Multi Agent System (MAS) [6], the WSN is the ability to handle the sensor for accumulating and collecting the data in database. The requirement of storage is low with the use of data reduction method. The amount of data stored is high. The power consumption is high while transmitting the huge stored data. Hence, the method in which they are transmitted is designed for concerning the low power consumption. There is a problem in storing large amount of data since the monitoring is continued.

Bayes Node Energy and Polynomial Distribution (BNEPD) technique [8] is capability of increasing the routing issue and energy drain rate. The stability between communication overhead and routing are not efficiently attained. The evaluation of distributed energy control in wireless sensor networks is not required to increase the large range of network with more sensor nodes. BNEPD technique is not accepting the data to developed and stored by each device with more resources.

Future Direction

The future direction of wireless body area network can be used to decrease the energy consumption and routing time is decreased. In addition, the transmission of data storage is developed where the utilization of energy is minimized.

CONCLUSION

The comparison of different techniques for wireless body area network technique is carried out. BNEPD model [8] evaluates the distributed energy control in WSN is not essential to improve the huge range of network with more sensor nodes. Thus, the rate of drained energy is decreased for enhancing the total network performance. In the MAS method [6], it is employed to achieve very high complexity. The MSA

method consists of reduction of data and therefore the amount of data is used to accumulate small value. In ARDO-WSN protocol [3], the consequence of large number of nodes is not recognizing the attractive future. Network distributes the medium with users of other BANs and entire number of nodes is minimized. In addition, the utilization of power is enlarged. Finally, from the result, the research work can decrease the consumption of energy and routing time. Thus the storage of data communication can be increased with better energy efficient

CONFLICT OF INTEREST

There is no conflict of interest

ACKNOWLEDGEMENT

None

FINANCIAL DISCLOSURE

None

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ARTICLE

AN EFFICIENT TRUST MODEL FOR PUBLIC-KEY AUTHENTICATION AND DETECTING MALICIOUS NODES IN MANET

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ABSTRACT

In Mobile Ad-hoc Networks (MANET), establishing trust among participating nodes is a challenging task due to the fact that these systems are generally operated in highly dynamic and distributed environments. A Pretty Good Privacy (PGP) like trust model considered to be more suitable for MANETs since they do not require access to a trusted authority. Instead, the nodes themselves are allowed to establish trust by certifying each other in a self-organizing way without involving any Trusted Third Party (TTP). Here, we adopt a strategy by using self-certifying ID-based cryptography that allows mobile nodes to determine public-keys of each other from the nodes' identities and their trust levels. And also, an Exclusion Access-control Mechanism based on trust metric evaluation is introduced to detect and isolate the malicious nodes that inject fake trust relations. We have proposed the certificate-less PGP trust model for public key authentication in MANETs. Hence, by improving trust metric in MANETs, trustworthy keys are determined through a given trust path. An exclusion mechanism is introduced to isolate the malicious nodes. Simulation results prove that the trust models and an exclusion access control mechanism provide an accurate malicious node detection and exclusion.

INTRODUCTION

Infection Mobile Ad hoc Networks (MANET) [5] are self-configured, dynamic networks in which nodes can move freely. It is an infrastructure-less network of mobile nodes and nodes are connected without wires. Each node in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. This results in a highly dynamic, autonomous topology.

Trust evaluation metric plays an important role in providing security against malicious nodes in Mobile Ad Hoc Networks [5]. Trust values are generated by analyzing and computing evidence collected from a number of evidence providers. Trust is generally evaluated based on the evidence that shows a trustor's belief on a trustee, observed performance or behaviour of the trustee, and recommendations on the trustee. The proposed model is intended for self-organized MANETs where mobile nodes do not have access to trusted third parties, not even in the bootstrapping phase. In our approach, public-key authentication is self-certified. Nodes need not to store the public keys of each other. These self-certified public keys are reconstructed whenever it is needed and it saves the memory space [5]. Trust metric is introduced which helps the nodes to reconstruct the public key. This work solves the problem of certificate chaining, computational and communication costs overhead. And, the major problem is detecting the malicious nodes which inject fake trust relations. An Exclusion Access-control Mechanism based on trust metric evaluation which was discussed in [7] is introduced to deal with malicious nodes which inject fake trust relations. An exclusion mechanism is introducing a jury node to detect the suspicious node based on the collected evidence from the reputation module. The rest of the paper is organized as follows. Section 2 presents a discussion of related work. Section 3 describes about the proposed work. Section 4 & 5 describes about the security analysis and performance analysis. Section 6 describes about the conclusion work.

RELATED WORKS

Khaled Hamoud et al. [5] have introduced a recommendation based trust metric to deal with malicious nodes and to allow evaluate the trustworthiness of the self-certified public key through a given trust path. A trust graph is defined with two-trust levels which are key-authenticity trust level and node reliability trust level. This can improve the reliability of the public-key authentication. Huanyu Zhao et al. [1] have proposed a methodology of self-certified public-key authentication using a trust architecture which is similar to Pretty Good Privacy (PGP). Here, the nodes themselves issue certificates for each other based on their own trust opinion and maintains a local repository in which it stores a partial certificate chains. This approach imposes extra delay and large amount of traffic for collecting certificates. Ing-Ray Chen et al. [2] have proposed an integrated social and quality-of-service (QoS) trust protocol (called SQTrust). This trust bias is minimized despite the presence of malicious nodes performing slandering attacks. This approach identifies and validates the best trust protocol settings under which trust bias is minimized and application performance is maximized. The node behaviour model is based on persistent attacks. Some of the random, opportunistic, and insidious attacks with fuzzy failure criteria applied to test the resiliency of our trust protocol design has not yet implemented. Leovigildo Sánchez-Casado et al [6] have discussed about the malicious node dropping and they introduced the dynamic trust model and the cross-layer approach is based on an analytical model that represents the forwarding process in an ad-hoc network. This technique improves the trust efficiency and also overcome the computational overhead. Have to improve the performance in nodes which exhibits lower activities. Mohammad Taqi Soleimani et al. [9] have proposed

KEY WORDS

Trust model;
Authentication;
Certificate; MANET; Trust

Published: 30Oct 2016

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a dynamic trust model to defend network against the malicious node. In this approach, initially a node trusts all immediate neighbourhood nodes and then the node updates their trust value based upon the feedback getting from the neighbours. NS-2 simulation results show that the attack is detected successfully with low false positive probability. This approach does not detect all types of attacks that impacts some delay to the network. Mohamed M. E. A. Mahmoud and Xiaodong Lin [8] have proposed E-STAR mechanism which combines the trust system with energy-aware protocol to achieve the efficient trust implementation system without any false acquisitions.

Saju P John et al. [10] have proposed a technique called self organized key management technique coupled with trusted certificate exchange. Due to the certification exchange the storage overhead exists in large scale networks. Shaheena Khatoon et al. [11] have proposed a combined technique of certificate-less key management and threshold cryptography. This scheme proposed an enhanced security attributes for key management in MANET and also eliminates the need for certificate-based public key distribution and the key escrow problem efficiently. In addition to that it completely removed a trusted third party to distribute the public keys, hence increasing the tolerance of the network to compromised nodes and also saving network bandwidth. But the time consumption is somewhat higher. Shuaishuai TAN et al. [12] have proposed a trust based routing mechanism to derive the security threats. In addition, to avoid malicious nodes, a trust based routing algorithm is proposed to select a path with the maximum path trust value among all possible paths. Then extend Optimized Link State Routing (OLSR) by using the proposed trust model and trust based routing algorithm, called Fuzzy Petri Net - Optimized Link State Routing (FPNT-OLSR). Simulation results show that FPNT-OLSR is very effective in establishing secure routes. It also performs better than existing trust based OLSR protocols in terms of packet delivery ratio, average latency and overhead.

Soumyadev Maity et al. [13] have proposed an on-demand public-key management protocol for self-organized MANETs which does not use certificates; it has some problem related with the authenticity of public keys since the keys are generated by nodes themselves and distributed without any authenticity evidence. This scheme does not use any of an explicit or implicit approach to ensure an authenticity of a public-key. Zhang Yong et al. [15] have proposed an on-demand public-key management protocol for self-organized MANETs which does not use certificates; it has some problem related with the authenticity of public keys since the keys are generated by nodes themselves and distributed without any authenticity evidence. This scheme does not use any of an explicit or implicit approach to ensure an authenticity of a public-key. By employing identity-based and threshold cryptography, the proposed scheme eliminates the burden of certificates management and can be high level tolerance to node compromise. Zheng Yana et al. [16] have proposed two security schemes of privacy preserving trust evaluation technique to achieve better computational efficiency and greater security. It ensures trust relationships among system entities and enhances system security. But trust evidence collection and process may cause privacy leakage, which makes involved entities reluctant to provide personal evidence that is essential for trust evaluation. The first scheme achieves better computational efficiency, while the second one provides greater security at the expense of a higher computational cost. Both schemes are secure enough but still there is an issue to overcome an internal attack without breaching privacy. Jin-Hee Cho et al. [3] have proposed a composite trust-based public key management to mitigate the security vulnerability. This proposed scheme employs that trust threshold to determine whether trust the other nodes or not. But this approach imposed some low performance. Sudha Chinni et al. [14] have introduced a distributed trust model for certificate revocation. This certificate revocation imposes a traffic delay to collect the certificates. Kanimozhi and Navamani [4] have proposed the certificate-less PGP trust model for public key authentication. However, detailed implementation has not done. In this work, implementation and performance analysis are presented.

The proposed trust establishment approach is similar to PGP-like trust model which was discussed in [5]. In this model, each entity can issue a certificate to other entity it trusts. This trust relationship is supposed to be transitive which allows the nodes to establish indirect trust relations. After reviewing the previous works, it is analyzed that certificate chaining approach incurs more overhead in terms of computation and storage costs. And also, the detection of node which injects fake trust is complicated in existing work. Hence, we have introduced a certificate-less PGP-like trust model for public-key authentication and a new technique for detecting the malicious nodes which inject fake trust relations.

MATERIALS AND METHODS

The basic idea of our approach is implementing certificate-less PGP-like scheme using an Identity based cryptography technique which in turn allows to performs public-key authentication in a self-organized way. An Exclusion Access-control Mechanism based on trust metric evaluation which was discussed in [7] is introduced to monitor the neighbor nodes which are misbehaved and those nodes inject the fake trust relations.

Network Model and Assumptions

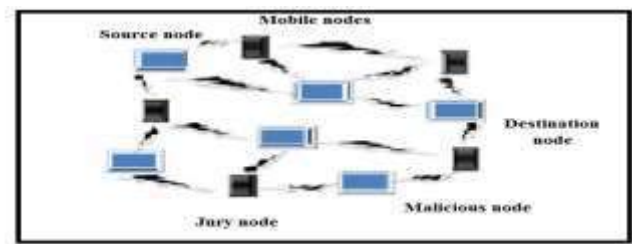


Fig.1: Network model of MANET

[Fig.1] shows the network model of MANET. The proposed network model consists of mobile nodes and jury nodes which are characterized by low capacity in the sense of processing power, storage, energy and bandwidth. Each node can communicate with other nodes via wireless links. Non neighbouring nodes can communicate via multi-hop communications based on ad-hoc routing protocols. The network can change dynamically in the size and topology as nodes can move freely and new nodes can join and others leave at any time without any cost. In this model, it is assumed that each node has a private/public key pair used for authentication and other security purposes. Public keys are self-generated by the node themselves and public keys are cryptographically bound to their owner's identity. The system architecture of the proposed system has source node, destination node and many intermediate nodes. The jury node tracks the information of the neighbouring nodes by monitoring their behaviour. Here, the jury node is used to detect the malicious node whenever it injects fake trust relations.

Notations

The symbols and their description that are used in the proposed scheme are given in the [Table 1].

Table 1: Symbols and notations

Symbols	Description
W_{ij}	Witness generated by node n_i to n_j
ID_j	Unique and public key identifier of node n_j
Rec_{ij}	Recommendation issued by node n_i for n_j
T_{valij}	Trust values between the nodes n_i and n_j
U	Reputation update unit
R_{i-1}	Previous reputation value
R_{max}	Maximum reputation value
sk	Public key
pk	Private key
h_{ij}	Hash function
k_{ij}	Prime values

Constructing Trust Model

The proposed trust establishment scheme is similar to PGP model in the sense that users certify each other based on their off-line trust relationships without involving any centralized trusted third party. Khaled Hamoud et al. [7] have introduced a trust model which is defined as two independent trust levels; key-authenticity trust level and node reliability trust level. These trust levels are computed by the neighbouring nodes when it trusts its own neighbouring nodes based on collected evidence.

[Fig. 2] shows the main functions which are happening among the mobility nodes. In our work, four modules are defined such as Constructing trust model, Trust graph establishment & malicious node exclusion, Self-certified key authentication and Key updation. Each node presents in the network having unique id, public-key and private key. While constructing trust level among the nodes, the authenticity of keys and the trustworthiness of the nodes are independent. By these trust levels, a trust graph is formed by issuing witness and recommendations among the nodes. An Exclusion Access-control Mechanism based on trust metric evaluation is introduced to detect and isolate the malicious nodes that inject fake trust relations using jury nodes. Public-keys are reconstructed whenever needed, it saves some memory space. To protect against key disclosure threats, it is better that the nodes should do their periodic

update of their keys. Whenever a node leaves the network, it sends a logout request to their trustors and trustees. Whenever a node joins the network, it looks for trustor and trustee nodes.

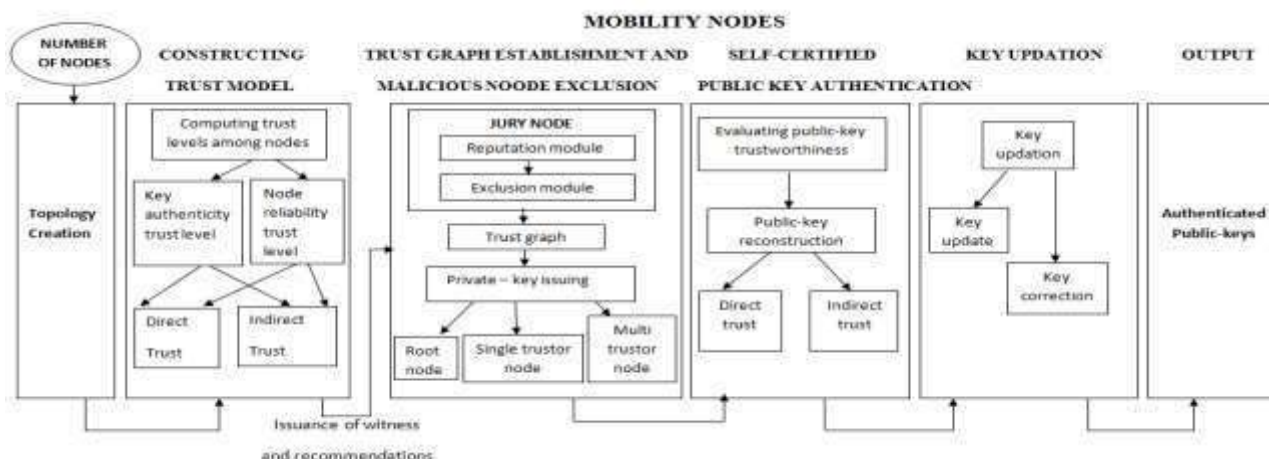


Fig. 2: Functional Architecture

Key Authenticity Trust Level

Key authenticity trust level is that a given node n_i trusts the public-key of another node n_j and should verify its authenticity. Let us assume that the trustor node n_i who trusts a given trustee node n_j . The node n_i issues a witness (W_{ij}) on the n_j 's identifier instead of certificates. The issued witness is sent over an authenticated channel to node n_j which uses it to generate the private key. This witness can be viewed as a signature of the issuing node on the ID_j of the node n_j .

Node Reliability Trust Level

It is defined as follows: A node n_i trusts to a certain degree of another node n_j to be reliable for executing the protocol to generate keys to any other nodes. By having this trust level, nodes can issue recommendations and valid witness for any other nodes. An Exclusion Access-control Mechanism based on trust metric which was discussed in [7] is integrated with the proposed system to exclude the misbehaving nodes by the use of accurate and precise trust model which uses past interactions and recommendations to build a trust evaluation in neighbours.

These two trust levels are independent of each other. For example, if a node n_i could not verify the authenticity of another node n_j but still n_i trusts the node n_j and vice versa. This implies that a node is able to evaluate the trustworthiness of another node even it cannot verify the authenticity.

Direct Trust and Indirect Trust Computation

For each trust level, a trust relation among the nodes may be either direct or indirect relationship. Direct trust is represented by a directed edge in the trust graph. If a node n_i has generated a witness to node n_j that can be used to generate its private-key by node n_j , a direct trust relation of level-1 exists. If a node n_i has recommended a node n_j to be reliable with a certain degree to generate a valid witness and recommendation (Rec_{ij}), a direct trust relation of level-2 exists. Indirect trust is based on the assumption that the trust is somewhat transitive. If a node n_i accepts public key of another node n_j as authentic for which witness has not generated by current node, an indirect trust relation of level-1 exists. Neighbouring nodes are trusted as reliable not by direct issuance of witness and recommendation but it can derive the trustworthiness, in such a way an indirect trust relation of level-2 exists.

Trust Graph Establishment and Malicious Node Exclusion

Integrating recommendations in the key generation process is to increase the reliability about authentication of public keys. The recommendations trust value generated by a trustor node (n_i) for a trustee node (n_j) is denoted as $Tval_{ij}$. When $Tval_{ij}$ is greater, the trustworthiness of n_j will be higher. Trust values are computed by a reputation system based on the collected evidence during interactions among the nodes. After issuance of witness and recommendations to neighbouring nodes, trust graph G is formed

where vertices represent users and edges are defined with three types. A non-weighted solid edge is formed when the node n_i generates only a witness for node n_j without recommending it which means that n_i trusts the n_j 's public key. A weighted dashed edge is created when the node n_i has issued only a recommendation without witness for node n_j . The node n_i does not necessarily trust the public key of n_j . A weighted solid edge is created when a node may be connected to another node by both edges of first type and second type at the same time. In such a case, the superposed edges can be replaced by a single weighted solid edge.

Private-key issuing

This private-key issuing scheme is based on Schnorr's signature and Elliptic Curve Cryptography which was discussed in [5]. This key issuing scheme depends on whether the corresponding node has a root node, single level 1's trustor or multiple level 1's trustor. The root nodes are considered as the initiators of the private-key issuing process. Any node n_i who has no level-1's trustors is considered as a root (i.e. $|Trustor_i^1|=0$). Any node who has only one level-1's trustor are considered as single trustor node (i.e. $|Trustor_i^1|=1$). Any node having more than one level-1's trustor are considered as multiple trustor node (i.e. $|Trustor_i^1|>1$).

Malicious Node Exclusion

An Exclusion Access-control Mechanism [7] based on trust metric evaluation is introduced to detect and isolate the malicious nodes that inject fake trust relations using jury nodes. Whenever the jury node identifies the malicious node, it excludes from the network. There are two different processes update the reputation value.

- In the degradation process, the reputation decreases whenever juror receives an evidence message. The equation for degradation process as follows,

$$R_i = \max(R_i^{t-1} - u, 0) \quad (1)$$

- In the improvement process, the reputation value grows periodically to allow nodes to recover the reputation when they perform good actions. The equation for the improvement process as follows,

$$R_i = \min(R_i^{t-1} + u, R_{\max}) \quad (2)$$

Self-Certified Public Key Authentication

Public-keys are self-certified in our trust establishment scheme similar to the approach discussed in Khaled Hamoud et al. [5] Nodes need not to store public-keys or certificates of each other which saves the memory space. Instead of that each node can reconstruct the public keys when they needed. Trust evaluation metric is introduced which allows to evaluate the confidence of the target key through a given trust path.

Evaluating public-key trustworthiness

It is necessary to consider intermediate misbehaving nodes which may cheat authenticity of the target key when public keys are reconstructed based on a given trust path. A trust metric is defined with the set of statements and inference rules. The inference rule and the statements are derived to the confidence of the public-key. By using a probabilistic trust model [5] the inference rules and statements are derived. The node n_3 has multiple trustor nodes such as n_2 , n_4 and n_5 . Each node generates its witness to the node n_3 which calculate its public key with those witnesses. This public key has high degree of trust worthiness because it is evaluated from the three trustor nodes.

Key Updation

To update any of a node's key, this requires a sequence of key updates of the entire subordinate chain. The key-correction operation causes some problems. If the same node frequently updates their keys, resource consumption will be high. The second problem is that the infinite loop of key correction occurs in a cyclic chain. For the node path $n_i \rightarrow n_j \rightarrow n_i$, this problem occurs due to the fact that everyone is a trustor of everyone in a cyclic chain. This key updation should be done which is used to avoid the infinite loop key-correction in a cyclic chain. MANETs can dynamically change in size and topology as nodes move,

join and leave the network at any time. Whenever a node leaves the network, it sends a logout request to their trustors and trustees. Whenever a node joins the network, it looks for trustor and trustee nodes.

RESULTS

The simulation was done to analyze the performance of the network for various parameters compared with the UDP [5]. Different metrics are used to evaluate the performance of the network under attacks. The performance analysis was measured with respect to metrics like time delay, computation cost, etc.

Average time delay at malicious environment

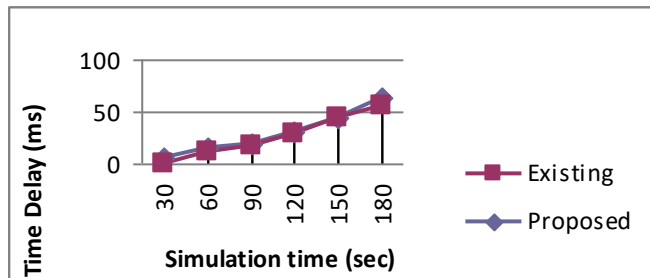


Fig. 3: Average time delay comparison

$$\text{Average time delay} = \frac{(\text{Time at which packets are received} - \text{Time at which packets are sent})}{\text{Total number of packets received}} \quad (4)$$

Time delay is calculated as in equation 4. [Fig. 3] shows that average time delay with respect to simulation time. Time delay is the time taken for a packet to reach a destination from a source. In the proposed system time delay is somewhat higher than the existing system. Since the proposed system uses trust levels for the authenticated public keys. Hence the proposed system of average time delay is slightly exceeding than existing system.

Computational cost at malicious environment

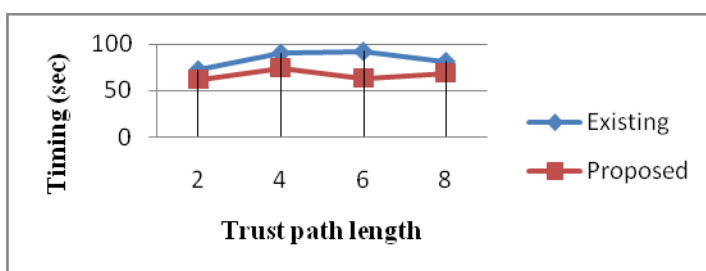


Fig. 4: Computational cost comparison

CONCLUSION

[Fig. 4] shows the computation cost with respect to the simulation time and the trust path length. The existing systems show quite lower than the proposed system. The computation timing will be higher in the existing system because it is using more number of certificates. But the proposed system is certificate-less approach. Our approach requires a single computation of a self-certified key. Hence proposed system has reduced the computational cost even in the larger network.

An enhanced certificate-less trust model for public key authentication in MANETs is designed and also an Exclusion Access-control Mechanism based on trust metric evaluation is introduced to investigate the problem of detecting malicious nodes which may inject fake trust relations. In this work, intermediate misbehaving nodes which may cheat the authenticity were detected and also isolated by improving the trust metrics. The performance and security analysis demonstrate the efficiency of our proposed approach. We have proposed the certificate-less PGP trust model for public key authentication. Detailed analysis has

been done with respect to the parameters. In this work, implementation and performance analysis are presented. Hence, by improving trust metric in MANETs, trustworthy keys are determined through a given trust path. We model the exclusion mechanism and perform a parameter analysis. Simulation results prove that the trust models and an exclusion access control mechanism providing an accurate malicious node detection and exclusion.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

PRIVATE SPEECH AND COGNITIVE DEVELOPMENT: A REVIEW OF THE TWO THEORIES

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ABSTRACT

This paper reviews the psycholinguistic phenomenon of private speech (i.e., self-directed speech) in verbal communication. Private speech was first introduced by two main characters in psychology Lev Vygotsky, the founder of a theory of human cultural and bio-social development commonly referred to as cultural-historical psychology and Jean Piaget, the Swiss developmental psychologist who essentially viewed private speech as evidence of egocentrism and the inability to take the perspective of others [18]. Private speech, or speaking aloud to oneself, is a phenomenon of child development that Vygotsky interpreted as the critical transitional process between speaking with others and thinking for oneself and Piaget considers it as a sign of cognitive immaturity and believes it develops into a fully mature and effective speech as children grow cognitively and gain communicative skills. Lev Vygotsky and Jean Piaget first introduced the private speech; in the three past decades, it has absorbed more attention from researchers. The researchers pointed out to a positive correlation between the application of private speech by children and their task performance and achievement, the fact that had already been noted by Vygotsky. This paper also discusses the theoretical origins of research interests in this field, and disagreement between, Piaget and Vygotsky, and reviews some works of other scholars and the role of private speech in children and adults as well [including some in L2 research] in various settings from a Vygotsky and Piaget perspectives. It also introduces the role of private speech in cognitive development and its contribution in language development, social development, and communication. While discussing the theories of Piaget and Vygotsky, it reflects the viewpoints of these two outstanding figures in their perspectives and the way they see the cognitive development and summarizes the studies conducted in this area. It also supports the view that private speech provides a self-regulatory function and guides behavior and problem solving.

INTRODUCTION

There are numerous theories developed to explain how cognitive development occurs in children. These theories attempt to explain how children's cognitive development occurs, what happen at the time of thinking, and what factors impact children's cognitive development. In the course of cognitive development, private speech plays a key role, which has been considered by scholars in the last decades. Private speech is defined as speech that is not explicitly addressed to another person and thus serves no apparent interpersonal communicative function [2]. Ohtadefines private speech as "audible speech not adapted to an addressee" [3]. The phenomenon has theoretical significance within both Piaget's and Vygotsky's works [4, 5]. It is a type of speech directed toward the self for communication and self-guidance of behavior. Private speech, or speaking aloud to oneself, is a phenomenon of child development that Vygotsky interpreted as the critical transitional process between speaking with others and thinking for oneself. It usually occurs among children around the ages of 2, when they begin to speak, and vanishes around the age of seven [6]. The idea is that private speech first occurs at the end of an action (reactions to one's actions), then during the action [describing one's own behavior], and finally before a child's behavior occurs (self-guiding speech) [7, 8]. Although a few studies have been conducted to reflect empirical support of changes when the private speech occur [9, 10], the majority of them did not differentiate development in the timing of children private speech with respect to action [11, 12, 13, 14]. Private speech has obtained a lot of consideration during the past 3 decades. Numerous studies have been conducted which indicate a positive correlation between the application of private speech by children and their achievement in performing a task [15].

As they become more proficient with word meanings and grammar, a child becomes capable of participating more fully in activities and conversations that involve higher psychological functions, such as planning and problem solving. This kind of speech is typically defined, in contrast to social speech, as speech addressed to the self (not to others) for the purpose of self-regulation (rather than communication) [16]. When children are engaged in private speech they talk to themselves and although it is audible, it has no addressee and is not directed to anyone [17].

In 1932, Piaget published "The Language and Thought of the Child". In this book, he brings his records and observations of children talking to themselves and he termed it "egocentric speech" which was the core of private speech. He sees it as a sign of cognitive immaturity and believes it develops into a fully mature and effective speech as they grow cognitively and gain communicative skills.

KEY WORDS

private speech; Piaget; Vygotsky; cognitive development; language development

Published: 30 Oct 2016

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On the other side of the spectrum is Vygotsky. In his book "thought and language", Vygotsky writes that self-talk or private speech is a part of the process of normal development of communication, self-guidance, self-regulation of behavior, planning, pacing, and monitoring skills[19]. Vygotsky explains that private speech arises from children's social interaction and it develops into talking aloud when they reach kindergarten or preschool age [7].

Both, Piaget and Vygotsky, were interested to study the children cognitive development and use of private speech by children. However, they had very different attitudes toward the role private speech plays in one's cognitive development. Their different approaches to this phenomenon (i.e., private speech) highlighted their fundamental differences about how human cognitive development proceeds. Piaget's theory of cognitive development was built upon three main principles, namely, assimilation, accommodation, and equilibration.

Assimilation is the process of adding new experience and information into already existing mental structure (schemas) [20]. As children grow, they develop cognitive structures to assist them make sense of their surroundings and world and when they face a new experience, they add it up to the already existing schemas. This is an ongoing and active process.

Children are not merely taking information and knowledge through absorption; they are actively involved in the process of assimilation. Among the pile of information, they select the ones that interest them, thus they do not grasp all the information they face.

Accommodation is the reshaping of an already existing schema because of a new experience. For example, a child may bear in mind and have a schema that all flying objects are birds, but when he encounters a Frisbee, he understand that it does not match the schema. It does not breath and isn't alive; therefore a new schema must be built. As children grow, they face the experiences, which the present schema is unable to explain. Therefore, a new experience demands new schemata.

Equilibration is the process of looking for achieving cognitive stability through assimilation and accommodation [20].The child is always looking for understanding and interpreting what new experience they encounter. The child has an image of the world in his mind to understand it and sees how it works, but it become challenging when he faces a new experience which do not fit the current schema and understanding. They attempt to build schemata to interpret the new experience. As result, all these interpretations and come together to build an image of the world and make equilibrium. However, this equilibrium changes constantly since the child experiences new things and it creates disequilibrium and it continues until assimilation or accommodation has taken place.

Piaget believed that a child cognitive development goes through different stages. Assimilation and accommodation are two processes in which the child's brain develops through the natural process of maturation. Thus, they can comprehend and understand the world around them and the ability of interpreting and predicting the world develop. Piaget stated that there is a positive and strong relationship between cognitive development, gradual, and biological maturation of the brain. According to him, the brain develops and matures and consequently the thinking matures and the understanding develops. Piaget, who wrote about child psychology, stated that thought could be followed in symbolic play during and at the end of the first years of life. Piaget does not think that the words of a child, when began, do not show any that the child is expanding thought development. Rather, he thinks that the process of thinking is only related to mental actions, which have been built through practical operations. Piaget believes that private speech is an evidence of egocentrism as well as inability to take the perspective of others [18]. Piaget viewed private speech as a sign of egocentrism and a cognitive deficiency which is represented through the inability to take the perspective of others and therefore engage in a reciprocal conversation with others [21].

Piaget observed and followed the activities of the kindergarten children and recorded them [22]. He concluded that children use verbal repetitions of others, monologues during an activity. In these instances, the child's utterances had no addressee and did not direct toward any other individuals. Piaget thought that private speech is a sign of cognitive immaturity. However, he believes that as the children get older and socialize with other people, private speech vanishes gradually and communicative speech takes its place. Self-speech moves away and changes to other-oriented. It shows that they can share their perspectives with the others. By the age of seven or eight, egocentrism fades away by emergence of critical and logical thinking.

In contrast to Piaget's theories about child development, Vygotsky stated that social learning precedes development. He believed that cognitive development proceeds from being social to individual. In other words, a child's cognitive development originates in socialization activities (e.g., mother-child interactions) and then goes through a process of increasing individuation. Vygotsky thought differently from Piaget and took a more positive view of the functionality and goal of private speech and considered it as a cognitive

tool that let the child regulate, plan, and guide behavior [23]. According to Vygotsky, the functional aspect of private speech shows that children can gradually takeover rules by the help of others. This "others" can be parents, teacher, or an experienced person who can help the child to go beyond his current knowledge and experience, which is known as the Zone of Proximal Development (ZPD)[1]. The ZPD is an area beyond the child level of mastery but it is not so cumbersome that he would not be able to complete it without the help of the "others". Within this zone, the role of adults would appear as collaborator, guide, help which is usually known as 'scaffolding'. There are three key factors in Vygotsky theory, namely as culture, language and, the Zone of Proximal Development [5].

Culture Vygotsky believes that construction of knowledge is done through the culture and social environment [5]. In other words, the society, where children belong to, determines the knowledge that children learn about the world and the way this knowledge is learned. Thus, children learn through communication and interaction as well as elements of their own culture including folklores, songs, language, art works, and the like. For instance, a child whogrows up in a society in which homosexual marriage is taboo in the society, takesstrong anti-homosexuality views. This will for sure affect his or her learning, knowledge, and attitude on this issue. In short, Vygotsky asserts that first culture would affect learning, as children learn through interactions, communication and cooperation with others and the environment, and also symbolic representations of the culture such as plays, art works, songs folklores and the like are important in developing child's views[5].Thus, the culture makes a framework in which the child builds meaning.

LanguageVygotskyviews language as the cornerstone of the learning process. He believes that there is a strong relationship between language development and cognitive development. He believes that the language shapes and encodes our world. That is, language is a system through which we communicate, cooperate, and interact and is a cultural tool. He held that there were three stages of language development. Namely, social speech (external speech) up to 3 years, the speech used to control the behavior of others, express simple thoughts, and emotions. Egocentric speech between 3–7 years, children talk to themselves regardless of other individuals who are listening (private speech). They say things aloud to guide their behavior. This inner speech is silent; it is used to direct behavior or thoughts. When this stage is reached, individuals can engage in all types of higher mental functions.

The zone of proximal development the notion that is central in the Vygotsky's theory is the zone of proximal development or ZPD. The idea was that a child functions at any point in time at a certain level of development. However, Vygotsky believed that providing support and guidance by experienced other, a child could develop and go further. The zone of proximal development or ZPD is the distance between what children are capable of doing and the potential level of the child. There is a friction between the actual level, what a child is capable to carry out and is already developed and the ZDP, which, consists of the processes, and function, which, have not been developed yet. A key element in this theory is the role the teacher or experienced other plays. Vygotsky stated that the teacher or the experienced other plays an essential role in helping the child, directing, and suggesting new ideas to them. They are capable of achieving something, which is beyond their own levels of ability. Thus, they move forward from their actual to their potential level.

Vygotsky argued that the earliest speech of child is essentially social. At first, it is global and multifunctional; later its functions become differentiated. At a certain age, the social speech of the child is quite sharply divided into egocentric speech and communicative speech. Egocentric speech, splintered off from general social speech, in time leads to inner speech, which serves both autistic and logical thinking" [6]. He believed that self-direct speech is not sign of cognitive immaturity but a kind of development. It is the time when a child differentiates between communicative talk and self-directed talk. As the child grows old, this self-directed speech is transformed into silent inner speech.

Beyond these two theories over cognitive development and private speech, Kohlberg et al examines these two opposing theories asserted by Piaget and Vygotsky [10]. In his theory, Kohlberg believes that both of these theories have a shared point which is a failure to differentiate the self from an external auditor[24]. Through a series of empirical studies and consistent with Vygotskian framework, Kohlberg et al found that private speech is positively related to mental age at young children and in children with higher intelligence it reaches its peaks [10].In addition, there is a positive correlation between private speech and social participation and it more often occur in circumstances of peers rather that adult presence. Also, it increased during cognitively demanding tasks [24].

DISTINGUISHING BETWEEN SOCIAL AND PRIVATE SPEECH

Child and adult speech utterances are typically classified as either social speech or private speech. Social speech is speech addressed to another person as indicated by either a pronoun reference, a gaze to another person, or other signals of social intent, such as physical contact, argumentation, or conversational turn-taking [16,25]. Private or self-directed speech are those kinds of words usually

children use to talk to themselves as they do their daily activities [26]. While social speech paves the way to communicate with others, private speech provides a means for thinking, communicating with the self, and also for self-regulation of behavior [16]. A typical approach to make distinction between social-private communications is to categorize utterances as social is based on the following characteristics [27-29]:

Eye contact

The child keeps eye contact with someone else during or within 2 seconds of a speech.

Behavioral

The child's conduct incorporates someone else (by physical contact, look direction, and so forth), or someone else's conduct incorporates in 2 seconds of the discussion.

Content markers

The utterance has the same theme as someone else's previous utterance, is a question addressed to someone else, or contains a vocative or someone else's name.

Temporal contiguity

The utterance occurs in less than 2 seconds after any other social utterance.

In spite of the fact that the above methods recognizing social and private discourse are regularly completed for comfort and clarity in the substance of information examinations, it can be contended that recognizing social and private discourse is frequently unhelpful. Among the explanations behind taking such a position are the way that all discourses, including social discourse, has self-administrative capacities, and that youngsters' private discourse is constantly pseudosocial (or 'parasocial') [10] in view of its social starting points and its sharing of etymological elements and auxiliary properties with informative social talk [30].

PRIVATE SPEECH USE AMONG ADULTS

It is obvious that if one averages over numerous young children, a wide range of settings, and various tasks, one understands that preschool-age children are more inclined to show spontaneous, obvious private speech than older ones. However, it is also obvious that private is not just limited to younger children. While engaging in challenging issues and problem solving activities older children [31], as well as adolescents [32], and even adults [33] use overt self-talk. Researchers who examined self-talk among adults also found the same micro genetic patterns of internalization during repetition and increased application of private speech in performing more difficult tasks as well as particular tasks over others [33]. The above observations, application of private speech among children, and the similar relationship available between speech and task difficulty among adults and children have raised the question that what these findings mean for Vygotsky's theoretical notions of developmental course and the particular contribution of private speech in early childhood.

The findings of the research on the role of private speech among young children are consistent with this hypothesis. However, recent data demonstrate that older children as well as adults use private speech periodically in some situations and under some certain tasks. The development strategy show that it is clear that all people use various tools and strategies in cognitive development during problem-solving tasks in which some of these strategies are use more frequently than the others [34].

In addition, a decline of frequency of use of a strategy during completing a task that is probable to occur for a particular activity does not reflect the fact that a strategy or behavior would not be appeared in accomplishing a different task [34-36]. Fernyhough features the phenomenon of private speech among adults as required as "re-externalization" which depends on contextual, personal stresses, or cognitive challenges [37].

SOCIAL ENVIRONMENT AND THE PRIVATE SPEECH

As it seems, private speech is a global and common feature among all children, no matter from what culture they come or what background they have. For instance, some studies and evidences show that developmental disorders including attention deficit/hyperactivity disorder (ADHD) and even specific language impairment put off the internalization of private speech instead of preventing children from using such speech to control their behavior [38, 39]. However, in spite of the fact that the private speech is global, application of it for individuals seems to be different at different ages. Such differences reflect the fact that social environment could have any possible impact on the development of private speech. For

instance, private speech has been discovered to be connected to are liable parenting style] and higher socioeconomic position [24,40, 41]. Conversely, it has been reported that children who were restricted to have social participation and presence put off private speech development. For example, children who grew up in low-income Appalachian families, where the vocal relationship and verbal communication between adults and children are restricted, private speech is delayed as well as among children who have a background of abuse and low-income families [42, 24]. In line with Vygotsky's theory that private speech originates from social communications, these individual differences in private speech have been inferred regarding the differing levels of involvement of social exchanges between adult and child. Vygotsky believes that what makes private speech is the social setting and the environment where the child grows [5]. The high positive correlation between the rates of the social interaction and private speech in children supports this fact.

FUNCTIONS OF PRIVATE SPEECH

The function of private speech refers to the possible consequences of the utterance for the individual's ongoing behavior [16]. For example, the sentence, "I am placing the red pen in my bag", could fall under the functional category Directing own activity or Self-guiding, if it occurs along with the child's behavior [16]. Similarly, if the sentence occurs prior to the action, it could be categorized as Planning. Another example is the sentence, "here is the black pen", which could be categorized as Focusing attention, suggesting that the child is using private speech to concentrate on one particular color of object [16]. Furrow categorizes private speech into 12 functional categories including:

- Instrumental: An utterance that indicates desire or is in the form of a whine; (e.g., "I want it").
- Regulatory: Referring to an imminent future event. The utterance is directing another person's actions; (e.g., "Go there.").
- Self-regulatory: Referring to an imminent future event. The child is directing his/her own actions; ("I put that there.").
- Attentional: Referring to an ongoing sensory event or a sensory event that is eminent; (e.g., "Look").
- Interactional: Talking to someone else or offering a greeting; (e.g., "Hi.").
- Expressive: Describing an internal state or affect, offering an opinion, or expressing a feeling; (e.g., "I love you.").
- Referential: Talking about an object in the immediate surroundings or referring to an event occurring in the present; (e.g., "That.").
- Description of one's own activity: The utterance refers to an event that is ongoing or an event that occurred right before the utterance. The event is one in which the child took part; (e.g., "Putting it.").
- Questions: The syntax of the utterance is in the form of a question or the child's inflection indicates a question; (e.g., "What that?").
- Imaginary: The utterance is sung, a word play or the child labels/describes an object using pretend words; (e.g., "That hat."- referring to a block the child placed on his/her head).
- Informative: Referring to an object or event not in immediate surroundings; (e.g., "Daddy at work.").
- Incomprehensible: Utterances that were inaudible [43].

In addition to the abovementioned functions, other functions proposed for private speech include emotional expression and role play[44]; language practice[45, 46]; practice for communicative encountering[47]; and building up the importance of one's own activities for self [10]. Besides self-regulation, recent research has set a part for private speech in the acquisition of self-knowledge[48, 49]. Rubin, after Mead[50], proposed that remarks on one's activities and emotions "make young speakers aware of their own actions and of their own separate existences"[14]. Swain et al confirmed the useful functions of the private speech in learning language and emphasizes the importance of two ideas of SCT[51]. That is speaking controls cognitive functioning and systematic notions form the appropriate instruction.

Studies show that there is a positive correlation between children's performance on cognitive activities such as planning [21], and puzzle solving [19]. In addition to facilitation of simultaneous cognitive performance, there is a positive correlation between children's involvement in private speech during planning tasks and their engagement in phonological recoding strategies[52] and with the richness that they call autobiographical memories[53]. Moreover, there is a consistency between children's use of private speech and different tasks and contexts [54, 55].

BENEFITS OF PRIVATE SPEECH

Behavioral self-regulation and emotion regulation

Recently conducted researches have shown that there is a connection between children's private speech and behavioral self-regulation in different ways. First, children's private speech has been observed to serve self-regulatory or self-guiding in cognitive problem-solving activities [18]. Second, as the children's task

difficulty and demands for self-regulation increase, the private speech is shown up systematically and automatically [56]. In addition, there is a positive and dynamic relationship between self-talk and children's task performance over time [11,16, 23].

Memory, motivation, communication, and creativity

Private speech is a strategy, which improves memory among children[19]. Private speech has been shown to have a positive impact on working memory, which helps the children to remember the information[6]. As an instance, a child may repeat the words of a story or other things to recall it. For instance, a child might reiterate a rule or story to himself or herself as to recollect it. Children also apply private speech to avail their ability to suppress certain replications or information, and rather use other, less prevalent replications or information, a process called as inhibitory control [6].

Children's motivation is increased by expressing purposes, opinions, and feelings via private speech [6]. For instance, while doing a challenging puzzle or task, a child may talk. Moreover, children were observed to use motivational private speech particularly during a challenging activity, which has a positive impact on the outcome of the activity. Some researchers have shown that private speech would help children to be a better social communicator. By doing so, children understand their own capabilities and practice their communication skills [6]. While playing and doing creative and imaginary tasks, children usually use private speech [19]. The more children use their private speech, the more flexible, creative, and original thought they show [19].

There also seems to be a positive correlation between private speech and working memory, which is also called short-term memory. According to Bradley, working memory paves the way to process the information and make an ephemeral storage for challenging and difficult activities such as comprehension, learning, and reasoning. He elaborates how people "recode materials verbally so as to take advantage of the capacity of the phonological loop for storing serial order" [57].

Private Speech and Problem-Solving

Vygotsky points out that private speech does not simply go with a child's acts but rather goes about as a device utilized by the creating child to encourage cognitive procedures, for example, overcoming hindrances, and upgrading imagination, thinking [5].

Children use private speech frequently amid doing challenging tasks in light of the fact that they are endeavoring to self-regulation by verbally arranging and sorting out their thoughts [58]. The recurrence and contents of private speech are then correlated behavior, execution, and performance. For instance, private speech seems, by all accounts, to be practically correlated with cognitive performance: For instance, activities associated with executive function, problem solving assignments, schoolwork in both languages, and mathematics [59]. Language is likewise being examined in connection to problem solving and has been seen by a few researchers as a key component[60]. They contend that the discoveries of their study are consistent along with the idea that language representations are included in specific types of intelligent problem solving[60]. The significance of private speech becomes possibly the most important factor as the problems turn out to be more difficult, and cannot be comprehended and solved automatically, yet they may be improved by the utilization of private speech to encourage problem solving. Scientists have shown that language is an essential segment for problem solving. Language and cognitive processes are often intertwined [60].

CONCLUSION

The relationship between language and thought has always been the arena of struggle between cognitive psychology, developmental science, as well as philosophy. Two key theorists in this field, whose works have become increasingly influential in years, were Piaget and Vygotsky.

In his book, *The Language and Thought of the Child*, Piaget described observations of children who talked to themselves in classroom environment and speculated as to the developmental significance of what he named at the time "egocentric speech"[4]. Substantially, Piaget considered private speech as poor social speech and at the last stage; it would be replaced by fully mature and effective social speech after the child conquered egocentrism and gained increased cognitive and communicative skills.

On the other hand, Vygotsky proposed that the substantial transformation of the child's cognitive functions initiates toward the completion of the second year of life, when preintellectual language and prelinguistic cognition combined to build verbally mediated thought. Vygotsky claims that inner speech (or verbal thought) roots from linguistic exchanges between the child and others and goes through a transitional stage of self-directed talk before becoming fully internalized. This self-directed speech later was known as private speech [61,62]. This process, private speech, can support children to develop superiority over their

own behavior, and to open a window toward the internalization process that, in Vygotsky's opinion, is central in the formation of higher levels of cognition.

Vygotsky proposed that private speech, rather than originating from within the child's mind and becoming more social over time as envisioned by Piaget, originates from the social world of the child in children's interactions with others. Social speech from parents and caregivers to the child, which functions in part to guide and regulate children's behavior and attention ["other-regulation"], gradually becomes internalized during the toddler and preschool years as the child begins to talk to the self out loud to guide his or her own thinking, behavior, and problem solving. Thus, the social/cultural tool or symbol system of language, first used for interpersonal communication is used by the child overtly not for communication with others but for intrapersonal communication and self-guidance. During this process of internalization or the appropriation of language for the self, a fundamental transformation of the child's cognitive processes takes place when preintellectual language and prelinguistic cognition fuse to create verbally mediated thought. A new level of functional organization of the brain and mind is thus created that allows children to engage in uniquely human, higher order cognitive processes, such as self-reflection and self-regulation of behavior.

This paper attempt to review two theories of the most outstanding psychologists about the relationship between the role and significance of private speech in cognitive development.

CONFLICT OF INTEREST

None

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

COMPARISON OF EFFECTIVENESS OF PHONETIC INTERVENTION, HOLISTIC INTERVENTION AND MIXED INTERVENTION ON THE RATE AND ACCURACY OF READING SKILLS OF CHILDREN WITH READING DIFFICULTY IN GRADE 2

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ABSTRACT

Objective: The purpose of this study is the comparison of the effectiveness of phonetic, holistic and mixed methods on reading accuracy and reading speed of students' with reading difficulties in grade two in primary school. **Materials & Methods:** This study is quasi experimental-comparative. The population is students with reading difficulties of the ordinary primary school in grade two in Jahrom and the investigated sample was 12 students with reading problems which were picked up from ordinary schools in access and randomly categorized into three groups, so that each group contained 4 people received one of the interventions in 35 sessions. The participants were investigated and compared regarding accuracy and speed of reading text, accuracy of non-words, and words before, after, and one month after the intervention using diagnostic reading test (Shirazi, Nili Pour 1384). Using software SPSS, descriptive statistics and statistical test were carried out. **Results:** After three interventions, the participants had a significant difference in all indices of reading skills in comparison to pre study ($p < 0.05$). But, after the invention, no significant difference was observed among intervention methods in all indices of reading skills ($p > 0.05$). **Conclusion:** During this study, it was perceived that the three phonetic, mixed and holistic interventions made a significant difference among students with reading difficulties. As the result, reading problems could be treated through three interventions.

INTRODUCTION

KEY WORDS
reading difficulties;
phonetics intervention;
holistic intervention;
mixed intervention.

Reading is the use of a set of complex and unique skills in human which requires extracting word written data, transforming it into mental representation, and then get to meaning and pronunciation. Thus, it is not surprising that some children have reading difficulties [1,2]. Reading difficulties is defined in various studies as the acquisition of one or two standard deviation below the reading mean of reading standard tests [3]. Reading difficulties is the main cause of failure in schools. These difficulties are, in fact, the most obvious danger signal by which the children failure can be predicted in educational fields, this is why successful reading is considered the foundation of success in other courses [4]. Without the assistance of experts in special education to children with reading difficulties, they would encounter with certain frustrations at school [5]. There are extensive evidences which show that reading difficulties of majority of the children can be prevented through early intensive intervention plans. Consequently, systematic and intensive complementary interventions are required to remove reading difficulties of the students who struggle with reading [6].

Process of reading is one of the basic functions of language which is categorized as one of the perceptive actions (receptive) and has received much attention in recent years. Numerous studies have been conducted to achieve receptive information processing of reading and the outcome was presenting models which are the results of experimental experiences. One of the reading models which absorbs a lot of attention is the dual route model [7]. According to the dual route model, various approaches have been created in reading education. Phonetic method, whole word method, and mixed method are the most popular methods which are applied. Phonetic method highlights the significance of Phonological sounds and the sounds of letters. Whole word method emphasizes encountering the written words, so that the children become familiar with the words and they create lexical thesaurus through frequent exposure to them. In this method, the emphasis is more on meaningful units of language than speech sounds [4]. Also in the mixed method, phonetic strategy is tested simultaneously with the whole reading strategies in a way that grapheme - phoneme correspondence and word phonological awareness skills are taught in which the word were by the whole reading. In this method, children would learn strategies associated with both phonetic and holistic methods and analyzing the structure of the words [8].

Lovett et al compared word reading skills in children with severe reading disabilities using both methods. One group was trained in whole word (holistic) treatment, and the other group in grapheme- phoneme correspondence, and the control group in study skills [10]. Each group received 35 hours of intensive training. In this study, children responded to both treatments. However, both groups failed generalization of what have learned in untrained words. Therefore, it seems that even the children who trained grapheme-phoneme correspondence, require a particular training to generalize learned cases to untrained words [9, 10]. Lovett et al compared two different intensive training of word recognition in children with

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severe reading disabilities [11]. One of the plans highlighted phonological awareness and syllable segmentation (through direct training of grapheme-phoneme correspondence) and the other emphasized the training of visual words. The results indicated that phonological training program was led to more generalization in phonological domain and reading visual words training program to learning transfer of real words [11]. In another study conducted by Gustafson et al the effects of three intervention methods on reading skills of children with reading difficulties in grade two of primary school were investigated [8]. The first method was based on processing in word and sentence levels and the second one emphasized decoding and phonological skills, and the third method was a combination of the first both methods. After 25 sessions of intensive treatment sessions, the results indicated the improvement of reading skills in three groups. However, the group who completed mixed intervention method had obtained the best results comparing other groups.

Most studies concentrate on word recognition since it is proved that the largest hindrance in most children with reading disorder is difficulty in fluent acquisition of off-context word recognition skills. The results of this study show that both phonological oriented approaches and whole word methods are effective fashions to improve word recognition skills in children with learning disabilities. Also, according to the results, mixed approach which in fact is a combination of two holistic and phonological approaches, reveal remarkable improvement in reading skills. As the result, these three approaches lead to improvement in reading learning [4]. However, conducting numerous studies in reading difficulties, there would be some contradictions considering various studies to each other in reading training [12,13]. In addition, since this study is language and culture dependent and no study in this field has been carried out in Persian language, the necessity of more studies on the effects of each method and comparing various studies with each other seems essential.

Considering the high population of students in Iran and widespread prevalence of reading difficulties, we encounter a high population of children with reading difficulties and this issue gives the studies a new dimension toward purposes of reading studies. Consequently, using the best methods and programs in reading learning is one of the most vital requirements in these children. The studies revealed that the gap of reading level between skillful and poor readers would be widen in the case they do not receive appropriate treatment and reading difficulty improvement is increasingly demanding after grade four of primary school. Also, the long term negative effects of reading difficulties have been proved on literacy skills [14]. Most children with reading difficulties and their families encounter a lot of psycho-emotional problems, and in some cases these children are transferred to exceptional schools which makes the situation more complicated and devastate the these students psychologically.

Although the symptoms of reading difficulties (such as inability to distinguish between letters or the connection between phonemes and the correspondent grapheme) might occur before the schools, they are rarely understood before preschool or in grade one of primary school since formal training of reading has not begun yet in most schools [15]. Thus, the best treatment method to remove the problems of these children in short term seems essential to abandon further effects of reading difficulties in other courses. This, in fact, avoids economic loss on the family and economy.

Considering the above descriptions, this study is an attempt to compare the effects of different intervention, holistic, and mixed methods on accuracy and reading rate in the students with reading difficulties.

MATERIALS AND METHODS

This study is a quasi-experimental comparative study. The samples were 12 students with reading difficulties in grade two of primary school. Inclusion criteria to this study were as followings: being monolingual of Persian language, possessing normal intelligence, auditory in normal range, student of grade two of ordinary primary school, obtaining standard score of -2 or less in diagnostic reading test. Exclusion criteria were using medications due to ADHT, and a history of epilepsy. The participants of this study were suffering from reading difficulties regardless of hearing or intellectual problems or other reasons.

Initially, the participants were introduced to the researcher according to their I.Q sampling among students of grade two on the behalf of the teachers as those who have reading difficulties. Then, reading test was taken from them [adopted from diagnostic reading test of Nilipour [16]. If the scores of students' reading test of two standard deviations were lower than normal scores, the students would refer to audiometric centers. Also, in the case there was no Weschler test in the academic record of the students, they would refer to psychologist to evaluate their I.Q. Finally, if the lack of hearing problems and overall natural I.Q were approved (over 85), the participants were picked up. Then, cooperating with the principal, an interview meeting was arranged with the children's families and teachers to present a brief introduction of the study and the required time and number of sessions to perform it. Meanwhile, in an interview with the students' parents, the interviewer was assured that children have no history of ADHT. Finally, if the parents were consent with their children participation, consent form was completed. After diagnosing reading difficulties in students, evaluation of reading difficulties was performed by one of the diagnostic reading test, non-word reading, and irregular words [16] as the baseline.

Random method was performed to divide the children into three intervention groups. It is worth noting that sampling stopped when the number of male and female students reached to 6. Then, each group of male and female student was randomly divided into three intervention groups. Each child received one of the three intervention methods (phonetic, holistic, and mixed) during 35 sessions in groups of 4 for 50 minutes. Once intervention was done, accuracy and rate evaluations were carried out immediately with the participants. This data was compared with the primary evaluation. Also, the results of the three interventions were compared with each other. In addition, accuracy and reading rate of non-words and irregular words were compared for one month after the interventions. This data was also compared with the previous data.

In holistic intervention method, intervention is in a way that the words are written on separate cards and the therapist asked the children to pronounce the words and then repeat them. The primary words are usually written frequent words. During this study the words were picked up from the books of let's read and write grades one and two of primary school. The children learned to identify word features by their whole words and associated pictures (drawn back of the word cards) and they gather a set of visual words. In fact in this training method, phoneme-grapheme rules are ignored. During this study, the words which have been used in tests before and after the intervention to evaluate students' reading level were removed from the training word list.

Phonetic intervention method was based on phoneme-grapheme correspondence. In this method, children were trained with some limited letters (grapheme), their corresponding phonemes, and corresponding grapheme with its corresponding phoneme which they were able to make various words. Gradually, some more words were added and more combinations were given to them. In fact, distinguishing words from each other (they were trained to assign each letter to a common word which began with that word), the relationship between sounds and letters (they were trained to assign each letter to natural sounds or animals) and combination of sounds (they were trained by playing with the environmental sounds or animal sounds) was highly significant in this approach. Once the students were trained the letters of a certain word, the word was presented to the student to read and through doing so, the number of were added gradually. The order of word training was based on the order of the book of grade one of primary school "let's read".

Once the students were trained the letters of a certain word, the word was presented to the child to read and gradually the number of words were added. The order of letter training was based on the order of presented letters in grade one of primary school.

In mixed approach, the words which have been chosen from the books "let's read and write" courses of grade one and two, were written on cards. Then, through holistic training, particular letters and letter correspondence with that phoneme were emphasized. Word choice was also based on words so that the words were chosen in which certain letters were repeated. The order of word training was based on the presented order of the book "let' read" of grade one. In fact, this training method focused on decoding skills in word level in combination with decoding skills in letter level and as it is obvious from its name, this method is a combination of two holistic and phonological methods.

Case history questionnaire (including demographic characteristics, medical history, and students' rehabilitation) and also diagnostic reading test [16] were used in this study. To analyze the data, initially, the data was entered into the computer, then using software SPSS version 16, descriptive statistics and frequency distribution of the samples were reported. Later, the Wilcoxon test, Kruskal-Wallis and Friedman (frequent measure analysis) were used. Considering the protocols approved by the research council of University of Welfare and Rehabilitation Sciences, families became aware of ethical purposes and different training stages. Also, consent was obtained from the families of students participating in the study and all students' information remained confidential throughout the study.

RESULTS

The objective of this study was comparing the efficiency of three intervention approaches in reading levels of the students with reading difficulties in grade two of primary school. It is worth noting that three states were supposed to read irregular words: holistic reading of irregular word (the words that takes the child less than 1 second to read), phonological reading of irregular word (the words that takes the child more than 1 second to read), or failed reading of irregular word (the words that the child is not able to read correctly). [Table 1] demonstrates the effects of holistic, phonological, and mixed intervention methods on reading rate and accuracy of the text, reading accuracy of non-words and irregular words after the intervention.

Table 1: the effect of three intervention methods on reading rate and accuracy, reading accuracy of non-words and irregular words after the intervention method

Intervention method	Phonological method		Holistic method		Mixed method	
Reading indices	Test criterion	p. value	Test criterion	p. value	Test criterion	p. value
Reading rate	6.5	0.039	8	0.018	6.5	0.039
Reading accuracy	6	0.05	8	0.018	8	0.018
Non-word reading accuracy	5.2	0.074	7.4	0.025	5.63	0.06
Holistic reading accuracy of irregular words	6.53	0.038	8	0.018	7.6	0.022
phonological reading of irregular words	2	0.386	14.5	0.076	6	0.05

As [Table 1] indicates, all three intervention methods showed significant difference in reading rate and accuracy and holistic reading accuracy of irregular words. Holistic method in reading accuracy non-words and mixed method in phonological reading accuracy of irregular words had significant difference.

All the indices in this study were compared intergroup intervention prior to the intervention and they did not show any significant difference considering the indices ($p < 0.05$). This means that they could be compared with each other after the intervention.

[Table 2] shows the comparison of reading indices in the three groups after the intervention.

Table 2: The comparison of three intervention methods after the intervention in reading rate and accuracy, reading accuracy of non words and irregular words Evaluation time

Evaluation time	Post intervention	
Reading indices	Test criterion	p. value
Reading rate	0.731	0.694
Reading accuracy	1.209	0.542
Reading accuracy of non-words	2.53	0.28
Holistic reading accuracy of irregular words	1.29	0.59
Phonological reading accuracy of irregular words	0.27	0.87

As the [Table 2] shows, the changes made by these three methods in reading accuracy and rate, reading accuracy of non-words and irregular words had no significant difference. Three intervention methods had no significant difference with each other in all reading indices after the intervention.

DISCUSSION

According to the theory of reading dual route, there are two separate courses for reading (lexical and non-lexical). If one of these courses is damaged or encounters a problem, the other course stays intact and operates naturally. This separation between reading courses leads in the separation between reading methods of irregular words and non-words and eventually the separation between reading rate and accuracy which indicate that the courses do not necessarily develop simultaneously and with the same rate [46].

According to reading dual route, if the lexical route (holistic) is damaged or do not develop normally, then the reading rate will not develop in the child since lexical route emphasizes the word reading as a general unit, and comparing non lexical route this would lead to faster decoding. And also the child is unable to read irregular words emphasizing non lexical route which is based on the corresponding principals of grapheme- phoneme and this would lead to increasing error and decreasing reading accuracy. On the other hand, if the non-lexical route (phonological) of a child is damaged, they cannot improve in reading accuracy of less familiar and less frequent regular words. On the other hand, if the child is able to read the words just through lexical route, they are expected to encounter problem reading non words or less familiar and less frequent words and reading accuracy is reduced in them. Consequently, this would lead to generalized errors in reading non words (for example reads apple as apple) [7, 17, 18].

When the child experiences from the correct words decreases, then he is not able to create sufficient visual representations from the written words in his mind and this reduces the rate of reading, since his visual lexical thesaurus is not enriched yet.

But as it was seen in this study, three holistic, phonological, and mixed groups showed remarkable improvement in all reading indices. According to reading dual route, and as it was explained before, when

a child is trained, it affects the whole reading process and all of the reading indices whether it is based on phonological, holistic, or mixed route. It is worth noting that the students participating in this study were picked up from the ordinary schools and were not necessarily dyslexic and had a combination of various reading difficulties (except reading difficulties resulted from low I.Q, hearing loss, and low vision). Consequently, the results of this study revealed that if any of these methods is presented thoroughly, correctly, and on time could be effective in removing reading difficulties.

Numerous proofs support this idea that two lexical (holistic) and non-lexical (phonological) routes in reading dual model two distinct and different mathematical method could be applied to extract pronunciation and meaning. Two routes can interact with each other. As it was considered in this study, holistic intervention method obtained higher score in reading non words. One of the reasons could presumably be attributed to the interaction of phonological and holistic routes in pronunciation of the word [19]. On one hand, different improvement in individuals to respond to different interventions may arise from individual differences particularly since all the participants of this group were not exactly suffering from a certain reading difficulty. Some children responded simply to the treatment while some were treated hard. Eventually, the results of the three intervention showed that all children benefited from these interventions. But some were resistant against treatment in three groups and improved less comparing other group members. These could be the reasons why despite significant progress in all reading indices in three groups, this progress showed no significant difference comparing three groups with each other (table 2) [19, 7].

According to reading dual route, since in phonetic method the training is based on increasing awareness of grapheme-phoneme correspondence, it is expected that reading accuracy rises. By increasing the child positive experiences in accurate reading of words, and increasing reading rate in holistic reading, it is expected to increase the students' understanding from the text and consequently reducing reading errors and increasing reading accuracy, since the student gradually reaches finer awareness from written units and is able to decode words in smaller units than single words. Also, according to reading dual route, in mixed method, both lexical and non-lexical route is activated and reading accuracy increases.

The fact is that children who encounter reading difficulties gradually make gap in reading (reading rate) psychologically from their normal peers this process is kept on by increasing age. These children are deprived from facing numerous vocabularies and practicing reading words while their peers regularly increase their visual vocabularies through accurate reading of words. This lack of reading practice for children with reading difficulties keeps them behind from their normal peers more and more particularly in reading rate. In fact the normal children promote decoding rate of words through increasing visual representation. Obtaining low scores in evaluating reading rate at the beginning of this study is for this reason. Since the individuals' responses are different due to personal differences, considering reading rate, some of the students were not placed in normal range even after group intensive intervention and were located more than -2standard deviation with the students without reading difficulties. However, probably the test conditions and the students' attempt to read with high accuracy brought on failure of reading rate. It is better to evaluate reading rate of the students regardless of test conditions. But totally, despite all these issues, the students' status was better in this index.

In this study it was observed that the three intervention groups had demonstrated better performance in evaluating reading non words based on the number of accurate non words. In phonological intervention which in fact was the direct phoneme-grapheme training, increasing reading abilities could be attributed to these trainings. The surprising result of this study was the positive changes of scores of non-words in holistic reading comparing two other groups which was different from our expectations according to reading dual model. One of the reasons in holistic reading according to reading dual model is possibly increasing reading rate of words and lexical decoding skills which could lead to increasing lexical decoding skills in smaller units and rising reading accuracy. The fact that how many words can make this improvement is different in individuals [7]. Since it was a group study, the rate of facing with visual words was much higher than individual intervention, since each word is practiced for each student consequently the student encounters other practices of his peers. Therefore, it is expected that the children gradually discover the correspondence and gradually reach the decoding abilities of words in phoneme and grapheme levels. It is worth noting that the researcher believes that after the intervention which lasted 35 sessions for an hour each were not sufficient for training the whole alphabet rules which is the aim of phonological group. In mixed method which concentrated on two units of the whole word and phonemes, we expected to encounter improvement in reading non words which achieved in this study.

The results show that three intervention methods in this study reduced the reading errors in irregular words and facilitate holistic process of irregular words. According to dual reading method, as the reading rate and accuracy increases, it is expected to have reduction of reading errors and increase of scores in holistic reading of irregular words. Rising percentage of phonological scores during phonological intervention method also could be the direct training results of grapheme-phoneme units and their correspondence which is the focus of this intervention since, according to dual path reading model, rising awareness of grapheme-phoneme correspondence would lead to decoding words phonologically. Lovett et al also found these results; however, they did not investigate the reading methods of irregular words separately [11].

Perhaps one reason why reading scores improved in all participants was enhancing the overall level of awareness of parents about their children's reading problems and exercises. As previously mentioned, all parents were aware of their children's problems, or in the case of awareness, they associated their children's problems to lack of classroom excursions. During interview with the parents whom the problems were explained to them by the researcher, Parents found that systematic and timely exercise can help them to overcome problems. Fortunately, during this study, except the participants' parents of 4, all parents worked well with the researcher to improve the intervention goals. Certainly, rising awareness of parents had a great impact on children's behavior and attitudes of parents toward children and consequently increased self-confidence in children. Meanwhile, each of these intervention methods in all three methods cannot be quietly net due to reading route interaction on each other and this factor can also be a cause of reading achievement scores of all students and is not a significant difference between the intervention methods. Since this study was carried out intensively and in groups of 4, and during intensive interventions, it was not possible to increase the number of samples in each group and this reduces the number of participants in each group comparing similar studies.

Perhaps the lack of significant differences between the three groups is due to the low number of participants. Also, since the study was conducted during the participants' study, it seems that the simultaneous training of the teacher at school and the researcher could be considered as the confounding variable of the results, however, since all the students were trained in three groups and also all the teachers used that same educational system, thus, it does not seem that these factors has affected the results.

It should be noted that all participants in this study were not examined in terms of having dyslexia; therefore, this factor (of course if there is dyslexia in one or more participants) can influence the research process and its results. But if the participants comprised solely of individuals with dyslexia, different results might be obtained. In other words, participants in this study comprised the people who had reading difficulty in ordinary schools. But, according to the results of this study and considering the inclusion and exclusion criteria, if in every person with reading problems (who has reading problem for any reason other than mental disability, hearing, and vision problems) any of the phonetic, holistic, and mixed interventions was conducted properly and timely, significant progress in all reading indices could be observed.

The last point is the impact of the group in which each strategy was carried out in group in this study. During this process, if one of the group member acquired a particular strategy later for any reason, or missed the session, the whole group had to wait for him to learn the strategy skillfully. Thus, this both wastes the time of the whole group and also lowers the scores of them. But, group practices could be considered as a positive point in this study, since these conditions were close to the class conditions [8].

CONCLUSION

In this study, it seems that by performing intensive, daily and group interventions, reading level of students' with reading problems could be improved. During this study it was observed that the three groups of phonological, holistic and mixed interventions created a significant difference in reading levels of the students with reading difficulty in 35 sessions. Consequently, reading problems can be solved in different ways if in any case, the sequences of steps are followed and we ensure that the skills of students at each stage of intervention are achieved. It should be noted that this is almost impossible in crowded classes. These results can be practical for the teachers of grade one and two and the authorities associated with educational lesson planning.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The students participating in this study and their families, Mr. Shadmehr and Jahrom Bahar Language Institute, and Jahrom Department of Education are appreciated earnestly in the implementation of this study.

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FINANCIAL DISCLOSURE

None.

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ARTICLE

ENHANCING PRIVACY AND SECURITY THROUGH MEDIATOR USING DCP-ABE WITH OTP

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ABSTRACT

In the previous 394Technology has given a wonder full gift to man which is called as Internet. Traditional internet techniques were based upon the centralized structure which is now extended to a complex network of decentralized smart devices. This shift requires a strict authentication which ensures that system's resources are obtained by legal user. In this proposed paper, an OTP concept is added to the existing DCP-ABE-M scheme which will add another layer of security to the current system. OTP (One Time Password) is a time dependent unique sequence of character code or password which is valid only for a single login session up to a specific time. The proposed system will complete the login session if and only if the user passes the primary and secondary check in test conducted by the system. Since the OTP code is transferred only to the registered phone number, the owner of the account will be only able to login successfully. This scheme focuses more on password authentication and login session. Existing approaches had used only user attributes and GID for secret key generation but in our approach secret key is a combination of data attributes, user attributes and One Time Password (OTP). The most effective feature of this system is, it performs three factor authentications. So even if the attacker gets the user attribute and static secret key, attacker will not be able to cross the login session without OTP which will be sending only to the registered phone number of account owner. Hence the proposed system is more reliable and secure than existing system.

INTRODUCTION

KEY WORDS
 Mediator, OTP; Three factor authentication; Time dependent login session; Data attributes; User attributes; Mediator; static key

All recent approaches are utilizing one of the most conventional and simplest authentication schemes over the insecure network, which is known as Password Authentication scheme. The identity of the connection originator can be validated by using the password authentication schemes which is based upon two-way hand shaking procedure. Since this scheme is vulnerable to playback attack, error attack, modification attack and trial attack, it can't provide high security. Hence numbers of researchers are focusing on new password authentication schemes which will provide highly secure network environment for legal users. The traditional password authentication based systems had provided a user identity (ID) and a unique password to each user for his authentication purpose during login process or when user wants to access remote server. The remote server maintains a password table which stores user ID and corresponding password. If and only if the user entered details matches with the password table details then only the server access permission will be granted. But this system have few drawbacks 1) it is vulnerable to stolen-verifier attack, 2) system load will be high when number of users were huge, 3) it is difficult to maintain a long password table when more number of users register in a same server.

In order to solve the problems related to password table a new scheme is proposed by A. Evans [1] in which the passwords are hashed or encrypted and then stored in password table. There are two types of hash function 1) computable hash function, 2) uncomputable hash function. The another new approach introduced a scheme which gives proof of erasure which is based upon uncomputable hash function. But still [1] is not secure because the passwords may get leaked or modified, if the intruder break the server. For solving this problem J.K. Jan and Y.Y. Chan [2] had proposed a new system in which the server doesn't require the verification of password table for a long time.

Later Lamport's method of one time password using one way hash function is further extended by Haller and Yeh [3] [4]. In 2002, two stolen-verifier attack on SAS and OSPA protocol is proposed by Chen and Ku [5] in terms of time computation and utilization of storage space. Some existing schemes had used smart cards for password authentication [6][7][8][9]. Here the existing [10] had given the smart card based schemes on secure one way hash function which had solved the problems such as 1) it doesn't require password table, 2) computational and communication cost is very low, 3) reply attack is prevented. But the major disadvantage of this scheme is, it can't achieve mutual authentication. These problems can be solved by using [11] which is given by I.En Liao and Cheng-Chi Lee. These techniques are further extended to [12] in order to improve the security level. Then further OTP concept had used in multi-authentication factor process. Multi-authentication process uses three factors for authentication. They are 1) Something you know, 2) Something you are, 3) Something you have. Here we have combined the concept of one time password with DCP-ABE-M in order to provide highly secure system.

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Published: 30Oct 2016

MATERIALS AND METHODS

IBE

The first Identity Based Encryption (IBE) scheme was introduced by Boneh and Franklin in 2001. As IBE doesn't require public key infrastructure, this scheme can be taken as an exciting alternative to public key encryption. That is the sender requires only latter identity instead of certificates and public keys of the receiver for sending messages to other side. Later Adi Shamir extended this concept IBE [13] where the user can use any string as his public key. For example: Alice and Bob are two persons who want to communicate with each other through mail. Alice sends an encrypted message to bob at bob@company.com. She encrypts her message by utilizing the public key string bob@company.com. Public key certificate of bob is not required by Alice, So Alice doesn't generate public key certificate of bob. Bob receives a message in an encrypted form. In order to decrypt the mail he contacts a third party, which we call private key generator(PKG).Bob introduces himself to the PKG. PKG generates a private key for bob which can decrypt the received mail. The PKG contains only bob's private key.

ABE

The main drawback of existing IBE scheme is, multicasting is not supported by this scheme. In order to solve this problem Sahai and Waters proposed a new scheme Fuzzy Identity Based Encryption or Attribute Based Encryption (ABE) [14] which allows multicasting. Here a set of descriptive attributes of user are utilized to provide his identity. In this scheme user is able to decrypt data if and only if the user holding attributes matches with the cipher text attribute. There are two types of ABE:

KP-ABE: In this approach, set of attributes will be attached with cipher text, while an access structure is integrated with in the secret keys.

CP-ABE: In this scheme, secret keys are attached with a set of attributes, while access structure embedded in the cipher text [15].

MABE

The existing approaches which use single authority can easily generate and share secret keys because single authority knows all the attributes of the user. But the main disadvantage of the existing schemes is, dependency on the central authority. That is the entire system get effected when the central system get failed. M. Chase introduced a new scheme Multi-authority Attribute Based Encryption (MABE) [16] in which central authority is not required for managing the entire system. Since there is no communication between the authorities, each authority work independently and follows his own procedure. In this approach two main authorities were introduced, Central Authority (CA) and Multiple Attribute Authorities (MAA). In these authorities, Central Authority is considered as main authority under which other allocated authorities are created according to assigning random attributes. Central authority is only responsible for MAA allocation or initial setup. These authorities are created according to requirement of the user communication setup. In MABE either its own policies will be applied or Cipher Policies will be applied. In both of these cases, attributes will be allocated randomly. The user can decrypt the cipher text if and only if he has all the required attributes which satisfies access policy. Secret keys are used for decryption, these keys corresponds to the attribute of a user. The key generation depends upon all the multiple authority. So when the user require secret key the system combine all the secret keys and generates the decryption key. For example: authority 1 and authority 2 both have some attributes of same cipher text. Let Alice have all the attributes of authority 1 and Bob has all the attributes of authority 2, it is not possible to decrypt the data even if we combine their keys. The cipher text can be decrypted only if the user holds all the attributes. The drawback of this system is dependency on multiple authorities and initializing authority.

DCP-ABE

Jinguang han, willy susilo had introduced a scheme called Decentralized Cipher Policy ABE (DCP-ABE) [17] which removes all kind of dependency. That is, here multiple independent authorities are organized in a decentralized environment which doesn't require a system for its initialization. It obtains secret keys for user from multiple authorities without knowing them the users global ID and attributes. Since the user sensitive attribute gives user identity, it protects the privacy of user sensitive attribute. Multiple authorities together generate a secret key by using user information. But the only disadvantage of this system is, if any authority gets failed then it will be difficult to get the secret key [18] [19].

DCP-ABE-M

In [20] this scheme multiple mediators are added in the existing DCP scheme, which stores half part of the secrete key in order to increase the security level. Here, both the authorities, mediators are independent and allocated based upon specific attributes.

Authority generates an encryption key according to user attributes. Mediators are important here to manage key sharing and attribute distribution. Mediators are created according to hierarchy and level of

the authority. Example can be student-faculty-admin. According to that mediators will have access rights and privileges. Each Mediator will be interlinked with specific authority only to validate itself. In this scheme failure of any authority doesn't affect the entire system because each user is handled by some specific authority and mediator not by all the authorities. The advantage of this scheme is it doesn't store any user data and entire key in any part of the system. The secret key will be divided into two and stored in authority and mediator. It provides more internal security but it doesn't provide high security at login page.

OTP

OTP (One Time Password) is defined as one true pairing. That is OTP is a password which is used for authentication and can be used only once before the limited amount of time or before getting expired [21]. Stefan D and Tomaz K have proposed a scheme called one time computable self erasing function [12] which had given one time computable pseudorandom function (PRF). In this scheme, it uses an adversary who is responsible for storing the key K which is generated by a PRF $FK(.)$. This adversary based research is further extended to [22][23][24][25][26]. Some of the existing schemes get effected by the various virus attacks in order to solve this problem few schemes are introduced [12][11]. All these existing methods are combined to provide a single efficient scheme [12] which computes one time computable code.

RESULTS

PROPOSED SYSTEM

Now days, a strong authentication techniques are required for preventing various authentication attacks. In order to reduce the complication networking different authentication techniques are used.

Authentication is defined as a first step of access control in which the authentication server compares the given user credentials with the authenticated user data files which are stored in the database of a local operating system. Authentication and identification are the one of the initial step of access control.

MULTI - FACTOR AUTHENTICATION

Authentication can be done by using three common factors 1) something you know, 2) something you have, 3) something you are. When a system makes the use of more than two authentication factors then it is called as multi-factor authentication. The following figure shows the concept of multi-factor authentication.



Fig.1: Multi-factor authentication

Something you know: User login ID and password is used as a factor in one factor authentication.

Something you have: This factor refers to the items such as hand held tokens, smart cards etc. A token or OTP is generated by using a hand held device (mobile, laptop etc) which displays a secret number on its LED display and the number is synchronized with authentication server.



Fig. 2: One Time Password

In above figure there is an authentication server and a user who holds a temporary OTP or token. Here the token held by user changes in each and every 60 sec under the surveillance of server. The user is able to login if and only if user's current OTP matches with the authentication server OTP.

Something you are: Attributes, biometric methods can be used as the authentication factors

MULTIFACTOR AUTHENTICATION IN DCP-ABE-M-OTP

Existing DCP-ABE schemes are focusing more on the internal process security but proposed system is focusing both on internal and external security in order to increase the reliability of the system. The already existing schemes are based upon 2 factor authentication while the proposed system is utilizing the concept of multi-factor authentication which increases the security level at login page.

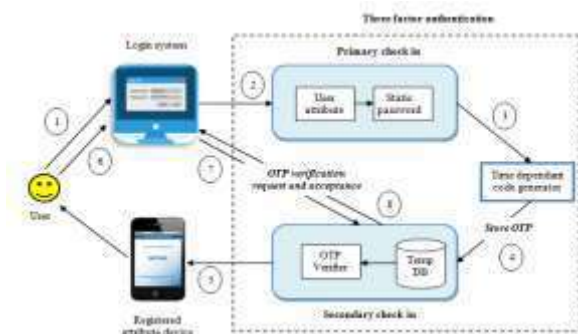


Fig. 3: Three factor authentication processing

Here, the user must go through the primary and secondary check in process for getting logged in into the system. Primary check in contains two factor authentications. Where, first factor is user attributes or biometrical methods and second factor is user name and password.

Primary check in:

During the user login period the proposed system checks two factors. First one is user attributes; the system checks whether the entered user attributes are same as the authorized user attributes which are stored in the server database. The second factor is user name and password, the system checks the user name and password and allow the user only if they are valid.

Here U_A indicates current user attributes and S_{UA} gives stored user attributes. F_{AP} , F_{AF} indicates First Factor Authentication passed and failed.

$$U_A = \{ U_1, U_2, U_3 \}$$

$$S_{UA} = \{ U_1, U_2, U_3, U_4, U_5 \}$$

$$\text{If } \forall U_A \in S_{UA} \rightarrow F_{AP}$$

$$\forall U_A \notin S_{UA} \rightarrow F_{AF}$$

$$\forall U_A \Delta S_{UA} \rightarrow \text{Fake user}$$

In second factor authentication: U_N , U_P indicates User Name and User Password. A_{UN} , A_{UP} specifies Authenticated User Name and Authenticated User Password. S_{AP} and S_{AF} gives Second Factor Authentication passed and failed.

$$U_N, U_P = A_{UN}, A_{UP} \rightarrow S_{AP}$$

$$U_N, U_P \neq A_{UN}, A_{UP} \rightarrow S_{AF}$$



Secondary check in:

It takes place only if the user passes primary check in. After two factor authentication, system will automatically generate a unique OTP (One Time Password) for the particular user which will be valid only for sixty minutes. This level will be completed only if the user entered OTP is same as system generated OTP. Here O_C indicates user entered OTP code and A_C specifies Authorized OTP code. T_{AP} and T_{AF} gives Third Factor Authentication passed and failed.

$$O_C = A_C \rightarrow T_{AP}, O_{CT} < 60 \text{ sec}, A_{CT} < 60 \text{ sec}$$

$$O_C \neq A_C \rightarrow T_{AF}, O_{CT} < 60 \text{ sec}, A_{CT} > 60 \text{ sec}$$

Where, OCT and ACT specifies the generated time of user OTP and Authenticated OTP.

The authentication process steps are given below:

- 1) User enters into the system then system performs primary check in.
- 2) Primary check in: user attributes, user name, password is verified.
- 3) After passing primary check in, system generates a unique password for the particular user.
- 4) System stores the OTP in temporary DB and sends an OTP copy to user hand held device.
- 5) Second check in: OTP is verified.
- 6) If OTP matches then login is allowed.

DISCUSSION

ARCHITECTURE

The important segments of the proposed system are 1) Decentralized environment: all members are independent in this system, 2) Multiple authorities: all authorities are independent and are based upon some specific feature, it reduces system load, 3) Multiple mediator: each mediator is based upon some specific feature, 4) Multi-Factor Authentication: It adds 3 layer of security to login page.

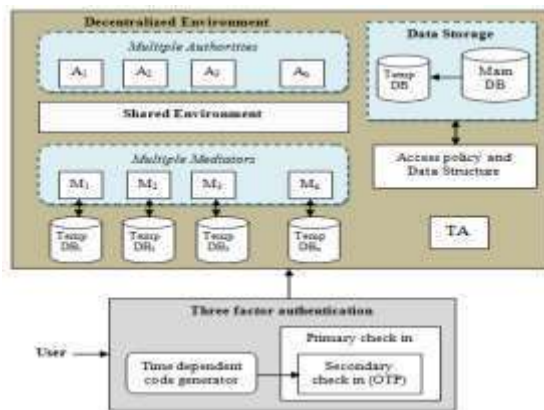


Fig. 4: DCP-ABE system with three factor authentication and multiple mediators

First the proposed system performs multi-factor authentication in order to check the user status. After completing the authentication successfully user will be able to enter into the system. After login, system will provide a unique temporary database for each user, which will be deleted after user logout. System stores all the user information such as time, uploaded file name, file size, file length, user attributes etc which will be used for secret key generation. This information will be stored in 2 different jar file in different location of the DB by giving different directories for each jar file. Here multiple authorities and mediators play an important role, which are based upon specific attribute. The system will allocate specific authority and mediator set to the user based upon user attribute type. For example: if the user is a b tech mechanical student then the system will allocate a student mediator and mechanical authority for that specific user. The specialty of this system is, it is not vulnerable to any attacks or hacking or leakage because it doesn't store any of user information in authority and mediator.

ENCRYPTION

In this proposed scheme, individual session is assigned for each user and all the user information will be stored in a decrypted path of a specific temp data base. When an authorized user tries to upload a data, our system will automatically generates a secret key by using user attribute set U_A , data attributes set DA , one time password OC and time at which the OTP is generated OT .

The secret key generating factors are given below.

$$U_A : \{ A_1, A_2, A_3, \dots, A_n \}$$

$$DA : \{ D_1, D_2, D_3, \dots, D_n \}$$

$$OC : \{ OTP, OC < 60 \text{ sec or } OC > 60 \text{ sec} \}$$

$$OT : \{ OT_1 \text{ or } OT_n \}$$

Here if OTP is generated in first 60 second then it will satisfies ($OC < 60 \text{ sec}$) condition or else ($OC > 60 \text{ sec}$) and the OTP generation time will be assigned according to the OTP taken. These four factors are combined for generating the encryption key. A main attribute set M_A is generated by combining the above given factors and by using the elements of M_A secret key or encryption key E_K is formed. By using encryption key the uploaded data is encrypted.

$$M_A : \{ U_A \cup DA \cup OC \cup OT \}$$

$$M_A : \{ A_1, A_2, A_3, \dots, A_n \cup D_1, D_2, D_3, \dots, D_n \cup OC \cup OT \}$$

$$E_K = (U_A + DA + OC + OT)_K$$

$$E_K = (U_{AK} + D_{AK} + O_{CK} + O_{TK})$$

Then after generating the secret key, it is divided into two sub keys where one part of the key will be stored in the authority and remaining half key will be stored in the mediator. Here A_K indicates authority key and M_K specifies mediator key.

$$E_K \rightarrow A_K + M_K$$

DECRYPTION

The decryption is only possible when the user get's the secret key which is combined correctly. Here DK specifies the decryption key which will be provided to the user only if he satisfies the access policy of the system. If DK is equal to E_K then only the user will be able to decrypt the data successfully.

$$DK = AK + MK$$

$$AK + MK = (UA+DA+ OC + OT) K$$

$$AK + MK = (UAK+DAK + OCK + OTK)$$

Here (UAK+DAK + OCK + OTK) is a combination of user attribute, data attribute, OTP and OTP generated time. If $AK + MK$ is equal to (UAK+DAK + OCK + OTK) which is equal to encryption key, then only the system will provide secret key to the user.

$$(UAK+DAK + OCK + OTK) = EK$$

$$AK + MK = EK$$

$$DK = EK$$

CONCLUSION

The existing schemes had focused more on internal security than the external security. Since the login of the existing system is based upon the users sensitive attribute which gives users identity, these systems are unable to provide full security and are disable to protect the privacy of the user sensitive attributes. The proposed scheme is focusing on both the internal and external security, for improving external security the concept of multi-factor authentication and for increasing the internal security mediator is added in the existing DCP-ABE scheme. The login process of existing system was based upon only a single factor that is user attribute but in the proposed system three security layers are added in the login page which increases the level of security of the proposed scheme as compared to existing schemes. Since in the existing approach the secret key is made up of user attributes which gives the user identity, any user can get the secret key if he knows the attributes of that specific user. In the proposed system, 4 factors are combined to generate the secret key so that no one can get the secret key by only holding specific user attributes. Hence the proposed system provides more internal and external security than the existing schemes.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None.

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ARTICLE

SIGNIFICANCE OF DATA MINING TECHNIQUES IN DISEASE DIAGNOSIS AND BIOMEDICAL RESEARCH – A SURVEY

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ABSTRACT

In the Biomedical sector, the current applications of data mining are the most successful and they have become the subfield of medical research. The basis for this growth is that nowadays most of the health related data are stored in small datasets scattered through various Hospitals, Clinics and Research centers. The healthcare sector is presently facing both the economic predictability and the methodological prospect of a data based approach for quality administration. Hence, abundant data mining techniques have been proposed to process medical data stream. Applying data mining techniques to the centralized database will offer to doctors investigative and foretelling tools from the surface of the data. Modern clinical practices also undertake transformation not only in diagnosis and treatment methods, but also in understanding of health and illness concepts. Data Mining can generate information that can be useful to all stakeholders in health care, including patients by identifying effective treatments and best practices. Though data mining methods and tools have been applied in diverse areas for more than 40 years already, their applications in healthcare are comparatively young. Therefore, this paper presents a survey on the significance of Data Mining techniques in Disease Diagnosis and Biomedical Research.

INTRODUCTION

KEY WORDS

data mining techniques;
diagnosis; health care
sector; medical
diagnosis; classification;
decision tree.

Infection Practically in every country, the cost of healthcare is increasing more rapidly than the readiness and the capability to pay for it. At the same time, more and more data is being obtained around healthcare processes in the form of Electronic Health Records (EHR), health insurance claims, medical imaging databases, disease registries, spontaneous reporting sites, and clinical trials. As a result, data mining has become important to the healthcare world. On the one hand, EHR offers the data that gets data miners excited. However, on the other hand, it is accompanied by challenges such as 1) the unavailability of large sources of data to academic researchers, and 2) limited access to data-mining experts [6]. But, still the quality of health care service at a cheap cost continues to be a difficult issue in developing countries. Although several countries have taken firm steps in providing aid services, the reach of those services to the poor, still remains as a difficulty. In different dimensions, un-imaginable services like separation of dual births, discovery of latest medicines for deadly diseases are happening. However, a few cases of death occur due to poor clinical diagnosing system and inadequate treatment. Most of the time, the clinical selections are created by the doctor's experience and skill. Hospitals do have info systems, call Support Systems, Image and Scan process systems. However, all hospitals do not have these facilities or their applications are restricted.

Call support systems with diagnosing support for naive doctors and for knowledgeable doctors would be a tenet for higher clinical cognitive process. The primary initiative is that the prospective costs and effects of diagnosis can be measured and used to enhance the task. Furthermore, the transitional enquiry steps such as asking for more systematic studies, or more examination done by human professionals, can also be computed in terms of cost and effect. Based on these cost and effect, the system can learn to recommend the optimal action. Providing precious services at cheap prices may be a major constraint encountered by the aid organizations (hospitals, medical centers). Valuable quality service denotes the correct diagnosing of patients and providing economical treatment. Acceptable computer-based info and/or call support systems will aid in achieving clinical tests at a reduced value. Due to the accessibility of integrated info through huge patient repositories, there is a swing within the insight of clinicians, patients and payers from qualitative health care sectors.

IMPORTANCE OF DISEASE DISCOVERY & ROLE OF DATA MINING IN CLINICAL DIAGNOSIS

President Obama has recently expressed a strong conviction that "Science offers great potential for improving health". The President has announced a research initiative that aims to accelerate progress toward a new era of precision medicine. The time is accurate for this idealistic initiative, and the National Institutes of Health (NIH) and other partners will work to attain this vision [7]. The concept of precision medicine speaks of prevention and treatment strategies that take individual variability into account. Even though it is not new, the impact of practicality is still deprived. If one considers blood typing, for instance, has been used to guide blood transfusions for more than a century. But the vision of applying this concept broadly has been intensely improved by the latest development of large-scale biologic databases (such as the human genome sequence), powerful methods for typifying patients (such as proteomics, metabolomics, genomics, diverse cellular assays, and even mobile health technology), and computational tools for analyzing large sets of data. Francis S.Collins et al. stated that, "What is necessary now is a broad

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Published: 2 Nov 2016

research program to encourage resourceful methodologies to precision medicine, test them rigorously, and eventually use them to build the evidence base needed to guide clinical practice" [7].

In precision medicine, the proposed initiative has two main components: a near-term emphasis on cancers and a longer-term goal to generate knowledge pertinent to the whole array of health and diseases. Due to advances in elementary research, both components are now within the scope, including molecular biology, genomics, and bioinformatics. Moreover, the initiative taps into congregating trends of improved connectivity, through social media and mobile devices, and Americans' budding desire to be dynamic partners in medical research [7]. The components are:

- (i) The cancer-focused component of this initiative will be intended to address some of the hindrances that have already been encountered in "precision oncology" [17]. Precision medicine's more customized, molecular approach to cancer will enrich and modify, but not replace, the successful staples of oncology - prevention, diagnostics, some screening methods and effective treatments while providing a robust framework for accelerating the adoption of precision medicine in other spheres. The most obvious of those domains are inherited genetic disorders and communicable diseases, but there is assurance for many other diseases and conservational reactions.
- (ii) The initiative's second component involves pursuing research progresses that will enable better assessment of disease risk, understanding of disease mechanisms, and prediction of optimal therapy for many more diseases, with the goal of expanding the benefits of precision medicine into countless aspects of health and health care [17].

Data mining may be a crucial step in discovery from giant data sets. A wide type of areas such as client relationship management, engineering, medicine, crime analysis, knowledgeable prediction, web mining, mobile computing rely on the utilization of data processing. In recent years, data processing has found its important hold in each field including health care. Mining method is over the info analysis which has classification, clustering, association rule mining and prediction. Varied fields related to medical services like prediction of effectiveness of surgical procedures, medical tests, medication, and also the discovery of relationships among clinical and diagnosing information are yet to use data processing methodologies [7].

NEED OF DATA MINING TO DIAGNOSE VARIOUS DISEASES IN MEDICAL HEALTHCARE SYSTEM

It is attainable to predict the effectiveness of medical treatments by strengthening the information mining applications. The real-life data processing applications are desirable since they supply information miners with varied set of issues, time and tests.

Lately, the practicality of data mining techniques has been realized in Healthcare domain. This realization is in the wake of explosion of complex medical data. As on today, lot of research is found in the field of biomedicine. This has led to the development of intelligent systems and decision support systems in Healthcare domain for accurate diagnosis of diseases, predicting the severity of various diseases, and remote health monitoring. The data mining techniques especially are more useful in predicting heart diseases, lung cancer, and breast cancer and so on [15].

Healthcare entities are reluctant to release their internal data to academic researchers and in most cases there is a limited interaction between industry practitioners and academic researchers working on related problems. According to the report [6] from the National Center for Health Statistics of USA, adoption of EHR in the USA as the most prominent medical information system is shown in Figure 1. It elucidates a linearly raising amount of non-sparse, but continual data reflecting patients' clinical continuity together with the treatment which took place and medication being used.

Due to the fact that the healthcare sector is very diverse and its entities as well as actors have different objectives and fields of activities, they employ different methods and tools in their operations [31, 19, 27].

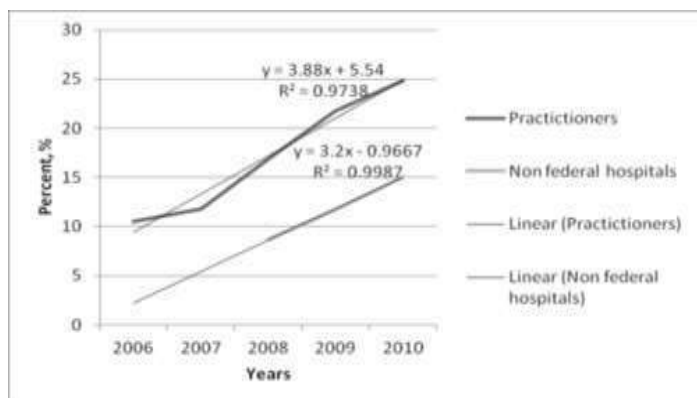


Fig. 1: EHR Adoption in USA

Any proposed automated medical diagnosis system, which is constructed using data mining methodology, will help the doctors to diagnose the correct disease in less time [33]. Table:1 highlights a few of such system's leading objectives along with their associated authors working in the field of predicting medical disease(s) using data mining technique. Common data mining techniques which are used in almost all the sectors are listed as: Naive Bayes, Decision Tree, Artificial neural network (ANN), K- nearest neighborhood (KNN), Support vector machine (SVM) etc. In order to improve the success of healthcare organization and health of the patients, the knowledge gained by data mining can be exercised for booming research problems in the associated arena [33].

Table 1: Details of Related Work Done for Various Diseases

Disease	Objective	Tools & Algorithms used	References
Breast cancer	An Efficient Prediction of Breast Cancer Data using Data Mining Techniques.	Tool: Weka Algorithm:SVM classifier.	[10]
Heart Disease	Diagnosis of Heart Disease using Data mining Algorithm	Tools: Weka & MATLAB Algorithms: Decision Stump, Random Fores and LMT Tree	[35]
	Predictive data mining for medical diagnosis: An overview of Heart disease prediction.	Tool: TANAGRA Algorithms: Naive Bayes, Decision Tree and ANN.	[36]
	Proposed a system for Heart disease prediction using data mining techniques.	Traditional Classification algorithms like j48, Naive Bayes, Neural Networks and GNP	[37]
	Applying K-nearest neighbor in diagnosing Heart disease patients	Decision tree, Classification via clustering and Naive Bayes	[39]
	To design a predictive model for heart disease detection to enhance their liability of Heart disease diagnosis.	Tool: Weka Algorithms: Decision Tree, Neural Network and Bayesian Classifier	[40]
Kidney Stone	Statistical and data mining aspects on kidney stones: A systematic review and meta analysis.	Classification techniques: Decision tree, ANN and Naive Bayes	[38]
Lung Cancer & Skin Cancer	Early prevention and detection of skin cancer and lung cancer risk using data mining.	Apriori Tid, Decision Tree, K-means and Medoid based clustering	[41],[42]
Liver Disorder	Performance evaluation of different data mining classification algorithm and predictive analysis.	Classification of medical data using Bayesian Ying Yang (BYY) Algorithm	[43]
Lung Cancer	Diagnosis of lung cancer prediction system using data mining classification techniques	Rule based Classification algorithm like IF-THEN Rule, Decision tree, Bayesian classifiers and Neural networks.	[44]
Kidney dialysis	Performance comparison of three data mining techniques for predicting kidney dialysis survivability	Tool: TANAGRA Algorithms: ANN, Decision Tree(C5), Logical Regression	[45]
Acute Abdominal Pain	An improved Medical Diagnosing of Acute Abdominal Pain with Decision Tree	Tools: C++ & MATLAB Algorithms: CART & OC1	[46]
Existence of Helicobacter pylori Microbe	Helicobacter pylori microbe and detecting with data mining Algorithms	Tool: Cross Validation model Algorithms: RBF Network, Naïve Bayes, PART, Decision Tree, Logistic Regression.	[47]
Liver Based Diseases	Classification of Liver Based Diseases using Random Tree	Tool: Weka Algorithm: Random Decision Tree	[34]
Gastric Cancer	Clinical Data Analysis Reveals Three Sub types of Gastric Cancer	Tool: MATLAB Algorithm: Hierarchical Clustering.	[32]
	A new algorithm to extract hidden rules of Gastric cancer data based on Ontology	Tool: MATLAB Algorithm: Mixture of Apriori Algorithm and Ontology	[48]

APPLICATION OF DATA MINING TECHNIQUES IN BIOMEDICINE

Well-known data mining techniques include the Artificial Neural Network (ANN), decision tree, Bayesian classifiers, Support Vector Machine (SVM) and many others [16]. The Text Mining Algorithms are designed assuming that a document is a collection of words with rules (model called, bag of words) and applied to perform Text Summarization, Document Retrieval, Text categorization, Document Clustering, Identifying key phrases and Entity and information extraction [26]. S. L. Ting et al. [25] introduced some basic data mining techniques, namely unsupervised learning and supervising learning, and reviewed the application of data mining in biomedicine. The researchers tried to combine both unsupervised and supervised methods for the analysis as advanced Data Mining Techniques, for instance, Hierarchical clustering, C-means clustering, self-organizing maps (SOM), Support Vector Machines (SVM) and multidimensional scaling techniques. Springer 2005 discusses the new concepts, technologies and practices of biomedical knowledge management, data mining and text mining that are beginning to bring useful “knowledge” to Biomedical professionals and Researchers [20].

DATA MINING IN BIO MEDICAL RESEARCHES

The researchers in the medical field determine and predict the diseases besides proffering effective take care of patients with the help of information mining techniques. Several different studies have investigated completely different technologies for the assessment of medical diagnosis systems.

Due to many factors, the diagnosis for sickness or symptoms identified may face a multi-layered drawback and results in false assumptions and erratic report. So it seems affordable to undertake utilizing the information and skill of many specialists collected in databases towards aiding the diagnosing method. The information mining techniques are used by a good type of works within the literature to diagnose numerous diseases including: polygenic disorder, Hepatitis, Cancer, Heart diseases and so on. Information related to the sickness, prevailing within the style of electronic clinical records, treatment info, sequence expressions, pictures and more were utilized altogether for diagnosis. In the recent past, the info mining techniques were used by many authors to gift diagnosing approaches to various kinds of heart diseases.

Historically, the well-mined info is painted as a model of the linguistics structure of the dataset. It would be attainable to use the model within the prediction and classification of the latest information. R. D. Wilson et al. [3] started to classify and collect medical publications where knowledge discovery and DM techniques were applied or researched from 1966 till 2002. According to their study, “...some authors refer to DM as the process of acquiring information, whereas others refer to DM as utilization of statistical techniques within the knowledge discovery process”.

APPLICATIONS OF DATA MINING ALGORITHMS - A LITERATURE REVIEW

The availability of enormous amounts of medical data leads to the need for dominant data analysis tools to extract useful knowledge. There is a lot of data available within the healthcare systems. However, there is a task of finding effective analysis tools to discover hidden relationships and trends in data. Knowledge discovery and data mining have found numerous applications in business and scientific domains. Researchers have long been concerned with applying statistical and data mining tools to improve data analysis of large data sets. Disease diagnosis is one of the applications where data mining tools are producing successful results [2].

A Computer-Aided Detection of prostatic adenocarcinoma in MRI [9]

Prostate cancer is one in every of the most important causes of cancer death for men within the western world. Magnetic Resonance Imaging (MRI) is being more and more used as a modality to find prostatic adenocarcinoma. Therefore, computer-aided detection of prostatic adenocarcinoma in MRI pictures has become a vigorous space of analysis. In this paper the authors tend to investigate a totally automatic computer-aided detection system that consists of 2 stages. In the 1st stage, they found initial candidates victimization multi-atlas-based prostate segmentation, voxel feature extraction, classification and native maxima detection. In the second stage segments, the candidate regions and victimization classification were acquired with cancer likelihoods for every candidate [9]. Options represent pharmacokinetic behavior, symmetry and look among others. The system was evaluated on an outsized consecutive cohort of 347 patients with MR-guided diagnostic test. This set contained 165 cancer patients. Performance analysis relies on lesion-based free-response receiver operative graphical record and patient-based receiver operative characteristic analysis.

Mining Time dynamical information Streams [8]

Most applied mathematics and machine-learning algorithms assume that the information may be a random sample drawn from a stationary distribution. Sadly, most of the massive databases offered for mining nowadays violate this assumption. They were gathered over months or years, and also the underlying processes generating them modified throughout this point, generally radically. Though numerous amount of algorithms are projected for learning time-changing ideas, they typically do not scale well to terribly giant

databases. In this paper, the authors tend to associate economical algorithmic program for mining call trees from continuously-changing information streams, which supports the ultra-fast VFDT call tree learner. This algorithmic program known as CVFDT, stays current by creating the foremost of recent information using another sub tree. CVFDT learns a model that is comparable in accuracy to the one that may be learned by reapplying VFDT to a moving window of examples. Each time a brand new example arrives with $O(1)$ complexity per example and hostile $O(w)$, where w is the size of the window. Experiments on a collection of huge time-changing information streams demonstrate the utility of this approach.

Mining time-changing information streams is of great interest. The elemental issues are the way to effectively determine the numerous changes and organize new coaching information to regulate the out-of-date model. Geoff Hulten et al. proposed a vigorous learning system to handle these problems. Whenever the suspected changes are indicated, it exploits a light-weight uncertainty sampling algorithmic program to settle on the foremost informative instances to label. With these tagged instances, it more tests the reality of the suspected changes. If the changes so cause important performance deterioration of the present model, it evolves the recent model. Thus, this technique is sensitive to important changes and strong to clanging changes, and might quickly adapt to concept-drift. Experimental results from each artificial and real-world information ensure the benefits of the system.

Application of Data Mining Algorithms in Heart Disease Prediction

Indians are undoubtedly victims to peculiar kinds of cardiovascular diseases that result in worse outcomes like anaemia cardiovascular disease - a condition characterized by reduced blood provided to the guts. Machine Intelligence is employed for Medical data processing wherever giant assortment of Medical information is well-mined for attention-grabbing pattern. 2% of total world deaths are because of Cardio tube sickness (CVD), which is anticipated to be the leading cause for deaths in developing countries because of modification in life style, work culture and food habits. Hence, additional careful and economical strategies of diseases diagnosis and periodic examinations are of high importance.

Numerous studies have been done that have focus on diagnosis of heart diseases. They have applied different data mining techniques for diagnosis and achieved different probabilities for different methods [14]. The problem of identifying constrained association rules for heart disease prediction was studied by Carlos Ordonez [4]. The resultant dataset contains records of patients having heart diseases. Three constraints were introduced to decrease the number of patterns [22], the result of which diagnoses the presence or absence of heart disease.

1. The attributes have to appear on only one side of the rule.
2. Separate the attributes into groups, i.e. uninteresting groups.
3. In a rule, there should be a limited number of attributes.

Sellappan Palaniappan et al. [21] proposed "An Intelligent Heart Disease Prediction System (IHDPS)" using data mining techniques, Naive Bayes, Neural Network, and Decision Trees. Each method has its own strength to get appropriate results. To build this system, hidden patterns and relationship between them is used. It is web-based, user friendly and expandable.

An overview on "Data Mining Techniques to Find out Heart Diseases" suggested that the medical diagnosis for Heart Diseases is an extremely important but complicated task that should be performed accurately and efficiently. It proposed to find out the heart diseases through data mining, Support Vector Machine (SVM), Genetic Algorithm, rough set theory, association rules and Neural Networks. It concluded that, out of the above techniques, Decision tree and SVM are the most effective ones for the heart disease. So it is observed that the data mining could help in the identification or the prediction of high or low risk heart diseases [2].

The prediction of Heart disease, Blood Pressure and Sugar with the aid of neural networks was proposed by Niti Guru et al. [18]. The dataset contains records with 13 attributes in each record. The supervised network, i.e. Neural Network with back propagation algorithm is used for training and testing of data.

A "Study of Heart Disease Prediction using Data Mining" [13] points out that the doctors and experts available are not in proportion with the population. Also, symptoms are often neglected. Heart disease diagnosis is a complex task which requires much experience and knowledge. Heart disease is the single largest cause of death in developed countries and one of the main contributors to disease burden in developing countries. In the health care industry, the data mining is mainly used for predicting the diseases from the datasets. So far, the Data Mining techniques, namely Decision Trees, Naive Bayes, Neural Networks, Associative classification, Genetic Algorithm have been applied on Heart disease databases.

The healthcare industry collects huge amounts of health connected data which, unfortunately, are not "mined" to discover hidden information for effective decision making. Discovery of hidden patterns and relationships often goes unexploited. Advance data mining techniques can help remedy this situation [24]. This research has developed a prototype Intelligent Heart Disease Prediction System (IHDPS) using data mining techniques, namely Decision Trees, Naive Bayes and Neural Network. Results show that each technique has its unique strength in realizing the objectives of the defined mining goals. IHDPS can answer complex "what if"; queries which traditional decision support systems cannot. Using medical profiles such as age, sex, blood pressure and blood sugar, it can predict the likelihood of patients getting heart diseases. It

enables significant knowledge, e.g. patterns, relationships between medical factors related to heart disease, to be established. IHDPS is Web-based, user-friendly, scalable, reliable and expandable. It is implemented on the .NET platform [24].

Application of Data Mining Algorithms in Breast Cancer prediction

Breast cancer is one of the leading cancers affecting women when compared to all other cancers [29]. It is the second most common cause of cancer death in women. Breast cancer risk in India revealed that 1 in 28 women develop breast cancer during her lifetime. This is higher in urban areas, being 1 in 22 in a lifetime compared to rural areas where this risk is relatively much lower being 1 in 60 women developing breast cancer in their lifetime. In India the average age of the high risk group is 43-46 years unlike in the west where women aged 53-57 years are more prone to breast cancer [29].

Breast cancer has become the most hazardous type of cancer among women in the world. Early detection of breast cancer is essential in reducing life losses [10]. The accuracy of classification techniques is evaluated based on the selected classifier algorithm. An important challenge in data mining and machine learning areas is to build precise and computationally efficient classifiers for medical applications. The performance of SVM shows a higher level compared with other classifiers. Hence SVM shows the concrete results of Breast Cancer in the patient records. Therefore, SVM classifier is suggested for diagnosis of Breast Cancer disease based classification to get better results with accuracy, low error rate and performance [10].

Abdelghani Bellaachia et al.[1] presented an analysis of the prediction of survivability rate of breast cancer patients using data mining techniques. The data used is the SEER Public-Use Data. The pre-processed data set consists of 151,886 records, which have all the available 16 fields from the SEER database. The problem investigated three data mining techniques: the Naïve Bayes, the back-propagated neural network, and the C4.5 decision tree algorithms. Several experiments were conducted using these algorithms. The achieved prediction performances are comparable to existing techniques. However, the result of the research found out that C4.5 algorithm has a much better performance than the other two techniques [1]. This paper has outlined various issues and identified the algorithms and techniques for the problem of breast cancer survivability prediction in SEER database. The authors approach takes into consideration, besides the Survival Time Recode (STR), the Vital Status Recode (VSR) and Cause of Death (COD). The experimental results show that their approach clearly shows that the preliminary results are promising for the application of the data mining methods to the survivability prediction problem in medical databases. The analysis does not include records with missing data; future work will include the missing data in the EOD field from the old EOD fields prior to 1988. This might increase the performance as the size of the data set will increase considerably. Finally, the research tried the survival time prediction of certain cancer data such as respiratory cancer where the survivability is seriously low [1].

G. Ravi Kumar et al. [10] presented a comparison among the different Data mining classifiers on the database of Wisconsin Breast Cancer (WBC), by using classification accuracy. This paper aims to establish an accurate classification model for Breast cancer prediction, in order to make full use of the invaluable information in clinical data especially that is usually ignored by most of the existing methods when they aim for high prediction accuracies. Experiments were done on WBC data. The dataset was divided into training set with 499 and test set with 200 patients. In this experiment, they compared six classification techniques in Weka software and comparison results showed that Support Vector Machine (SVM) has a higher prediction accuracy than those methods. Different methods for breast cancer detection were explored and their accuracies are compared. With these results, it was concluded that the SVM are more suitable in handling the classification problem of breast cancer prediction, and recommended the use of these approaches in similar classification problems [10].

The aim of this paper is also to investigate the performance of different classification techniques. They have analyzed the breast Cancer data available from the Wisconsin dataset from UCI machine learning with the aim of developing accurate prediction models for breast cancer using data mining techniques. In this research, a total of 683 rows and 10 columns had been used to test, by using classification accuracy. The experiment result proves that, they compared three classification techniques in Weka software and comparison results shows that Sequential Minimal Optimization (SMO) has a higher prediction accuracy, i.e. 96.2% than IBK and BF Tree methods.

Application of Data Mining Algorithms in Gastric & lung Cancer prediction

The problem of "Discovering Association of Diseases in the Upper Gastrointestinal Tract using Text Mining Techniques" measures the negative health impacts on acidic environment of the stomach. Historically, it was widely believed that the highly acidic environment of the stomach would keep the stomach immune from infection. Having too little or no gastric acid is known as hypochlorhydria or achlorhydria respectively and are conditions which can have negative health impacts [26]. Gastric cancer is the fourth most common cancer and second leading cause of cancer-related death worldwide [32]. Gastric cancer, or stomach cancer, refers to tumors that develop in the lower part of the esophagus, in the stomach, or in the uppermost part of the small intestine. It is the 4th most common cancer and second leading cause of cancer-related death worldwide [28].

The clinical data of over 1,500 gastric cancer patients was analyzed. It is interesting to find that gender is a major factor for gastric cancer subtype characterization. Actually several types of cancer, including stomach, liver, and those of colon, are far more common in men than in women. Some scientists have hypothesized that variances in lifestyle such as diet and smoking, may account for the role of gender factor. On the other hand, growing evidence also submits that the variances are rooted in basic biological differences between men and women. For example, recent research indicates that “Estrogen” protects against gastric cancer [23].

Cancer research is commonly clinical and/or biological in nature, and data driven statistical research has become a command counterpart. Predicting the outcome of a disease is one of the most interesting and challenging tasks where to develop data mining applications. Cancer is the most vital reason for death of both men and women. The early detection of cancer can be supportive in curing the disease completely. So the requirement of techniques to detect the occurrence of cancer nodule in early stage is growing. Lung cancer is a disease that is commonly misdiagnosed. Early diagnosis of Lung Cancer saves many lives, failing which may lead to other severe problems causing sudden incurable end. Its cure proportion and prediction depends mainly on the early detection and diagnosis of the disease [30].

Decision Tree results are easier to read and interpret. The drill through feature to access detailed patients' profiles is only available in Decision Trees. The decision tree shown in [Fig. 2] was built from the very small training set [Table 2]. In this table each row corresponds to a patient record. The data set contains 3 predictor attributes, namely age, gender, intensity of symptoms and one goal attribute, namely disease whose values (to be predicted from symptoms) indicates whether the corresponding patient has a definite disease or not [30].

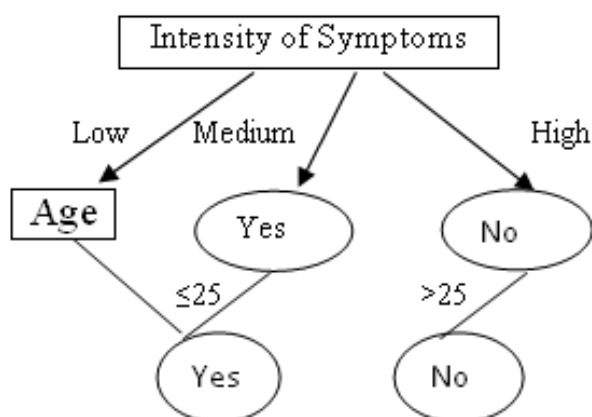


Fig 2: Decision tree

Table 2: Data set used to build decision tree of Fig: 2

Age	Gender	Symptoms	Disease
25	Male	Medium	Yes
32	Male	High	Yes
30	Female	Low	No
21	Male	Low	No
34	Male	Medium	No
18	Female	Low	No
55	Male	Medium	No

In DM, IF-THEN prediction rules are very popular, which signify the discovered knowledge at a high level of abstraction. In the health care system, it can be applied as: (Indications) (Earlier— history) → (Cause-of-disease).

Example: If_then_rule induced in the diagnosis of level of alcohol in blood.

IF Sex = MALE AND Unit = 8.9 AND Meal = FULL THEN Diagnosis = Blood_alcohol_content_HIGH.

CONCLUSION

Application of Data mining Algorithms in healthcare industry plays a major role in prediction and diagnosis of various diseases. This paper plotted the need and application of Data mining in several disease discoveries and outlined the associated research problems which were proposed in the Prediction and Detection of diseases using Data Mining Algorithms. Thus the survey presents the Significance of Data Mining Techniques that had been employed for Bio Medical Research. Therefore, it was initially agreed to define the scope of this paper as Data Mining applications in the healthcare providers' institutions. The paper screens the commonly accepted belief that data mining is widely used in medicine by comparing academic advances with practical achievements in the field. This will positively help when incorporated into a knowledgeable decision making system.

FUTURE DIRECTION

In future, many diseases can be diagnosed in terms of various parameters through the patient's symptoms gathered from the clinical data centers. An intelligent disease diagnosis system using the novel hybridized classification approach may be developed. In this hybridization approach, clustering may be done before classification and in the iteration of classification, data pruning may be done. By doing so, better classification accuracy can be obtained.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

INVESTIGATION OF THE NONLINEAR OPTICAL PROPERTIES OF THE SALEN-H₂ LIGAND USING Z-SCAN TECHNIQUE

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ABSTRACT

Background: nonlinear optical properties of organic materials are widely used in optical switching and optical labeling. **Methods:** In this study, nonlinear optical properties of Salen-H₂ (N, N'-ethylenebis (salicylideneimine)) ligand have been investigated. Linear optical responses of Salen-H₂ have been studied using Uv-Vis spectroscopy. Non-linear refractive index and non-linear absorption coefficient of this ligand have been calculated using z scan. The scan method has been studied with the open and closed aperture. **Results:** Non-linear refractive index and absorption coefficient are related to the real and imaginary components of third order susceptibility coefficient, respectively.

Conclusions: Using Z scan method, the value of the nonlinear refractive index is calculated of the order of $10^{-16} \frac{\text{cm}^2}{\text{W}}$ and is positive.

INTRODUCTION

KEY WORDS
Z-Scan; non-linear refractive index; non-linear absorption coefficient

In recent years, nonlinear optical properties of organic materials have been taken into consideration. These materials, with nonlinear optical properties are widely used in optical switching and optical labeling [1, 2]. The material used in the optical switching has high nonlinear refractive index and rapid response to radiant light intensities [3, 4].

Medium interaction with light is described in both linear and nonlinear optics and environmental loads caused by lighting are oscillated and this oscillation causes radiation of the electromagnetic waves. Phase-shift is between the resulting electric field and the radiant electric field [5]. Medium refractive index varies with charged particles environment. If the shifted refractive index is heavily dependent on the input spectrum, the refractive index is nonlinear and otherwise the medium has linear refractive index [5]. The nonlinear optical response of a material is often explained by polarization. Material polarization may be extended to the following formula:

(1)

$$p(t) = \chi^{(1)} E + \chi^{(2)} E^2 + \chi^{(3)} E^3$$

Where $\chi^{(n)}$ is Electric susceptibility of the material and E is the electric field. $\chi^{(2)}$ and $\chi^{(3)}$ are linear and nonlinear susceptibility, respectively, and for typical intensities of light passing, only the first extended statement is considered. For fields with high intensity, higher-order statements should be considered with extended series [6]. The principle of superposition is not true about the area of nonlinear optics and the frequency is not fixed in this medium. As well as the absorption coefficient and refractive index vary with changes in light intensity. $\chi^{(n)}$ is a complex quantity which its real and imaginary components express the nonlinear refractive index [7]. Non-linear refractive index dependence with heavy light intensity can be written as follows:

(2)

$$n = n_2 I + n_0$$

If n_2 is positive, the light beam while passing through the non-linear medium receives greater refractive index than around, therefore, it passes by lower speed than the previous medium and stay behind the edges. As a result, the initial wave front is changed too much. In this case, the medium acts like a convergent lens [8, 9].

However, if n_2 is negative, in this case the medium will be act like a divergent lens. In this case defocusing phenomenon occurs [10]. The easiest way to determine is the z- scan method which firstly evaluated by Sheikh Bahai. In this study, the method is used to determine the coefficients in C₁₆ H₁₆ N₂ O₂.

MATERIALS AND METHODS

Synthesis of Salen

4.0 mmol of 2-hydroxybenzaldehyde in ethanol (50 ml) was added dropwise to an ethanolic solution (10 ml) of 2.0 mmol ethylenediamine. This mixture was refluxed for 2 h. Afterwards the mixture was cooled to

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Published: 2 Nov 2016

room temperature, then cooled for 24 h at 5°C. The yellow solid was filtered off, and recrystallized from ethanol [11]. Yield: 92.5%. m.p.: 125°C .

Selected IR bands (KBr, cm^{-1}): 3450 (OH); 1635s (C=N); 1576m (C=C); 1371m (C-N); 1283m (C-O); UV-Vis (DMSO): λ_{max} =410 (nm).

Schiff base ligand is shown in [Fig. 1]

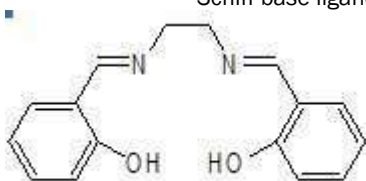


Fig. 1: Schiff base ligand structure (SalenH₂ or (N, N'-ethylenebis (salicylidene amine)

Optical absorption graph

Firstly, the absorption spectrum of the material was measured and according to [Fig. 2], we find that material is absorbed in the region of 200 to 450 nm.

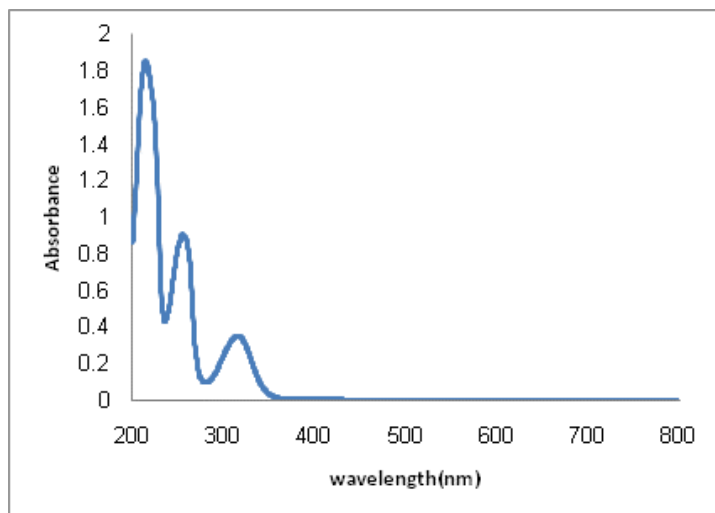


Fig. 2: Absorption graph versus wavelength

RESULTS AND DISCUSSION

Z-scan arrangement includes two open and closed apertures that determine β nonlinear absorption coefficient and n_2 non-linear refractive index respectively. In [Fig. 3], z-scan experiments layout has been shown [12, 13].

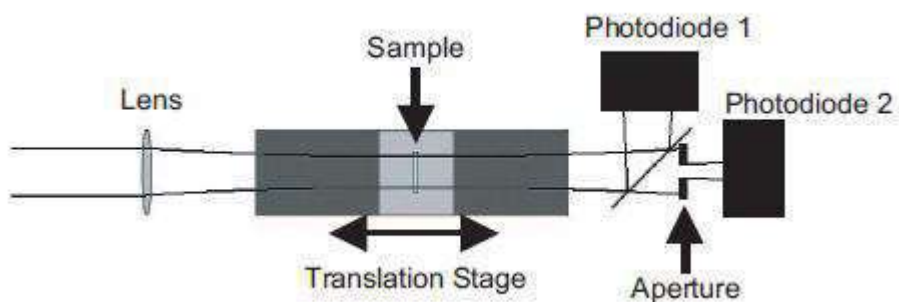


Fig. 3: Arrangement of Z-scan test

In this technique, the sample moves to the laser beam radiation towards to focusing beam point. This movement causes the light intensity to change the sample. During this motion, every evident step by the power meter is recorded.

For open aperture, the intensity increases until they reach the center of the sample absorption. The lowest transition occurs at the center because of the high absorption and then is decreased with the passage of nonlinear absorption center and finally transition is increased to reach to the linear transition. The resulting graph will be the valley. As the sample is passed from a focal area of the beam, (1) detector measures the total transmitted intensity. Since in scanning only the radiant density from the sample is changed, any deviation in the intensity of the total transmission is caused by multi-photon absorption.

β is calculated using open aperture arrangement with nonlinear absorption coefficient. If the nonlinear absorption coefficient β is positive, crossing is increased by increasing the input power implying that the two-photon absorption occurs in this case. If β is negative, increasing input power decreases crossing and saturated absorption takes place in this case. The value β is obtained by fitting the [Fig. 4] and by the following approximation [14].

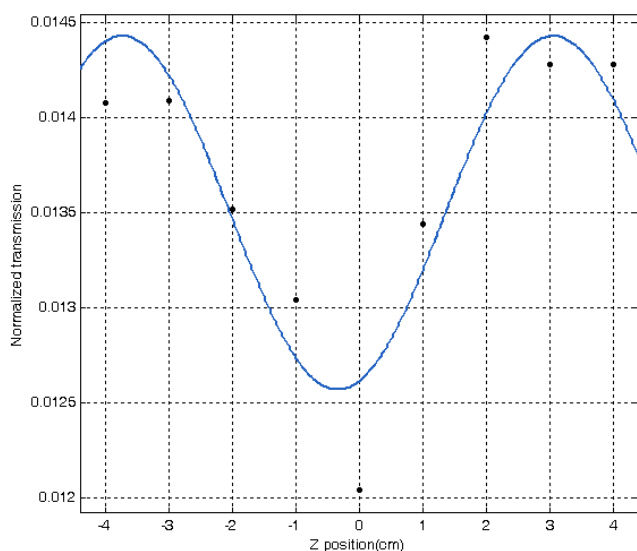


Fig. 4: Z-scan graph in the Open apertures

(3)

$$q_0 < 1$$

$$T(z, s=1) = \sum_{m=0}^{\infty} \frac{[-q_0(z)]^m}{(m+1)^2}$$

The $q_0(z)$ is obtained from the following equation

(4)

$$q_0(z) = \frac{I_0 L_{eff} \beta}{\left(1 + \left(\frac{z}{z_0}\right)^2\right)}$$

In the above equation z_0 is diffraction length and its value is [15]:

(5)

$$z_0 = \frac{K \omega_0^2}{2}$$

Z negative values indicate that the sample position between the lens and the focal point of the beam is narrow and positive values Z represent the position of the focal point between the beam and detector. Given the values of I_0 , L_{eff} , q_0 , and an estimated value for β , graph is plotted and empirical data curve on this graph has been plotted. By changing the value of β , good fit has been made between experimental and theoretical graph and finally the nonlinear absorption coefficient is calculated.

In the closed aperture, as the sample passes from a narrow focused area, photon detector measures the reduced intensity from the transmitted sample. The nonlinear refraction coefficient has been calculated by [Fig. 5] and the following relationship.

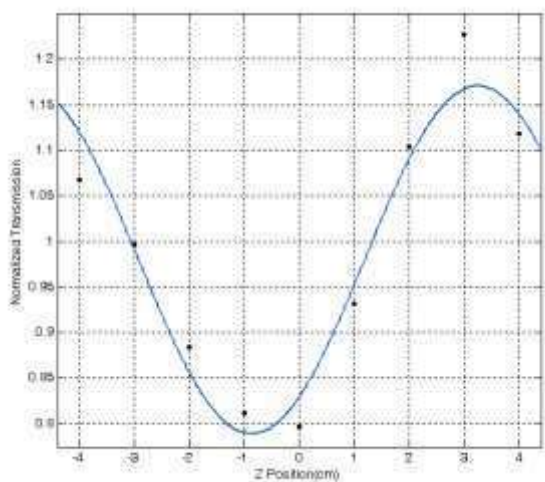


Fig. 5: Z-scan graph in the closed aperture

(6)

$$\Delta T_{p-v} = 0.406(1-S)^{0.25} \left(\frac{2\pi}{\lambda} \right) n_2 I_0 L_{eff}$$

ΔT_{p-v} is the distance between the valley and the passing graph from the aperture and I_0 is the intensity in the focused sample.

(7)

$$I_0 = \frac{2p}{\pi \omega^2}$$

Also S is the linear transition which is obtained by the following relationship.

(8)

$$S = 1 - \exp\left(\frac{-2r_a^2}{\omega_a^2}\right)$$

Where r_a is the aperture beam and the beam radius in w_a aperture, L_{eff} is the effective length which was calculated through the following relationship [16]

(9)

$$L_{eff} = \frac{(1 - e^{-\alpha L})}{\alpha}$$

Finally, α is the absorption coefficient in low laser powers and is calculated through the following relationship [16]

(10)

$$\alpha = -\frac{1}{L} \ln\left(\frac{P}{P_0}\right)$$

Where P is the output power with sample and P_0 is the output power without the sample. The initial power of laser in without the sample is 45 mW. In this experiment, the laser beam intensity is $8 \times 10^3 \frac{W}{m^2}$.

According to the figure 5, since a peak is observed in the curve after the valley, it can be inferred that the non-linear refractive index is positive and actually self-focusing phenomenon has been occurred here.

Here for the calculation of non-linear phase shift, the data obtained from the results of the closed aperture data is divided by open aperture data. The laser used in the experiment has nm532 wavelength and diffraction length Z_0 is 3.68 mm.

The results are shown in Table 1 for β and n_2 .

Table 1: The nonlinear absorption coefficient and refractive index

$n_2 \frac{m^2}{W}$	β_{non}	$\frac{dK_{non}}{dI_{non}}^{-1}$
0.81×10^{-5}	0.407×10^{-3}	0.325

If the non-linear refractive index material is on the order of $10^{-7} - 10^{-5} \frac{\text{cm}^2}{\text{W}}$ and the sample is placed under a continuous laser solution, it could be argued that the origin of non-linear effects for the refractive index is thermal.

CONCLUSION

In this paper, using the z sweeping test, both nonlinear refractive index and two-photon absorption coefficient values were calculated. Thus, this graph of material has a positive nonlinear refractive index and self-focusing phenomenon has occurred in this case. In fact, when its thickness is smaller than the diffraction length, nonlinear refractive index of the sample is focused and makes it as a thin lens with a variable focal length. And also due to the value measured for nonlinear refractive index, it could be argued that the origin of nonlinear effects of the refractive index is thermal.

CONFLICT OF INTEREST

There is no any form of conflict of interest

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

No financial sponsor in the form of person, institution or organization is involved in the present work.

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ARTICLE

REVIEW AND COMPARE ATTACHMENT AND PARENTING STYLES IN MOTHERS OF NORMAL AND BEHAVIORAL DISORDERS STUDENTS

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ABSTRACT

The aim of this study was to evaluate and compare the attachment and parenting styles in mothers of normal and behavioral disorders students. The research design was a descriptive with casual-comparative method. The research population included all fifth and sixth grade Male and female in primary school in Yazd in 2015 school years. The Sample was included 840 people, 350 student behavioral disorders and 490 normal students. Sample of normal school students was selected using a multistage random sampling method. Census method was used to select groups of students' behavioral disorders. Data collected from the Hazan and Shaver attachment styles questionnaire and Baumrind parenting styles questionnaires. The data were analyzed with Multivariate analysis of variance (MANOVA). The results of Multivariate analysis show that there are significant differences between attachment styles of behavioral disorders and normally parents. The results also showed that the authoritarian and authoritative parenting style was significant difference in behavioral disorders and normally. Families that has a strong emotional relationship with their children and apply proper operation, subsequent children are less prone to behavioral disorders.

INTRODUCTION

Behavioral disorders are a special form of aggressive behavior and it can be described as a status that the students reputedly and consequent exposure to the negative behavior of others [1]. These negative behaviors cure when there is no balance between the victim and aggressor. Consecutive behavioral disorders are defined as a recurrent behavior that is repeated, sometimes several times per month, or weekly.

According to the definition of behavioral disorders, the following items should be included:

- 1- The behavioral disorders that lead to injury, frightening and annoying the victim.
- 2- This behavioral disorder is not pre exited;
- 3- It occurs repeatedly
- 4- Commonly bullies in comparison with victims are more powerful. In other words behavioral disorders occur in an unequal situation in terms of power or social status.
- 5- It happens in a small social group that its members are familiar with each other. Behavioral disorders are clearly different from a battle between two persons that are equal to each other in terms of physical strength [2]. The behavioral disorders can be as a direct physical behavioral disorders, direct oral behavioral disorders and indirect behavioral disorders. Direct physical, behavioral disorders can be in the form of pushing, kicking, hitting or giving the objects of others by force. The direct oral, behavioral disorders contain the behaviors such as: calling with a bad name, threatening and mocking [3, 4, 5, 6, and 7].

The indirect behavioral disorders are considered as communication or psychological, behavioral disorders [8]. The different form of indirect behavioral disorders includes insulting, gossiping, excommunicating the others in terms of social and seeking dominance in friendly relationships [7, 8]. Behavioral disorders are a social serious prevalent problem especially in school age.

Due to media attention to the increased violence and behavioral disorders among children and adolescents in school, it has attracted the public attention in the current year to itself. Estimating the exact prevalence percent of behavioral disorders in schools is still difficult because of the diversity extension of this type of behavior [9]. The international research findings in all the countries show that 4 to 45 percent of children are victim or bully [10]. One out of ten students is bully [11].

One of the main preventive approaches focuses on identifying the hazardous factors in high risk populations. According to the family role and the effect of family as the first sociable institution, contains some risk factors related to the family, including lack or poor relation between children-parents, lack of suitable pattern among adults, rough family environment, behavioral disorders parenting method, Physical punishment upbringing, lack of parents support of children [12, 13].

As in this research there is no opportunity to take into consideration all predisposing factors, so, besides emphasizing on being this disorder behavior as a multifactor, this is analyzed from the aspect of attachment styles and parenting methods. It is obvious that study on growth and development of children without considering the attachment styles and parenting methods, it will be as an inadequate and incomplete matter.

KEY WORDS

Attachment, parenting, behavioral disorders, mothers, student.

Published: 8 Nov 2016

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The relation between mother and child is the most important principle in growth of personality that is emphasized by most of psychologists such as: Froid, Celarin, Salivan and Balbii. Different theories of psychology science, different terms are used for describing the relation between parents-children such as: thematic relation, dependency and attachment. Bulbi (1980) states that the relation patterns between children and mother constitute an attachment style of a person that includes: the sustainable patterns of communication perceptions, emotions and behaviors [14].

The attachment theory focuses on cognitive schemata. These schemata have an effect on the organizing the personal relation to the others and also his perceptions of surrounding world [15]. These schemata evolve during the lifetime. The schemata form in childhood according to experiences that baby has from first care and in childhood and adolescence become completed [16]. Following the assumptions of Bulbi, Enzorth et al. (1987) to determine the child's attachment style, an experimental visual situation entitled unfamiliar situation was planned; according that, the child experiences three stressful components:

1-unfamiliar environment 2- interacting with an unfamiliar person; 3- short term separation from parents or any protector. Accordingly, three styles of safe attachment, avoidance attachment style and anxious - ambivalent attachment style have defined [14].

The safe attachment style is defined as being comfortable at the time being close to the others and being sure from the others' reactions. The avoidance style implies to have been unsafe in interaction with the others and tends to be separate from the others. Anxious-ambivalent style is defined as being not safe against the others reactions and having high enthusiasm to sincerity. The researchers believe that constituted attachment in childhood, continues in the next life stages and effects on the person's lifestyle [16]. Most of these researches have conducted according to the elements of parenting defined by Baumrind (1967) [17]. As it was mentioned, Baumrind has presented three methods of behavioral disorders, forcefulness and easygoing parenting by considering parental control.

The obtained results of conduct researches on these three methods have shown that these methods may increase the negative or positive consequences in children [17]. The behavioral disorder parenting is specified with strong inhibitor, high level of seriousness, unstable and strict discipline and relatively low levels of emotional sincerity. Forcefulness parenting is specified by the combination of a high emotional support inhibitor, appropriate levels of independence and mutual interaction between children and parent (Diaz, 2005). The easygoing method that has attracted less researches to itself in comparison with two other methods, is determined with the shortage of parents inhibition, accordingly parent exercising power on the children behavior fails; and willingness to accede to the child's wishes [17].

The relationship between attachments styles and parenting methods with the child's behavior problems has been shown in the researches. Kamijani and Maher, (2007), by their study entitled "the comparison of parents, parenting methods of adolescents with disorder behaviors, with the ordinary adolescence" show that the method of behavioral disorders, parenting with parents of adolescents with disorder behavior is used more than the parents of normal adolescents [18]. Baezzat, et al. (2009), in their study examined the attachments methods of students with disorder behavioral and normal behavioral [19].

The obtained results show that the normal students have secure attachment style; and the students with disorder behavioral have ambivalent insecure attachment style. Sadeghkhni, et al. (2012), conducted a study entitled "comparison of mothers parenting methods of the son students aged 7 to 9 in primary school with stubborn and disobedience disorder and ordinary son students" The findings of study showed that the mothers of children with stubborn and disobedience disorder in comparison with mothers of normal children, use more the behavioral disorders and easygoing parenting method; and less use the forcefulness parenting method [20].

Smart (2001) according to the obtained results of a study found that how the interaction of parent- child mainly can be used as a predictor for children's behavior problems. The interactions that usually are along with mutual hostility, pessimism, over control and violence have intervened in most of childhood pathologies [21]. Allen, et al. (2002), by reviewing the attachment style as a social skills predicator and criminal behaviors in adolescents found that safe attachment style increases social skills in adolescence, while the style of insecure attachment is as a predictor of criminality in this period [22].

Jenifer and Peterson, (2006), by reviewing the type of family and its relation to criminality found that the best predictor of adolescent criminal had been the quality of their relation with their parent. It means, this bad relation is the cause of their criminality [23]. Since children spend much time with their mother and conversely fathers less time are near their children. And there was not any research that directly reviews and compares the attachment styles and parenting methods in bully and normal students.

The purpose of present study is reviewing and comparing the attachment styles and parenting methods of bully and normal students' mothers. Conducting a study in this regard, to clarify the attachment styles and parenting methods of bully and normal students' mothers for obtaining the practical strategies seems necessary. For this purpose some hypothesizes were proposed as follows:

1- There is a significant relationship between attachment styles of behavioral disorders and normal students' mothers in fifth and sixth grade in primary school.

2- A significant relation has been seen between parenting methods of the behavioral disorders and normal students' mothers in fifth and sixth grade in primary school.

MATERIALS AND METHODS

The research project is descriptive; and in terms of data collecting method is considered among scientific-comparative researches. The target population includes all mothers of girls and boys students in fifth and sixth grade in primary schools of Esfahan city in the 2015 academic year. The case study of the present study was 840 persons includes 350 persons of behavioral disorders' mother and 490 people of normal students. The case studies of normal students' mothers were selected by using the method of multi-stage random sampling. To select the behavioral disorders' mother, the census method was used. The behavioral disorders of fifth and sixth grade of 32 primary schools were selected for this purpose; and were examined in the form of sociometry in a way that is explained in tools chapter.

To implement the project after doing sociometry and analyzing its obtained results, the selected students in sociometry, responded to the questionnaire of relationship with homogeneous (a part of that measures the behavioral disorders rate of children). Then, 200 children based on analysis of the obtained results of sociometry and also the obtained scores of relation with homogeneous questionnaire were considered as a bully student.

For collecting data, the questionnaires of Hazan and Shaver attachment styles and the method of Baumrind parenting were at the disposal of bully and normal students' mother. For collecting data, the following tools were used:

1- Sociometry: in reviewing the sociometry it has asked from children to evaluate their homogeneous based on the understanding from them. Sociometry in general was conducted on the present children with a group. Researches in general ask the children to report their peer's social position. In review of sociometry it was asked from children of one class to introduce some of their classmates that like them as well as some classmate that don't like them; or classify their peers according to their cooperation rate [24]. In the present study it was asked for participants to confidentially, write the name of their bully classmates on the available papers. Finally, by summarizing the students' responses, the students that were introduced as a bully person by a greater number of their peers were considered as a bully.

2- Parenting Relationship Questionnaire [25]: it has regulated for reviewing the relationship between primary school students. This self-report tool has 20 types that are scored from 1 to 5 in Linkret scale. The alpha coefficient of the Persian version of this scale for the three subscales of: behavioral disorders, victim and socially acceptable behavior is reported 0.73%, 0.70% and 0.53% respectively [26].

3- Attachment styles questionnaire of Hazan and Shiver: this questionnaire includes 15 questions that 5 articles of this questionnaire relate to safe attachment style, 5 articles are about avoidant attachment style and 5 articles are regarding anxious attachment style / ambivalent. The questions are scored by using 5 degrees scale of Linkret, never (score: zero), randomly (score: one), sometimes (score: two), most of the times (score: three) and almost always (score: four). Hazen and Shaver, (1987) [27], obtained total retesting reliability of this questionnaire 0.81 and reliability with Cronbach alpha was 0.87 as well.

Colitz and Rid, also obtained validity by using the Cronbakh alpha method 0.79. According to the obtained results of a study conducted by Hadinejad, (2008), [28] on the students in grade high school, questionnaire reliability coefficient is reported more than 0.83. Pakdaman, (2004), [29] reported the validity of this test for safe style, avoidance and anxious/ambivalent 0.37%, 0.53% and 0.73% respectively; and the amount of Cronbach alpha was reported 0.79.

3- Baumrind parenting questionnaire: this questionnaire according to the Baumrind theory and by himself in 1972 was regulated and contain 30 questions that evaluate 3 methods of parenting; 10 questions evaluate behavioral disorders method, 10 questions forcefulness and 10 questions easygoing as well. The questions by using the 5 sores scales of Linkret, quite disagree (score: zero), disagree (score: one), almost disagree (score: 2), agree (score: three) and completely agree (score: four) are scored. This questionnaire in several studies is reviewed and its validity and reliability is reported in a desirable level.

Boon, (2007), [30] reported the reliability coefficient of this questionnaire by using retesting method between mothers group for behavioral disorders method 0.86, forcefulness 0.88 and easygoing 0.81. In Iran Esfandiari, (1995), [31] by surveying from 10 expert psychologist and psychiatrist reported validity of the content of the questionnaire at a high level and its reliability by using retesting method after one week, for behavioral disorders method 0.77, forcefulness method 0.73 and easygoing method 0.76.

Studied data in SPSS 20 software and using multivariable analysis of variance statistical method was analyzed.

Ethical Considerations

1-About objectives, method and how doing research, the required explanation was given to the case study group and they were satisfied.

2-To respect the privacy of persons, it was refrained to mention their name in questionnaire and reports.

3- The participants could exclude in any phase of the study if they wish.

RESULTS

In [Table 1]- frequency distribution, average and standard deviation of bully and normal students' mother attachment styles.

Table 1: Frequency distribution, average and standard deviation of bully and normal students' mother attachment styles

Variable	Group	Frequency	Average	Standard deviation
Safe attachment style	Bully	192	18.08	4.59
	Normal	200	20.85	3.43
Acvoidnace attachment style	Bully	192	19.59	3.28
	Normal	200	17.48	2.55
Anxious-ambivalent attachment style	Bully	196	21.45	6.20
	Normal	200	18.69	5.22

[Table 1] shows that the average scores of behavioral disorders' mother anxious-ambivalent and avoidance attachment style is higher than normal students' mothers; and in return, the average scores of safe attachment styles of normal students' mothers are higher than the average scores of behavioral disorders' mothers.

In [Table 2] the frequency deviation, average and standard deviation of bully and normal students' mother parenting styles are estimated.

Table 2: The frequency deviation, average and standard deviation of bully and normal students' mother parenting styles

Variable	Group	Frequency	Average	Standard deviation
Behavioral disorders	Bully	192	25.36	6.59
	Normal	200	18.06	3.87
Forcefulness	Bully	192	16.03	4.01
	Normal	200	21.11	2.12
Easygoing	Bully	196	22.49	5.43
	Normal	200	19.98	4.11

[Table 2 shows that the average scores of forcefulness and easygoing students' mothers parenting styles is higher than normal students' mother and conversely, the average scores of forcefulness parenting style of students' mother is higher than average scores of normal students' mothers.

[Table 3]: The results of multivariable variance analysis of attachment styles scores and normal and behavioral disorders' mother parenting methods scores are shown.

Table 3: The multivariable variance analysis of attachment styles scores and normal and behavioral disorders' mother parenting methods scores

Name of test	Amount	df	Freedom degree error	F	Significant level
Pillai's trace	0.487	3	56	6.43	0.001
Wilks Lambda	0.565	3	56	6.43	0.001
Hotelling's Trace	0.784	3	56	6.43	0.001
Roy's Largest Root	0.784	3	56	6.43	0.001

As it is observed in [Table 3], the amount of F is multivariable id equal to 6.43 in level ($P < 0.001$) is significant statistically. The obtain results of multivariable variance analysis show that there is a significant relation between bully and normal students' mothers attachment styles. To find out this difference the multivariable analysis of variance was used that the obtained results is shown in [Table 4].

Table 4: unavailable variance analysis on attachment styles and parenting methods of bully and normal students' mothers

Variable	SS	df	MS	F	dig	R ²	Test ability
Safe attachment	62.711	1	62.711	4.011	0.050	0.44	1
Avoidance attachment	175.451	1	175.451	19.352	0.001	0.33	0.8
Ambivalent-anxious attachment	140.937	1	140.937	5.687	0.005	0.28	0.9
Behavioral disorders parenting	276.501	1	276.501	6.814	0.001	0.23	1
Forcefulness parenting	520.493	1	520.493	6.117	0.001	0.19	0.8
Easygoing parenting	12.373	1	12.373	0.313	0.652	0.20	0.8

As it is shown in [Table 4], there is a significant difference between attachment styles and forcefulness and behavioral disorders parenting methods of bully and normal students' mothers. According to the results, behavioral disorders' mothers more than normal students' mothers have unsafe attachment styles (avoidance and anxious- ambivalent). And also behavioral disorders, parenting method in behavioral disorders' mothers is used more than normal children's mothers ($P < 0.001$). Forcefulness parenting method in behavioral disorders' mothers is used less than normal children's mothers ($P < 0.001$). There is no any significant difference between normal and behavioral disorders' mothers in easygoing parenting method ($P < 0.005$).

DISCUSSION AND CONCLUSION

The purpose of this study is reviewing and comparing the attachments styles and parenting methods of normal and behavioral disorders' mothers.

With a glance to the average and standard deviation of scores in variable styles attachment and parenting methods of mothers, a relatively clear imagination can be gotten from the status of bully and normal students.

One of present study hypothesizes indicates that there is a significant difference between the bully and normal students' mothers attachment styles in fifth and sixth grade; and this hypothesis was confirmed. The results show that normal students' mothers more than behavioral disorders' mother use safe attachment style.

It can be said that people with secure attachment from their childhood under sincere and constructive relationship with their parent learn how to show the excitements in a social acceptable form, and react to the emotions expressed by the others. The forceful parent with a high degree of expectation and accountability help to safe attachment formation in their children; and the children increase in them a positive functional model related to themselves and others. According to this base, they believe that are lovely and others also are accountable and receptive. Such attachment with mental health and other social merit indexes has positively relating. Sincere and kind parent, are supported and involve themselves in the children's work, and increase safe attachment in their children. Accordingly, children find a positive attitude to themselves. Such cognitive schema protects them from dangerous treatments and bring them mental health and competency. Also, the results show that behavioral disorders' mothers more than normal students' mothers have insecure attachment styles (avoidant and anxious-ambivalent).

As it has been mentioned in the history of the study, no any scientific research has found in this field, but Allen et al. (2002), [22] Jenifer and Pattereson, (2006), [23] and Baezzat, et al. (2009). [19] Prove a positive and strong relationship of mother's attachment styles with decrease of problems and behavioral disorders and criminality in children and adolescents.

It can be said that avoidance and ambivalent-anxious attachment style has relation with behavioral disorder behavior, so that this attachment style is as predictive of powerfulness for a behavioral disorder, criminality and antisocial character. The parent that increases the unsafe attachment in their children, as a result the children find a negative attitude to themselves, such cognitive schema not only predispose them for risky behavior but also weaken social competence and self-esteem in them. According to the obtained results of study, it can be said that the attachment styles difference is due to different interactions of parent and others especially mothers.

Yagon, (2003), through a study showed that the persons that in childhood had an unsafe attachment to their parent, show bad behavior with their friends. According to the researcher's belief, parents have overlooked these children and have showed inappropriate responses to their child's behaviors. Overall, it can be said that protection, quality and how the interaction is between family persons, determine the type

of attachment in child, adolescent and adult. So the families that have a powerful emotional relationship with their children and apply an appropriate procedure subsequently create safe attachment in the children; and less expose to the behavioral disorders. As parent sensitivity and accountability to the child's needs and wishes influences on the creation of safe attachment style [32].

Another finding of this study is as a confirmation of this hypothesis that there is a significant difference between the mother's parenting methods of bully and normal students in fifth and sixth grade in primary school. According to the obtained results, the behavioral disorders, parenting method is more applied by behavioral disorders' mothers than normal students' mothers. The forcefulness parenting method is less used by behavioral disorders' mothers than normal students' mother; and also there is no any significant difference between parenting easygoing method of mothers of bully and normal students. There is no any reported scientific study in this regard; but conducted studies by Smart (Kamijani and Maher, (2007), [18] and Sadeghkhni, et al. (2012), [20] have proved the positive and powerful relation between parenting methods of parent for decreasing problems and behavioral disorders and criminal.

To explain how this relation is formed, it can be said that the children who are educated according to the behavioral disorders pattern, usually suffer from types of neuron-psychiatric and behavioral disorders. According to this pattern parent due to make errors punish the child; but never explain about the cause of punishment. Usually there is no any logical relation between the type of punishment and child wrong behavior. Unlike mothers, fathers spend less time beside their children; and since the child makes any mistake, with an unnecessary violent attack to child characteristic, and this is along with feeling guilty.

Continues blames causes that a poor imagination forms in the child's mind from themselves that gradually decrease their self-confidence, make their behavior worse; as a result, they think that what their parent imagine about them, is a fact. All these conditions are sufficient to make teenager tend to do the types of unbridled behaviors such as behavioral disorders. Vindictive punishment, continuous blame and creating felling guilty causes the child believes he is bad enough that deserves disrespect and disregard. In most of antisocial behaviors, running away from home, using drugs, theft, constituting stray and criminal groups and other antisocial behavior, the effects of this educational model can be seen. The methods that parents apply to their children's education have an essential role in providing mental health of their children. By a sound relationship, it is possible to recognize the children's need and make attempts to meet them. As it was mentioned, each of these methods has some effects on a child's behavior that in this regard the destructive and negative effects of the behavioral disorders method are more than the others. Sometimes parent in their children's education makes some mistakes that compensation them is impossible. Most of parent suspects that by using force and violence, threatening and creating an atmosphere of fear and not paying attention to children's mental- psycho needs can educate obedient, healthy and submissive children. On the other hand, there are parents that suppose the best method for a child's education is being relaxed, neglecting and being indifferent; that in fact both of them have gone wrong. Despite doing necessary control, there are some limitations in the present study that are as follows:

- 1- This study was limited to the view of students in the field of bully group.
It is obvious that comment of parent and teachers in this regard can be as a complementary of the students' view
- 2- Because of doing studies on the student in fifth and sixth grade of primary school, we should be cautious in generalizing the results to the other grades
- 3- This study has done in a city and province, so generalize the results to other cities and provinces should be done with caution.

According to the obtained results of this study, it is suggested that parents be informed about educational pattern and their effects on the children, by holding educational workshop.

CONFLICT OF INTEREST

There is no any form of conflict of interest

ACKNOWLEDGEMENTS

Hereby, the respected authorities of Esfahan education general administration are appreciated for paving the way of this study as well as the students and their mother that participate in this study

FINANCIAL DISCLOSURE

No financial sponsor in the form of person, institution or organization is involved in the present work.

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ARTICLE

HUMAN-MACHINE INTERACTION IN FACIAL EXPRESSION RECOGNITION SYSTEM

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ABSTRACT

Image processing is an image-in and image-out work, in that artificial intelligence in affective computing is scientifically challenged Research area in the field of computer vision technology. Facial expressions are the fundamental way to express human emotions and also an effective method of non-verbal communication, development of artificial intelligence and pattern recognition, researchers paying more and more attention to the facial expression recognition system. The Human can easily recognize facial expression, but it is quite a challenging task for the machine to do this many application which use facial expression to evaluate the human nature, feelings, judgment and opinion. This paper presents a broad review of various modules in the facial expression recognition system and robust techniques used at each level. An ongoing challenge in this field is to design an intelligence system for effective human-machine interactions.

INTRODUCTION

KEY WORDS

Emotion, expression, computer vision, recognition, affective computing

Human invented computers are faster and more accurate than human beings in processing numerical data but human beings scoring over computers in recognition capability. A human can recognize an object in a few seconds, without any difficulty. The methods by which human gathers knowledge for recognition is unique because human beings use all the five sensory organs (visual, hear, taste, smell, and touch) to gather knowledge about the outside world. Among these perceptions of visual information plays a major role in understanding the environment. There are many ways a human can express emotions the most natural way of expressing emotions is using facial expressions because the face is the index of the human mind. Facial expression detection means finding the face in an image and classifying into one of the emotional states among six universal labels of angry, disgust, fear, happy, sad and surprise. If none of the above states presents it consider as neutral.

Facial expressions are playing an important role in human communication. A picture worth thousands of words, i.e. a face contains much information about a person id (identification) and also about mood and state of mind. Artificial intelligence in expression classifier system has lots of attention due to its potential application in many commercial fields like the advance driver assistance system, criminal investigation, gaming, human behavior analysis, human-machine intelligent interaction, health support appliances, intelligent robotic system, lie detection, smart rooms, surveillance, and depression detection. Facial expression recognition system [FERS] utilized in the automatic analysis of human emotion. Human interpersonal behaviors are affected by facial expression during communication. Although the technology for emotion recognition is an important one which demanded in various fields, it still remains the unsolved problem. Automatic facial expression recognition has undergone substantial advancement over the past two decades. To truly achieve effective human-computer intelligent interaction, there is a need for the computer to understand a facial expression scene to naturally interact with the user as similar to the way how human to human interactions are taking place.

Recognizing human facial expression is not just an easy and straightforward task due to several circumstances [Fig. 1] like illumination, facial occlusion, face shape, low-resolution images, head pose variations, dark-skin faces, the color of the image, the distance between facial landmarks variation from person to person, an absence of a neutral face for comparison, low intensity expression and so on. Facial expression is a specific and a hard case for the object recognition. Our faces can express the things which are difficult to put into words. In modern computer vision technology, face to face encounters are expected in next generation computer systems to convey information about the state of the mind of a person may be inferred. As per Albert Mehrabian's [1] in communication research, 7% of meaning in the words that are spoken, 38% of meaning is paralinguistic (the way that the words are said), 55% of communicating cues can be judged by facial expression, and hence recognition of facial expression becomes a major modality. In 1872- Darwin's Charles [2] demonstrated the universality of facial expression and their continuity in man and animals. The early 1970s, Paul Ekman has performed an extensive study of human facial expressions. 1971 American Psychologist Ekman and Friesen [3] defined six basic emotions: angry, disgust, fear, happiness, sadness, and surprise. In 1978 Facial Action Coding System was developed by Ekman [5] for facial expression description. The approach in FACS [4] which separates the expression into upper and lower face action. In 1978-suwea and et.al, [6] presented a preliminary investigation on automatic facial expression analysis from the sequence of images.

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Published: 8 Nov 2016

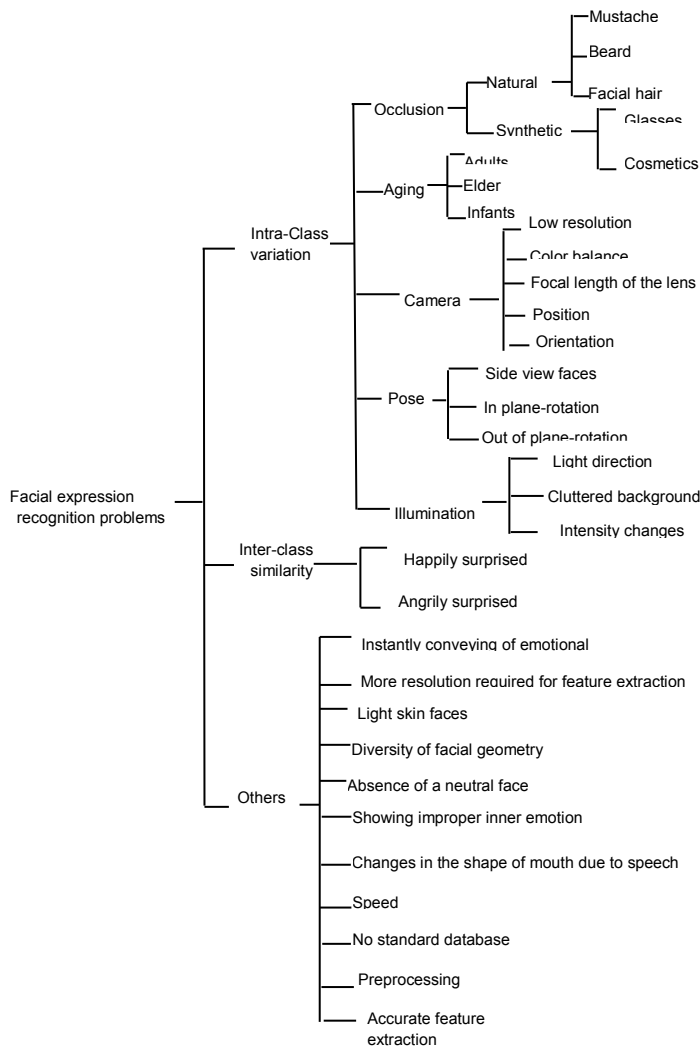


Fig. 1: Taxonomy of various issues in facial expression recognition system.

PHASES IN FERS

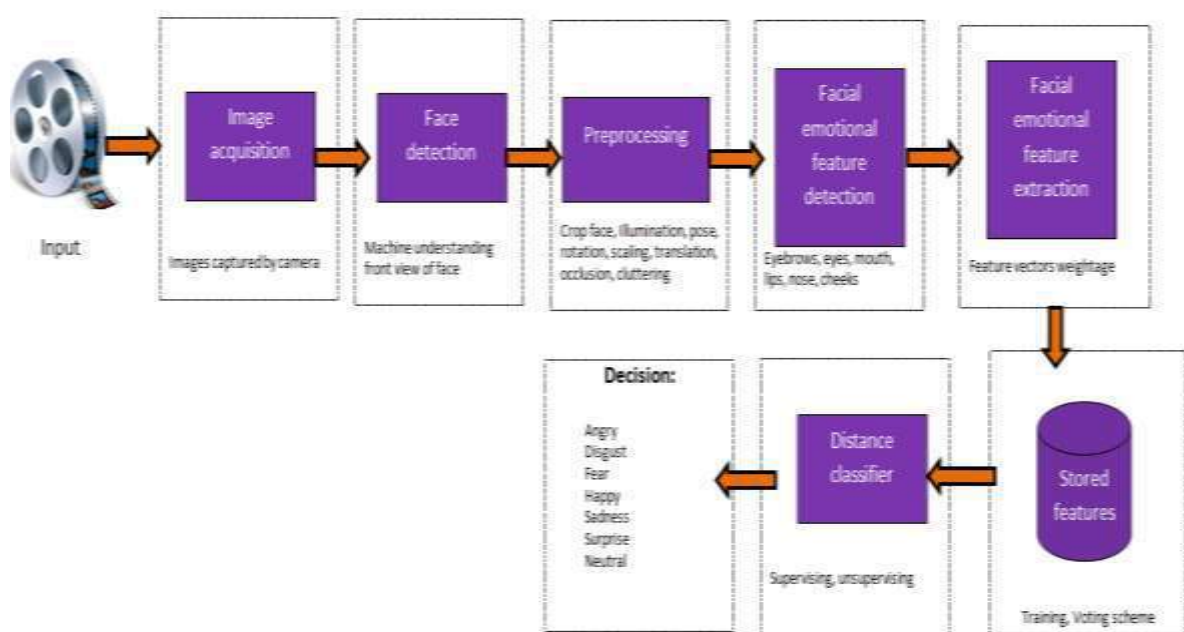


Fig. 2: Structure of facial expression recognition system.

Every FERS [Fig.2] must perform a few steps before to classifying the expression into a particular emotion. FERS categorized into following phases.

Image acquisition

Without image acquisition, the processing on the image is not possible so the first step of the FERS system is to capture an image. This phase would normally be done by using the standard video Camera. The Image acquisition phase itself includes several issues like image properties, a number of devices connected (camera, digitizer), the size of the face image, total image dimensions [Table 1], ambient lighting and so on. All of these factors may influence the facial expression analysis. Images acquired in low light or coarse resolution can provide less information about facial features. The methods that work well in studio lighting may perform poorly in more natural lighting when the angle of lighting changes across an image sequence. Most researchers using single-camera setups, usage of a single camera may difficult to standardize when the input is in out of a plane rotation in this circumstance multi camera setup is required, it supports the three-dimensional modeling and assesses the accuracy of the image alignment.

Table 1: Similar size face with different resolution

Same size face					
	Various resolution	96 x 128	69 x 93	48 x 64	24 x 32
	Detect?	Yes	Yes	Yes	Yes
	Pose?	Yes	Yes	Yes	Yes
	Recognize?	Yes	Yes	Yes	May be
	Features?	Yes	Yes	May be	No
	Expressions?	Yes	Yes	May be	No

Pantic and Rothkrantz [7] were the first to use two cameras mounted on a headphone-like device; one camera is placed in front of the face and the other on the right side of the face. The cameras are moving together with the head to eliminate the scale and orientation variance of the acquired face images. Otsuka and Ohya [8] applied an adapted gradient-based optical flow algorithm to estimate the motion in the local facial [9] areas of the right eye and the mouth. The inputs of the facial images are acquired by a camera mounted on a helmet worn by the subject and sub sampled by eight in both directions. Professional grade PAL cameras provide very high-resolution images and by contrast, security cameras provide images that are seriously degraded.

Face localization

The face detection is a process of identifying the location of the face in the input image. Face detection method uses computer learning technique to detect the location [10] of the any faces in an image. For better performance in facial expression recognition, the importance of the facial landmark detection [11] is an undeniable fact. Face detection uses mathematical techniques on the pixel values or features in the facial area of an image to determine the human face. The human face is a dynamic object and has a high degree of variability in its appearance, which makes face detection [12] a difficult problem in computer vision. Face detection is the stepping stone to all the facial analysis algorithms, including face alignment, face relighting, face modeling, face recognition, head poses tracking, face verification/authentication, facial expression tracking/recognition and gender/age recognition. Only when computers can recognize faces well will they begin to truly understand people's thoughts and intentions.

Face detection appears as a trivial task for human beings, but an extremely tough task for computers. The difficulty associated with face detection [13] can be attributed to variations in scale, location, orientation (in-plane rotation), pose (out-of-plane rotation), facial expression, occlusions, illumination and so on. In the dynamic form of the input, face detection is performed to detect human faces in a plurality of frames. The location of the face in an image is detected using the well-known Viola-Jones method that's based on the Haar-like features and the AdaBoost learning algorithm [14]. The Viola-Jones method is familiar to an object detection algorithm providing competitive object detection rates in real time. The features used by Viola-Jones are derived from pixels selected from rectangular areas, which are imposed over the picture and show high sensitivity to the vertical and horizontal lines. [Fig. 3] show the different approaches used to detect the human face.

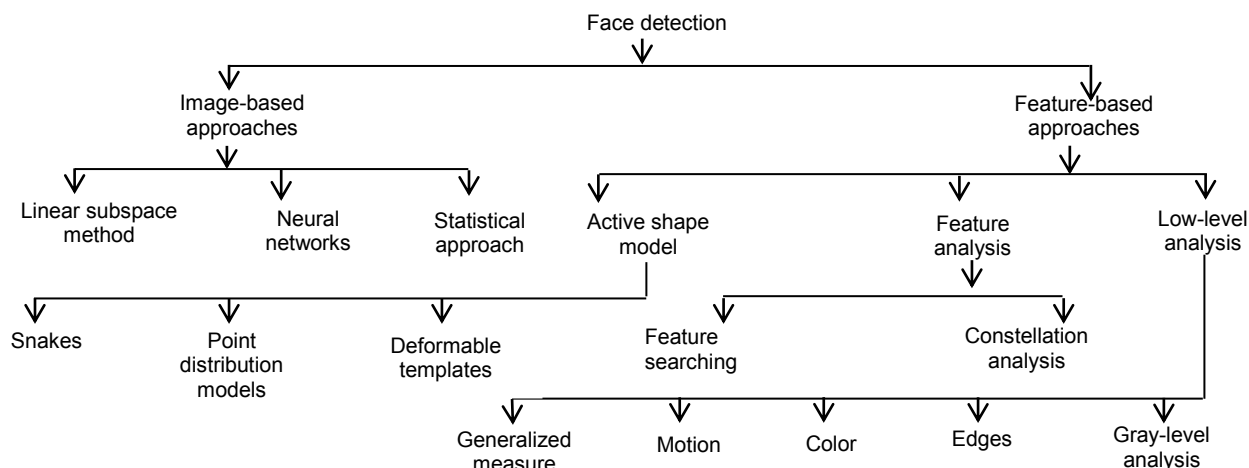


Fig. 3: Taxonomy of different face detection approaches.

Preprocessing

Image pre-processing techniques make the image easier to process the data and increase the chances of getting correct matches. Better chances of success with the change in illumination, pose, and picture quality can decrease the processing time and increase the feature detection performance, compared with a non-preprocessed image. Common pre-processing methods are resampling, edge detection and face alignment is an essential step and is usually carried out by detection and horizontal positioning of the eyes. A change in lighting conditions provides a considerable decrease in recognition performances. To solve this problem better preprocessing methods should be used before the feature extraction stage. The common preprocessing methods used to normalize the illumination [16] in facial images are gamma intensity correction, histogram equalization, logarithm transform and cosine transform. Gabor filter is the robust preprocessing technique in the FERS.

Feature extraction

Facial feature extraction is an important part in the FERS. The emotional model features are the features used to represent emotion in the face. It is the process of extracting relevant information from the image. The facial elements, especially key elements are constantly changing their positions when subjects are expressing emotions in other word feature extraction [Fig. 4] refers to the identification of facial feature points [17], preferably independent, which together represents a given emotional expression, which is responsible for particular facial behavior. The prominent emotional features of the face such as eyebrows, eyes, pupil diameter, nose, mouth, lips, and chin. The contours of the mouth, eyes, and eyebrows are playing an important role in the classification.

The accurate feature extraction method heavily depends upon the selection of the database and selection of the emotional features affects the classification accuracy. Feature extraction and representations are critical in FERS. The facial features can be extracted from either dynamic image sequences [18] or static images [19]. The choices of features employed for emotion recognition are classified into two main categories, i.e., geometric features (facial points and shapes of facial components) and appearance features (descriptions of the texture of the face). Gabor wavelet-based technique & local binary pattern method is widely used for the facial emotional feature extraction process it can detect multi-scale, multi-direction texture changes [20], as well as by the effects of illumination is relatively small. The output of the feature extractor stage must contain separable and classifiable vectors.

10	60	71	0	0	1	1	2	4
150	65	53	1		0	128		8
140	200	18	1	1	0	64	32	16

3x3 neighborhood

Threshold

Binary weights

Pattern 11100100

LBP=4+32+64+128=228

Local binary pattern algorithm [LBP] is familiarly used in the facial emotion recognition system to extract the emotional features. LBP method is introduced by Ojala, it is a robust method for feature extraction. In a 3 x 3 image pixel are threshold by its center pixel value.

The neighborhood consists of 8 pixels; a total of $2^8 = 256$ different labels can be obtained depending on the relative gray values of the center and the pixels in the neighborhood. In a given image a pixel at (x_c, y_c) , the LBP result can be expressed in decimal format as

$$LBP(x_c, y_c) = \sum_{p=0}^{P-1} s(g_p - g_c) 2^n$$

n -runs over the 8 neighbor of the central pixel, g_p and g_c are gray level values of the central pixel and the surrounding pixels, the function $s(x)$ is defined as $s(x) = \begin{cases} 1 & \text{if } x \geq 0 \\ 0 & \text{if } x < 0 \end{cases}$, limitation in the LBP operator is noise sensitivity and lack of rotational invariance.

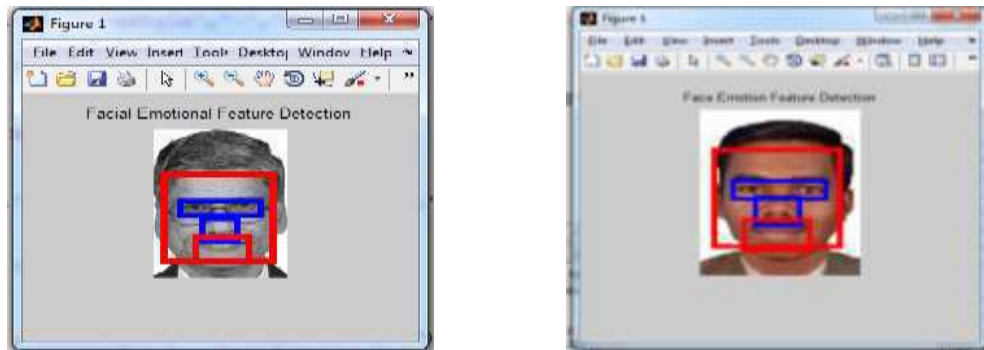


Fig. 4: Emotional features extraction from various faces

Database

To implement the new facial expression recognition system one of the most important aspects is the choice of the database [21] that will be used for testing the new system. The main drawback in the facial emotion recognition system is no standard database available it still an open challenge problem, the main reason is human face is defined with respect to age. If a common database is used by all the researchers, then testing the new system, comparing it with the other state of the art systems and benchmarking the performances are becoming a very easy and straightforward job. Table 2 describes the familiar databases available for facial emotion recognition system.

Table 2: Analysis-familiar facial emotion recognition database

S.no.	Name of database	Year	Image size	No. of picture per head	No. of unique people	Availability
1	FEI face database	2012	640x480	14	200	Yes
2	The MUCT face Database	2010	480x640	10-15	276	Yes
3	BU-3D FE database	2006	512x512	25	100	Yes
4	MMI database	2005	720x576	1280video	43	Yes
5	The yale face database	2003	320x243	11	15	Yes
6	PIE database	2002	640x486	9	68	Yes
7	CK database	2000	256x256	-	182	Yes
8	FERET database	2000	256x384	-	1,136	Yes
9	JAFFE database	1998	256x256	7	10	Yes
10	AR face database	1998	576x768	26	70male+56 female=126	Yes
11	Richard's MIT database	1996	480x640	6	82male+72female=154	Yes

MUCT-Milborrow University of Cape Town, BU-3DFE-Binghamton University 3D Facial Expression, CK-Cohn Kanad, FERET-Facial Recognition Technology, JAFFE-Japanese Female Facial Expression Database, AR-Aleix Martinez and Robert Benavente, MIT-Massachusetts Institute of Technology.

Expression classifier

After completion of the feature extraction phase, the final piece in the puzzle of facial emotion recognition system is a good classification [22] module. A classification aims at mapping emotional features into one of the six emotional labels. Information extracted from the face is the input for expression classifier that will classify the extracted features into particular expression. Image classification is a method of teaching the computer to make and improve predictions or behaviors based on some data. The robust algorithm

used to classify the facial expression is a Support Vector Machine (SVM) is a valid machine learning method [Fig. 5], it was originally proposed by C Cortes and V Vapnik [23] in the year of 1995.

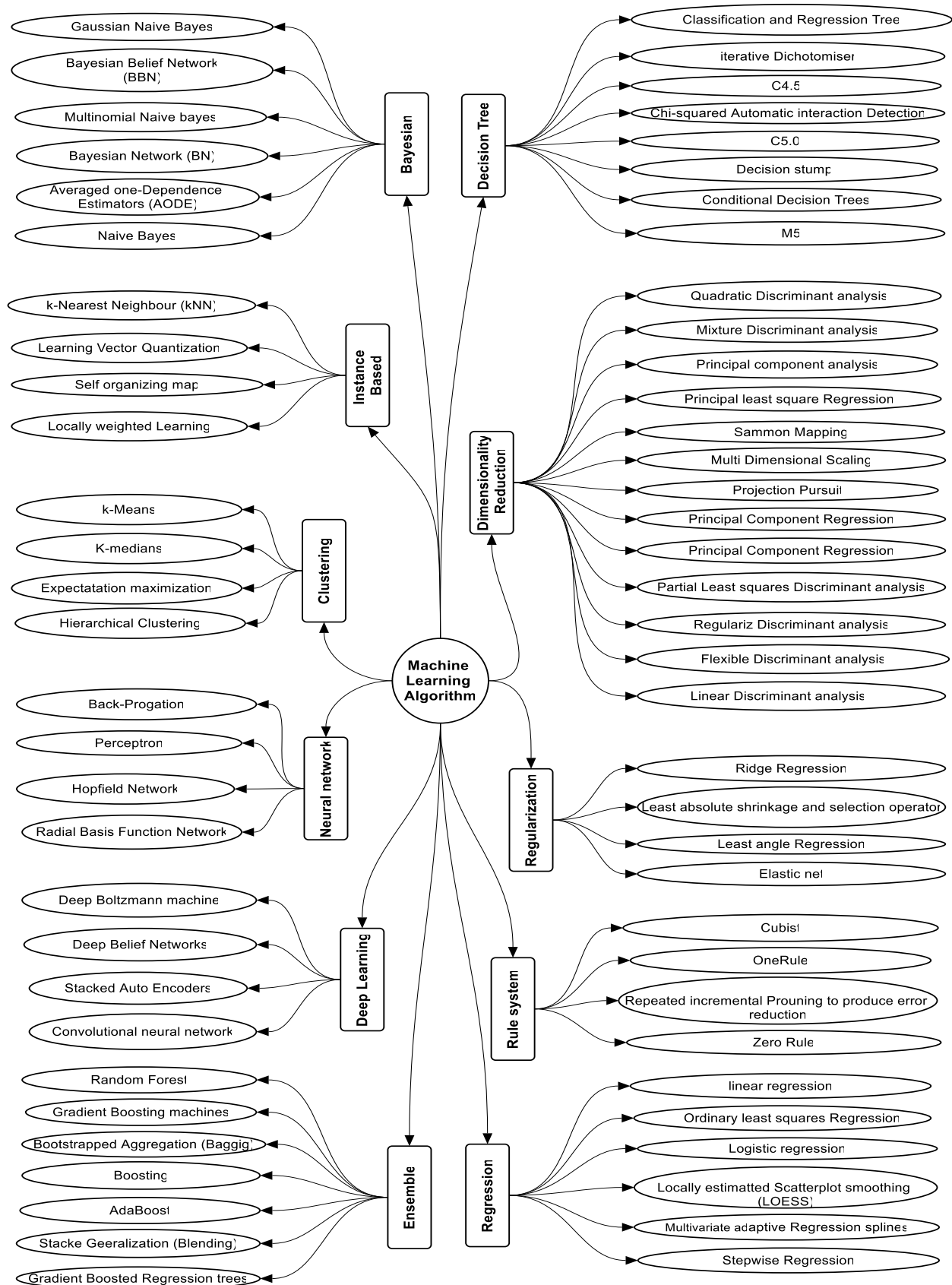


Fig. 5: Mind map-machine learning algorithm.

SVM is a supervised learning method used for classification and regression. A special property is that they

simultaneously minimize the empirical classification error and maximize the geometric margin, hence they are also known as maximum margin classifiers the dominating approach to doing so is to reduce the single multiclass problem into multiple binary classification problems. Each of the problems yields a binary classifier, which is assumed to produce an output function that gives relatively large values for examples from the positive class and relatively small values for examples belonging to the negative class. Kernels-support vector machines use a particular type of function class classifiers with large margins in a feature space induced by a kernel. The fuzzy rule-based system has been used for classification of six facial expressions of the face. Generally, each fuzzy image processing system has three main stages: image fuzzification, modification of membership values i.e., fuzzy Inference System and if necessary, image defuzzification. The emotion recognition systems of neural network algorithm [24] consist of three stages i.e. training of neural network, testing of neural network and performance evaluation of neural network. The accuracy of the emotion classification doesn't depend on only the selection of classifier algorithm; it is a framework of entire FERS.

EXPERIMENTAL RESULTS

Table 3 describes some recent works done on the facial emotion recognition system.

Table 3: Comparison of recent work results

S.no	Author	Feature extraction	Classifier	Database	Recognition rate	Emotion model
1.	S.I. happy, aurobind and routray (2015-IEEE) [25]	LBP	SVM	CK+	94.39%	6
2	Poialachiranjeevi, et. al's (2015-IEEE) [26]	Key emotional point	Personalized appearance model	CK+ ISL	98%	6
3	Ali moeini, et.al's (2015-IEEE) [27]	Feature library matrix	Support vector machine	FERET	99.09%	6+1 (neutral)
				CMU-PIE	98.24%	
4	Amin mohammadian, et.al's (2015) [28]	Feature vector	Style transfer mapping classifier	CK+	83.9%	6
5	Mostafa k et.al's (2014-IEEE) [29]	PCA	SVM	BU-3DFE	89.5%	6
6	Vassilis g. kaburlasos, et.al's (2013-IEEE)[30]	Orthogonal moment segmentation	Fuzzy ARTMAP neural classifier	JAFFE	93.96%	6
7	Jeemonikalita, et.al's (2013) [31]	Eigen vector	Euclidean distance	Self-database	95%	6
8	Yongqiang li, et.al's(2013-IEEE) [32]	Gabor transform	Dynamic bayesian network	CK+	87.43%	6
9	Michel f. valstar, et.al's (2012-IEEE) [33]	Gabor feature	Gentle boost+SVM	CK	95.3%	6
10	Govindukhandraokharat, et.al's(2008) [34]	Discrete cosine transform	Feed forward neural network	Self- database	100%	6

Table 4: System success rate of classification

Expression	Number of images experimented	Number of correct recognition	Success rate
Anger	25	22	88
Disgust	25	23	92
Fear	25	22	88
Happy	25	25	100
Sad	25	20	80
Surprise	25	24	96

Table 4 shows the successive of recognition rate 91% obtained for 150 samples with various expressions.

CONCLUSION

It is tricky to find the good coconut without opening similarly human emotion recognition system is mind intention related research work. In this paper briefly overviewed different phases in human-machine interaction in facial emotion recognition system. In the development of FERS fronting of various issues in each phase and robust practical algorithm available to solve various issues at each level are highlighted. This paper extremely guide & boost to the researcher who is new to in the area of human-machine interactions. Our future enhancement work will concentrate on the context aware online tutoring system i.e. our system automatically adjust the presentation style of an online tutor when negative attitude appeared on the candidate.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The authors would like to thank the Reviewers for their detailed reviews and constructive comments which have helped to improve the quality of this paper and also Dr. Sujatha Balasubramaniam CEO GKM group of institution for providing facility.

FINANCIAL DISCLOSURE

None.

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ARTICLE

ANALYZING SENTIMENT IN INDIAN LANGUAGES MICRO TEXT USING RECURRENT NEURAL NETWORK

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ABSTRACT

This paper aims at improving the system which is submitted to the shared task on Sentiment Analysis in Indian Languages (SAIL2015) at MIKE 2015. In this work the tweets are classified into three polarity category namely positive, negative and neutral. Twitter data of three languages namely Tamil, Hindi and Bengali are already provided by SAIL 2015 task organizers as we have participated in the contest. Recurrent neural network is used for analyzing the sentiment in the tweets. The system performs well for recurrent neural network when compared with the system submitted to the shared task as the accuracy of the system had increased. This is due to the fact that the recurrent neural network concentrates more on language specific feature. In training, the recurrent neural network tries to learn based on the error that are generated as intermediate output. By this way the network seeks to pursue sentiment oriented feature which improves in analyzing the sentiments on tweets. We have obtained a state accuracy for the proposed system, where we achieved an accuracy of 88%, 72.01% and 65.16% for Tamil, Hindi and Bengali languages respectively for SAIL 2015 dataset.

INTRODUCTION

Sentiment analysis is an improving and exciting field in language processing area, as sentiment plays a very important role in day to day life. Every individual depends on others opinion for many activities such as getting things from a shop, for watching movies etc. Such opinion or reviews are regularly commented on social media sites such as Facebook, Twitter, Google plus etc. Every individual are into social media for socializing with old friends, getting new friends and to entertain themselves. Social media are providing support for many companies such as Marketing, Sales, Advertising etc. Hence many companies are into social media in search of new customers for buying their product, knowing about the opinions of customers such that to improve the product based on the expectation of customers. The social media provide a wealthy textual data which contain many hidden information or opinion about the product to leverage for a fierce edge. For example, the marketers will riddle the big amount of social media information to find and information and interesting patterns, understand what their competitors area unit doing and also the means the trade is dynamic, and use the findings and improved understanding to attain competitive advantage against their competitors [1]. Resolution makers use the textual information for improving their product and to enhance the business effectiveness based on the opinion that are extracted from the social media sites. Hence, mining the social medial information holds a very important role and it is necessary. Many companies are into this field for improving their product and to customizing it.

Mining the sentiment from social media is a challenging task as many unpretentious words are seen recurrently. This is due to fact that these opinions are not from experts and are from common people especially native speaker. Generally the opinion of a customer about a product or a movie is expressed in a chatty way. The opinion may also contains abbreviations, emoticons, idioms, with many grammatical fallacy. Emoticons are portrayal of body language in text based message [2]. Emoticons plays an important role in expressing the opinions. Many kinds of emoticons are available. These are used in places where the opinions are to be expressed with minimum number of words. For example, in Twitter one should express their opinion within 140 characters. So in most of the tweets emoticons plays a vital role. For analyzing the tweets, one should know how the emoticons are used and how one emoticons are different from others. An ample amount of work has been done in past few years in the field of analyzing the sentiment.

RELATED WORKS

In recent years, the sentimental analyzing work has been turned towards social media text. Now analyzing the sentiment on social media text is an emerging field where, many companies are much interested in knowing about their product outcome. Sruthi et al., proposed a frame work for classifying the sentiment using a competitive layer neural network where the polarity of the text are classified into positive negative and neutral [3]. Ouyang, Xi, et al. suggested a method for analyzing sentiment using word2vec and convolution neural network. In this work 7 layer architecture model is applied for word2vec and convolution neural network for analyzing the sentence level sentiment [4]. Severyn et al. developed a new model in convolution neural network from an unsupervised method to a supervised method for initializing its parameter weight so as to improve the network [5]. Chintala et al. explores the unconventional approach using neural network for analyzing the sentiment of movie and sentence polarity [6]. Dos Santos et al. proffer a new deep convolution neural network for performing sentimental analysis in short text where character to sentence level information is exploited [7]. Sharma et al. proposed a method for

KEY WORDS

Sentiment Analysis;
Recurrent Neural
Network; Polarity
measure; Indian
Languages

Published: 14 Nov 2016

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analyzing the sentiment using back propagation artificial neural network (BPANN). In this work along with BPANN, it uses domain knowledge which are available in sentiment lexicon [8]. Kang et al. presented an improvised Naïve Bayes algorithm for classifying the sentiments that are collected from a restaurant. These data are classified into positive and negative using a senti-lexicon where the gap between the positive and negative reviews is narrow down [9]. Rao, Yanghui et al. offered two opinion topic framework to examine the sentimental analysis of the readers [10]. Mittal et al. suggested an approach for analyzing the sentiment on Hindi language where the Hindi SentiWordNet plays a vital role. Discourse and negation rule are taken into account for analyzing the Hindi sentiment [11]. Balamurali et al. explained a new approach to cross lingual sentiment analysis using wordnet senses as feature. This is a supervised sentiment classification which is used for Hindi and Marathi languages [12]. Kumar et al. presented an approach for classifying sentiment in Indian languages with the support of distributional thesaurus and sentence level co-occurrences [13]. In the work of Yadev et al., they suggested a sentiment analyzing system for health news where it is classified into positive, negative and neutral. Here for a faster processing, neural network is used to train the system [14]. Pooja et al. uses the Hindi SentiWordNet for evaluating the sentiment from Hindi movie review. Synset replacement algorithm is used in finding the polarity of words which is associated with Hindi SentiWordNet [15]. Kamal et al. participated in Sentiment analysis in Indian languages (SAIL) contest for Hindi and Bengali languages. They classified the tweets based on Multinomial Naïve Bayes where an accuracy of 50.75% and 41.20% for Hindi and Bengali respectively [16]. For Hindi opinion mining system (HOMS) Jha et al., uses Naïve Bayes classifier for exploring the sentiment in Hindi movies as positive, negative and neutral. They also used POS tagging in which adjective is used for mining the opinions [17]. Sanjanasri in her work develop a computational framework for supervised Tamil document classification. She claim RKS can be effectively alternate to the kernel for a classifiers [18]. Vinithra et al. in their work they focus on mining the feeling in microblogging site, Twitter. Here, R tool is utilized for examining the factual information [19]. Sachin et al. participated in Sentiment analysis in Indian languages (SAIL) contest where the tweets are classified into three polarity using Regularized least square method [20]. In our previous work, Naïve Bayes algorithm is used for classifying the tweets into positive, negative and neutral [21]. Reshma et al. in their work, they proposed a classification method for classifying unstructured data [22]. Arunselvan et al in their work, Tamil movie reviews are classified into positive and negative using the word frequency as one of the feature. An accuracy of 65% is obtained for feature frequency count [23].

PROPOSED SYSTEM

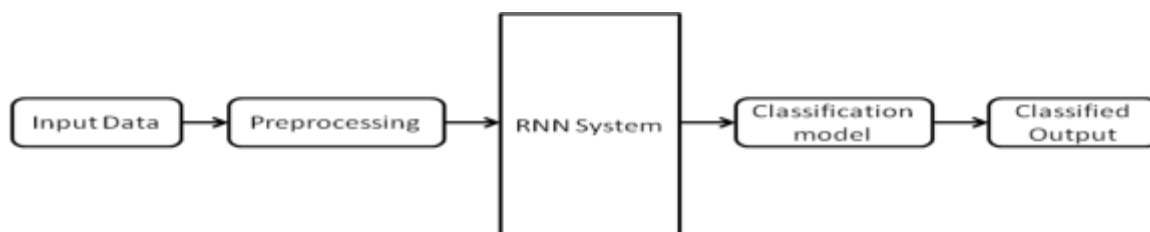


Fig.1: Sequence of the proposed system

The flow diagram of the proposed system is shown in the [Fig. 1]. As this system is an improvement of SAIL 2015, the training and testing data are given by the contest. The next step is preprocessing where the tweet id given in the input data are removed and are given to RNN system. Finally the tweets are classified into positive, negative and neutral using RNN. The system is iterated for 1000 times and the accuracy of the system is measure through F-score measure.

Input Data

This system is for improving the SAIL system. The Input of the system is already provided by the SAIL 2015 contest, as we participated in the contest. The data provided by the SAIL contest is used without any change in the size of the dataset. Both the training, development and testing data are provided earlier. SAIL is a contest mainly for Indian researchers to work on automatic sentiment analysis for improving the NLP towards Indian languages. In this contest, three main Indian languages are taken into account namely, Tamil, Hindi and Bengali. The count of training and testing data for each language is given in the [Table 1].

Preprocessing

In Data mining preprocessing plays a vital role. Due to proper preprocessing, accuracy of the system can be improved [24]. Generally, quality of the data is based on the good preprocessing [3]. The input data consist of tweet id and the tweets. In training data, the tweets are provided in three different files with the name of the respective labels. The tweet id are removed from those files with the corresponding label are provided along with the tweet

separated by comma. All the files are combined to form a single file. This file is given as input to the RNN system. [Table 2] shows the tweets before and after preprocessing.

Table 1: Detailed description of Training and Testing data provided by the SAIL 2015 contest

Languages	Training Data			Test Data
	Positive	Negative	Neutral	
Tamil	387	316	400	560
Hindi	168	545	493	467
Bengali	277	354	368	500

Table 2: Tweets before and after preprocessing

S.No	Before Preprocessing	After Preprocessing
1	5,08784E+17 இந்தநிமிடத்தைமுறையாகப் யன்படுத்தும்துன்புதுஇன்றையநா ளைமுறையாகப்பயன்படுத்திக்கொ ள்கிறோம். இனியகாலைவணக்கம்... http://t.co/lg8X53FJMQ	Positive, இந்தநிமிடத்தைமுறையாகப் யன்படுத்தும்துன்புதுஇன்றையநா ளைமுறையாகப்பயன்படுத்தி க்கொள்கிறோம். இனியகாலைவணக்கம்... http://t.co/lg8X53FJMQ
2	508708022852796416 सच्चाईकोअपनाआसाननहीं...दुनियाभरसे झगड़ाकरनापड़ताहै	Negative, सच्चाईकोअपनाआसाननहीं...दुनियाभरसेझ गड़ाकरनापड़ताहै
3	508667343808258048 আমরা90 degree rocker thek।পেজটারমাধ্যমেবাংলারকসিনারিওতুলেধরার চেষ্টাকরেছিঁশুরুথেকেই।সাথেবাইরের...	Neutral, আমরা90 degree rocker thek।পেজটারমাধ্যমেবাংলারকসিনারিও তুলেধরারচেষ্টাকরেছিঁশুরুথেকেই।সাথেবাই রের...

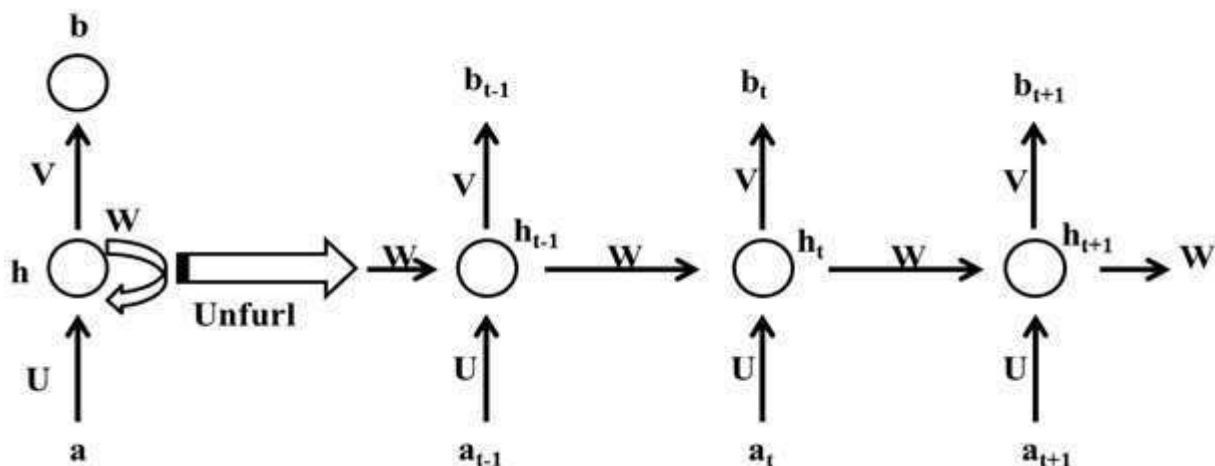
Recurrent Neural Network

Here in our work we used a simple recurrent neural network. The network consist of an input ' a ' and an output ' b ' with some hidden layer ' h '. In time ' t ' the inputs, output and the hidden layer to the network are represented as ' $a(t)$ ', ' $b(t)$ ', ' $h(t)$ ' respectively. Each input are in vector format. The input vector are formed by adding up the current word vector with the previous word vector. The input layer, hidden layer and the output layer are computed as follows,

$$a(t) = w(t) + h(t-1) \quad (1)$$

$$h_j(t) = f(\sum a_i(t)u_{ji}) \quad (2)$$

$$b_k(t) = g(\sum_j h_j^i(t)v_{kj}) \quad (3)$$



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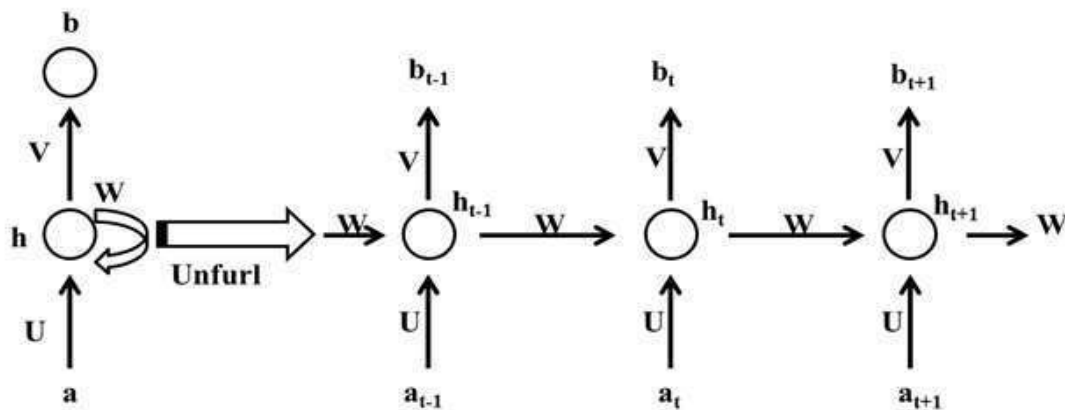


Fig. 2: Explanation of RNN network in an elaborated manner

EXPERIMENTAL ANALYSIS

The experiment is conducted on Windows-64 bit machine with 8GB RAM and i5 core processor. The SAIL (Sentiment Analysis in Indian Languages) 2015 contest is conducted as Shared task with MIKE (Mining Intelligence and Knowledge Exploration) which held at IIT Hyderabad. In the contest, twitter data of three different languages are given which is provided in the [Table 1]. The tweets are to be classified into positive, negative and neutral. The input data contains tweet id and the corresponding tweets. As preprocessing, the tweet ids are removed, the label and the corresponding tweets are given as input to the system. The preprocessed data is given as input to the RNN system. All the three languages are preprocessed and are given to the system. The system undergoes several iterations. The accuracy of the system is obtained using F-score measure. F-score can be calculated using precision and recall. Precision is the ratio of true positive to all predicted positive and recall is the ratio of true positive to all actual positive. The accuracy of the system which are obtained using RNN is given in the below [Table 3]. [Table 4] shows the accuracy of the system submitted to the SAIL contest with the state of art accuracy of SAIL 2015 contest with the accuracy obtained using RNN system. The system submitted to the SAIL contest is Naïve Bayes system. Extra feature are added along with the sentiwordnet for the system submitted to the SAIL. The accuracy of the system is dissipated in the second column of the [Table 4]. From the table it is clear that RNN system performs well when compare with the system submitted to SAIL contest (Naïve Bayes system) and also with the state of art accuracy of the SAIL system. The accuracy of the system is improved for all the three languages and it shows a better improvement for Tamil language. [Fig. 3] represents the bar chart obtained by plotting the accuracy of the system acquired using Naïve Bayes algorithm with the state of art accuracy of the SAIL contest versus the accuracy attained using Recurrent Neural Network. From the figure-2 it is clear that the RNN system outperforms well when compared with the Naïve Bayes algorithm and we obtained a state of art accuracy for the SAIL 2015 dataset.

Table 3: Accuracy and F-Score measure of the RNN system obtained for all the three languages

S.No	Language	F-Score Measure	Accuracy
1	Tamil	0.802	88.23
2	Hindi	0.714	72.01
3	Bengali	0.644	65.16

Table 4: Accuracy of the system obtained using Naïve Bayes which is submitted to the SAIL 2015 contest and the state of art accuracy of SAIL 2015 and the accuracy obtained using Recurrent Neural Network

Languages	Accuracy of SAIL 2015(Naïve Bayes System) (%)	State of art accuracy of SAIL 2015(%)	Accuracy obtained using RNN(%)
Tamil	39.28	39.28	88.23
Hindi	55.67	55.67	72.01
Bengali	33.6	43.2	65.16

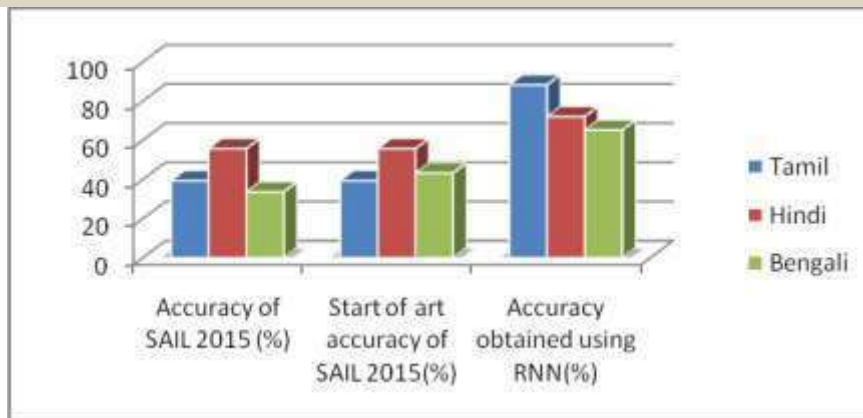


Fig. 3: Bar chart representation of accuracy obtained using SAIL 2015 system and the state of art accuracy of SAIL 2015 to the accuracy of the system obtained using RNN

CONCLUSION AND FUTURE WORK

The proposed system used to classify the tweets into positive, negative and neutral based on the content available. The system uses RNN for classifying the tweets. The accuracy of this system is higher than any other system which is submitted to the contest. An accuracy of 88.23%, 72.01% and 65.16% is obtained for Tamil, Hindi and Bengali languages respectively which is a state of art accuracy for the SAIL 2015 system. The accuracy can also be improved by using LSTM instead of RNN. The RNN has long term dependency problem but in LSTM the long term dependency problem can be overcome which leads to better accuracy. As future work, the data can be cleaned and Sentiwordnet can be added as extra feature which will lead to a better accuracy. The unsupervised data can also be added as future work.

FINANCIAL DISCLOSURE

No financial support was provided for the project

ACKNOWLEDGEMENT

I would like to express my gratitude to CEN family for their valuable support, advice and help. I avail this opportunity to express my sincere thanks to my friends, family members and staff members of my institution for their guidance, advice and encouragement at every step of this endeavor. I also express my thanks for SAIL2015 organizers.

CONFLICT OF INTERESTS

There is no conflict of interest

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ARTICLE

AN EVALUATION OF PETROPHYSICAL RESERVOIR ZONE PARAMETERS OF ASMARI FORMATION IN A HYDROCARBONIAL FIELD IN THE WEST SOUTH OF IRAN

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ABSTRACT

Petrophysics is the study of the properties of rocks and their relationship with such fluids as gases, liquid hydrocarbons and the water solution inside. This study intends to investigate the distribution of petrophysical parameters, such as determining the type of porosity, field formation lithology and mineral clay in a hydrocarbonial field of Iran in Asmari formation. The results suggest that there are two main zones of oil reservoir zone and five secondary zones. The first zone (zone 1), in the depth of 3573- 3581, mainly composes of sandstones with an average effective porosity of 25%, low water saturation and high permeability. And the second zone (zone 2), in the depth of 3627. 5 – 3643, mainly composes of sandstone with an average effective porosity of 28%, low water saturation and high permeability. It was also determined that the main clay minerals are mixed clay minerals and Ill it and a composition of clay minerals. The speed rate of primary waves comparing to secondary waves, which are of important parameters in distinguishing layers, is almost 1.8 times of secondary rate, with the most amount of 0. 35 for the Poisson ratio. In the end, elastic impedance has inconstant amounts.

INTRODUCTION

Petrophysics is the study of rock properties and their interactions with fluids (gases, liquid hydrocarbons and water solutions). The geological elements composing reservoir rock for gathering hydrocarbons must have a three- dimensional net of connected pores to save fluids first and then let them move through the reservoir. Hence, the most fundamental physical properties of reservoir rocks relating to saving and transferring the fluids in reservoirs are porosity and permeability. The thorough knowledge of these two properties for each hydrocarbonic reservoir, and also the knowledge of the properties of fluids, are really influencing for the effective development, planning and predicting the prospective function of oil field [1, 2]. Schematic analysis has been introduced to the oil industry for more than half a century and since then the advanced devices for schematic analysis have been invented and applied. The art of interpreting data also progressed as the science of well- logging moved forward. A schematic analysis program together with core analysis can provide the data needed for making the subsurface structural maps and determine the lithology and the production zone. It can also determine their exact depth and thickness and the distinction between oil and gas. Finally, it makes the reliable quantitative and qualitative interpretation of the properties of reservoir including porosity, permeability and fluid saturation possible. Unfortunately, these petrophysical properties can be measured directly, hence, they must be induced by measuring other parameters of reservoir rocks such as resistance, intensity, sound transit time, radioactive properties and the amount of hydrogen within the rock [3,4]. The aim of this study is to investigate the Petrophysical properties for appropriate diagnosis the economic aspects of this field in Asmari formation. To analyze data, Geolog and Hampson Russell software's were applied.

MATERIALS AND METHODS

Geology of the Area

Asmari formation

The name of the formation has been taken from Asmari Mountain in the east south of Masjedsoleiman, where the sample was taken from. In the past, it was also called Kalhor limestone, Khamir limestone, Jarib limestone and Forat limestone. The place of cutting the sample, in Goltorosh Valley, in the western domain of Asmari mountain, has been formed by 314 meters of resistant beige or brown cement limestone with abundant cracks and gaps in the eroding surfaces where is between the thin shaly layers. This segment is the age of Miocene formation and the subsections are changed into Pabdeh formation. The under and upper barriers have the same slope as Pabdeh and Gachsaran formation. Asmari limestone is the most important reservoir rock in the sediment basin in Iran and since oil has been discovered there for the first time in Middle East, it is world- known. A well, in an almost good oil field can give an average of about 25000 barrel a day. There is Asmari limestone throughout the Zagros area. The lower sections of Asmari formation has changed into Pabdeh facieses around Bandar Abbas (Abbas port) but it didn't exist in the eastern parts of Ghesh Island in Holoor well, while it exists the island center in Gorzin anticline. Asmari formation is divided into three sections of lower, middle and upper sections based on fossils and its age. The age of the lower Asmari is Oligocene and the age of the middle Asmari and the upper Asmari is the Miocene of the lower. Generally, the age of a formation is Oligocene to fore Miocene. Asmari formation includes Ahvaz and Kalhor [5, 6, 7].

KEY WORDS

Petrophysical
Evaluation, Porosity and
Permeability, Saturation,
Clay Mineral, Lithology

Published: 14 Nov 2016

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The characteristics of the study area

The above mentioned hydrocarbonical field is one of the southwest oil fields of Iran. This field covers an anticline with the length of 67 square kilometers and the width of 6 square kilometers. This field which spreads from west north to east south (parallel to Zagros Mountain) forms two separate anticlines (saddle-shaped) in Asmari horizon. Asmari formation, in the oil field of Ahvaz, in the south of Dezfool, includes the sandstone section of Ahvaz. Asmari reservoir, part of which is sandstone, forms the main reservoir which covers about three fourth of the reservoir of this field. Another stone reservoir of this field is Sarvak formation. The oil API degree in Asmari and Sarvak are 32.6 and 26 API degrees, respectively. Asmari brimstone weighs 1.5 percent and Sarvak brimstone weighs 3.5 percent. Hydrocarbon has also been found in Khami group, however, nothing has been done for description and revival of this horizon and the amount of its reservation is not determined [7, 8, 9].



Fig.1: The schema of the study oil field.

In this paper are discussed about the zones reservoir using logs and petrophysical properties and related charts. In continue showed the results.

RESULTS

To determine lithology, the type of clay mineral, total and effective porosity and the hydrocarbonical reservoir zone, Petrophysical logs were applied in this study. Petrophysical logs, specially density logs, neutron and sonic were applied to determine the lithology. Regarding the lithology column and the depicted logs, lithology mainly includes: in upper sections as deep as 3561 to 3565 meters mainly encompass Dolomite with a little Shale and Limestone, in depths of 3535 to 3568 mainly Calcarnite with a little Calcite and Shale, in depths of 3568 to 3571 mainly Calcite with a little Dolomite and clay minerals, in depths of 3571 to 3573.5 mainly Shale and clay minerals, in the depths of 3581 to 3573.5 mainly Sandstone and a little Calcite, the depths of 3581 to 3591 mainly Limestone, Marl Limestone and Dolomite Limestone, depths of 3591 to 3593.5 Shale and clay minerals, the depths of 3593.5 to 3608 mainly Limestone and Marl Limestone, the depths of 3608 to 3620 mainly Sandstone with a little Calcite, the depths of 3620 to 3624 mainly Shale and clay minerals, the depths of 3624 to 3627.5 mainly Limestone and Dolomite lime, the depths of 3627.5 to 3643 mainly Sandstone with little Calcite and the depths of 3643 to 3644 mainly Shale and clay minerals.

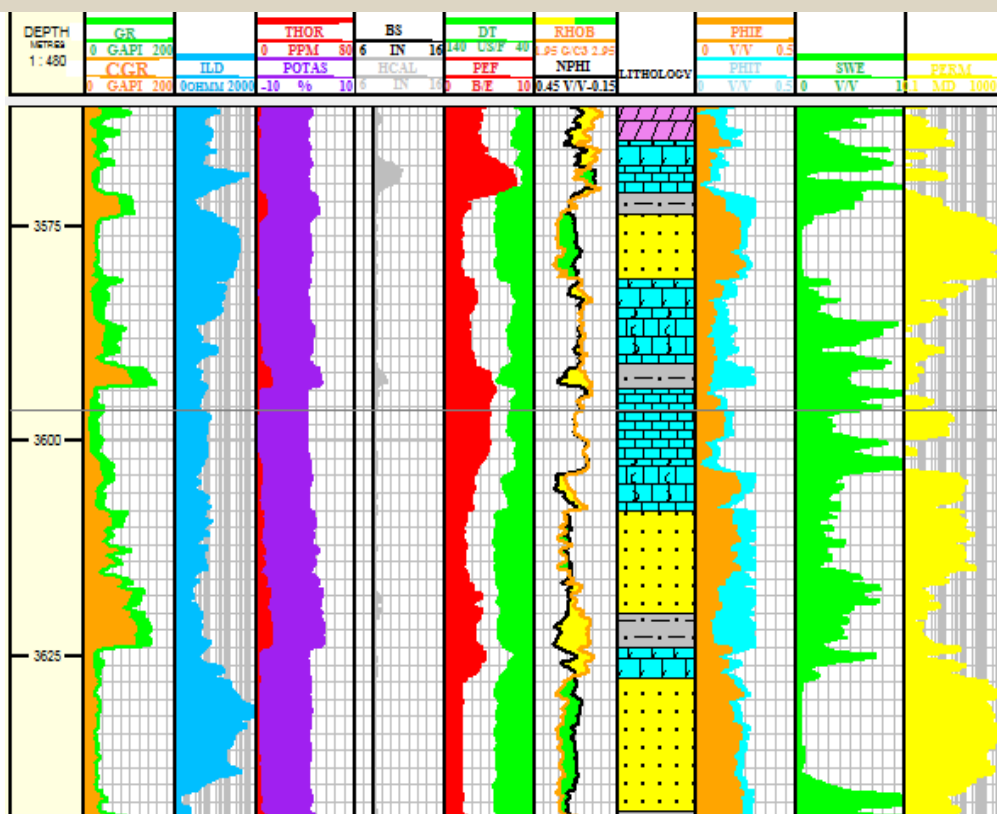


Fig. 2: Diagrams for lithology and permeability diagnosis.

In [Fig. 3] 'A', intensity-sonic crossplot, and in [Fig. 2] 'B' neutron- intensity crossplot has been depicted for lithology diagnosis.

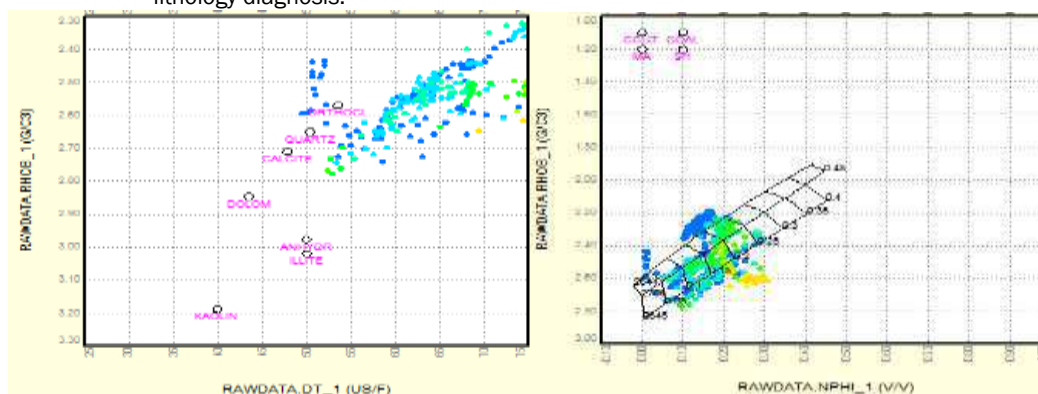


Fig. 3: Well-logging crossplots: A) drawing neutron- intensity crossplot (the right figure), B) sonic- intensity crossplot (the left figure), to determine lithology [10,11,12,13,14].

In continue, total porosity logs and effective porosity are drawn in [Fig. 2]. The most porosity was observed in sandstone layer in the depth of 3571.5 to 3581 with a total porosity of 35% and effective porosity of 30% and in the depth of 3608 to 3616 with a total porosity of 35% and effective porosity of 15% and the depth of 3627.5 to 3643 with a total porosity of 34% and effective porosity of 28%, as the main zones and the depth of 3561 to 3570 with a total porosity of 25% and effective porosity of 15% and the depth of 3581 to 3591 with a total porosity of 30% and effective porosity of 15% and the depth of 3593 to 3608 with a total porosity of 28% and effective porosity of 13% and the depth of 3624 to 3627.5 with a total porosity of 30% and effective porosity of 14%. The frequency chart for effective frequency and frequency porosity based on depth are depicted in [Fig. 3].

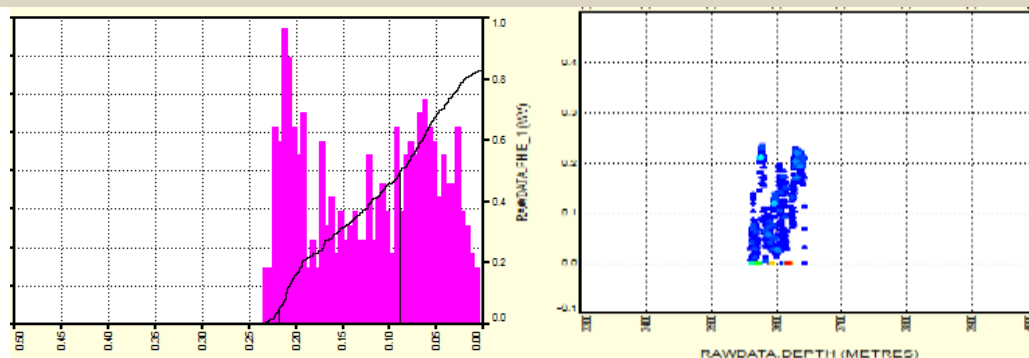


Fig. 4: Changes A) effective porosity based on depth (the left figure) B) effective porosity frequency chart (the right figure).

Realizing the effective porosity and the lithology of different zones, it can be claimed that Sandstone zones are the main hydrocarbonal zones. The two Sandstone zones in the depth of 3571.5 to 3581 and 3527.5 to 3643, the resistivity chart also shows a high amount, and also have a high amount of effective porosity 30% and 28%, respectively in the above mentioned zones and low water saturation and high permeability can specially be introduced as the oil zone. Among the secondary and rather important zones are the Limestone zone and the Dolomite Limestone zone in the depth of 3624 to 3627.5 with an effective porosity of 15% and the Limestone and Marl Limestone zone in the depth of 3602 to 3607 with an effective porosity of 14% and Sandstone zone in the depth of 3607 to 3616 with an effective porosity of 13%. Considering the diameter logs and the bit size, the depth of 3567 to 3581 shows the slide of the formation. In continue, using the amount of thorium (brown log) and potassium (green log), the type of clay mineral has been investigated. Looking at the amounts of logs and the clay mineral chart, there is more Illite and a composition of clay layers in reservoir zone. In [Fig. 5], the charts for the changes in the amounts of potassium and thorium based on the depth, and in [Fig. 6] the chart for the diagnosis of clay mineral, based on which, and considering the amount of potassium and thorium on logs, the type of the clay mineral has been determined, are shown [16,17,18].

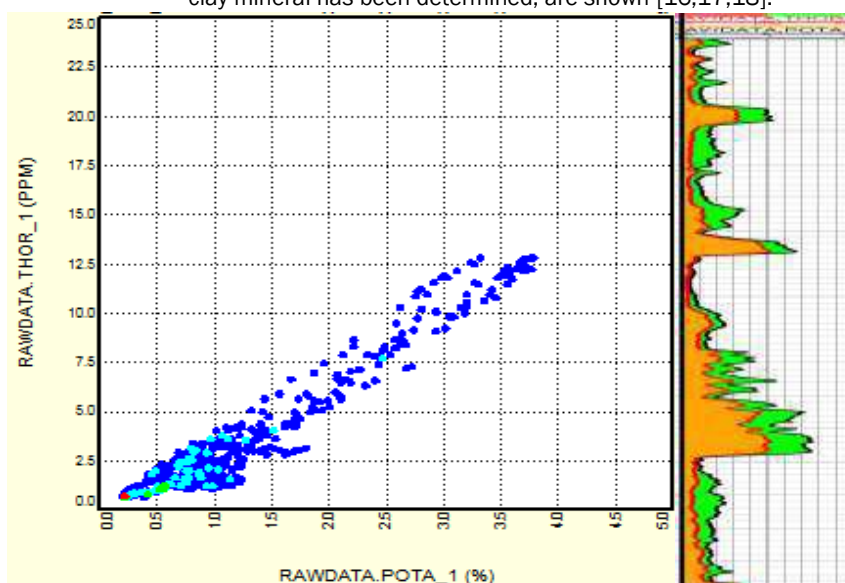


Fig. 5: A) dispersal chart for thorium versus potassium (the left figure), B) thorium and potassium logs (the right figure).

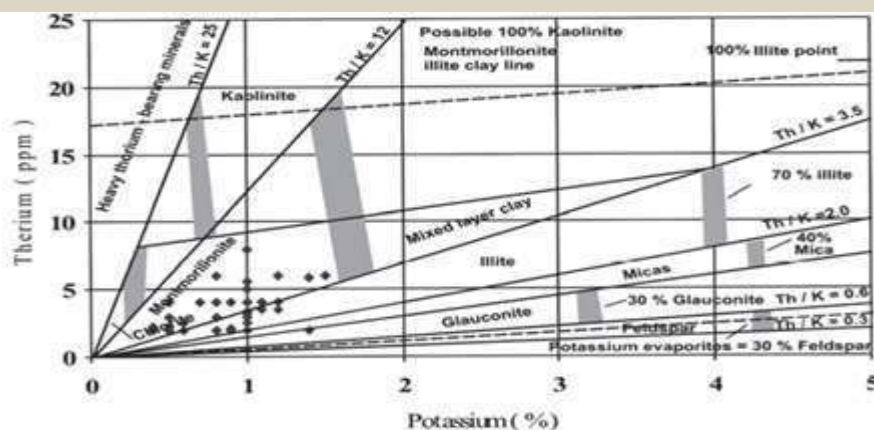


Fig. 6: Clay mineral diagnosis chart [14,19].

[Fig. 7], which is GR chart versus ILD, displays some parts which can be indicative of the intended reservoir. The parts with low GR and high ILD resistance can display the characteristics of a good reservoir [14, 15, 21].

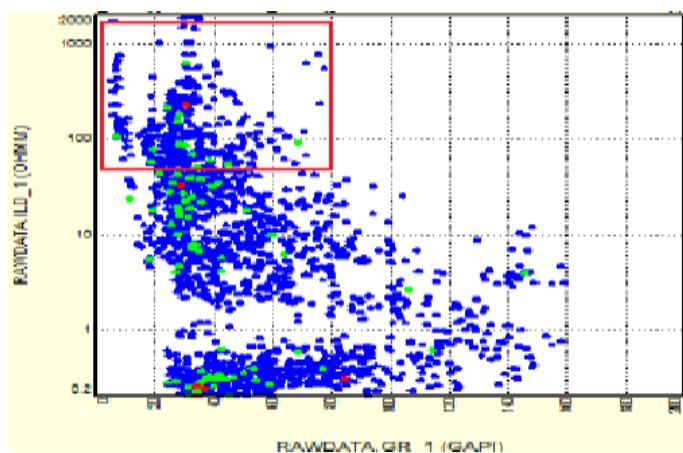


Fig. 7: GR chart versus ILD.

In the continue, the speed logs for the primary waves applying the reverse Grander equation, and the speed of the secondary waves using Castagna equation, the log for the ratio of the speed of primary waves (V_p) to the speed of the speed of the secondary waves (V_s) are calculated using the following relations [9,20]. The resulted logs are displayed in [Fig. 8].

The relation between the speed of primary waves applying the reverse Grander equation: $P\text{-wave} = C_1 \cdot \text{Density}^4$, which $C_1 = 0.23$.

The relation between the speed of primary waves applying the Castagna equation:

$$S\text{-wave} = C_1 \cdot P\text{-wave} + C_2 \quad C_1 = 0.86, \quad C_2 = -3845.14$$

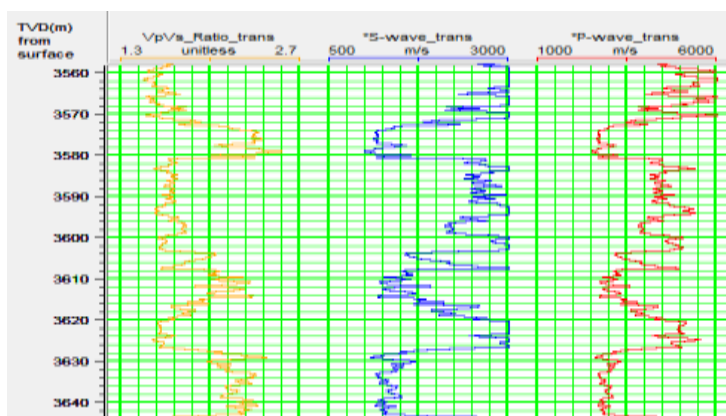


Fig. 8: The primary and secondary waves speed log draw and their ratio.

In the following, applying natural gamma log, Poisson coefficient log is drawn in which the following relation has been used [3,21,22]:

Poisson log= [(gamma ray-sand baseline)/ (shale baseline- sand baseline)]* (Poisson shale value- Poisson sand value) + Poisson sand value

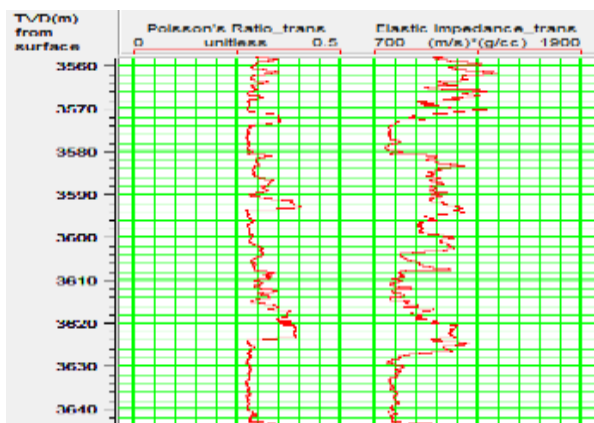


Fig. 9: Poisson Coefficient Log Draw and Elastic Impedance.

CONCLUSION

Applying the sonic, neutron and natural gamma logs and its corrected logs, and also considering the sonic- intensity and intensity – neutron well logging crossplots, the hydrocarbonical reservoir of the well was investigated. The studied hydrocarbonical field in Asmari formation was divided into two main reservoir zones and 5 secondary zones. Zone (1) in the depth of 3571.5 to 3581 was mainly Sandstone with an average effective porosity of 30%, the other zone in the depth of 3627.5 to 3643 was mainly Sandstone with an average effective porosity of 28%. Limestone and Dolomite lime zones in the depth of 3624 to 3627.5 with the effective porosity of 15% and Limestone and Marl Limestone with the effective porosity of 3602 to 3607 with the effective porosity of 14%, and the Sandstone zone in the depth of 3607 to 3616 with the effective porosity of 13% can be mentioned as some important secondary zones. In the next stage, applying potassium and thorium logs and investigating the related crossplots the type of the clay minerals, which was mainly a composition of clay minerals and Illite and an amount of a composition of clay minerals was determined. Next, the speed of the primary waves using the reverse Grander equation, and the speed of the secondary waves using Castanga equation and their ratio which were among the important parameters for distinguishing layers were calculated. The primary speed was almost 1.8 times of the secondary speed and Poison ratio gives different amounts for each layer with the most amount of 0.35. Finally, the elastic impedance was drawn to determine the reflex coefficient of the layers which gave different amounts.

CONFLICT OF INTEREST

The author declares having no competing interests.

ACKNOWLEDGEMENTS

Paper Authors appreciate from *Islamic Azad University Lamerd Branch* for corporate.

FINANCIAL DISCLOSURE

None.

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ARTICLE

PEST IMAGE SEGMENTATION USING SWARM INTELLIGENCE IN AGRICULTURAL ECOSYSTEM

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ABSTRACT

Precision Agriculture is concerned with all sorts of within-field variability, spatially and temporally, that reduces the efficacy of agronomic practices applied in a uniform way all over the field. Because of these sources of heterogeneity, uniform management actions strongly reduce the efficiency of the resource input to the crop or for the agrochemicals used for pest control (i.e. pesticide). In order to increase the Production rate of vegetation crop, the presence of whitefly pests which cause leaf discoloration is the major problem. In standard PSO the non-oscillatory route can quickly cause a particle to stagnate and also it may prematurely converge on suboptimal solutions that are not even guaranteed to local optimal solution. In this paper a modification strategy is proposed for the particle swarm optimization (PSO) algorithm and ACO algorithm applied in processing pest images. In order to implement clustering under the condition that the number of clusters is not known a priori, we propose in this paper PCPSO a novel pest image clustering algorithm based on particle swarm optimization. PCPSO can partition image into compact and well separated clusters without any knowledge on the real number of clusters. PCPSO used a novel representation scheme for the search variables in order to determine the optimal number of clusters. The partition of each particle of the swarm evolves using evolving operators which aim to reduce dynamically the number of cluster centers. The performance are analyzed using nonlinear objective assessment or the quantitative measures like structural content, peak signal to noise ratio, normalized correlation coefficient, average difference and normalized absolute error. Experimental results demonstrate the effectiveness of the PCPSO approach in processing pest images.

INTRODUCTION

India is the “Land of agriculture” which has many traditional and even a large variety of cultures. Approximately 75% of the Indian population is connected with agriculture. New modern agricultural technique is established in order to the quantity and quality of the yield. But the production is reduced nowadays due to reduction in landscape and also increasing of different kinds of pest, there is no possible way to increase the landscape but there is a possibility to reduce the effects of pest. In most of the cases, pests or diseases are seen on the leaves or stems of the plants like tomato plant, cotton, sugarcane and crop yielding are also reduced due to mealy bug. The identification of plants leaves with pests or diseases, symptoms of the pest or disease attack, plays a key role in successful cultivation of crops. Hence to conduct high throughput experiments, plant biologist need efficient computer software to automatically extract and analyze significant content [1] respectively, the applications of color transformation and Neural Networks (NNs) have been formulated for classification of diseases that affect on plant leaves. [2] Bodhe, T.S work suggests Entropy based thresholding in which the maximum information content is used to decide the segmentation rule dependent upon a color space selection. His suggested segmentation algorithm is applied for images of pest infected leaves and their results are compared with the results of Fuzzy c-mean method. The application of different image segmentation and clustering algorithm addresses to solve the problem of checking the consistency of different algorithms based on some small number of images or images from one particular field [3] and [4] consider generic segmentation of the medical images which is carried out for different types of medical images and compared using quality measures.

[5] illustrate the consistency based on the study of multimodal biometric system, the feature of face and palm print are extracted separately using Gabor wavelet [6] demonstrates the K- means clustering method is a useful technique, which can sustain exact detection and recognition of Plant pests in their various shapes, sizes, positions, and orientations. The detection and recognition of crop pests by many farmers in major parts of the world according to [7] is observation based on the naked eye. This method requires continuous monitoring of the crop stems and leaves, which are expensive, labor intensive, inaccurate for large farms. [8] Listed various methods to increasing throughput & reducing the labour arising from human experts in detecting the plant diseases. His research work reveals that different methods are used by different researchers for plant disease detection and analysis. The various techniques demonstrated Self organizing maps & back propagation neural networks with genetic algorithms for optimization & support vector machines for diseases classification. [9] Identified the rate of browning within Braeburn apples and created an image recognition system to detect pest damage with the use of a wavelet based image processing technique and a neural network. [10] measured the pest detection and positioning depends on binocular stereo to get the location information of pest, which is used for guiding the robot to spray the pesticides automatically, if there are changes in the orientation or position of the pests on the leaf, the robot is likely to

KEY WORDS

Pest segmentation, PSO, ACO, Optimal Parameters

Received: 12 October 2016
Accepted: 28 October 2016
Published: 15 November 2016

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miss the target and spray on areas not affected by the pest. [11] Starts with an estimate of the local distribution, which efficiently avoids pre-assuming the cluster number. Then the seed clusters that come from a similar distribution are merged by this clustering program was applied to both artificial and benchmark data classification and its performance is proven better than the well-known k-means algorithm. [12] Demonstrated a cognitive vision approach to early pest detection in greenhouse crops, his work concentrated on low infestation cases, which is crucial to agronomic decision making, particularly on white flies. It was very good work for early detection of white fly but did not extend to more complex cases and on all forms or species of the pest, especially when the pest changes position or orientation.

This paper is organized as follows. In Section II, for the integrity of this paper, we simply describe the materials and methods for pest segmentation. Here Image segmentation based ACO algorithm and PSO algorithm is presented. In Section III, we evaluate the non linear objective measures for the proposed techniques using pest images and compare the leading technique from the literature. Section IV presents the experimental results of the proposed system and finally concludes this paper.

MATERIALS AND METHODS

Tiny pests such as aphids, whiteflies, and spider mites are more likely to infest greenhouse crops than beetles or caterpillars. Therefore, it is of great both theoretical and practical significance to develop the automatic identification and diagnose system of Whiteflies insect about 1.5 mm long; found in conjunction with tiny yellow crawlers or green, oval often present on leaves. It snacks on foliage, coating the leaves with a sticky white residue that shrivels them and attracts black mold to the fruit. Using the whiteflies as the research subject, image of insect pest of whiteflies based on ACO algorithm with PCPSO was proposed and also analyzing the performance based on non linear Objective assessments [Fig.1].

ACO model for pest image segmentation

For image segmentation into multiple regions purposes each ant is assigned to a different colony. Ants from different colonies can crossover with the same probability as with ants from the same colony. New ant colony is chosen from the surrounding ants and parent ant colonies by a roulette-wheel method. The ants communicate using a chemical substance called pheromone. As an ant travels, it deposits a constant amount of pheromone that other ants can follow. When looking for food, ants tend to follow trails of pheromones whose concentration is higher [13]. In this section image segmentation methods are applied to pest image and the various parameter values are calculated. Ant Colony Optimization techniques are simulated for pest image segmentation. Application of ACO for image segmentation depends on acceptable parameter values. Initial parameters of ACO are chosen according to [14] [15]: $\alpha = 0.025$; $\beta = 3.5$; $\delta = 0.2$; $\eta = 0.07$; $\rho = 1.5$; $K = 0.01$; $\mu = 0.1$ and Population size S is 30 % of the total image size. Simulation is performed in MATLAB environment. For estimation of ACO model parameters, ant's behaviour is simulated on synthesis pest image which consists of 35 pests, 15 separate pests, 8 pests joined horizontally, 7 pests joined vertically, and 5 pests joined together. A total of 2000 iterations are performed. [Fig. 3] shows the segmented output of Pest segmentation. During each experiment different ACO parameters are tried in order to improve the further segmentation. The input image is taken as whitefly pest image and it's processed based on ACO acceptable parameters and various population sizes.

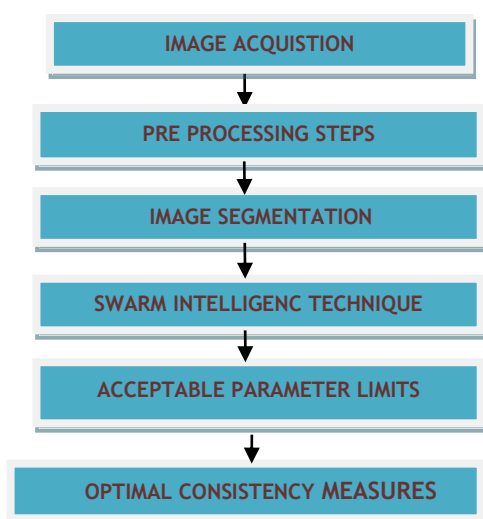


Fig. 1: Overview of pest segmentation

PSO algorithm

Particle swarm optimization (PSO) is a population-based evolutionary computation method first proposed by Kennedy and Eberhart [18]. It originated from the computer simulation of the individuals in a bird flock or fish school, which basically show a natural behaviour when they search for some target (e.g., food). The PSO algorithm is initialized with a swarm of n particles randomly distributed over the search area with a random velocity and a random position. Each particle encodes a potential solution to the optimization problem. Particle flies through the search space and aims to converge to the global optimum of a function attached to the problem. Each particle x_i in the swarm is represented by the following characteristics: the current position of the particle (p_i) and the current velocity (v_i). Its movement through the search space is influenced dynamically according to its personal best position P_{best} , which is the best solution that it has so far achieved and its neighbours' best position P_g . At each iteration t , the particle's new position and its velocity are updated as follows:

$$p_i(t) = p_i(t-1) + v_i(t)$$

$$v_i(t) = wv_i(t-1) + c_1 \times rand_1(P_{best} - p_i(t-1)) + c_2 \times rand_2(P_g - p_i(t-1))$$

The parameter w is an inertia weight and it is equivalent to a temperature schedule in the simulated annealing algorithm and controls the influence of the previous velocity: a large value of w favours exploration, while a small value of w favours exploitation [19]. As originally introduced, w decreases linearly during the run from w_{min} to w_{max} . C_1 and C_2 are two constants which control the influence of the social and cognitive components such that $C_1 + C_2 = 4$. $rand_1$ and $rand_2$ are random values in the range $[0, 1]$. Two topologies of neighbourhoods exist in the literature: the g_{best} model and the l_{best} model. The g_{best} model maintains only a single best solution, called the global best particle, across all the particles in the swarm. This particle acts as an attractor, pulling all the particles towards it.

The g_{best} offers a faster rate of convergence at the expense of robustness. The l_{best} model tries to prevent premature convergence by maintaining multiple attractors. In fact, g_{best} model is actually a special case of the l_{best} model. Experiments have shown that l_{best} algorithm converges somewhat more slowly than the g_{best} version, but it is less likely to become trapped in an inferior local minimum.

PCPSO algorithm

In this section, Pest clustering based on a new version of particle swarm optimization algorithm called PCPSO is discussed. Let $Z = \{Z_1, Z_2, \dots, Z_n\}$ be the image with n number of pixels. The PCPSO maintains a swarm of particles, where each particle represents a potential solution to the clustering problem. Each particle encodes an entire partition of the image Z . PCPSO tries to find an optimal partition $C = \{C_1, C_2, \dots, C_n\}$ of K optimal number of compactness and well separated clusters. In PCPSO, both the numbers of clusters as well as the appropriate clustering of the data are evolved simultaneously using the search capability of particle swarm optimization algorithm. The initial population $P = \{X_1, X_2, X_3, \dots, X_{pop\_size}\}$ is made up of pop_size possible particle. user-defined maximum cluster number K_{max} , a single particle x_i is a vector of K_{max} binary numbers 0 and 1 (flags) and K_{max} real numbers that represents the K_{max} cluster centres. If due to the update of the position of a particle some flags in a particle exceed 1, it is fixed to 1 or zero, respectively. However, if it is found that no flag could be set to one in a particle (all cluster centres are invalid and so no selected), two random flags are selected and we re-initialize them to 1. Thus the minimum number of possible clusters is always 2. To generate the initial population of particles, we use in this paper the random generation strategy until all particles in a population are created. For a particular particle x_i , K_i cluster centres are randomly selected points from the given data set and K_i flags are randomly generated. Note that if the number of valid centres contained in a particle is less than two, then its flags are reinitialized.

CONSISTENCY MEASURES

The performance of image segmentation approaches are analyzed and discussed.

- 1) Structural Content
- 2) Peak Signal to Noise Ratio
- 3) Normalized Correlation Coefficient
- 4) Normalized absolute error
- 5) Average Differences are considered.

Structural Content (SC)

The Structural content is given by Eq. (1) and if it is spread at 1, then the image is of better quality and large value of SC means that the image is of poor quality

$$SC = \frac{\sum_{i=1}^N \sum_{j=1}^N |I(i,j) - \bar{I}|}{\sum_{i=1}^N \sum_{j=1}^N I(i,j)} \quad (1)$$

Peak Signal to Noise Ratio (PSNR)

Large PSNR indicate a smaller difference between the original (without noise) and reconstructed image. An important property of PSNR is that a slight spatial shift of an image can cause a large numerical distortion but no visual distortion and conversely a small distortion can result in a damaging visual artifact, if all the error is concentrated in a small important region. This metric neglects global and composite errors PSNR is calculated using equation

$$PSNR = 10 \cdot \log_{10} \left[\frac{\max(x(i,j))^2}{\frac{1}{n_i \times n_j} \left[\sum_{i=0}^{n_i-1} \sum_{j=0}^{n_j-1} (x(i,j) - y(i,j))^2 \right]} \right] \quad (2)$$

Normalized Correlation Coefficient (NK)

It measures the similarity between two images like an original color space in the image other one converted color space image. All the correlation based measures tend to 1, as the difference between two images tend to zero and Normalized Correlation is calculated using equation (3).

$$NK = \frac{\sum_{i=1}^M \sum_{j=1}^N [x(i,j) \times y(i,j)]}{\sum_{i=1}^M \sum_{j=1}^N x(i,j)^2} \quad (3)$$

Normalized Absolute Error (NAE)

Normalized absolute error computed by equation (4) is a measure of how far is the conversion image from the original image with the value of zero being the perfect fit. Large value of NAE indicates poor quality of the image.

$$NAE = \frac{\sum_{i=1}^M \sum_{j=1}^N |x(i,j) - y(i,j)|}{\sum_{i=1}^M \sum_{j=1}^N |x(i,j)|} \quad (4)$$

Average Difference (AD)

A lower value of Average Difference (AD) gives a “cleaner” image as more noise is reduced and it is computed using equation

$$AD = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N [x(i,j) - y(i,j)] \quad (5)$$

RESULTS

In order to evaluate the ability of our algorithm PCPSO to find the optimal clusters, we have tested natural images with varying range of complexity [17]. The performances of PCPSO algorithms were determined by both referring to original papers and performing empirical studies. It reports an optimal set-up of the parameters that gives the best results. Population size = 50, Max. Inertia = 0.9, Min. Inertia = 0.4, Kmax= 20, Kmin=2. The clustering algorithms used in the experimental tests have been run several times for each test image. The experimental results obtained over the gray scale images in terms of the mean and standard deviations of the number of clusters found and the results have been stated over 40 independent runs in each case. The value of optimal cluster is 7 and mean and standard deviations of the number of clusters found is 5.70 +0.106. The proposed algorithm PCPSO outperforms the state of-the-art for the pest images than ACO [Table 1].

Table1: Performance comparison of swarm intelligence

Methods	Performance Measures				
	PSNR (dB)	SC	NK	NAE	AD
ACO	39.23	1.015	0.99	0.021	0.129
PCPSO	42.47	0.981	0.988	0.016	0.114

Structural content is 1.015 for ACO, 0.981 for PCPSO. The structural content with value spread at 1 indicates a better quality image and it is very close to 1 for output. Normalized correlation gives closeness between the input and segmented image and is obtained as 0.988 for PCPSO and 0.99 for ACO algorithm respectively. This value tends to 1 if the difference between the images is zero and from the computed values, it is observed that for the ACO segmented images obtained highly correlated to the original images. NAE which is a measure to study the quality of the images is 0.016, 0.021 for PCPSO and ACO respectively. The Average difference with low value indicates good quality image and that is observed with the value of 0.114 for PCPSO and for ACO, it is the maximum with 0.129 indicating the poor quality of the segmented images. Segmented image of PCPSO reached the value of PSNR is 42.47dB and for ACO segmented image is 39.23dB. Practically it is in the range of 25 to 40dB hence ACO shows lowest value than PCPSO. Of all the objective quality measures, PSNR which is the most commonly used quality measure which reflects the quality of segmented images approximately. Comparatively the PCPSO provides better performance in image segmentation when compared to ACO algorithm.

CONCLUSION AND FUTURE WORK

This paper compares the performance of image segmentation methods such as ACO and PCPSO algorithm are discussed. The performance of proposed PCPSO algorithms is measured using segmentation parameters PSNR, SC, NK, NAE and AD. PCPSO used a novel representation scheme for the search variables in order to determine the optimal number of clusters. The partition of each particle of the swarm which aims to reduce dynamically the number of clusters centers. Therefore from the computational results conclude that the PCPSO performs better than ACO algorithm in terms of performance measures and better convergence rate. In future work, the performance measures will be analyzed based on simulated annealing and comparison will be extended to wide range of applications

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

COMPARISON OF MARITAL SATISFACTION IN WORKING AND NON-WORKING PREGNANT WOMEN

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ABSTRACT

Introduction: Pregnancy and breast feeding are factors lead to special situations for female in work place and marital satisfaction is an index of psychological health that is affected by working. In other words, mood changes and pregnant women requirements at home and work place can cause some problems for them. This study aimed to assess marital satisfaction of working and non-working pregnant women. **Materials and methods:** This is a descriptive, cross-sectional study. 239 pregnant women referred to the gynecology clinic of Jahrom, Iran between March and May 2015 were assessed. Enrich Marital Satisfaction Scale was used in order to assess Marital Satisfaction in four different domains of conflict resolution, communication, idealistic distortion and satisfaction. Finally, the data analyzed by descriptive statistics and Student's T test to evaluate groups by the SPSS statistical software [v. 21]. **Results:** Mean age of pregnant women was 28.47 ± 4.95 in age range of 18-45 years old. Total marital satisfaction in working pregnant women was 44.60 ± 10.51 and in non-working was 48.25 ± 9.47 and difference between two groups was statistically significant [$P=0.03$]. **Conclusion:** The results of this study showed that marital satisfaction is different in pregnant working women and the housekeepers. It seems that the decline in marital satisfaction of pregnant working women is due to work stress and mood changes caused by hormonal variation in pregnancy. Thus, counseling programs, would be effective steps to improve the satisfaction

INTRODUCTION

Is one of the effective factors in satisfaction with marital life, Women's working out of the house [1]. Marital satisfaction can be affected directly by the professional conditions [2]. Of course, this is varied in different societies and is affected by individual as well as social factors. Overall, various factors, such as income, children, illness, and employment, affect the couple's relationship and lead to their satisfaction or dissatisfaction [3]. Today, with progress in science and technology, women are present in the society more than before. Yet, they still have their responsibilities at home and both the family and the society expect them to perform as a responsible housewife, as well. On the other hand, just being a housewife and doing the household chores can seriously damage the family as well as the woman's personality [4]. Nowadays, expansion of the women's working fields, continuation of academic education, dependence on two incomes for supplying the family's demands and competitiveness of the workplace have caused a large number of women to work even during pregnancy [5].

Pregnancy is one of the most sensitive periods of women's life. The physiological and anatomical changes, changes in the individuals' mental image of their body, and feeling of reduction of attractiveness for the husband during pregnancy affect the couple's sexual relationship, marital satisfaction, and relationship which lead to their anxiety and lack of self-confidence and eventually disturbs the family's mental health [6]. Also, it has been shown that pregnancy can result in a lot of changes in the couple's emotional and sexual relationships [7]. Nowadays, the number of employed women is increasing around the world and women comprise 50% of the workforce in some developed countries [4]. In the U.S., 60.7% of the women between 15 and 44 years old work for more than 6 months during their pregnancy period [46% as full time workers and 14.6% as part time workers] [8]. No accurate statistics are available on the employed women in Iran; however, their cooperation rate was reported as 10.4% in 2002 and they comprised 13.9% of the society's workforce [9].

In general, the women's special biological and anatomical status increases their sensitivity toward the occupational factors in comparison to men. Therefore, making decisions about the pregnant and lactating women's working conditions is of great importance. In fact, their working condition is relatively different from men and, consequently, considering the pregnant women's safety and health in the workplace is highly important [4].

In addition to performing their role as wives, women also have to perform their social roles even during pregnancy. Nevertheless, their mood changes and needs during pregnancy may cause problems in their workplace [10]. Moreover, mood changes may be intensified by women's working and affect the couples' relationship and marital satisfaction [11]. Psychological and developmental changes during pregnancy are

KEY WORDS

marital satisfaction,
working women,
pregnancy

Received: 30 August 2016
Accepted: 15 October 2016
Published: 15 November 2017

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varied depending on the stage of pregnancy. The first trimester of pregnancy is accompanied with uncertainty and doubt, ambivalence feeling and primary focus on own self. In the second trimester, the fetus, is the center of her attention, narcissism and changes in sexual relations occur and in the third trimester with vulnerability, increasing dependence on partner, imitation of her role playing and daydreaming [12]. During pregnancy due to women physiological and psychological changes, couples relationship would be changed that not only affects the mother and child health but also affects sexual satisfaction [13]. 68% of women have some problems in the marital relationship during pregnancy. [14]. Physical problems, depression, fear, emotional instability and impaired sexual relations that occur during pregnancy affect the marital satisfaction [15]. Following pregnancy, changes in perception of self, beliefs and values, priorities, behavioral pattern, communication, problem solving skills and coping would be occurred [16]. Focusing on own self and the baby by the pregnant woman, reduce her attention to her husband and other children and sometimes offends them [17]. Due to changes of sexual desire, fear of abortion and fetal injury, sexual activity during this period decreased [18] and with changes in appearance and feeling of heaviness in pregnant women, social and entertainment activities and relationship with friends and acquaintances became minimized [19]. Besides, increasing the economic needs of the family and pregnant women, also preparing facilities for arrival of a new member of family can impose financial problems for the family [20]. Furthermore, physical and mental changes in pregnant women can lead to avoid performing the housekeeping duties and routine tasks and can result in undesirable behaviors [19]. Thus, all aspects of marital satisfaction is affected by pregnancy. However, studies have shown that professional status of women plays an important role in marital satisfaction: low income, job insecurity and job tension are associated with low marital satisfaction. [1].

Razavieh et al. found that workplace related factors influence marital satisfaction and there are closely relationship between occupational stress and marital conflicts. In other words, increasing marital disputes significantly reduces job satisfaction. So, increased marital satisfaction significantly associated with increased job satisfaction. [21]. Rohani study showed that increased job strain caused marital dissatisfaction. [22]. In fact, job stress threatens marital satisfaction and survival of marital relationship, as in the fourth conference of "work and stress" it is warned that not far that our staffs have no family and there is that unsafe working conditions caused family members and family relationships influenced by negative job process [23].

Studies conducted to evaluate couple awareness of changes during pregnancy and its effect on the marital relationship is indicative of limited and incomplete information about this subject, which often reduce marital satisfaction [24, 25, 26]. Khojasteh Mehret et al. [2006] suggest that women employment decreased marital satisfaction and increased psychosis in their husbands [27]. Sedgh Amiz studied marital compatibility related factors in 577 patients in Shiraz. In this study, there was a significant relationship between the age of the couples, marriage age, number of children, age difference between couples, male and female educational status, male occupational status, female employment, remarriage, how couples become familiar with each other, consanguinity or being relatives and the marital compatibility [28]. In general, a large number of factors can be effective in marital satisfaction and various researchers have expressed different factors according to their specific attitude and their research findings [29]. As mentioned before, mood changes during pregnancy can affect marital satisfaction as well as the couples' intimacy. Moreover, when occupation, as a major source of mental pressure, is added to these changes, it affects marital satisfaction of pregnant women [30].

Given that women make almost half of our country population, their activities and efforts, whether at home or at work place, result in multiple roles for them, although, mental health and growth and development of society depends on the family health and specially family mental health, so it was decided to design a study to compare the marital satisfaction of pregnant working and non-working women.

One of the dilemmas during pregnancy is that whether working in this period worth or not? And what effects have on their families, and marital satisfaction. Thus, in this study, according to the importance of marital satisfaction instability of the family, increasing unemployed educated women in Iranian society, marital satisfaction is assessed in married employed pregnant women and married housewife pregnant women in Jahrom. With a view to the above aim, the following question was raised in this research: Is marital satisfaction (in the ENRICH Questionnaire) differ in the scope of 1) distorted ideals, 2) conflict resolution, 3) Communications and 4) marital satisfaction between employed and unemployed pregnant women?

MATERIALS AND METHODS

The present analytical, Descriptive, cross-sectional study was conducted on 239 pregnant women who had referred to the gynecology clinic of Jahrom, Iran for receiving the routine pregnancy cares between March and May 2015. The subjects were selected through simple random sampling.

Convenience sampling method used to select the samples. This means that researcher selected the subjects from the patients referred to the center. In order to select the subjects, coordination was made with the experts and the officials of the organization, so they referred the women to counseling center for fulfilling the Enrich marital satisfaction questionnaire. Inclusion criteria was 15-45 years old pregnant women referred to the women clinic. The women with psychological disorders, diagnosed depression, experience of divorce and

husband's death, history of hypertension, diabetes, and underlying clinical diseases, and history of infertility during their reproductive period were excluded from the study. The study was approved by the Ethics Committee of Jahrom University of Medical Sciences. After explaining about the study, the study questionnaire was given to the women who were interested in taking part in the study.

The study data were collected using a questionnaire including the demographic characteristics such as (occupation, age, level of education, place of living, marital age, duration of marriage, and age difference between the couples, Husband's job) and Enrich marital satisfaction questionnaire. The reliability and validity of Enrich questionnaire have been evaluated by both Iranian and foreign researchers. For instance, Olson et al. reported the Cronbach's alpha of 0.92 for the questionnaire. Enrich questionnaire was used as a data gathering tool in this study. The validity of the questionnaire determined by content validity and reliability was assessed by test-retest reliability (TEST-RETEST). The questionnaire was fulfilled by 24 pregnant eligible women, then ten days later questionnaires were refilled by them. After data analysis, spearman or relation coefficient obtained 95%. The results of this pilot study showed this data collection tool is a suitable one to evaluate marital satisfaction. After the pilot study, the main study implemented.

This questionnaire consists of four 35-section subscales (idealistic distortion, marital satisfaction, communication, and conflict resolution) for an overall measurement of marital relationship. The range scores of the questionnaire for three scopes of marital satisfaction, conflict resolution and a communication skill was 10 to 50 and for ideal distortion was 5 to 25. The average scores for scopes of marital satisfaction, communication skills, conflict resolution and ideal distortion were 2, 32, 6, 31, 2, 30, 8, 14 orderly. The powerful relationship of couples is calculated by summing the scales. This scale is executed on the 21501 couples in the United States and have been standardized and then the validity approved. Validity of the test is a structural validity (agreement validity) for marital satisfaction and life satisfaction were correlation of 0.60 and 0.41. The validity of this scale through internal consistency by Cronbach's range of 0.70 to 0.86 and 0.79 for the whole test for each of the 4 scale had.

Also, the test-retest reliability of the test after 4 weeks was 0.86. [31]. In the study of Sadeghi, this scale was translated and back translated by psychologists and linguists and conducted on the Iranian samples. In the study titled as "Marital interaction pattern in the Iranian culture and the effects of culture-based skills training on increasing the opportuneness of incompatible couples", internal consistency validity using Cronbach's alpha for the total scale was 0.84 and for subscales was 0.68. The reliability of the scale obtained 0.94 in this study [32].

The questionnaire is scored based on a 5-point Likert scale ranging from 1 being strongly agree to 5 being strongly disagree. Of course, negative items are reversely scored; 1 and 5 points are assigned to "completely disagree" and "completely agree", respectively. Then, the scores obtained in the two groups were investigated [33].

Statistical analysis

After collecting and encoding the data, the SPSS statistical software (v. 16) was used in order to compute the central index, variables' scattering, and frequency distribution of the demographic variables based on the satisfaction level. In order to describe the study subjects' information, mean and standard deviation were used for the quantitative variables, while frequency percentage was used for the qualitative ones. In addition, Pearson and Spearman correlation coefficients were utilized in order to determine the correlation based on the type of variables. Besides, the relationship between the qualitative variables and marital satisfaction was assessed through chi-square test. Also, independent T-test was used to compare the mean scores of satisfaction and the subscales between the two groups. $P < 0.05$ was considered as statistically significant.

RESULTS

The mean age of the participants was 28.47 ± 4.95 years ranging from 18 to 45 years old. In addition, 51.6% of the women were homemakers, while 48.4% were employed. Furthermore, 90.2% of the employed women had academic degrees, while 80% of the unemployed ones had under diploma degrees. Moreover, 25.7%, 27.5%, and 46.8% of the employed women and 20.3%, 34.7%, and 44.9% of the unemployed ones were in the first, second, and third trimesters of pregnancy, respectively. Besides, 82.8% of the employed women and 82.9% of the unemployed ones had planned pregnancies and 55.3% of the unemployed subjects and 44% of the employed ones were primiparous. [Table 1]

The study results revealed a significant difference between the employed and unemployed pregnant women regarding marital satisfaction (44.60 ± 10.51 and 48.25 ± 9.47 , respectively; $P = 0.03$). The study findings revealed a significant difference between the two groups regarding conflict resolution, communication, and idealistic distortion domains ($P < 0.05$). [Table 2]. However, no significant difference was found between the two groups regarding the satisfaction domain.

According to the results, 82.1% of the homemakers and 62.6% of the employed women had average marital satisfaction [Table 3].

In the employed women's group, a significant positive correlation was observed between marital satisfaction and age ($r=0.24$, $P=0.02$) and husband's cooperation in doing the household chores ($r=0.49$, $P<0.001$). In the other group also, a statistically significant relationship was found between marital satisfaction and education ($r=0.3$, $P=0.01$), Spouse's education ($r=0.4$, $P=0.001$), and husband's cooperation in doing the household chores ($r=0.33$, $P=0.008$).

Table 1: Demographic characteristics of the study subjects

Variable	Employed(n=116)	Unemployed (n=123)
Age	30.84±4.08	26.30±4.66
Husband's age	34.43±5.27	31.22±5.84
Age at marriage	24.86±3.28	21.04±4.10
Couple's age difference	4.39±4.30	5.22±3.36
Marriage duration	6.08±4.13	20.00±5.51
	Frequency (percent)	Frequency (percent)
Living place		
Rural	12(10.3)	51(41.5)
Urban	104(89.7)	72(58.5)
Education level		
Under diploma	9(6.8)	106(80)
Diploma and above	107(92.2)	17(20)
Spouse's education level		
Under diploma	53(45.2)	105(85.4)
Diploma and above	63(54.8)	18(14.6)
Husband's job		
Employed	56(48.3)	16(13)
Self-employed	60(61.7)	106(87)
Type of pregnancy		
Planned	96(82.8)	102(82.9)
Unwanted	20(17.2)	21(17.1)
Husband's cooperation at home		
Yes	105(90.5)	92(74.8)
No	11(9.5)	31(25.2)

Table 2: Comparison of marital satisfaction in employed and unemployed pregnant women

Domains	Mean and SD of the groups Unemployed(n=116)	Employed (n=123)	P-value
Conflict resolution	46.95±9.82	42.74±9.49	0.003
Communication	40.84±12.60	37.30±11.40	0.03
Idealistic distortion	58.74±12.39	62.33±13.81	0.04
Satisfaction	47.50±10.83	46.08±12.53	0.4
Total marital satisfaction	48.25±9.47	44.60±10.51	0.03

Numbers are presented as mean±SD. * p-value: Student's t-test: between groups. $P<0.05$ was considered as statistically significant

Table 3: Frequency distribution of marital satisfaction

marital satisfaction	Unemployed (n=123)		Employed(n=116)		Totaln=249	
	N	%	N	%	N	%
low	10	14.9	20	22	31	19.5
moderate	55	82.1	57	62.6	112	70.4
high	2	3	14	15.4	16	10.1

DISCUSSION

This study aimed to compare marital satisfaction between the employed and unemployed pregnant women, the findings of this study showed a significant difference between average satisfaction scores in both groups ($p = 0.03$). Marital satisfaction differs indifferent periods of life, but pregnancy undoubtedly is considered as the most important events in every woman life [34]. Mood changes caused by pregnancy and in the other hand the stress of the working situations can affect other aspect of life including quality of relationships and marital satisfaction. In other words, job stress factors such as high volume work, lack of support and negative interactions with colleagues cause a feeling of irritability, tension and frustration; finally result in increased interactions conflict with the spouse [35].

In the present study, the pregnant homemakers obtained significantly higher scores of conflict resolution. Women with full time jobs have conflicts between their occupation and family demands; therefore, they are

less able to balance their individual, familial, and occupational identities. This consequently causes conflicts in the family which can damage the couple's relationship. Studies have shown that in case the women's employment does not lead to conflicts in their occupational and familial roles, it can have positive impacts on their husbands, children, and social relationships [36,37]. Considering the communication domain, a statistically significant difference was found between the two groups and the housewives performed more actively. Housewives can spend more time in their family life and, as a result, create more profound relationships with their family members; thus, they are more satisfied in this domain.

In idealistic distortion domain, homemakers got significantly higher scores compared to the employed women, which shows their more realistic attitude toward the marital relationship. Women's working out of the house and having responsibilities in doing the household chores result in conflicts and problems whose negative consequences lead to undesirable outcomes for the family structure, husband, and the children. At first, these outcomes lead to the women's physical as well as mental fatigue and finally results in dissatisfaction with life. This has destructive effects on both the marital life and the children which are reflected by the defective messages in the family's communication network. According to the study results, the employed women performed more weakly in this domain. In this study, no significant difference was observed between the two groups regarding the satisfaction domain. Satisfaction cannot only be explained based on the workplace and other external mental pressures because in addition to work pressure, other factors are also effective in satisfaction.

The mean scores of marital satisfaction were statistically significant in both study groups. It seems that as the importance of the employed women's roles increases, their marital dissatisfaction increases, as well. This is consistent with the results of Hall's study [38]. Due to their extra responsibilities and tolerating more pressures in the house and the workplace, employed women tend to show more disinterest toward their marital relationships. However, Saco et al. showed that marital satisfaction was higher among the part-time working women compared to the housewives. Also, the shift workers, particularly night shift workers, had lower marital satisfaction compared to other employed women [39]. In contrast to the findings of the current study, Tahmasbi Silly reported that employed women were more satisfied with their marital lives compared to the housewives [40].

The findings of the current study revealed a significant relationship between age and marital satisfaction among the employed subjects. Studies have shown that compared to the housewives, employed women get married at higher ages [38,41]. Age can both physiologically psychologically affect the marital relationship. Since as age increases, the family life's stability also increases, the couples become more dependent on each other and this dependence keeps them satisfied. Thus, they believe to be highly satisfied with their marital lives.

In this study, a significant positive correlation was observed between marital satisfaction and husband's cooperation in both study groups. This relationship shows the agreement and common spirit between the couple. In fact, the women whose husbands help in doing the household chores are unsparingly supported by their husbands and, consequently, have more tranquility and fewer struggles in their marital lives [42].

Michel (1971), conducted a study on 450 couples, found that women along with their partners involved in planning and decision making related to the funding of equipment, housing and children education are satisfied with their lives. This satisfaction was strongly associated with changeable couples roles that facilitate decision making.

The study findings also showed a statistically significant relationship between marital satisfaction and the women's and the husbands' level of education, which is consistent with the results of other studies conducted in Iran. For instance, Afshari, SedghAmiz, and Banaeian reported a statistically significant relationship between the husband's and wife's level of education and marital satisfaction [18-20]. In the same line, Telsiz's study showed that as the level of education increased, marital satisfaction increased, as well [21]. In fact, increase in the level of education results in improvement in social skills and the problems related to marital satisfaction.

In contrast to the previous studies, the present research investigated marital satisfaction in employed and unemployed pregnant women. The study findings showed that the employed subjects had lower marital satisfaction compared to the housewives.

Government programs to ease the women's working situation, prepare special professions with high salary and more convenience facilities will encourage women to work. Familiarize families with division of works within the family members at home and responsibility of the members. Meanwhile, establishing institution sand organizations to provide home care, makes women less busy and more active to do substantial work at home, so through this potential work power growth and development of the country is more accessible.

CONCLUSION

The results of this study showed that marital satisfaction is different in employed and unemployed pregnant women. It seems that, increase in the importance of the employed women's social roles and the special mood changes during pregnancy which intensify due to their working lead to their marital dissatisfaction. Therefore, paying attention to the pregnant women's safety and health in the workplace is of utmost importance. Also, it is necessary to provide the pregnant women with marital consultation classes accompanied by prenatal care in health and treatment centers.

STRENGTHS AND WEAKNESSES OF THE STUDY

- This is the first study to compare the marital satisfaction of pregnant and non-pregnant women in the Iranian society, also the use of internationalist and add questionnaire of Enrich is the strength of this study that is used in few studies.
- Variables and other factors such as family and social context of pregnant women such as addiction, unemployed husband, family income, being immigrant, having no access to basic supportive resources, health problems especially for fetus, kind of occupation and working hours per week may affect the mood and behavior of the women. In this study, although we have insight to this factors, but we couldn't change them and their impact on the results was not ignorable. Due to these limitations generalization of results should be taken with caution
- Pregnant housewife women fulfill questionnaires reluctantly because of inadequate familiarity with research and its importance. We try to solve this problem by making several briefing.
- We suggest that spouse satisfaction of pregnant women be examined. Moreover more demographic variables such as being immigrants, family income, number of children, and spouse addiction as moderating variables should be assessed in future researches.
- Other studies with large sample size, as well as different variables, such as higher education level, different area of the country, depression, happiness and pregnant women's kind of job can be implemented.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this paper

ACKNOWLEDGEMENTS

The present article was extracted from proposal approved by Jahrom University of Medical Sciences, Jahrom, Iran. Hereby, the authors would like to thank the education and research vice-chancellors of the university. They are also grateful for all the individuals who helped in conducting the research

FINANCIAL DISCLOSURE

None

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ARTICLE

IMPACTS OF CREATIVITY ON ARTISTIC APPROACH OF HANDICRAFT PACKAGING

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ABSTRACT

Handcrafts are one of the most valuable heritages of the Iranian Art with a great antiquity. Application of packing aims to protect the content, facilitate and help with its application and transportation, as well as its maintenance and distribution. Today, packing is of really high importance around the globe in a way that it is considered to be an art form itself. This important issue is neglected in our country, especially in regard to handcrafts. In this respect, the current writing attempts to study the impacts of creativity on artistic approaches of packing of handcrafts so that it attracts more attention. The question is, what are the major factors affecting creativity in packing and the photo on the wraps. Findings of this study include grace, color, form, application, and important of all the photo or image on the package. The said factors enhance attractiveness of the package which results in more emphasis on the importance of the product inside. The packing overtly and covertly conveys the message that there is something valuable inside the package. The result is helping with more durability and preventing any damage to the product.

INTRODUCTION

Artwork is considered as any kind of creative arrangement of one or more forms of expression whose main function is to proclaim or convey an important and meaningful aesthetic issue. [10] Emphasizing artwork packing is something must be practiced. Indeed, production of artwork package is seen as a serious work for attracting and respecting. Inadvertency regarding handcrafts is an issue that manifests in packing and is an emphatic view on preserving artwork. Moreover, external factors such as a form proportionate to the artwork, used material, color, form and image are useful where the artwork packing is considered to be an art form itself. This is because creativity and function play a major role. The packing is considered as an art because it develops a relationship with artwork. Similarly, when this is explicit it becomes evident that we may face works moving this purposeful chain that are considered to be an artwork due to having creativity and beauty in addition to the function of preserving and protecting artworks. In this research, we practiced the importance of handcrafts packing and factors impacting the creativity. Levinson supports this approach to the art which explicitly is functionalist because the primary goal of the art is focused on "most of identical impacts and values for protection of which the art has attempted".

MATERIALS AND METHODS

The research method here is based on descriptive- analytical approach. This research was performed using documentary and field and data collection and analysis and combination of them. The documentary method in this research deals with data collection from books, journals, papers and websites. The field method was performed attending the place under study and obtaining statistics on the status on Creativity handicrafts packaging. Finally, we attempted to propose solutions for their improvement.

Definition of handcrafts

Different definitions have been provided for handcrafts. Two indigenous definitions are as follows:

- Handcrafts is referred to a field of industries within which few or all of its products making process is performed by hand and is made in the context of culture and philosophical dispositions and taste and art of people living in a region with respect to their tribal heritages.
 - Handcrafts is referred to a set of art- industry that leads to creation of products mostly local material and performing main steps of the process by the aid of hand and manual tools; products within each unit of which the craftsman's artistic taste and intellectual creativity are manifested at any means and this is the main distinctive factor of those products from machine and factory artifacts.[6]
- Our handcrafts and traditional arts with a very long history and relying on millennia and centuries are well exemplified by stone carving, Pottery, glass works, Metalworking, stamping, enamel, jewelry, weaving, engraving, Batik, dental and brocade, embroidery, basket weaving, rural and tribal shoes, felt, rugs, Jajim, Zilu, Dandani, carpet weaving, natural dyeing of Iran, scolding, inlaid, musical instruments, paintings, architecture arrangement. [9]

Packing as an artwork

Packing products is an inseparable part of modern life. World around us is unimaginable as it is without packing industry. This art and industry which has long been accompanied human life developed during last

KEY WORDS

Creativity, Art,
Packing, Handcrafts

Received: 23 September 2016
Accepted: 13 November 2016
Published: 15 November 2016

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one or two centuries with increasing importance day by day. Without colorful and attractive packages, not only economic growth and development would meet a stop but also we'd be deprived of many goods. We are attracted toward goods by their packages and without them it will be difficult to identify quality, quality and producer. Efficiency and impressiveness of packages is closely and directly related to sales. Indeed, packing is an art made by human act of hand which is created and supplied to the art community. Community consists of group of people whose members have partly prepared and ability of understanding an object supplied to them.[13]

Indeed, what is important here is relationship between the work and the artist and with art community or consumer of the artwork. Dickie believes that other entities or professions out of the art world are also contributed in it. For an instance, tourism formal manual which has been published by the board of tourism organization grants special status to what is worthy of admiration. One can imagine that advertisement does so as if certainly is the goal. In fact, there are various systems for producing and supplying handcrafts out of the art world. Those systems are applied wherever a product is produced for consumers. [10] Since packing and distribution of a good play a role preserving and protecting it, it is essential to practice an appropriate form for protection of the product and the way of distribution such that deserves the artwork. They are actually considered to be an art because manifest the historical relationship artists' intent and artworks. Thus, their aesthetic values are essential for their functions. [16] As Levinson points out the artwork is something whose production has been accepted as the artwork for attracting people's attention and respecting them. [16] The artwork packing must be understood and identified. Many examples have been provided seemingly with needed intent but they aren't certainly an artwork. In 1915, Duchamp attempted to transform the Woolworth building to an industrial made object. He failed but not because of lacking suitable intent. [12] Duchamp failed because he was deprived of the right of proprietary. The forger of a painting canvas creates no artwork though with intent of achieving most of respects directly granted to Rembrandt because those respects are directly granted Rembrandt. Other objections result in this question: does a definition predispose required conditions for being considered as an art? There are, may be, objects that achieve a place like an art functionally; objects that respect a set of internal considerations but do not have required intent. It is perhaps derived from a kind of artistic intent based on a misunderstanding on older artworks or from an egotistic intent which leads randomly in emergence of an object with intrinsically valuable properties. [10]

Creativity

There isn't a consensus among thinkers and researchers on the definition of the creativity. For example, Gilford (1962) recognizes the creativity as a set of personal characteristics and abilities. Indeed, Gilford considers the creativity as divergent thinking including various aspects and directions while others like Harington (1990), Amabail (1989) and SikzentMihaly (1989) identify it as a social subject. Hensy and Amabail believe their researches indicated that social and environmental play a major role in a creative work and there is a strong relationship between personal motivations and the creativity main part of which is determined by social settings or at least certain aspects of them. The creativity has three aspects: non-cognitive, cognitive and motivational. Non-cognitive aspects include creative features on motor and artistic subjects and certain capabilities that identical individuals rarely have them in common. [2] Motivational aspects of creativity screen one's internal motivation and persuade one to practice his/ her favorite work continuously without any external reward.

Cognitive aspect

The cognitive theory is based on the divergent thinking. However, the divergent thinking is a kind of thinking with no clear answer for a question and considers various questions in different directions while convergent thinking answers questions clearly. [2]

Alike the art, the creativity is an abstract concept and is fraught with contradiction which hadn't had a clear appearance. The fact is that the artwork isn't created rather with a prudent view and lots of conditions we can say that it is discovered. The artist neither creates the artwork nor in a common sense discovers it. The artwork is manifested in the structure discovery process. We can put it in this way that the artist perform and execute the artwork. In other words, the artist implements his worldview on the canvas and critics and viewers decode and discover it. The painter may change and mislead the reality, emphasize certain aspects in the process of representation and create a new vision which is synonymous to the creativity. [5]

The real theory of creativity is impossible without relative excitement. [2] The creativity isn't considered neither as excitement or multi-talented nor being unconventional. Moreover, the creativity is not just imitation or memorization, is not just an accident like the time a child makes a mistake without perceiving the mistake contains a concept or value. It also isn't seen as strange, irregular or uncontrolled reflections. [2] Definitely, unintentional mistakes may be resulted in more creativity. Alexander Filming was probably the first scientist who exposed randomly a culture to the air until a mold was formed and eliminated bacteria. However, Filming recognized that mold can be very useful for destroying and eliminating bacteria and this led in Penicillin to be discovered. [2]

Ordinary and extraordinary creativity

We are exposed to the expression “creative individual” we probably think of an extraordinary person and definitely popular and famous; one who with unconventional life within which he/ she has fulfilled certain creativities. Unfortunately, this is to say that few of us are creative. [3]

Process of creativity

Being creative is just like preparing soup. During recent decades, researchers and theorists have recognized five stages for creativity. The first step is to present a problem when an assignment is determined. It is where you are asked to prepare soup or you decide to prepare soup. Second step is preparation where you collect information and resources needed for solving a problem or fulfilling a task and it is when you buy from store or take out anything for refrigerator needed for preparing soup. Third step is to propose ideas or provide facilities. In this step, the chef blend ingredients in the best way he thinks. It must be noted that the latency occurs in this step at times. Latency means that one drops the problem for a while. The fourth step of the process is validation meaning transferring various facilities created over the third step. The fifth step is the final step and assessing the results. In this step, one decides either to stop because the task has been accomplished or to review it because the results were not satisfactory and/ or stops it because it's unlikely to obtain a proper result. [2]

The scope of skills is considered as raw materials of talent, training, and experience in a special field. This scope is inherent relatively. It is quite clear that talent is required for one who wishes to be skillful in a field while most of us ignore this. The second ingredient is the creative thinking and work skills. There are certain thinking practices and personal traits inherently that allow people to implement their scope of skills in new ways. It seems like that some of thinking skills are inherent.

A creative work practice has following characteristics:

A commitment to get a task done well

Ability for concentrating efforts and attention for a long time

Ability to drop non-creative ideas and put away more complicated problems temporarily

Insisting on facing problems

Enthusiasm for hard work

The traditional handcraft is a term that may express these methods well. Most of those who perform creative tasks continuously consider the quality accurately because they develop a personal pride feeling by producing any part or piece. [2]

Third ingredient is intrinsic motivation. That is the desire to do something because the task itself and because it is interesting, satisfactory and a kind of personal challenge. The intrinsic motivation may be partly innate but depends on social environment to a large extent.[2]

Innovation

In case that we accept the creativity is synonymous with innovation and invention at any way means art then it is not consistent with this unknown classification of multiple arts and rendering functional and non-functional attributes for arts and the only attribute which is inseparable here is the attribute of being new and innovative. It means that we cannot call at anyway repetitive production an art. Therefore, the art in general meaning refers to creation of a phenomenon including invention, innovation, initiation and discovery and will be based on design of a new theory or even a new method for old problems. [13] The artistic creativity means creating a work while innovation refers to any phenomenon different from others. However, ingenuity is associated to human's power and capabilities and all these three terms can be taken in account in an artistic expression at time. [7] The innovation has been defined differently in different scientific works based on used analysis. The more macro the approach (e.g. cultural or social), the more different the definitions will be. Some of definitions are general and inclusive while others are focused on special initiatives such as implementing an idea on a new product and service. Innovative examples in an organizational environment is considered as making ideas practical for reorganization or saving costs, improved communication, new technology for production process, new organizational structures and new staff plan. [1] It is the facility of using which may be obtained through de-familiarization when providing product of good packing. The creativity includes, for example, getting rid of established restrictions but one must not hesitantly infer that the artistic regulations are barriers for the creativity.

Artistic aspects of package design

It is sometimes wrongly perceived that the artwork means creating an unusual work which is perceptible only by artists or few intellectuals. Nevertheless, the design carrying whatever message must be perceived by its special addressees in case of applied arts in particular packing. There are few goods that are planned and produced for artists and intellectuals. In case of those products and goods newly introduced into the market or a creative or initiative aspect has played a major role constructing it, innovation in designing package may be very desirable. In addition to attempts for innovation or emphasizing previous methods, when designing a package is the case two factors are influencing package planners and designers' performance; practicing artistic aspects and making a creative package. [8] We investigated certain visual elements to assess artistic aspects of an artwork.

Beauty

According to Kant, fine art is one of aesthetic arts; those arts within which feeling pleasure is something that is considered directly or indirectly. The pleasant art aims making one feel pleasure. Unlike, the pleasure obtained through representing a fine art is the pleasure of interaction. That is to say it is derived from stimulation of imaginative and cognitive faculties. The fine art consists of a method of representation with aspects and makes subjective forces to develop toward establishing social communications. [10] The aesthetics is defined as a branch of philosophy practicing the nature of beauty and judging on it. If the sublime goal of any artistic product is beauty, the beauty will be same as the form. However, beauty of artistic products is not limited to a restricted set of principles. The form approving beauty will not thoroughly be finished at least within our view. The art cannot reveal beauty or form explicitly rather summarizes and simplifies it as philosophy does but never make it equivalent for life. [1]

Form or formalism

Formalists challenge several assignments defining the art. Those assignments are associated to the understanding this point that how we must use the concept of form in a definition. It is not justified to put only that the art is form or it is something with a form because anything has a form in a sense. The most popular formalist definition out of the art has been provided by Clive Bell.

According to Bell and is what having signifying form. Signify say form is a form that makes thing qualified with it rich in a special kind of value that is the effect created in these who perkier it. Bell calls this effect (a esthetic affection).[15]

Color

Although peoples intellectual background or individual experiences is the most effective factor in color effectiveness in them, colors have different meanings in different meanings in different nations that is maybe related to geographic cultural and social factors to the great extent. Also several studies have been done about form and color harmony and for the three main geometric forms foe shapes. The three main colors have been introduced more harmonic intuitively and empirically, but it should be considered that these conventions can change in today's modern design for people's needs and tastes have changed widely. Color proposes its special possibilities and expression by form contribution. Colors real power and effectiveness becomes impressive in harmony with designs other factors and gives the visual necessary charisma to the package or the same work of art. The effect of color side form is more apparent about glossy and metallic colors. Form and color relationship is a permanent and unbreakable one. No color could be studied separately and without form. This matter is to the extent that estheticians have considered special colors for some forms. They have known red suitable for square objects, yellow for triangular and blue of circles.[17]

Size

Packages size or dimensions or in other words their volume and quantity, give meaning to packaging form and structure as a art work. A small package represents different usage and consumers relative to a large one, even if having common form and design. The size and quantity of a package is selected more based on 3 points : first applicable tasks like carriage and preservation ease , second legal requirements, like export rules and standards and third on is to select packing dimensions according to consumers need, that is the amount of product a consumer needs in consumption course. [17]

Structure

Structure has close relationship with form and like it has expression and offers perceivable identify. A new and intelligent structure can be a new, attractive, interesting and unforgettable experience. In fact, structure is the way to reach a three – dimensional form that have volume. In other words, a special form can be obtained by different methods. These different methods in fact stem from structure and the manner of forming and 3 dimensionality of a flat sheet. The raw material constitutive of package is very effective in structure type.

Although the structure product is the packing form and sometimes these two becomes a unit category in many cases structure is itself distinct a technical and specialized and very important part of the set of works of package design. Structure has also expression and offers a special identity like form, but independently. The raw material making package is very effective in selection of structure type. Also existing technology and machinery have key role in this case. For a constant form of different material different structures should be considered Most probably. Structure has such a link with form that sometimes becomes a unite category with it and of course these two are often separated. [18]

Eye leading

In packages in tense completion in market, this is a key question that which of design factors the viewer should consider before others. In package design like other graphic works and works of other visual arts it is very important that the works designer or creator leads addressee impalpably, that sees which design elements sooner than other ones and with more attention. And of the most determinant factors in an art work success is to decide how and in what stages the viewer and the addresses behavior and response

depends completely on this step by step understanding. Packages form and design Lego and other writings like lines, figures, picture, imaging and tens of other similar cases have all special importance in forming package design. But in each package there exists elements like Lego form or color that are seen and perceived immediately and attract addresses attention. Other parts like secondary writings, advertising slogans, smaller pictures and figures are seen at the second glance. [15]

Picture or Image

Image or picture is a landscape that has been recreated or transcribed. It is a display or a set of displays having separated from their manifestation initial place and time and have been preserved for some moments or some countries. The photographer look manner is reflected in subjects he/ she select for photography. By photo registration from the product that object can become immortal by image and this is a more emphasis on the product. When looking at on objects image we merge ourselves with it. But when looking at a product or goods picture we are usually affected by photographer look and its applicable effect. For what is considered the most in goods photography is goods definition and encouraging addressee to buy it. So the role of picture in introducing a product and increasing sale rate is undeniable. Photos convince us that the object inside the package could be known by the picture on this cover. Since photography changes art concept and intention according to Rolan Bart. it has special place in world line. Photos encourage addressee to buy to object inside the package by image language. ((I said photo and image language)) to call photography a language is both right and wrong. It is wrong in literal and straight meaning for photographic image is a reproduction similar and comparable to reality and has no separate element perse that can be called indication. Without exaggeration there is no language equivalent such as a word or letter in a photo. Photo has been sacrificed for its remarkable power. Transcription of reality has caused nobody to think about its power and connotation up to now. We sometimes consider photos simply as pictorial report of a goods while a concern and idea and emphasis on the objective is hidden in such simple report. In fact commercial and advertising photo is a means for simulating addresses enthusiasm. Have photographer tries (by goods photo) to satisfy our stadium our enthusiasm a way. So all photos can be seen in the directory. The feature of emphasis on reality is of factor having role in sale increase. This precise classification is visual art for organizing the work is called compositions that most of artists know its importance it should be mentioned that photography depends on using these features more than other arts. Photographer can describe a better world when he sees his surrounding world better. That this quality happens in different forms. Its most prevalent form is extent lack of contrast. Contrast means inconsistently and consideration that is created between the lightest and darkest part of the case of image and photo. Low contrast causes the image to become soundless. Lack of specific form and color and subjects results from the not observing technical matters and right viewing angle. Artificially is of categories that discreate the photo. Artificially means damaging subject, scene or an event originality. The most significant of which is taking photo of scenes outside studio inside the studio. For whatever the photographer is innovative and skilled and the studio is equipped there are always points that reveal its artificiality. For example either the background lack depth or shadows interfere with each other or the light artificial. For example either the background shadow. All of these factors can unite and remove the sense of reality and life that the photo target is to show it. [15]

Not using flash is of other factors helping to the attractiveness of image or the goods being advertised. For the flash light shows the part of the subject or flash excessively light and the part far from photos depth. Because the shadows giving depth to photo are those created by side back light. Using very wide angles causes miniaturize and importance of subject having no emphasis on product. Equally using tele lens in the deletion of part the goods and forms selection. So choosing suitable lens that leads to precise and right viewing angle is of great importance in goods display. Perspective part eyes in the center of visible world. Every coverage towards eyes infinite point that erases everything in it. According to this agreement of perspective there is no relationship of vision. Camera says: I am one eye one mechanical eye. I as a machine show life in a way I can see it. I have rescued one and for all from humans movement limitation. I close and gateway from objects I rotate under the above them. I coordinate any world point however I want free from time and place boundaries. My work method results in a novel perception of world. For I introduce you the unknown world with modern clarity. The product viewing point is of the most important points considered by photographers. This important factor in photography. For vision affects perspective from different angles and transforms photo meaning. Up to down viewing point results in non significance of the photography. Conversely down to up viewing point indicates emphasis on products antiquity and importance. [18]

Composition

This is of the most photography important proposed categories. The location of subject or goods in the frame attracts the most attention. For example sometimes it is difficult to distinguish whether the goods photography should be taken vertically or horizontally. Unity in a board composition helps basically its visualization power and this is extent as if composition has been the emotional theme of the work perse. Terms like (harmonious amalgamation) (unforgettable contrast) that reaches the peak of breath taking and power and cases like it show emotional statues that is visualized from life scene and experiences in board will be transferred to incomplete addresses artistic understanding. The significant result is that no negative space on photo. So it is significant to observe that goods neither be in frame cover nor exactly in the centre. What is important is that subject fills the frame. Consequently, considering the golden ratios and golden points in frame is important. That in this case photography for packing handicraft products is

not excluded and the target of a good design or enjoyable composition is not simply to emphasize on photographer capabilities. But it is better introduction of the main subject and attracting viewers attention to the image for some more moments. That in this case, there is an opportunity for transferring the photos concept from inside of the image family photo albums but totally these are results to viewer minds. Its right that pay attention to pictures correct composition. A good photographer has a conscious look to good visual design both while taking photo and while seeing photos. The rule being discussed here is that photography has introduced a new technique of imagery in visual arts. (making image). So photography emphasizes on (choosing) not combining. One of the photography main laws is the process of choosing things that should or should not be in the picture. This process forces photographer to separate the space outside the frame) from the space (inside the frame). [17]

Advertisement

Advertisement stems from humans social life. This is an operation in which seller or producer by doing an action tries to inform potential buyer of the production of this product. This action has at first informing aspect than commercial one. This is done by different methods. Today advertisement is as a kind of investment and is part of goods production. When we talk about a manual work since this product has been produced completely different from other products it absolutely can better find its place among buyers for this work has been created by artists sense and taste. So employing today advertisement method this goods can easily find its place among buyers. Suitable package creates buyers interest and this is the best advertisement for valuing the object inside it. The first thing is seen is package and this is more effective than any advertisement. [14]

Advertisement has another important special and social role. Though this role was not been considered by the one who innovated advertisement but this doesn't decrease its importance. Advertisement sets consumption culture instead of democracy. The selection of food (clothing or car) replaces appropriate political selection advertising notices and brands help hiding whatever the covers of behind its mask. Advertisement links to a kind of philosophic system. It states everything with its special terms. It defines the world. The whole world in the service of advertising for life gives us a happy smile. It offers itself to us and since imagined that they all seem more or less one. By advertisement and brands being sophistry allow us live and it knows nothing but purchasing power and the ability to take. It shows all humans other abilities or needs a secondary matter than this power. The public and produces the last national economy. This statement is very close to special ideals we have about freedom. Choice freedom for buyer. Medium is of communication means having a significant role in products introducing and importance. Media in any range and with any type of facilities either as a previous social communication or a new one have a determinant role in motivating or discouraging by declaring programs and stating each societies aims. The aim is creating entertainment and time passing and increasing quantity in social communication programs production. It is obvious that one can explain culture making and creating high morale. Instead by considering addresses range of each medium. Programs can be codified in life with motivating and the highest national religious power that reaches human ideals realization. So attempts should be done for realizing human targets by creating methods of artistic creativity media in our society have governmental approach so based on a national and design. They can be used to create capability and the ways of making this target. Any narrow mindedness or lack of necessary knowledge about. Correct usage of media results in deterrence of artistic creativity in societies segment that leads to cultural and artistic backwardness and in wider range destruction of individual and social power and cultural and artistic heritage. [11]

Packing, Distribution and Supply

Packing is in fact a granting dignity to the goods being sale and (it is in fact results in the registration of the handmade work created for supplying to art world as a work of art) .

According to Dicky, what is an art work if and (1) is handmade and (2) a set of its aspects has given it a dignity that is understood and admired by those who work in favor of art world. Since granting and the manner of products great seems a kind of action one can ask himself that what is the artist does to yield such a result. This is not absolutely just making this possibility that something with its numerous features is considered for reviewing. Steven Daris said that grantor is one enjoying appropriate authority that makes or proposes such an object.[4]

CONCLUSION

Packing industry and art is so wide deep and has different sights that all of its aspects could not be recognized at once and just an introduction could be written to it. This area is growing , moving and transforming permanently like alive creature and its end seems unattainable like a boundless sea. In this paper tried to address the effective factors in increasing visual appeal of handicrafts package by studying effective factors in the attractiveness of products package. It should be mentioned that many of these features can be compared and studied in all artworks. Since this paper has particularly an artistic look at handicraft products packing. These factors and features were tried to be studied in this format. By this paper the question creation in handicraft products packing is of great importance was answered clearly and factors like goods picture, simplicity kind and material and works maintenance and survival have been enumerated among its most important features.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

PREVENTING TRANSMISSION DISTANCE RELAYS MALOPERATION UNDER UNINTENDED DG TRIPPING USING SVM

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ABSTRACT

This paper presents a novel protection scheme based on support vector machine (SVM) approach. The proposed scheme detects bulk DG tripping following a fault in the power transmission system, and then makes sure there is no follow on distance relay maloperation. It is also able to detect a fault if it happens during the blocking period and hence unblock the relay operation correspondingly. Wide-area (WA) measurements obtained from phasor measurement units (PMUs) are used, in addition to local measurements, to improve the scheme selectivity. Simulation results are discussed and illustrated.

INTRODUCTION

KEY WORDS
Support Vector Machine
Distance Relays
Distributed Generation
Novel Protection Scheme

In today's modern power systems, DGs are growing rapidly based on economic and environmental incentives [1]. One critical consequence of the additional imposed load flow stress on the upstream network as a result of the unintended bulk DG tripping is the probable unforeseen interference with the conventional distance protection [15–17]. It is worth pointing out that the above mentioned concern does not extend to conventional generator tripping in the system for two main reasons. Firstly, according to the NERC standard, conventional generators are required to stay connected to the grid throughout almost all the disturbances to maintain the system's synchronization by their turbine-generator inertia [18,19]. They participate in load frequency control (LFC) and automatic governor control (AGC) actions performed by ISOs sending control signals and set points to the generators in real-time to set their outputs [20]. Secondly, the dynamic planning studies performed by ISOs according to the NERC standard [21] already check the dynamic behavior of the system to be reliable and safe for N-1 contingency cases including each conventional generator tripping. Before a conventional generator is connected and added to the grid, it will be verified that its unintended tripping will not lead to any system instability or cascade event and the required precautions and corrective actions would be planned [21]. The distance protection on transmission side is coordinated for these N-1 contingency cases [22]. However, planning and protection studies for transmission network are based on the network models that do not contain DG protection models, and detailed protection information is not included in the bulk DG planning studies [23,24].

They are required to follow standards for connecting to the grid and have control and protection measures on their interconnections to be able to disconnect from the distribution grid in case of an inadvertent islanding [2–7]. Inadvertent islanding is called to the situation when DG continues energizing a portion of the system, e.g. the feeder that it is connected to, while being disconnected from the main grid [8]. The duration and probability of an inadvertent island occurrence must be minimized for several reasons such as mitigating power quality, maintaining protection settings, addressing auto reclosing issues, and most importantly ensuring the staff safety [8]. Several anti-islanding protection schemes which are mainly categorized into communication based and local measurement based methods have been proposed and developed based on this necessity [8,9]. Since deploying communication based methods, known as transfer trip, is not cost effective for widespread use, the local measurement based methods are commonly used for anti-islanding protection purposes at the distribution level [8]. Generally, the local measurement based methods are divided into active and passive ones for which the set of protection schemes consist of under and over frequency and voltage relays [8,9].

According to what is mentioned thus far, it could be concluded that it is necessary to make sure the dependability and security of the protection on the transmission side is not affected by such unintended events to prevent damage extension from distribution to the bulk power system. Although the impacts of unintended DG tripping on transmission protection coordination has been brought up in the literature [15–17], no protection scheme has been specifically proposed against undesirable tripping of distance relays under such circumstances. In this study, a novel SVM-based scheme is proposed to maintain the transmission protection security and dependability under unintended bulk DG tripping on the distribution side, which may occur as a result of maloperation of the deployed anti-islanding schemes.

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Received: 11 Aug 2016
Accepted: 21 Sept 2016
Published: 15 Nov 2016

SVM performance, when compared to the other conventional classifiers such as neural networks, fuzzy logic, etc., the performance of which might suffer from handling huge feature spaces, is not significantly affected by classified vectors dimension [25]. Neural-network approaches have been shown to be effective in many applications; however, their main disadvantage is the need for significant training burden (data and time) for a reliable performance of the approach especially when the operating conditions vary widely [25]. Furthermore, the great advantage of SVM, which makes it more powerful than other traditional methods based on risk minimization is that it deploys various ideas such as the Vapnik-Chervonenkis theory, statistical learning, maximum margin optimal hyperplane, kernel functions and so on [25].

SVM technique is deployed here to implement a protection scheme that enables the vulnerable distance relays (target relays), the backup settings (second or third zones) of which might get affected under unintended DG tripping events, to distinguish such events from faults and block/un-block the relay operation correspondingly. A recently proposed and implemented novel setting coordination check module [31,32] is used to identify the target relays in the test system. Selective WA measurements obtained by PMUs in addition to local measurements at the distance relay location are used to improve the proposed scheme accuracy. The scheme's robustness against PMU data loss or unavailability as well as cost-wise use of WA measurement technology has been taken into consideration in the proposed method. The SVM is trained such that it distinguishes the faults from the DG tripping cases and acts as the supervisory control of the distance backup protection. In the case of unintended DG tripping interference with the distance relay setting coordination, the proposed scheme blocks the conventional trip signal resulting from the distance mho elements' pickup and prevents any follow on the distance relay maloperation. Furthermore, unlike conventional blocking schemes, the proposed method is able not only to block the relay operation due to DG tripping interference, but also to detect a fault during the blocking period and unblock the relay correspondingly. The proposed scheme is easily and quickly trainable for various possible scenarios of system operation in practice and gives significant selectivity. Furthermore, it could be considered as another complementary application of SVM along with previously proposed ones to obtain a comprehensive supervisory control protection scheme and improve the protection security and dependability.

PROBLEM DESCRIPTION

The critical need to prevent islanding occurrence, especially in order to guarantee the personnel's safety, along with some probable hard-to-detect cases of islanding [17] drives the anti-islanding protection control and measures to be sensitive enough to detect the islanding cases. On the other hand, these sensitive protection measures could affect the DG output unnecessarily under certain circumstances and aggravate the power system dynamic behavior during or after disturbances. Under frequency and voltage sensitivities are two important indicators of such conditions. The former corresponds to a generation-load mismatch situation which may trigger bulk DG tripping, which deteriorates the situation further. Such cases of unintended DG tripping could be mitigated by taking proper immediate load shedding actions, which is not the focus of this study.

The anti-islanding protection schemes are responsible for detaching the DGs from the grid in case of an inadvertent islanding. The basic idea is sensing the voltage and frequency deviations and checking them against the threshold values to come up with the control action. The voltage sag caused by severe disturbances such as 3-phase faults at the transmission side could propagate to the distribution level and interfere with DG's under-voltage protection measures, which may lead to unintended DG tripping. This might not raise any significant issue if the existing DG in the system is of small scale and the system is well-designed to handle that. However, in case of high penetration of DG in the distribution network, connected to upstream through a point of common coupling (PCC), the large scale tripping of the DG units puts an extra power flow burden on the transmission lines. As a result, protection coordination of distance relays' backup protection zones on transmission side might get affected. The sudden power flow increase to compensate the lack of DG in the system which is already under stress from previous disturbance could initiate distance relay miss-operation and lead to cascade events. Other disturbances such as major switching actions (lines or generators tripping) could also lead to significant voltage deviations which might be potential cause of DG tripping.

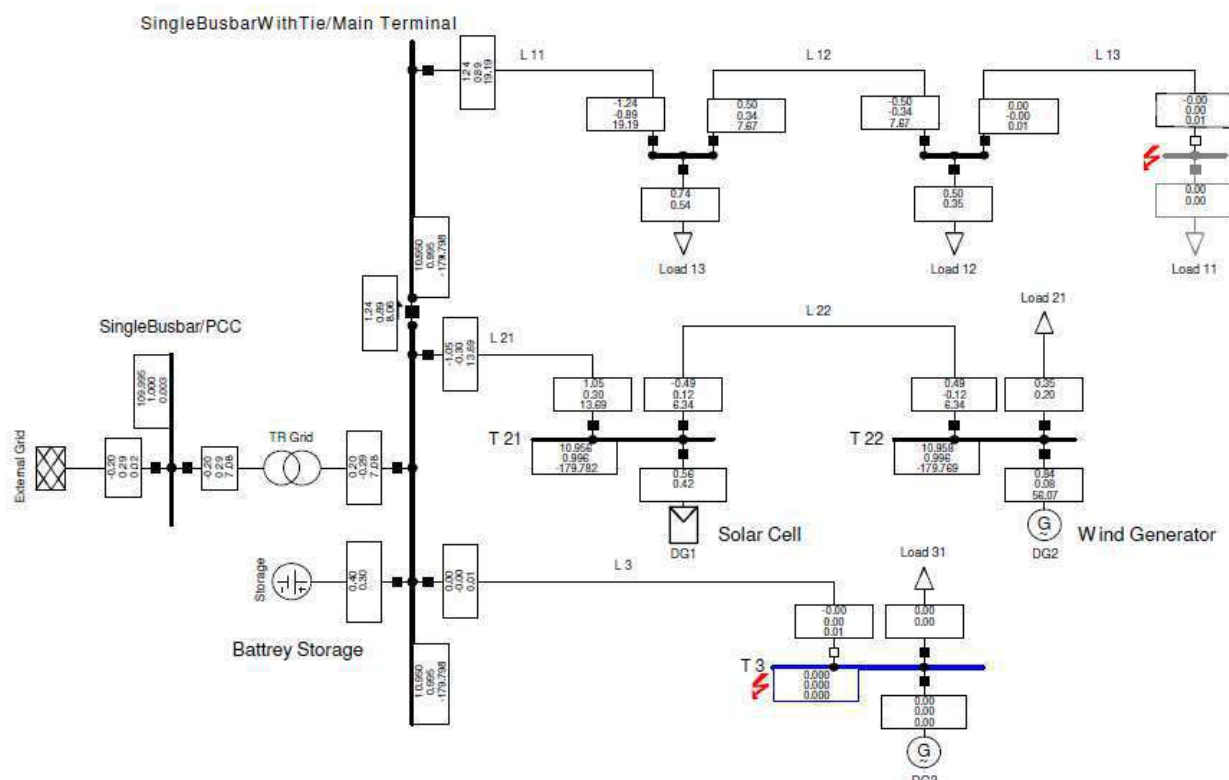


Fig. 1: Possible scenario of unintended bulk DG tripping as a consequence of under voltage trip sensitivity.

[Fig. 1] helps to illustrate the problem under consideration. An islanding protection scheme makes sure that the DG connected to a feeder (Feeder 1-Feeder 4) would trip if the feeder's source-side circuit breaker (CB1-CB4) opens, usually as a result of a fault on the feeder. A short-circuit happens on the line 9-6 and it is tripped to clear the fault. The voltage drop and deviations as a result of fault occurrence and clearing event propagates to the distribution side. Assuming the DGs are tripped mistakenly by their anti-islanding protection systems, a sudden power flow increase is imposed on the lines 5-4 and 4-6 to compensate for the lack of DGs while the system is still under the stress of the previous disturbance. This might cause an interference with setting coordination of distance relays on these lines (marked by red arrows) as a result of unexpected dynamic change of the impedance trajectory and trigger their misoperation, isolation of buses 4 and 6, and lead to the total system collapse consequently. It should be noted that, this is just a simple graphical example to help picturing the problem tentatively; of course, various parameters including the dynamic behavior of the system, impedances of the lines, the settings of the distance relays, the capacity and instant of the tripped DG, loadability of the lines, etc. are important in determining whether it would cause the distance relays misoperation or not. A real demonstration of this scenario on New-England 39-bus system will be presented in Section 5.

The problem described above highlights the necessity to manage the protection on transmission side to be able to come into the action and act quickly in case of an unintended operation by antiislanding schemes on the distribution side to save the upstream network. It should be able to distinguish such cases from faults and block/unblock tripping signals of vulnerable relays' backup protective zones accordingly.

SUPPORT VECTOR MACHINE (SVM) TECHNIQUE

Brief overview

SVM is a relatively new and promising machine learning technique to be deployed as a pattern recognition and classification tool. It is based on the statistical learning theory for 'distributionfree learning from data' proposed by Vapnik [33]. In this method, first, the input data is mapped into feature space which is a highdimensional dot product space and then it is classified through a hyper-plane. Using optimization theory, the maximum separation is obtained by the optimal hyper-plane.

Suppose $x_i \in R^n$ and $i \in \{1, \dots, l\}$ is the input data including l data points which could be classified into two classes, class I and class II, with the labels of $y_i = 1$, and $y_i = -1$. The goal of SVM linear separation is to identify the optimal hyper-plane which creates the maximum separation between the data points in regards

to their classes. For the above mentioned classes, such a separating hyperplane could be achieved by finding out proper values for w , vector of weights, and b , biased scalar, in the following equation:

$$f(x) = w^T x + b = 0 \quad (1)$$

For a separating hyper-plane:

$$\begin{cases} f(x_i) \geq 1 & \text{if } y_i = +1 \\ f(x_i) \leq -1 & \text{if } y_i = -1 \end{cases} \quad (2)$$

Therefore $y_i f(x_i) = y_i w^T x_i + b \geq 1$ for $i = 1, \dots, l$. From the geometry, it is found that: $m = 2 \|w\|^{-1}$ in which m represents the separation margin. So, maximizing m which means better generalization capability of SVM requires to minimize w . Hence, finding the optimal hyper-plane could be formulated as the following convex optimization problem:

$$\begin{aligned} \min & \frac{1}{2} w^T w \\ \text{s.t.} & y_i (w^T x_i + b) \geq 1 \quad \forall i \end{aligned} \quad (3)$$

There exist no hyper-plane if it is not possible to separate data linearly; i.e., the constraints in (2) cannot be satisfied all together. In such cases, a penalty factor C and slack variables ξ_i are deployed to introduce a soft margin. The optimization problem then changes to:

$$\begin{aligned} \min & \frac{1}{2} w^T w + C \sum_{i=1}^l \xi_i \\ \text{s.t.} & y_i (w^T x_i + b) \geq 1 - \xi_i \quad \text{for } i = 1, \dots, l \\ & \xi_i \geq 0 \quad \text{for } i = 1, \dots, l \end{aligned} \quad (4)$$

In (2), ξ_i are non-negative variables which bring training errors into the scene. The penalty factor C , also called regularization factor, is always positive. In case it is small, the separating hyper-plane is more focused on maximizing the margin (m) while the number of misclassified points is minimized for larger C values. Support vectors which include the points closest to the optimal hyper-plane maintaining maximum margin, satisfying (2) with equality sign, are required to obtain the separating hyper-plane.

The classification problems in practice are usually not linear. To implement SVMs for such cases, so called kernel functions are deployed for mapping training data by the use of nonlinear transform function $(X)\Phi$:

$$\Phi(x_i) = (\Phi_1(x_i), \dots, \Phi_m(x_i)), \text{ where } m > n \quad (5)$$

The equation which could define a kernel function is: $K(x_i, x_j) = (x_i)^T \Phi(x_j)$. Having done such a mapping, the goal is to be able to implement the linear classification of the original input data x in the higher-dimensional space by the use of linear SVM formulations.

Although SVMs are designed to be deployed for the binary classifications, they could be used for multiclass classification purposes too. Generally, there are three approaches to implement a multiclass SVM: one-against-one (OAO), one-against-all (OAA), and one-step methods. The first two approaches are based on combining several binary SVMs; however, in the one-step method the SVM is designed in a way to include all the classes at once during the learning algorithm and solve only one optimization problem [33–35]. The performance comparison between these three methods has shown that the one-step approach gives better accuracy in addition to be faster than the others [27]. Hence, this method is chosen here.

In one-step method, the idea is to create p two-class rules which are separated by p decision functions. For example, the vectors of class k are separated from the other vectors by the k th function $W_k^T \Phi(x) + b$. However, all the decision functions are obtained by solving one problem as follows:

$$\begin{aligned} \min & \frac{1}{2} \sum_{k=1}^p W_k^T W_k + C \sum_{i=1}^l \sum_{k \neq y_i} \xi_i^k W_{y_i}^T \Phi(x_i) \\ & + b_{y_i} \geq W_k^T \Phi(x_i) + b_m + 2 - \xi_i^k \end{aligned} \quad (6)$$

$$\text{s.t. } \xi_i^k \geq 0 \quad \text{for } i = 1, \dots, l \text{ and } k \in \{1, \dots, p\} \setminus y_i$$

And the decision function is:

$$\text{argmax}_{k=1, \dots, p} (W_k^T \Phi(x) + b_m)$$

Kernel function selection

Various kernel functions have been proposed by researchers such as linear, polynomial, radial basis function (RBF), and sigmoid kernel functions. In this study, RBF kernel $F(x_i, x_j) = \exp(-Y\|x_i - x_j\|^2)$ for $Y > 0$ is considered as a reasonable first choice because of several reasons. Deploying RBF kernel provides non-linear mapping of input data sets and is able to deal with the non-linear correlation of the class labels and features so it overweighs the linear kernel [35]. Besides, a linear kernel is considered as a subset of RBF because for a definite penalty factor, C , it could be represented as the RBF kernel having specific parameters (C, Y) [36]. Sigmoid kernel also performs like RBF for certain parameters [37]. Moreover, there are some parameters for which the sigmoid kernel is not the dot product of two vectors so it is not valid [33]. Polynomial kernel has more unknown parameters to be determined compared to RBF kernel and this makes the model selection for polynomial kernel more complex. Furthermore, polynomial kernel values might be not properly bounded. Last but not least, numerical difficulties for the RBF kernel are fewer than the others [35].

PROPOSED SCHEME

Identifying the vulnerable relays

To implement the proposed protection scheme, first, the relays which settings coordination might get affected due to unintended DG tripping should be identified according to the network topology. In [31,32], an automatic distance setting coordination check module is proposed and implemented, and its performance is verified by comparison with a commercial package (CAPE) [22]. The module has been run on the real-sized networks as well as New-England 39-bus system. The module is able to identify the affected relay settings coordination issues following a network topology change such as generation trip, line switching, etc. In such studies, usually the relay settings are calculated based on the line ohms only. In practice as well as in the developed module, the short-circuit calculations and apparent impedances are deployed in calculating the backup protective zones (zones 2 and 3) settings of the relay. The network operating conditions such as power flow are also considered in the setting coordination check process. The relays are assumed being set in forward direction and the backup zones settings are time-delayed, i.e. 20 and 60 cycles for zones 2 and 3 operation respectively [22]. With the use of the proposed setting coordination check module in [31,32], a list of relays vulnerable to unintended DG tripping based on the network topology and DG placement is determined. The relays with a change beyond 5% in their zone 2 or 3 settings are identified as critical relays and sorted correspondingly [31,32]. Then, the proposed protection scheme could be implemented to those critical relays.

SVM-based scheme

In this paper a SVM based protection scheme which enables the distance relay to distinguish between a fault and a DG tripping scenario when interfering with the protection coordination of distance backup protective zones is proposed. The detection is based on the DG tripping impact on the system dynamic behavior. As shown in [Fig. 2], two multiclass SVMs are deployed, one is trained based on local data only (SVM-1) and the other one is provided with WA data as well (SVM-2). Based on whether the PMU data is being received at the relay location or not, the method could switch between the employed SVMs outputs through the multiplexer shown in [Fig. 2]. This is for maintaining the scheme's robustness under probable PMU data unavailability or loss; however, the accuracy may decrease to some extent when using local data only as will be discussed in Section 5. SVM-1 and SVM-2 are trained to classify fault, DG tripping, and other cases as "1", "0", and "-1" respectively. The outputs of these SVMs are filtered by a comparator as class label -1 is not of interest. The logical AND of the backup protective zones pickup signal and the output of the comparator, as shown in [Fig. 2], determines the trip/block signal value, i.e. 1 or 0.

A proper modeling of the DG units is important to get a fair observation of their impact on the dynamic behavior of the network following a disturbance. In this study, the focus is on PVs in the distribution level (residential PVs) which are modeled as constant current loads corresponding to the negative power injections, which is used in other studies of this type [16,19,38]. The equivalent of DG units aggregated based on their generation type from the transmission perspective could be represented as shown in Fig. 3 [16,19]. For studies of this type, the downstream distribution network, regardless of its connections, is modeled as the aggregated load and distributed generation imposed on the upstream network from the transmission point of view [16,19]. This accepted type of modeling is especially appropriate when the distribution grid is connected to a well interconnected and stable upstream network, as is the case in this study. The cluster of PVs is modeled as an equivalent power output equal to the sum of individual outputs of each one of the units [16,19]. It is worth to note that DGs are usually operated in constant power/power factor control mode [17]. From the transmission point of view, different types of DG would not be experienced significantly different from each other. Under specific cases of DG operation, if the majority of the DGs are facilitated with voltage regulation or speed controls based on their type, they should be modeled correspondingly [16]. We have focused on PVs because of their modeling simplicity. They are considered as

the most promising type of DGs growing fast in the distribution level because of their economic and environmental incentives [19].

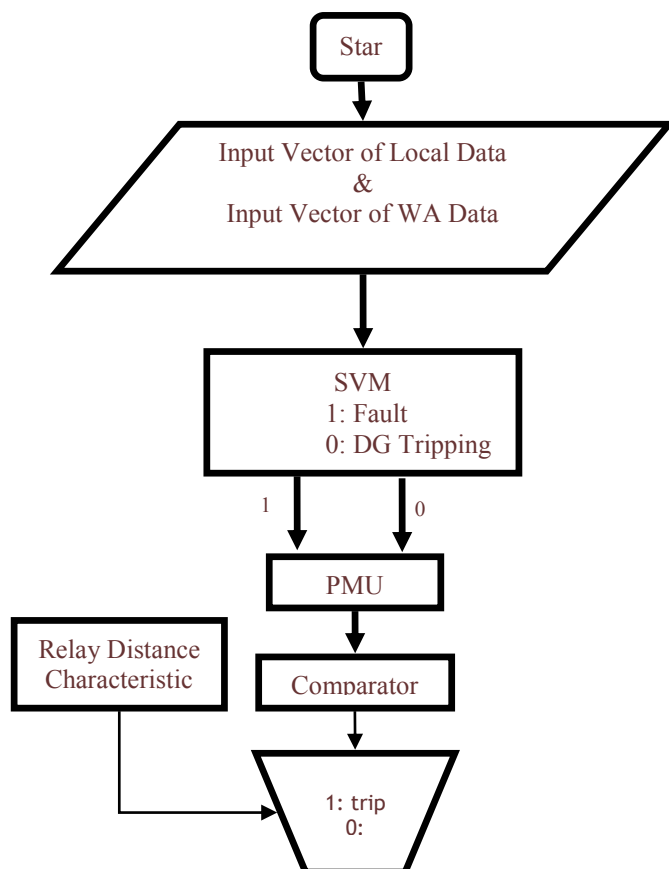


Fig. 2: Block diagram of the proposed scheme.

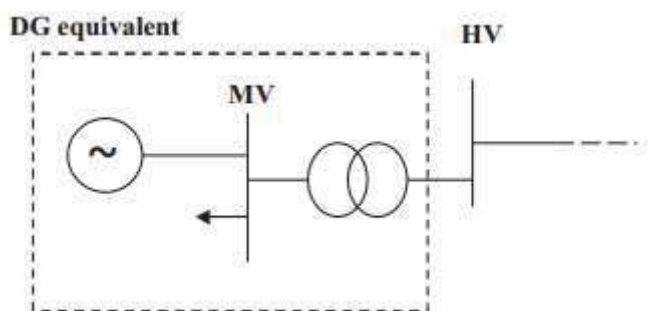


Fig. 3: DG plants equivalent from the transmission side.

Depending on the application of the PMU, the role of communication requirements and latencies could get highlighted. The delay related to PMU deployment is caused from three main processes: phasor creation, transmission of data through the available communication link, and merging of data streams in phasor data concentrators (PDCs) [39]. The PMUs use fast mathematical algorithms, such as discrete furrier transform (DFT) and calculate the voltage and current phasors from RMS measurements obtained by voltage and current instrument transformers [39]. Then the phasor measurements are transmitted according to IEEE C37.118 [40] data format to PDCs via available communication link and the delay depends on the link's data transfer capability, the size of the PMU data output, as well as physical distance between PMU and PDC. The PDC delay, at the target substation in this study, corresponds to implementing time tag on the data and preparing a system-wide measurement [41]. There are various communication options available for wide area measurement system (WAMS) including telephone lines, fiber-optic cables, satellites, power lines, and microwave links [39]. Studies show that the average combined delay caused by the above mentioned reasons over even long transmitting distances (in the order of 1000 miles) when using a communication

media with a band-width of 56 Kbps (data rate in telephone lines) is around 5–7 cycles of a 60 Hz system [41]. Therefore, deploying wide area measurements in the proposed method is a proper fit with regards to the method's application for the purpose of improving distance relay back-up protection which, as mentioned before, operates with a time delay (20 and 60 cycles for zones 2 and 3 respectively). Deploying advanced communication media such as fiber-optic cable by utilities provides a data transfer speed up to 2Mbps and significantly reduces the delay by removing the delay corresponding to the PMU data size [39].

Local measurements and calculations based on them at the relay point are the required elements of almost all of the protection schemes. Features selected from the local measurements as inputs for the SVM-1 and SVM-2 are: V_{bus} , $|I_{line}|$, P_{line} , and Q_{line} representing the bus voltage phasor, line current phasor magnitude, line active and reactive power flow respectively. Thanks to the PMU technology, WA measurements from various points of the system could be provided in today's power system operation. When employing WA measurements technology, implementation cost must be considered for the method to be economically justifiable. In other words, the more PMUs are deployed; the significantly higher implementation cost would be experienced although a better system behavior observation may be obtained. It is assumed that phasor measurements from PCC and target relay bus in regards to the reference bus are available and by PCC, as shown in [Fig. 1], only the distribution to upstream connection bus is meant rather than all of the DG units' interconnections individually. Therefore, implementing the proposed method would be economically practical. Net active (PDG) and reactive (QDG) power injections from the PCC into the transmission grid calculated from the PCC's PMU measurements are two good features to be utilized to improve the SVM-2 pattern recognition and classification accuracy. The other proper feature is the voltage phasor at the PCC on the grid side (VDG). Deploying these measurements and calculations is specifically beneficial to improve the SVM's performance accuracy when classifying under more complicated scenarios such as detecting a second fault when the system is already under the stress of a post fault and subsequent DG tripping events. As it will be shown in Section 5, the proposed scheme is able to detect such cases and unblock the trip signal so the protection security and dependability is well maintained.

The SVMs training scenarios includes different DG tripped capacities following 3-phase faults on the transmission side at various points in the vicinity of the DG placement in order to have realistic scenarios of the severe disturbance impact propagation from transmission to distribution level. The possible DG tripping instant following the disturbance varies in a range assumed according to the standards for anti-islanding protection schemes. Having prepared the training data set the SVMs go through the learning process and their performances are verified on the testing data set as will be discussed in the following Section.

Employing SVM technique to approach the problem under consideration from the distribution side, when using local data only, may not be a proper fit. To maintain its operation accuracy under the probable upstream disturbances might be challenging. After all, the primary issue was raised when deviations propagating from transmission to the distribution side are close to and almost not differentiable from those caused by islanding situation which is a probable thread to any anti-islanding protection scheme. Under such circumstances, the accuracy of SVM may be affected if only relying on local measurements because training the SVM to differentiate between such cases actually means training it for instances with similar features yet different labels which lowers the classification accuracy. The unintended DG tripping risk still remains unless remote measurements are provided for each DG unit's interconnection relay which is the same as the costly method of transfer trip.

Table 1: Vulnerable relays to DG tripping

Rank	Critical relay
1	R_{25-26}
2	R_{29-26}
3	R_{16-17}

CASE STUDY

The simulations have been conducted on the test system, [Fig. 1]. Having conducted a sensitivity analysis on the test system using the setting coordination check module from [31,32], the buses for clustered DG location with higher impact on the network distance relay settings and their corresponding list of critical relays (target relays) are identified. It was concluded that clustered PVs on bus 27, as shown in [Fig. 1], is one of the locations with highest impact on distance relay settings for unintended PV tripping cases and the corresponding list of critical relays to this location is brought in Table 1.

Maximum PV penetration in the system is assumed to be a considerable amount of 250 MW all of which has been tripped to sort the vulnerable relays in the system as the worst case scenario. The penetration level could be defined in various ways based on the system's total generation, system's peak load, or amount

of energy served [19]. For example, considering the system's total generation, the penetration level is obtained from the following equation:

$$DG \text{ Penetration}(\%) = \frac{\text{Total DG generation (MW)}}{\text{Total generation (MW)}} \quad (7)$$

The SVM training data set consists of different cases (84 cases in total) including: 3 DG tripped capacities (100 MW, 250 MW, and 500 MW), faults on transmission system at different distances in the vicinity of the DG placement, which also includes some points along the lines in the third zone of the target relay, and multiple DG tripping instants following the disturbance. According to the IEEE standard, the anti-islanding schemes should be able to detect all possible islanding conditions and trip DGs within 0.16 to 2 s depending on the level of voltage and frequency variations [8]. The reporting rate of the PMUs is considered 60 phasor per second in a 60 Hz system according to the standard [40]. It should be noted that this is different from the PMU sampling rate on the input signal. The sampling rate might be up to 512 samples per cycle [40]; however, one phasor per cycle is computed and reported by the PMU. Each instance of training includes 2 cycles of data. As mentioned before, the local measurements include Vbus, |Iline|, Pline, and Qline at the target relay location. Deploying the PMU technology, VDG, PDG, and QDG at the DG PCC are also available. Note that the voltage phasors measurements include both magnitude and angle. Therefore, considering 1 phasor per cycle reporting rate and length of each instance (2 cycles), the input vector for each instance of training consists of 10 (5 × 2) features from local measurements and 8 (4 × 2) from those of WA. Hence, the input vectors for SVM-1 and SVM-2 consist of 10 and 18 features respectively. Considering all the simulated training cases, i.e. 84 cases of one-and-half seconds system operation time, the training set consists of 3780 instances. The same procedure is taken to create the testing data set. The conditions including DG tripped capacity, fault location and instant of DG tripping, are chosen intentionally different from the training set to assess the performance of the SVMs for unseen scenarios. In total, there are 1692 instances in the testing data set. Different types of DGs and their modeling might cause a change in the measurement values of the selected features and the SVMs should be trained based on the updated values correspondingly.

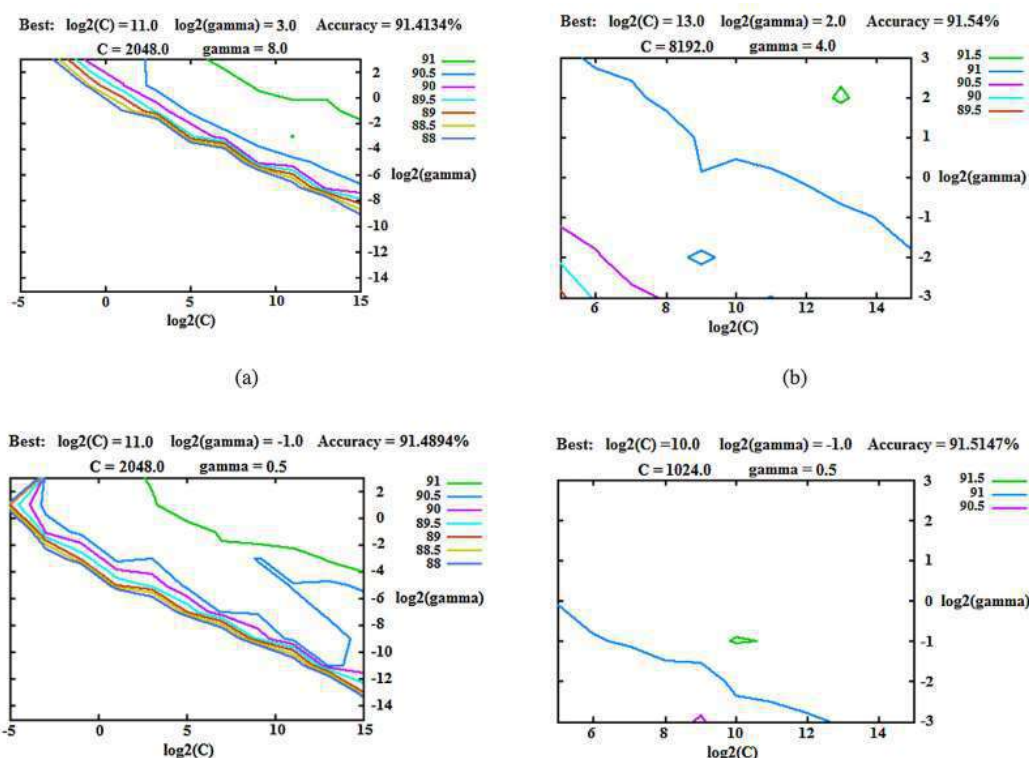


Fig. 4: Interactive grid search using cross-validation for selecting SVMs parameter values; (a)-(b) loos and fine searches on training data-set for SVM-1; (c)-(d) loos and fine search on training data-set for SVM-2.

Table 2 : SVMs specifications

SVM No.	SVM-1	SVM-2
C	8192	1024
γ	4	0.5
No. Iterations	2112058	98096
No. of SVs	772	753
Testing Accuracy (%)	93.8	97.6
Training Time (s)	39.67	8.76
Testing Time (s)	0.147	0.19

CONCLUSION

The main contributions of this paper are as follows:

- A SVM-based protection scheme which prevents maloperation of distance relays in unintended DG tripping scenarios is proposed.
- WA measurements have been used in addition to local measurements to increase the SVM's classification accuracy and that of the protection scheme consequently. The proposed scheme is robust against PMU data loss or unavailability.
- Unlike conventional blocking schemes, the proposed protection scheme not only blocks the relay following the interference of aDG tripping scenario with distance coordination but also detects a fault if it happens during the blocking period and unblocks the relay to operate properly.
- Since the proposed scheme is easily and quickly trainable, it is applicable to various possible practical system operation scenarios and gives significant selectivity.

In summary, deploying the WA measurements infrastructure not only improves the scheme accuracy but also makes it independent of the aggregated DG location in the system. The proposed scheme could be implemented in combination with other protection schemes such as power swing blocking to help maintaining power system protection dependability and security.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

THE STUDY OF ORGANIZATIONAL CITIZENSHIP BEHAVIOR AND ITS ROLE IN IMPROVING THE COMPONENTS OF ORGANIZATIONAL INTELLIGENCE (STUDY AT THE UNIVERSITY OF SISTAN AND BALUCHESTAN)

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ABSTRACT

Nowadays, organizations make use of organizational intelligence to make the individuals more compatible with the environment. On the other hand, organizational intelligence is an experimental and scientific process which underscores the organization's successes or failures. The objective of the present study is The Study of Organizational Citizenship Behavior and Its Role in Improving the Components of Organizational Intelligence (Study at the University Of Sistan and Baluchestan). The present study is an applied research according to its objective and it is a descriptive-survey study based on the data collection method. Two methods of library research and field study (Albrecht's (2003) organizational intelligence questionnaire and the organizational citizenship questionnaire by Podsakof (2000) were used according to the type of the information required for conducting the current study. The questionnaires' validity was confirmed by professors and the questionnaires' reliability was also confirmed by taking advantage of Cronbach's alpha method. The study population of the current study included all of University Of Sistan and Baluchestan staff members which reached the total number of 200 people. To determine an appropriate study sample volume there was made use of the Cochran's formulae and Morgan's table and according to the number of study population the total number of the study sample volume was equal to 130 individuals who were selected based on the simple randomized method and the questionnaires were administered to them. To study the variable changes in the organizational citizenship behavior and also for the prediction of the amount of the change in behavior variable there was dealt with the regression analysis and in doing so it was made use of SPSS software. The results of the study indicated that the organizational intelligence and its components were effective on the organizational citizenship behavior that means that with the increase in the organizational intelligence among the managers and the employees of the University Of Sistan and Baluchestan citizenship behavior will also improve.

INTRODUCTION

Nowadays, the organizations make use of organizational intelligence to make the employees more compatible with the environment. On the other hand, organizational intelligence is an experimental and scientific process which emphasizes more on the organization's accomplishments and failures [1]. That is to say that it is exactly based on experiences which are more likely to be applied for a more effective performance of the organization. Based on this, according to the specific characteristics of the organizational intelligence it became evident that although the organizational intelligence has similarities with the individual intelligence but it has to be considered as a social and group outcome. That means that the organizational intelligence is the result of a group of individuals' performance who work as a unit [2] and it differs considerably from individual intelligence from this perspective. Based on the most recent evidences and the study results it can be stated that the organizational intelligence as a mental faculty is comprised of components which influence the entire scope of the daily human life. Research also indicates clearly that the organizational intelligence is in relationship with positive results such as socially accepted behaviors, favorable relationships with colleagues and family (Rice, 1999). In some of the researchers' ideas including Vander the characteristic capabilities such as organizational intelligence can be perceived based on their real manifestations in the real world such as the job, family and social statuses. Especially the recent researches recognize the organizational intelligence as one of the very important capabilities for work environment [3]. However, organizational intelligence should be considered as a group outcome of the social symbols, organizational culture and the interpersonal interactions and it should be taken into consideration that a social structure cannot be envisaged without its internal emotions. Due to the same reason, the emotional intelligence which in itself possesses grandeur background is mostly regarded as an extension to the organizational intelligence. Also, the existence of definite citizenship behavior-organizational performance relationships reveals another necessity for finding their role alongside the organizational intelligence variable. Based on what has been presented regarding the organizational intelligence apparent overlapping between this variable and the citizenship behavior can be easily detected and it is expected that the quality of their interrelationships can be determined to a great extent via the present study. In relation to the organizational citizenship behavior it can be said that "the staff contribute to their organization efficiency and improvement by performing their responsibilities beyond the predetermined tasks and responsibilities that means that they conduct extra cooperation which is not necessary, nor predictable." [4]. Organizational intelligence is the organizational competency for the creation of knowledge and its consequent strategic use in the market place. Organizational intelligence and intelligence quality are similar to each other, but the former is implemented in the organizational environment, while it previously dealt with the review of the information gathered from duties, products, employees and work processes, today it seems that all of these items have been enhanced and augmented in the knowledge management intelligent systems. Researchers have shown that the organizations are committed to make use of knowledge intuition

KEY WORDS

Organizational intelligence, citizenship behavior, University Of Sistan and Baluchestan

Received: 12 Aug 2016
Accepted: 21 Sept 2016
Published: 15 Nov 2016

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tactics, data storage in computer hardware and the information collected from the environment in their learning process. Such cases can be used in predictable and reasonable decision making, since such a complicated process deals with a great number of individuals who contrastively work in information system navigation. Organizational intelligence in an organization is something more than the sum of the individual intelligences. This whole intelligence is alone a great system. The individuals' abilities to solve problems make several factors such as affective and intellectual intelligence. In a similar way, researchers have defined organizational intelligence as the organization's ability in solving the problems through the use of the subsystems. These subsystems include organizational structure, culture, shareholders, knowledge, capital and strategic processes. All of these cases and items are in some way subjected to the information technology and they are shared in information technology in each and every subsystem of the organizational intelligence since information technology conducts the fundamental objectives and cognitive performances.

Intelligence, as an attractive and interesting concept and a new research field, has found a significant role in many of the study fields. One such field is management. In spite of the word "intelligence" extensive use in management, but it is still an ambiguous lexicon due to the lack of a united theory regarding intelligence in organizations.

While there are various researches, though few in number, have been conducted in this field we have not been bearing witness to such studies in University Of Sistan and Baluchestan, therefore we are seeking to deal with the organizational intelligence effect on citizenship behavior in the present study. So, the main question that should be coped with in the present study is that:

"Can organizational intelligence predict University Of Sistan and Baluchestan employees' citizenship behavior?"

Theoretical framework

Karl Albrecht in 2002 in a book entitled as "minds power at work: organizational intelligence in practice" points out that one of the organizational intelligence functions is prevention from collective mental slackness." In his idea, success in business needs three elements: intelligent individuals, intelligent teams and intelligent organizations. He realizes the organizational intelligence as the talent and capacity an organization has for mobilizing the organizational mental capabilities and concentrating such capabilities in reaching to the organization's mission. He introduces seven aspects for organizational intelligence in his book [Fig. 1-3]. In his opinion, these seven aspects are attributes rather than a collection of behaviors or structural characteristics or a certain operational process or method. Each of these attributes or intelligences has various precedents or factors. Precedents can include qualified leadership, appropriate products or processes, market demand, coherent missions, vivid objectives, pivotal values and policies which determine the staff members' behaviors and rights. In each of these aspects some precedents can be identified which are effective on maximizing the related intelligence, therefore, the following conceptual model reflects each of the organizational intelligence components effect on the organizational citizenship behavior.

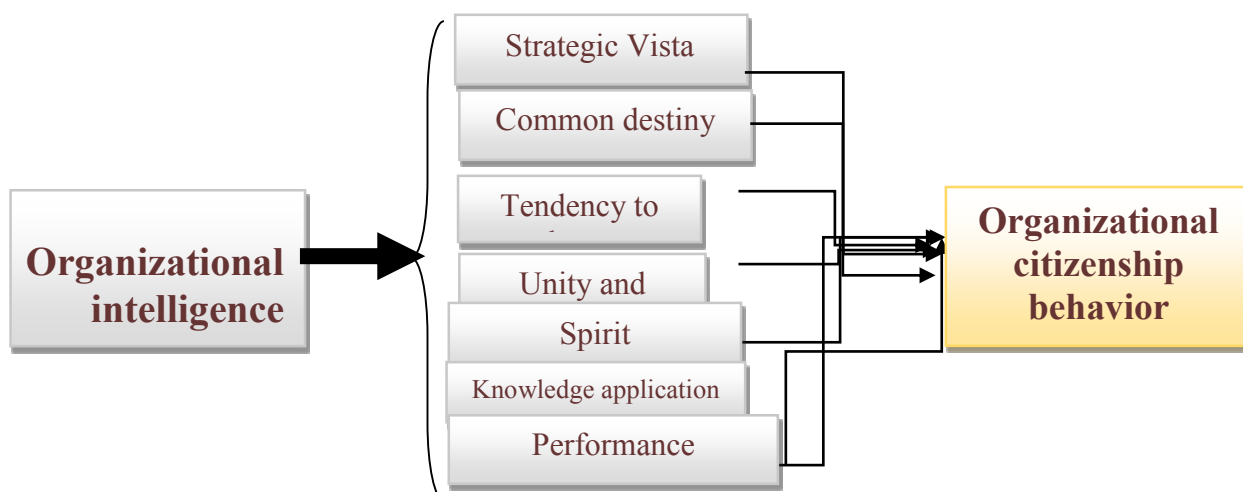


Fig. 1: study conceptual model.

The main study hypothesis states that

Organizational intelligence is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

Secondary hypotheses

- Strategic Vista is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.
- Common destiny is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.
- Tendency to changes effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.
- Unity and agreement is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.
- Spirits effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.
- Knowledge applications effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.
- Performance pressure is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

STUDY METHODOLOGY

The study methodology is of the descriptive-survey type, and it is an applied research from the objective point of view, besides the descriptive-survey method used in the present study the correlation analysis method has also been taken advantage of. The study population of the current research includes all of the employees working in University Of Sistan and Baluchestan who were 200 people. To determine the study sample there was made use of the Cochran method and Morgan table, who were 130 individuals according to the 200-people study sample all of whom were selected by means of a simple randomized method and the questionnaires were administered to them. To collect the information there were made use of two questionnaires and library research and in the current study Albrecht's organizational intelligence questionnaire (2003) and Pudsakof's organizational citizenship behavior standard questionnaire (2000) were used. And according to the results obtained by the use of Cronbach's alpha method (higher than 0.7) it became clear that the questionnaires enjoy the required reliability. To determine the validity according to the questionnaires being standard and according to the consulting and supervising professors and also the experts of the field the questionnaires' validity was verified and confirmed. To analyze the data there was made use of inferential statistics and linear regression test be taking advantage of SPSS software.

Study findings

Main hypotheses: Organizational intelligence is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

To survey the amount of the effect the data were analyzed based on the regression model goodness of fitness, which is dealt with in the following section. Thus, to survey and offer a model for the relationships between the organizational intelligence (Y) and organizational citizenship behavior (X) which is illustrated in the following table we deal with the processed model.

Table 1: Regression model goodness of fitness between Organizational intelligence and organizational citizenship behavior

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.557		0.310	0.305	0.311

Correlation between the independent variables and dependent variables is equal to 0.557. The determination coefficient is 0.310 and this value indicates that 31% of the organizational intelligence variations pertains to the organizational citizenship behavior. Because this amount of the degree of freedom is not considered thus the adjusted determination coefficient has been used for this purpose and it is equal to 30.5% in the present test. According to the indices and indicators expressed here the model can be claimed that has the required adequacy.

Table 2: Regression equation calculation of OCB

Model		Non-standardized coefficient		Standardized coefficient	T	Sig
		B	Std. Error	Beta		
1	Constant	2.10	0.252	0.557	8.36	0.000
	Organizational intelligence	0.466	0.061		7.59	
Dependent variable: OCB						

The variable inserted to the regression model is the main core of the regression analysis which is given in the above table. The regression equation can be calculated as below by the use of non-standardized coefficients column:

$$\text{Organizational intelligence } 2.10 + (0.466) = \text{organizational citizenship behavior}$$

It can be said that by enhancing each independent variable by one unit, the dependent variable will be enhanced by the written coefficient amount. Or in other words, enhancing the organizational intelligence by one unit the organizational citizenship behavior standard deviation will be increased by 0.466, therefore they are of a positive relationship. The t-test related to the regression coefficients has also been given in the table for the independent variable. And its amount has been equal to 0.000 for the independent variable consequently the organizational intelligence is effective on the organizational citizenship behavior.

First sub-hypotheses: Strategic Vista is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

To survey the amount of the effect the data were analyzed based on the regression model goodness of fitness, which is dealt with in the following section. Thus, to survey and offer a model for the relationships between the Strategic Vista (Y) and organizational citizenship behavior (X) which is illustrated in the following table we deal with the processed model.

Table 3: Regression model goodness of fitness between Strategic Vista and organizational citizenship behavior

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.425		0.180	0.174	0.340

Correlation between the independent variables and dependent variables is equal to 0.425. The determination coefficient is 0.180 and this value indicates that 18% of the Strategic Vista variations pertains to the organizational citizenship behavior. Because this amount of the degree of freedom is not considered thus the adjusted determination coefficient has been used for this purpose and it is equal to 17.4% in the present test. According to the indices and indicators expressed here the model can be claimed that has the required adequacy.

Table 4: Regression equation calculation of OCB

Model		Non-standardized coefficient		Standardized coefficient	T	Sig
		B	Std. Error	Beta		
1	Constant	2.84	0.222	0.425	12.83	0.000
	Strategic Vista	0.273	0.051		5.30	
Dependent variable: OCB						

The variable inserted to the regression model is the main core of the regression analysis which is given in the above table. The regression equation can be calculated as below by the use of non-standardized coefficients column:

$$\text{Common destiny } (7.90) + 55.39 = \text{organizational citizenship behavior}$$

It can be said that by enhancing each independent variable by one unit, the dependent variable will be enhanced by the written coefficient amount. Or in other words, enhancing the Strategic Vista by one unit the organizational citizenship behavior standard deviation will be increased by 7.90, therefore they are of a positive relationship. The t-test related to the regression coefficients has also been given in the table for the independent variable. And its amount has been equal to 0.000 for the independent variable consequently the Strategic Vista is effective on the organizational citizenship behavior.

Second sub-hypotheses: Common destiny is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

To survey the amount of the effect the data were analyzed based on the regression model goodness of fitness, which is dealt with in the following section. Thus, to survey and offer a model for the relationships between the Common destiny (Y) and organizational citizenship behavior (X) which is illustrated in the following table we deal with the processed model.

Table 5: Regression model goodness of fitness between Common destiny and organizational citizenship behavior

Error standard deviation	Adjusted determination coefficient	Determination coefficient	Correlation coefficient
0.463	0.215	0.208	0.332

Correlation between the independent variables and dependent variables is equal to 0.463. The determination coefficient is 0.215 and this value indicates that 21.5% of the Common destiny variations pertains to the organizational citizenship behavior. Because this amount of the degree of freedom is not considered thus the adjusted determination coefficient has been used for this purpose and it is equal to 20.8% in the present test. According to the indices and indicators expressed here the model can be claimed that has the required adequacy.

Table 6: Regression equation calculation of OCB

Model		Non-standardized coefficient		Standardized coefficient	T	Sig.
		B	Std. Error	Beta		
1	Constant	2.60	0.240	0.463	10.82	0.000
	Strategic Vista	0.340	0.057		5.91	
Dependent variable: OCB						

The variable inserted to the regression model is the main core of the regression analysis which is given in the above table. The regression equation can be calculated as below by the use of non-standardized coefficients column:

Common destiny (0.340)+ 2.60= organizational citizenship behavior

It can be said that by enhancing each independent variable by one unit, the dependent variable will be enhanced by the written coefficient amount. Or in other words, enhancing the Common destiny by one unit the organizational citizenship behavior standard deviation will be increased by 0.340 therefore they are of a positive relationship. The t-test related to the regression coefficients has also been given in the table for the independent variable. And its amount has been equal to 0.000 for the independent variable consequently the Common destiny is effective on the organizational citizenship behavior.

Tirth sub-hypotheses: Tendency to change is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

To survey the amount of the effect the data were analyzed based on the regression model goodness of fitness, which is dealt with in the following section. Thus, to survey and offer a model for the relationships between the Tendency to change (Y) and organizational citizenship behavior (X) which is illustrated in the following table we deal with the processed model.

Table 7: Regression model goodness of fitness between Tendency to change and organizational citizenship behavior

Error standard deviation	Adjusted determination coefficient	Determination coefficient	Correlation coefficient
0.271	0.073	0.066	0.361

Correlation between the independent variables and dependent variables is equal to 0.271. The determination coefficient is 0.073 and this value indicates that 7.3% of the Tendency to change variations pertains to the organizational citizenship behavior. Because this amount of the degree of freedom is not considered thus the adjusted determination coefficient has been used for this purpose and it is equal to 6.6% in the present test. According to the indices and indicators expressed here the model can be claimed that has the required adequacy.

Table 8: Regression equation calculation of OCB

Model		Non-standardized coefficient		Standardized coefficient	T	Sig
		B	Std. Error	Beta		
1	Constant	3.52	0.157	0.271	22.44	0.002
	Strategic Vista	0.117	0.037		3.18	
Dependent variable: OCB						

The variable inserted to the regression model is the main core of the regression analysis which is given in the above table. The regression equation can be calculated as below by the use of non-standardized coefficients column:

Tendency to change $(0.117) + 3.52 =$ organizational citizenship behavior

It can be said that by enhancing each independent variable by one unit, the dependent variable will be enhanced by the written coefficient amount. Or in other words, enhancing the Tendency to change by one unit the organizational citizenship behavior standard deviation will be increased by 0.117, therefore they are of a positive relationship. The t-test related to the regression coefficients has also been given in the table for the independent variable. And its amount has been equal to 0.002 for the independent variable consequently the Tendency to change is effective on the organizational citizenship behavior.

Fourth sub-hypotheses: Unity and agreement is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

To survey the amount of the effect the data were analyzed based on the regression model goodness of fitness, which is dealt with in the following section. Thus, to survey and offer a model for the relationships between the Unity and agreement (Y) and organizational citizenship behavior (X) which is illustrated in the following table we deal with the processed model.

Table 9: Regression model goodness of fitness between Unity and agreement and organizational citizenship behavior

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.450		0.203	0.196	0.335

Correlation between the independent variables and dependent variables is equal to 0.450. The determination coefficient is 0.203 and this value indicates that 20.3% of the Unity and agreement variations pertains to the organizational citizenship behavior. Because this amount of the degree of freedom is not considered thus the adjusted determination coefficient has been used for this purpose and it is equal to 19.6% in the present test. According to the indices and indicators expressed here the model can be claimed that has the required adequacy.

Table 10: Regression equation calculation of OCB

Model		Non-standardized coefficient		Standardized coefficient	T	Sig
		B	Std. Error	Beta		
1	Constant	3.10	0.161	0.450	19.23	0.000
	Strategic Vista	0.242	0.042		5.70	
Dependent variable: OCB						

The variable inserted to the regression model is the main core of the regression analysis which is given in the above table. The regression equation can be calculated as below by the use of non-standardized coefficients column:

Unity and agreement $(0.242) + 3.10 =$ organizational citizenship behavior

It can be said that by enhancing each independent variable by one unit, the dependent variable will be enhanced by the written coefficient amount. Or in other words, enhancing the Unity and agreement by one unit the organizational citizenship behavior standard deviation will be increased by 0.242 therefore they are of a positive relationship. The t-test related to the regression coefficients has also been given in the table for the independent variable. And its amount has been equal to 0.000 for the independent variable consequently the Unity and agreement is effective on the organizational citizenship behavior.

Fifth sub-hypotheses: Spirit is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

To survey the amount of the effect the data were analyzed based on the regression model goodness of fitness, which is dealt with in the following section. Thus, to survey and offer a model for the relationships between the Spirit (Y) and organizational citizenship behavior (X) which is illustrated in the following table we deal with the processed model.

Table 11: Regression model goodness of fitness between Spirit and organizational citizenship behavior

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.388		0.151	0.144	0.346

Correlation between the independent variables and dependent variables is equal to 0.388. The determination coefficient is 0.151 and this value indicates that 15.1% of the Spirit variations pertains to the organizational citizenship behavior. Because this amount of the degree of freedom is not considered thus the adjusted determination coefficient has been used for this purpose and it is equal to 14.4% in the present test. According to the indices and indicators expressed here the model can be claimed that has the required adequacy.

Table 12: Regression equation calculation of OCB

Model		Non-standardized coefficient		Standardized coefficient	T	Sig.
		B	Std. Error	Beta		
1	Constant	2.94	0.226	0.388	13.04	0.000
	Spirit	0.262	0.055		4.76	
Dependent variable: OCB						

The variable inserted to the regression model is the main core of the regression analysis which is given in the above table. The regression equation can be calculated as below by the use of non-standardized coefficients column:

Spirit (0.262) + 2.94= organizational citizenship behavior

It can be said that by enhancing each independent variable by one unit, the dependent variable will be enhanced by the written coefficient amount. Or in other words, enhancing the Spirit by one unit the organizational citizenship behavior standard deviation will be increased by 0.262 therefore they are of a positive relationship. The t-test related to the regression coefficients has also been given in the table for the independent variable. And its amount has been equal to 0.000 for the independent variable consequently the Spirit is effective on the organizational citizenship behavior.

Sixth sub-hypotheses: Knowledge application is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

To survey the amount of the effect the data were analyzed based on the regression model goodness of fitness, which is dealt with in the following section. Thus, to survey and offer a model for the relationships between the Knowledge application (Y) and organizational citizenship behavior (X) which is illustrated in the following table we deal with the processed model.

Table 13: Regression model goodness of fitness between Knowledge application and organizational citizenship behavior

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.344		0.118	0.105	0.386

Correlation between the independent variables and dependent variables is equal to 0.344. The determination coefficient is 0.118 and this value indicates that 11.8% of the Knowledge application variations pertains to the organizational citizenship behavior. Because this amount of the degree of freedom is not considered thus the adjusted determination coefficient has been used for this purpose and it is equal to 10.5% in the present test. According to the indices and indicators expressed here the model can be claimed that has the required adequacy.

Table 14: Regression equation calculation of OCB

Model		Non-standardized coefficient		Standardized coefficient	T	Sig.
		B	Std. Error	Beta		
1	Constant	872.	2460.	3440.	4413.	0.000
	Knowledge application	2680.	70.05		04.5	
Dependent variable: OCB						

The variable inserted to the regression model is the main core of the regression analysis which is given in the above table. The regression equation can be calculated as below by the use of non-standardized coefficients column:

Knowledge application (0.268) + 2.87 = organizational citizenship behavior

It can be said that by enhancing each independent variable by one unit, the dependent variable will be enhanced by the written coefficient amount. Or in other words, enhancing the Knowledge application by one unit the organizational citizenship behavior standard deviation will be increased by 0.268, therefore they are of a positive relationship. The t-test related to the regression coefficients has also been given in the table for the independent variable. And its amount has been equal to 0.000 for the independent variable consequently the Knowledge application is effective on the organizational citizenship behavior.

Seventh sub-hypotheses: Performance pressure is effective on the organizational citizenship behavior of University Of Sistan and Baluchestan staff members.

To survey the amount of the effect the data were analyzed based on the regression model goodness of fitness, which is dealt with in the following section. Thus, to survey and offer a model for the relationships between the Performance pressure(Y) and organizational citizenship behavior (X) which is illustrated in the following table we deal with the processed model.

Table 15: Regression model goodness of fitness between Performance pressure and organizational citizenship behaviors

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.254		0.064	0.060	0.452

Correlation between the independent variables and dependent variables is equal to 0.254. The determination coefficient is 0.064 and this value indicates that 6.4% of the Performance pressure variations pertains to the organizational citizenship behavior. Because this amount of the degree of freedom is not considered thus the adjusted determination coefficient has been used for this purpose and it is equal to 6% in the present test. According to the indices and indicators expressed here the model can be claimed that has the required adequacy.

Table 16: Regression equation calculation of OCB

Model		Non-standardized coefficient		Standardized coefficient	T	Sig
		B	Std. Error	Beta		
1	Constant	612.	3210.	2540.	.0412	0.000
	Performance pressure	1870.	0780.		95.3	
Dependent variable: OCB						

The variable inserted to the regression model is the main core of the regression analysis which is given in the above table. The regression equation can be calculated as below by the use of non-standardized coefficients column:

Performance pressure (0.187) + 2.61 = organizational citizenship behavior

It can be said that by enhancing each independent variable by one unit, the dependent variable will be enhanced by the written coefficient amount. Or in other words, enhancing the Performance pressure by one unit the organizational citizenship behavior standard deviation will be increased by 0.187, therefore they are of a positive relationship. The t-test related to the regression coefficients has also been given in the table for the independent variable. And its amount has been equal to 0.000 for the independent variable consequently the Performance pressures effective on the organizational citizenship behavior.

CONCLUSION AND DISCUSSIONS

Based on the study theoretical background related to this two main variables and the results obtained from the study it can be said that in University Of Sistan and Baluchestan, the supervisors and the employees with higher organizational intelligence have been able to enhance and change personal promotion (self-development), innovation [5], social ethics [6], work conscience, manliness and organizational citizenship behaviors standards [7]. Among the citizenship behaviors and organizational intelligence common characteristics one can refer to creativity [8] in both of them. Being creative in individuals with organizational intelligence is generally for the purpose of better organizational tasks performance, activities improvement and reaching to the organizational goals and objectives. The individuals with proper citizenship behavior

also possess such an attribute. Organizational intelligence is a factor behind the enhancement of the citizenship behaviors which is performed via helping the individuals to make themselves more compatible [9], observation of more proper relationships [10], tendency to participate more in the decision making process [11] and participation at work, higher creativity for improving the activities and organization's access to the goals and objectives and recognition of the conditions existing in the organization.

Organizational intelligence helps the individual understand that the human beings' growth and development results from helping the others. Employees with high organizational intelligence know better than others that if the managers, peers, clients and individuals in relationships with the organization and in a broader and more general scale "fail to succeed they cannot be themselves individually successful as well. Also, they know that their creativity today, helping the other mankind, recognition and improvement of the organizational objectives, the improvement of the individual and group performances, individual, group and organizational growth and development are all variables which bring about positive evolutions and changes for the organization and they all can take advantage in these positive conditions and circumstances. They know that by helping the others they have helped themselves in deed and they are aware of this important fact that creativity makes jobs and works better and more attractive, makes the work environment more pleasant and more tolerable and they are perfectly aware that observing and keeping more proper relationships with the others makes the work environment more favorable and the lesser unnecessary tensions will be imposed on the individuals. Meanwhile, they can enjoy appropriate growth and promotion when the organization is working and upright and the others can reach their own personal and organizational objectives [12]. These staff members are well aware that they and the others and even the organization will face fewer problems by respecting an organization's culture and the staff members and the organization can move steps forward by better performance of the duties and tasks assigned. On the way to the success which is simpler and more readily available for the intelligent individuals in an organization they are generally provided with more enhancements and acquire more positive bonuses and thus the self-development pleasant path is more likely to be fully covered.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

SOCIAL RESPONSIBILITY COMPONENTS ROLE IN MELLI BANK CLIENTS' LOYALTY IN THE CITY OF ZABOL

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ABSTRACT

The present study aims at the investigation of social responsibility components role in Melli Bank clients' loyalty in the city of Zabol. The study population included all of Iran's Melli Bank clients the number of which is limitless. 278 individuals were selected based on Cochran's formula as the study sample volume and a simple randomized method was used for administering the questionnaires. The present study makes use of an applied method in order to accomplish the objectives and it takes advantage of a descriptive method based on the study nature and methodology. The information and data required for the present study have been collected based on library research and questionnaire. The questionnaire used for the present study has been comprised of two parts, social responsibility section excerpted from Carol's model (2000) and loyalty section which is designed and constructed by the researcher. Hypotheses tests were carried out in SPSS software. The study results indicated that social responsibility and its components concerning the banking scope exert a positive and direct effect on the clients' loyalty. The present research provides the reader with results regarding bank's social responsibility and clients' loyalty which can be of great help to the bank directors.

INTRODUCTION

KEY WORDS

Social responsibility,
loyalty, bank, clients

Infection Social responsibility, based on a voluntary premise, incorporates business strategies and behaviors in workmanship areas, staff empowerment, staff and work environment safety and health, clients' rights, bioenvironmental concerns, energy consumption management and cost-effectiveness, observation of the human rights principles, ethical codes and behavior criteria, organization's social and charitable activities [1].

Social responsibility is pointed towards a direction along which the social advantages are established. Thus, it has been tried to arrange the organizations' profit and loss in such a way that no additional costs are imposed on the people. By social responsibility we mean that the organizations exert substantial effects on social systems and, hence, the way they act should be corresponding with the idea that the society is not incurred with extravagant expenditures, and in cases that such costs are imposed, the related organizations are required to compensate for them. In other words, the organizations should not see themselves as independent from their external environment and they should not consider themselves as separate entities, rather, they should know themselves as a part of a whole to wit an external environment and community and their activities and objectives should be in line with social ideals and society's welfare and comfort. Nowadays, the entire array of the managers should take measures which are accepted by the society and are corresponding with its values. The organizations failing to adjust themselves with such a critical issue will not succeed [2].

Organizations' social responsibility deals with offering methods which are exercised by the organizations in business environment and they consequently stay responding to the society's business, legal, ethical and social expectations. That is because organizations have great responsibilities in social, economical and environmental areas regarding their staff, shareholders, clients, government, suppliers and all of their stakeholders. Undoubtedly, if the individuals, groups, organizations and various institutions in the context of a society realize themselves as being responsible in respect to the incidents, happenings and various crises and each of them make efforts within the framework of their jurisdiction and work environment scope to solve the aforesaid crises, many of the problems will be removed and a healthy and calm society will emerge. Furthermore, the way an organization works is effective on the society. Therefore, the organizations should get on the jobs which are accepted by the society and resultantly corresponding to its values. The organizations falling short of adjusting themselves with such a critical issue will not be successful in their actions. In other words, in order for the organizations to be able to preserve their position in the society or improve it in a manner that it results in their survival and success at work, they are required to pay necessary attention to social responsibility and the factors effective thereon. Therefore, social responsibility of the organizations is an essential factor behind every organization's survival and neglecting it will jeopardize the organization's survival [3].

Similar to the other organizations striving in a society, health sector and its organizations that are trying to offer complex health and treatment services to the society via the interaction of the variegated expertise, departments, industries and equipment, should assume social responsibilities [4].

A review of the studies on social responsibility indicates that a great majority of such studies have been conducted on sectors other than bank services and they have aimed at the identification of the organization's social responsibility model, the determination of the relationship between the organization's social responsibility and their financial performances and leadership styles, the survey of various interested

Received: 12 Aug 2016
Accepted: 21 Sept 2016
Published: 15 Nov 2016

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groups' ideas and attitudes in respect to organization's' social responsibility, evaluation of the organizational measures taken in regard of the social responsibility and the effects of assuming such responsibilities [5]. Also, the existence of a significant relationship between the social responsibility rate and clients' loyalty was tested. The two abovementioned variables were selected according to the results of the studies by De Greje who indicated the relationship between the bank types and the social responsibility acceptance level and Akar who reported a significant difference between social responsibility levels in various organizational groups [6]. In fact, the main question posed by the present study is that "according to the high importance of the society's welfare and social responsibility and based on the idea that the ultimate goal of the entire organizations within a society is gaining access to clients' loyalty and then turning them to loyal customers, how can social responsibility acceptance influence the clients' loyalty in Zabol's Melli Bank?"

Study Conceptual Model

In the present study which deals with the survey of two variables, Carol's model (2000) has been used for the independent variable (social responsibility) and it has four dimensions:

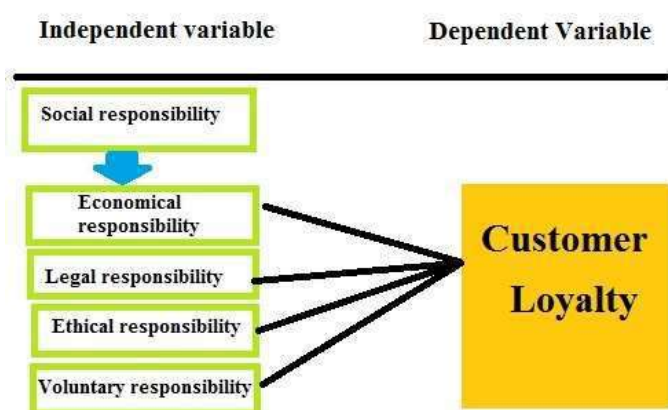


Fig. 1: Study conceptual model

The Study Hypotheses

Main Hypothesis

Zabol's Melli Bank social responsibility is effective on clients' loyalty.

Secondary Hypotheses

- Zabol's Melli Bank economical responsibility is effective on clients' loyalty.
- Zabol's Melli Bank legal responsibility is effective on clients' loyalty.
- Zabol's Melli Bank ethical responsibility is effective on clients' loyalty.
- Zabol's Melli Bank voluntary responsibility is effective on clients' loyalty.

MATERIALS AND METHODS

The present study makes use of an applied method in terms of its objectives and it is a non-experimental (field) study, or more precisely, it is a descriptive research according to the way the data have been collected (study methodology). The study population included all of Iran's Melli Bank clients suggesting a limitless number of study population out of which 278 individuals were selected based on Cochran's formula as the study sample volume and a simple randomized method was used for questionnaire distribution.

There is made use of two methods for collecting the information, namely library research and questionnaire. The questionnaire applied in the current study is comprised of two parts, social responsibility section excerpted from Carol's model (2000) and a researcher-made loyalty-connected section the validity and reliability of which have been confirmed. SPSS software was used to analyze the data. Statistical tests were performed in two levels, firstly, in descriptive statistics level tests like frequency, frequency percentage and the related diagrams were undertaken and in inferential statistics level linear regression tests were taken advantage of.

RESULTS

Main Hypothesis: Zabol's Melli Bank social responsibility is effective on clients' loyalty.

Table 1: Social responsibility-loyalty regression model fitness

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.447	0.456		0.461	0.679

Correlation between the independent and dependent variables was 0.679. Determination coefficient was 0.461 and this value indicates that 46.1% of the social responsibility variations pertain to the extant loyalty. Because degree of freedom has not been taken into consideration in calculating the value, thus the adjusted determination coefficient should be used to serve the same purpose and it was computed as equal to 45.6%. According to the indices proposed above it can be said that the model enjoys the required adequacy.

Table 2: Loyalty regression equation calculation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	-0.438	0.478	0.679	-0.916	0.000
	Social responsibility	1.15	0.114		10.16	
Dependent Variable: loyalty						

The variable inserted into the regression equation forms the main core of the regression analysis which has also been presented in the above table. Regression equation can be calculated as shown below by making use of the unstandardized coefficients column:

$$\text{Social Responsibility (1.15)} + -0.438 = \text{loyalty}$$

It can be said that with a unit enhancement of every independent variable, the dependent variable will be also increased by the value of the dependent variable obtained value; or, in other words, with a unit increase in social responsibility, loyalty standard deviation will be increased by 1.15 units, therefore they are in a positive relationship. Regression coefficient-related t-test has been also presented in the above table for independent variable. The variable's significance level was found 0.000, thus it is effective on loyalty.

Sub- Hypothesis 1: Zabol's Melli Bank economical responsibility is effective on clients' loyalty.

Table 3: Economical responsibility-loyalty regression model fitness

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.570	0.114		0.122	0.349

Correlation between the independent and dependent variables was 0.349. Determination coefficient was 0.122 and this value indicates that 12.2% of the economical responsibility variations pertain to the extant loyalty. Because degree of freedom has not been taken into consideration in calculating the value, thus the adjusted determination coefficient should be used to serve the same purpose and it was computed as equal to 11.4%. According to the indices proposed above it can be said that the model enjoys the required adequacy.

Table 4: Loyalty regression equation calculation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	2.75	0.407	0.349	6.75	0.000
	economical responsibility	0.399	0.098		4.09	
Dependent Variable: loyalty						

The variable inserted into the regression equation forms the main core of the regression analysis which has also been presented in the above table. Regression equation can be calculated as shown below by making use of the unstandardized coefficients column:

Economical Responsibility (0.399) + 0.2.75=loyalty

It can be said that with a unit enhancement of every independent variable, the dependent variable will be also increased by the value of the dependent variable obtained value; or, in other words, with a unit increase in economical responsibility, loyalty standard deviation will be increased by 0.399 units, therefore they are in a positive relationship. Regression coefficient-related t-test has been also presented in the above table for independent variable. The variable's significance level was found 0.000, thus it is effective on loyalty.

Sub- Hypothesis 2: Zabol's Melli Bank legal responsibility is effective on clients' loyalty.

Table 5: Legal responsibility-loyalty regression model fitness

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.542	0.200		0.207	0.454

Correlation between the independent and dependent variables was 0.454. Determination coefficient was 0.207 and this value indicates that 20.7% of the legal responsibility variations pertain to the extant loyalty. Because degree of freedom has not been taken into consideration in calculating the value, thus the adjusted determination coefficient should be used to serve the same purpose and it was computed as equal to 20%. According to the indices proposed above it can be said that the model enjoys the required adequacy.

Table 6: Loyalty regression equation calculation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	2.27	0.382	0.454	5.95	0.000
	legal responsibility	0.49	0.088		5.61	
Dependent Variable: loyalty						

The variable inserted into the regression equation forms the main core of the regression analysis which has also been presented in the above table. Regression equation can be calculated as shown below by making use of the unstandardized coefficients column:

Legal Responsibility (0.496) + 2.27=loyalty

It can be said that with a unit enhancement of every independent variable, the dependent variable will be also increased by the value of the dependent variable obtained value; or, in other words, with a unit increase in legal responsibility, loyalty standard deviation will be increased by 0.496 units, therefore they are in a positive relationship. Regression coefficient-related t-test has been also presented in the above table for independent variable. The variable's significance level was found 0.000, thus it is effective on loyalty.

Sub- Hypothesis3: Zabol's Melli Bank ethical responsibility is effective on clients' loyalty.

Table 7: Ethical responsibility-loyalty regression model fitness

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.859	0.055		0.063	0.250

Correlation between the independent and dependent variables was 0.250. Determination coefficient was 0.063 and this value indicates that 6.3 % of the social responsibility variations pertain to the extant loyalty. Because degree of freedom has not been taken into consideration in calculating the value, thus the adjusted determination coefficient should be used to serve the same purpose and it was computed as equal to 5.5%. According to the indices proposed above it can be said that the model enjoys the required adequacy.

Table 8: Loyalty regression equation calculation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	3.30	0.381	0.250	8.73	0.000
	ethical responsibility	0.270	0.095		2.84	
Dependent Variable: loyalty						

The variable inserted into the regression equation forms the main core of the regression analysis which has also been presented in the above table. Regression equation can be calculated as shown below by making use of the unstandardized coefficients column:

Ethical Responsibility (0.270) + 0.3.30=loyalty

It can be said that with a unit enhancement of every independent variable, the dependent variable will be also increased by the value of the dependent variable obtained value; or, in other words, with a unit increase in ethical responsibility, loyalty standard deviation will be increased by 0.270 units, therefore they are in a positive relationship. Regression coefficient-related t-test has been also presented in the above table for independent variable. The variable's significance level was found 0.000, thus it is effective on loyalty.

Sub- Hypothesis4: Zabol's Melli Bank voluntary responsibility is effective on clients' loyalty.

Table 9: Voluntary responsibility-loyalty regression model fitness

Error standard deviation	Adjusted coefficient	determination	Determination coefficient	Correlation coefficient
0.524	0.724		0.726	0.852

Correlation between the independent and dependent variables was 0.852.Determination coefficient was 0.726 and this value indicates that 72.6% of the voluntary responsibility variations pertain to the extant loyalty. Because degree of freedom has not been taken into consideration in calculating the value, thus the adjusted determination coefficient should be used to serve the same purpose and it was computed as equal to 72.4%. According to the indices proposed above it can be said that the model enjoys the required adequacy.

Table 10: Loyalty regression equation calculation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	-0.533	0.277	0.852	-1.924	0.000
	voluntary responsibility	1.129	0.063		17.91	
Dependent Variable: loyalty						

The variable inserted into the regression equation forms the main core of the regression analysis which has also been presented in the above table. Regression equation can be calculated as shown below by making use of the unstandardized coefficients column:

Voluntary Responsibility (1.12) + - 0.533=loyalty

It can be said that with a unit enhancement of every independent variable, the dependent variable will be also increased by the value of the dependent variable obtained value; or, in other words, with a unit increase in voluntary responsibility, loyalty standard deviation will be increased by 1.12 units, therefore they are in a positive relationship. Regression coefficient-related t-test has been also presented in the above table for independent variable. The variable's significance level was found 0.000, thus it is effective on loyalty.

CONCLUSION AND SUGGESTIONS

It was made clear from the data analysis that social responsibility is effective on the clients' loyalty. And, the individual hypotheses will be investigated after a short discussion is presented.

Nowadays, the organizations' social responsibility deals with presenting methods exercised by the organizations in the business environment and make them respondent to the society's business, legal, ethical and social expectations that is because the organizations have great social, economical and environmental responsibilities in respect to their staff, shareholders, government, suppliers and the entire array of the interested stakeholders. Undoubtedly, if various individuals, groups, organizations and institutions within the framework of a society realize themselves responsible and dutiful to the events, happenings and various crises and do their best to resolve such bottlenecks within the realm of their job jurisdiction and work environment, many of the problems will be decreased and a healthy and calm society will be generated. In other words, the way an organization acts is effective on the society. Therefore, the organizations should get on the jobs which are accepted by the society and corresponding to its values. Organizations unable to adjust themselves to such an important issue will not succeed in practice. Therefore, organizations' social responsibility is the fundamental factor behind their survival and neglecting it will endanger the organizations' survival [7]. Organizations are made by the human beings and it is the duty of them to take social responsibility and ethical concerns into consideration in establishing and creating their organizations. Social responsibility concept incorporates several relevant issues connected to companies' behavior in their immediate society environment. Social responsibility deals with issues transcending the economical topics and profit and loss statements. The objective of the present study was the survey of the

banking social responsibility effect on clients' satisfaction. According to the results obtained herein, it was made clear that social responsibility can exert positive and direct effects on the customers' satisfaction. The positive relationship between these two variables has also been previously approved in some researches [8].

Finally, the present study comes up with the following suggestions:

- Creating a safe environment for individuals who are in a connection with the organization both inside and outside the organization and the lack of making unsafe situations for the other individuals;
- Feeling responsibility in respect to the properties belonging to the individuals who have invested in the organization and such a responsibility is exercised regarding the people's properties and national wealth in large organizations;
- Creating an ethical charter for the organization and making endeavors to observe the principles and the basics established therein;
- Paying attention to the existing interested individuals' needs without harming the later generations' abilities in satisfying their needs.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

THE RELATIONSHIP BETWEEN FEELING LONELINESS, AND ANXIETY AND LIFE SATISFACTION OF ELDERLY PEOPLE LIVING IN NURSING HOMES OF TEHRAN

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ABSTRACT

Background and objective: life satisfaction is an important variable and plays key role in the last years of people life. Feeling loneliness and anxiety are the most common problems in elderly people that it is correlated with life satisfaction. The objective of this study was to determine the relationship between loneliness and anxiety and life satisfaction of elderly people living in nursing homes in Tehran. **Methods:** In this descriptive-analytical study, population included all the elderly people living in nursing homes of Tehran in 2015, which 217 of them were selected randomly as sample of study. Demographic questionnaire, Yukla feeling loneliness questionnaire, geriatric anxiety scale, and Diener's life satisfaction scale were used as tools of study. The collected data were entered into SPSS and they were analyzed using Kolmogorov-Smirnov test, Pearson correlation, independent t-test, variance analysis, and regression analysis. **Results:** The mean and standard deviation of feeling loneliness, anxiety and life satisfaction were (23.31 ± 4.92) , (60.14 ± 12.86) and (11.32 ± 5.09) , respectively. Feeling loneliness with having meeting on a regular basis ($P=0.02$), anxiety with variable of education level ($P=0.03$) and chronic disease ($P=0.03$) and life satisfaction with age ($P=0.04$) had a significant relationship. In addition, feeling loneliness ($r= -0.165$) ($P=0.008$) and anxiety ($r= -0.142$) ($P=0.029$) had a significant relationship with life satisfaction and in total they predicted about 14% of life satisfaction. **Conclusion:** the elderly people living in nursing homes of Tehran had high anxiety, high feeling loneliness, and lower of life satisfaction. According to the obtained relationships, it is recommended for officials and planners in charge of affairs of elderly people living in Tehran nursing homes to pay more attention on reducing their feeling loneliness and anxiety by increasing their life satisfaction level.

INTRODUCTION

KEY WORDS

life satisfaction, feeling loneliness, anxiety, elderly people, nursing homes for elderly

The aging population is the phenomenon discussed in recent years in the global health and well-being area [1] so that some of the communities are faced with it and some others will be faced with it in near future [2]. Aging in many countries starts usually from retirement age according to regulations (60-65 years old) [3]. In general, the likelihood of being affected with diseases and the incidence of disabilities in the last years of life increase as age goes up [4]. According to studies, the prevalence of disability is high among the elderly people [5] and they are more prone to harms and injuries compared with other age groups [6]. The domestic reports indicate that Iran experience a transition from young population to middle-aged population and it will join to countries with old population composition in near future [7, 8]. Considering rapid increase in elderly people population in Iran [9, 10] providing welfare and health for them has found newer and more extensive dimension [11] and paying attention to the issues and needs of this sensitive stage of life has become a social requirement [12]. Life satisfaction is an important factor in raising the people's welfare [13]. Life satisfaction in elderly people can be achieved by individual accesses to important sources of life. These key resources are effective in maintaining and advancing the well-being of the elderly people. In other words, these resources can help elderly people in meeting their basic needs [14]. Those who are at the aging and disability age often experience several problems that these factors and conditions affect their life satisfaction [15, 16]. In this regard, the effect of feeling loneliness and anxiety has great importance [17]. Feeling loneliness is the core of many affective disorders [18] and anxiety disorders are the most common problems of elderly people [19]. Elderly people are more prone to feeling loneliness and anxiety due to several reasons [6, 20, 21]. Loneliness and anxiety have negative effects on health, well-being, and quality of life of individuals [22-25]. Evidence shows that feeling loneliness is a comprehensive and common phenomenon so that 25 to 50 percent of the over 65 years old population experiences it [17]. The prevalence of anxiety in the elderly people is estimated between 3 and 14 percent [26] and it is estimated 23.5 percent in Iranian elderly people [27]. The literature review, there are scattered and sometimes contradictory studies about feeling loneliness, anxiety and life satisfaction of elderly people. Kucheki et al showed significant relationship between loneliness and life satisfaction [28], but Hojjati et al in their study did not report relationship between feeling loneliness and life satisfaction [29]. Investigation of life

Received: 12 Aug 2016
Accepted: 24 Sept 2016
Published: 17 Nov 2016

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satisfaction of the elderly people and its related factors is an action for evaluating the effectiveness of providing health care services, including nursing services to them. In addition, paying attention to the behavior promoting the health and life satisfaction is an important issue that reduces health care costs, including nursing care costs [12, 30]. Considering the existing research gap, if the relationship between feeling loneliness and anxiety in the elderly people and their life satisfaction is confirmed, results of the study can be used to reduce the feeling loneliness and anxiety of elderly people by designing and implementing the interventions, and consequently increase their life satisfaction. In this regard, some experts believe that any attempt that helps reduce feeling loneliness and anxiety of elderly a dam against the wave of complex psychosocial and social problems of the elderly people and it will improve the self-esteem and life satisfaction of them [21]. Therefore, the main objective of the researchers in this study was to determine the relationship between feeling loneliness and anxiety and life satisfaction of the elderly people living in nursing homes of Tehran. We hope that results of this study expand our knowledge in these areas. In addition, findings of the study could be helpful for planners and officials who are in charge of providing aging services, especially nurses providing care and service for elderly people.

MATERIALS AND METHODS

In this descriptive-analytic study that was conducted by using cross-sectional method, population consisted of elderly people living in nursing homes of Tehran in 2015. The following formula was used to calculate the sample size:

$$n = \frac{(\sigma_1^2 + \sigma_2^2) \left(Z_{1-\alpha/2} + Z_{1-\beta} \right)^2}{|\mu_1 - \mu_2|^2}$$

Formula 1- sample size

To obtain the sample size using a pilot study, 30 elderly people were studied that mean and standard deviation of the variables of life satisfaction and feeling loneliness in these 30 elderly people were obtained as followed:

According to the results of the pilot study, and the use of a significant level of power of, sample size was estimated to be 217 subjects. Simple sampling method was also used in this study. Sampling was conducted from all nursing homes of elderly people proportional to number of elderly people in each nursing home. In addition, the ratio of men and women was according to their number in each nursing home. The inclusion criteria were: 1-the age of 60 years and higher, 2- Staying in the elderly people nursing home (for a period of at least three months), 3-ability to communicate, 4- the lack of obvious cognitive impairment (based on the content of patient file and medical team information), 5 non-acute physical problems, and 6- willingness to participate in the study. The tools used for the implementation of this research include four questionnaires as follows:

The Demographic questionnaire including the information of age, gender, marital status, education level, length of staying in nursing home, the existence of chronic disease, the number of medicines used, having a meeting on a regular basis, and the history of the departure from home by family for recreational or party.

Yukla feeling loneliness questionnaire: The questionnaire has 8 items assessing the feeling loneliness of individuals. The scale of measurement is in the form of four-point Likert from never (score 1) to always (score 4). Accordingly, minimum and maximum score in this questionnaire is 8 to 32, respectively. The total score of 8 to 20 in this questionnaire indicates low feeling loneliness and score of 21 to 32 indicates high feeling loneliness. Wua et al reported that this tool is reliable to measure feeling loneliness and they obtained its Cronbach's alpha coefficient 0.84 [31]. Kucheki et al translated this questionnaire from English language to Persian language, and then its Persian form was translated again to English language by two English language experts. After revising its gaps in one study conducted on elderly people of Gorghhan and Ghonbad, its Cronbach's alpha coefficient was reported 0.89 [28]. In this study, to evaluate the reliability of the questionnaire, Cronbach's alpha was used and its value was obtained 0.86 that indicates high reliability of the questionnaire.

Geriatric Anxiety Scale: This scale was developed by Sigal et al and it consists of 30 questions. This scale was developed in four-point Likert of never, sometimes, most of the time, and always in which zero and never to always score 3 is intended. Thus, the score the questionnaire range between zero is given for never and score 3 is given for always. Accordingly, the scoring range of the scale is from zero to 90. Total score between 0 and 45 indicates the low anxiety and score between 46 and 90 indicates the high anxiety. According to questionnaire guideline, elderly people were asked to score each question according to their feeling in the past week [32]. Bolghanabadi et al in the research on 295 Iranian elderly people evaluated the validity of the questionnaire high and obtained its reliability 0.92 using Cronbach's alpha [33]. Rashidi et al in an investigation on elderly anxiety living in Hamadan used this tool and evaluated its psychometric characteristics desired [34].

Diener's life satisfaction questionnaire: This questionnaire has five items assessing the life satisfaction of people by a 7-point Likert scale from completely disagree (score 1) to completely agree (score 7). The scores range is from 5 to 35. Total score from 5 to 20 represents the low life satisfaction and total score of 21 to 35 suggests high life satisfaction. Dainer et al reported retest correlation coefficient of this scale scores 0.82 and its Cronbach's alpha 0.87 [35]. Bayani et al in a study on elderly people translated this scale into Persian language and calculated its reliability 0.69 and they reported that this scale is a reliable and valid tool to be used in psychological studies of elderly people [36].

For the implementation of this study after approval of the proposals, and the approval of the Ethics Committee of the University (number of IR. USWR. REC. 1395.16), and obtaining the necessary permits and coordination with officials of the nursing homes, the inclusion criteria were examined and sampling was conducted accordingly. After obtaining the informed consent of the samples, questionnaires of research were provided for them. Questionnaires were in the form of self-reporting and they were responded by elderly people, unless they were illiterate and low literate or not able to fill it. In such cases, questionnaires were collected by interview. If understanding some of the concepts and the tool questions was difficult for them, researcher tried to explain them in simple words and if there was ambiguity, more explanation were asked to clarify the response. Subjects of study had full authority to refuse participating in the study at any time, and in the case defect in completing the questionnaire (defect in information), the questionnaire was excluded from study (exclusion criteria). After collecting the questionnaires, data were entered to SPSS software (version 20) and they were analyzed through central indices and dispersion of descriptive statistics including frequency, percentage, mean and standard deviation and inferential statistics tests such as Kolmogorov-Smirnov test, Pearson correlation test, variance analysis and regression analysis. In all tests, the level of significance was considered less than 0.05.

RESULTS

In this study, 217 elderly people aged 60 to 95 years with a mean age of 87.66 ± 11.78 participated. The mean duration of their stay in nursing homes was 36.20 ± 30.36 months that the minimum duration was 3 months and maximum duration was 85 months. In addition to demographic characteristics of samples, the mean and standard deviation of study variables are presented in [Table 1]. The results of this table show that the mean and standard deviation of feeling loneliness, anxiety and life satisfaction were respectively (23.31 ± 4.92), (60.14 ± 12.86) and (11.32 ± 5.09). In addition, investigating the difference significance of means in variables of gender, chronic disease, and having meeting on regular basis, and the experience of departure from home by family for party and recreation, independent t-test was used, and variance analysis was used for marital status, education level, and number of drugs take, and Pearson correlation test was used for variables of age and duration of staying in nursing home in this regard. P values were reported in each case (Table 1). The results of this table show that feeling loneliness had significant correlation with having meeting on regular basis ($p=0.02$), anxiety has significant correlation with variables of education level ($P=0.03$) and chronic disease ($P=0.03$), and life satisfaction had significant correlation with age ($P=0.04$). Kolmogorov-Smirnov test was used to assess the normality of variables and it was determined that all variables are normally distributed ($P>0.05$). To evaluate the correlation between variables, Pearson test was used that findings are presented in [Table 2]. According to findings, feeling loneliness ($r= -0.165$) ($P=0.008$) and anxiety ($r= -0.142$) ($P=0.029$) had a significant inverse relationship between life satisfaction. To evaluate the explanatory power of the predictor variables (feeling loneliness and anxiety), stepwise multiple regression model was presented that its findings are presented in Table 3. Findings of this table show that about 14% of changes in dependent variable (life satisfaction) are explained by two variables of anxiety and feeling loneliness and share and role of anxiety is more than the variable of feeling loneliness in explaining the life satisfaction.

DISCUSSION AND CONCLUSION

The aim of this study was to determine the relationship between feeling loneliness and anxiety and life satisfaction of elderly people living in nursing homes of Tehran in 2015. Based on the findings of the study, feeling loneliness was high in elderly people. The Kucheki et al reported the loneliness of elderly people living in Ghorghan and Ghonbad high [28], which it is in line with result of the current study. In contrast, Sheikholeslami et al reported the feeling loneliness among the retired employees of Gilan University of Medical Sciences in Rasht low [37], which it is in contrast with finding of this study. According to research findings, females had more feeling loneliness compared to males, while this difference was not significant. Another study showed that female elderly people are more prone to feeling loneliness. In studies conducted by Sheikholeslami et al [37], Jakobsson and Hellberg, and Ekwall et al, the feeling loneliness was higher in females compared to males. In contrast, the study conducted by Hazer and Boylu, contradictory results were obtained since the feeling loneliness in males was higher than that in females.

Table 1: Demographic characteristics of samples, mean, and standard deviation of study variables

		f		Feeling loneliness		Anxiety		Life satisfaction	
		n	%	SD ±mean	P value	SD ±mean	P value	SD ±mean	P value
Gender	Female	144	66.4	24.77±4.64	0.57	63.17± 11.86	0.32	11.17±5.02	0.55
	Male	73	33.6	22.03±4.40		58.56±12.36		12.56±5.36	
Marital status	Single	46	21.3	23.61±4.39	0.18	61.61±12.39	0.17	10.61±5.22	0.58
	Spouse died	119	54.8	25.88±4.69		62.47±14.69		9.47±5.19	
	Divorced	32	14.7	23.37±4.21		64.45±10.21		10.45±5.45	
	Married	20	9.7	21.65±4.46		55.78±12.46		12.78±5.74	
Age group	60 to 70 years	50	23.0	21.24±4.63	0.22	55.63±10.63	0.32	14.63±5.63	0.04
	40	40	18.4	24.77±4.54		59.11±11.54		12.11±5.54	
	70 to 80 years	103	47.5	23.68±4.52		60.02±10.52		10.02±4.52	
	80 to 90 years	24	11.1	23.96±4.63		67.86±12.63		8.86±4.63	
	Over 90 years								
Education level	Illiterate	99	45.6	25.74±4.38	0.14	64.74±12.38	0.03	9.74±5.38	0.26
	Secondary school	76	35.1	23.71±4.64		62.71±11.64		10.71±4.64	
	High school	27	12.4	22.33±4.00		59.33±11.00		11.33±5.00	
	Academic	15	6.9	21.53±4.30		54.53±12.30		12.53±4.30	
Duration of saying in nursing home	Less than 12 months	72	33.2	23.78±4.59	0.25	66.14±11.59	0.11	10.14±4.59	0.36
	82	82	37.8	21.79±4.64		56.74±12.64		12.74±4.57	
	12 to 36 months	20	9.2	21.85±4.42		65.54±11.42		11.54±5.02	
	36 to 60 months	43	19.8	24.11±4.48		58.12±12.48		9.12±5.08	
	Over 60 months								
Chronic disease	Yes	157	72.3	23.78±4.59	0.51	66.78±11.59	0.03	10.78±4.79	0.44
	No	60	27.7	21.79±4.64		51.79±12.64		12.02±5.64	
Number of drugs taken	Does not take	72	33.2	23.48±4.41	0.34	58.04±12.41	0.36	13.01±6.01	0.21
	82	82	37.8	22.79±4.98		62.11±11.98		11.45±6.13	
	1-2 drugs	43	19.2	21.75±4.47		61.65±11.47		9.76±5.47	
	2-5 drugs	20	9.8	24.14±4.71		64.36±11.71		8.14±5.04	
	Over 5 drugs								
Having meeting on regular basis	yes	110	50.6	18.97±4.14	0.02	59.21±12.14	0.30	12.04±5.74	0.09
	no	107	49.4	27.14±4.78		61.07±12.78		9.89±5.03	
The experience of departure from nursing home for party or recreation	Yes	128	58.9	21.45±4.73	0.12	57.15±11.73	0.19	11.45±5.73	0.58
	no	89	41.1	24.89±4.74		64.74±12.74		11.11±5.74	
Total	-	217	100	23.31±4.92	-	60.14±12.86	-	11.32±5.09	-

Table 2: Correlation between feeling loneliness and anxiety and life satisfaction by the Pearson correlation Test

Variable	Life satisfaction				
	Correlation coefficient	P value	Determination coefficient	Adjusted correlation coefficient	Error SD
Feeling loneliness	-0.165	0.008	0.032	0.028	14.95
Anxiety	-0.142	0.029	0.130	0.126	14.17

Table 3: Results of stepwise regression of life satisfaction according to feeling loneliness and anxiety in elderly people

	Predictor variables	B	β	t	R	R ²	adjusted R ²	R ² changes	P value
1	Anxiety	1.368	0.361	5.677	0.361	0.130	0.126	0.130	0.000
2	Anxiety Feeling loneliness	1.296 -1.238	0.342 -0.128	5.355 -2.01	- 0.383	- 0.146	- 0.138	- 0.016	0.000 0.046

Other research finding was that elderly people whose spouse has died had high level of loneliness and divorced and single elderly people were placed at next ranks. In addition, married elderly people had the lowest level of loneliness, while these differences were not significant. According to results of study conducted by Sheikholeslami et al, married elderly people had lower level of feeling loneliness compared so single and divorced elderly people [37]. In fact, death of spouse and lack of intimate friend were main indicators of feeling loneliness in elderly people [39]. According to the results of other research, elderly people aged 71-80 years had the highest rate of loneliness. In contrast, elderly people aged 60-70 years had the lowest rate of loneliness. Generally, in this study, loneliness raised as age increased. However, significant relationship was not found between age and feeling loneliness. The study of Hazer and Boylu showed that with increasing age, feeling loneliness increases in elderly people [40]. In fact, aging is associated with many changes in elderly people social life that provides the condition for creation of loneliness [38]. According to other research findings, the elderly people who were illiterate had the highest rate of feeling loneliness and by increasing educational level, feeling loneliness decreases, so that elderly people with academic education had the lowest level of feeling loneliness, but the difference in various groups was not significant in terms of education level. It was also found that elderly people who stayed at nursing homes for 12-36 months had the lowest level of feeling loneliness and those who stayed at nursing home over 60 months had the highest level of feeling loneliness. The other finding of the study showed that elderly people with chronic disease feel significantly more loneliness. However, a significant relationship was not between loneliness and staying at a nursing home or chronic disease.

Another finding of the research was that elderly people who had meeting regularly had significantly lower loneliness. In addition, elderly people who went with his family to a party or recreation had lower level of loneliness, while this difference was not significant. Based on the findings of the Sheikholeslami et al, elderly people who have fewer interactions and those who were unemployed had higher level of loneliness, and those had higher social and emotional support experienced lower level of loneliness [37]. According to some researchers, one factor that can reduce the loneliness is frequent contact with children and relatives. Elderly people who have a weak social network do not receive sufficient support and emotional satisfaction, and they feel loneliness highly [40]. Peplau considers the feeling loneliness as unpleasant feeling caused due to problem in social relations of the person and lack of access to desired relations with others [41]. Therefore, more contacts with general and vocational centers and use of its facilities expand the communicative network of elderly people, leading to reduced loneliness.

Based on the findings of the study, the anxiety of elderly people is high. Vassiliadis et al [42], Rashedi et al in a study on elderly people living in Hamadan [34] and Alipour et al in a study on elderly people living in District 2 of Tehran [43] reported high anxiety in the elderly people and obtained similar results. On the other hand, Alizadeh et al reported the anxiety in elderly people who are under coverage of Shahid Beheshti University of Medical Sciences at moderate level [44]. Etemadi et al reported the anxiety of elderly people living in nursing homes at lower level [45] that it was not in line with finding of this study. The difference could be due to different population and sample volume, different assessment tools or different living place of elderly people (home / nursing home). In the present study, females were more anxious than males, although this difference was not statistically significant. Alizadeh et al [44], Rashedi et al [34] and Pachana et al [19] reported that anxiety in females is higher than that in males and they found consistent results. In addition, single people had the lowest anxiety level, followed by married and widowed people. Divorced elderly people had the highest level of anxiety, while the difference between different groups was not significant in terms of marital status. In the study conducted by Alizadeh et al, findings suggested that married people have worse condition compared to single people [44] that it is in line with the findings of this study. On the other hand, in the research conducted by Mobasheri and Moazzezi in elderly people in Semnan, it was found that married people had better conditions [46]. This inconsistency may be due to differences in living place of elderly people (home / nursing home), the structure of urban life, rural or metropolitan areas, or the impact of income and employment. Conducting applied research in future to explore these differences is recommended. In the present study, the age group of 60-70 years had the lowest levels of anxiety, followed by age groups of 71-80 years, 81-90 years, and above 90 years. Accordingly, anxiety increased as age increased, while significant relationship was not found between anxiety and age. In two different studies conducted in Semnan, similar findings were obtained [47, 48]. The results of Alizadeh et al showed that up to 80 years of age, anxiety increases with increasing age, and after 80 years of old, anxiety decreases [44]. In the current study, illiterate people had the highest level of anxiety, and by increasing the education level, anxiety decreased significantly. In a study conducted by Alizadeh et

al, the education level of elderly people was effective on anxiety, so that elderly people with high school and higher education level had lower anxiety, while illiterate and low literate people had undesired situation, which this result was in line with result of our study. This result seems to be reasonable, since highly educated people have greater access to information resources in each area, that this issue affects the rate of learning, strengthening of skills and changing the behavior of people. The results of a study conducted by Alizadeh on Iranian elderly people living in country of Australia also revealed the same results [49]. In the present study, elderly people who have less than 12 months of experience in staying nursing homes have the highest level of anxiety. However, the significant relationship was not found between anxiety and length of staying in nursing home. This is probably due to a change in the living place of elderly people from home to nursing home. Elderly people had 37 to 60 months, over 60 months and 12 to 30 months of experience of staying at nursing homes placed at next ranks. It seems after spending the first year in nursing home, elderly people are adopted more with a new environment and their anxiety and stress decrease. However, other factors are involved in increase of their anxiety again. In addition, findings of other study showed that elderly people who had chronic disease had higher anxiety compared to those who had no chronic disease. Elderly people who had meeting regularly or those who were going party and recreation with their family had lower anxiety, that difference of none of them was significant. In explaining these findings, it could be stated that the family is the most important source of support and interpersonal relations that can reduce anxiety in elderly people by providing adequate support [50]. According to the findings, life satisfaction of elderly people was at the lower level. Niknami et al in a study on elderly people who were member of retirement centers in Rasht [51] and Inal et al in a study on elderly people living in nursing homes reported their life satisfaction at low levels. Their results are in line with results of the current study. Aging is naturally associated with changes in body function, disease and disability and these conditions can affect their life satisfaction. In this study, the married elderly people had the highest life satisfaction, followed by unmarried and divorced elderly people, and those whose spouse were dead, although these differences were not significant. In this study conducted by Kudo et al [53] and Park and Kim [54], married elderly people had higher satisfaction with life. According to Liu, loneliness in elderly people decreases life satisfaction and the elderly people who live alone (single / divorced / widowed) have lower life satisfaction [55].

Other result of study suggests that elderly people aged 60-70 years had the highest life satisfaction and age groups of 71-80 years old, 81-90 years old and above 90 years old placed at next ranks. With increasing age of the elderly people (older age groups) life satisfaction significantly reduced. In the studies conducted by Borge [56] and Kudo et al [53], the younger elderly people (aged 65 to 74 years) had higher satisfaction with life. It seems that multiple disorders of elderly people that increase as age goes up to affect the status of elderly people, which may result in lower levels of life satisfaction. In the current study, elderly people who had academic level of education had the highest level of life satisfaction, followed by elderly people who had high school, secondary school education level, and illiterate people, respectively. In studies conducted by Kudo et al [53] and Kucheki et al [28], it was found that elderly people with higher education had higher level of life satisfaction. In this regard, Sung believes that increasing level of education is associated with more active participation for healthy lifestyle [57], which this factor causes an increase in life satisfaction in elderly people. Results of another study revealed that males had higher life satisfaction compared to females. The elderly people stayed 12-36 months in nursing homes had the highest life satisfaction, followed by those who stayed in nursing homes for 37-60 months, less than 12 months, and over 60 months, respectively. On the other hand, elderly people who had meeting on regular basis, and those who were going for party and recreation with their family had higher life satisfaction, but the differences were not significant. Another finding showed that loneliness in the elderly people has a significant relationship with satisfaction with life. The research conducted by Kucheki et al showed significant relationship between loneliness and life satisfaction [28] which it is consistent with the findings of this study. In explaining this finding, it can be noted that loneliness weakens social interactions of people and it affects their health and quality of life, leading to lower life satisfaction [23, 50, 58]. According to other research findings, the anxiety level of elderly people had a significant relationship with their anxiety. Despite multiple searches in databases, a similar study to report this relationship was not found. In Iranian culture, family and interpersonal relationships are the most important support resources that can reduce the anxiety of elderly people by providing adequate support [50]. It seems that change in living environment of elderly people from home to nursing home, new conditions are created for the elderly people. Change to new situation is associated with tensions that create or increase the anxiety of the elderly people. It could be concluded that loneliness and anxiety of elderly people living in nursing homes of Tehran were higher and their life satisfaction was undesired, and the significant correlation was found between feeling loneliness, anxiety, and life satisfaction of elderly people. In addition, the relationships between feeling loneliness and having regular meeting, and the relationship between anxiety and education level and the relationship between chronic disease, life satisfaction, and age were confirmed. According to this conclusion, it is recommended for officials (considering the growth in population of elderly people) to consider specialized counselors in order to improve their mental health and increase their social relations by providing appropriate plans. Health care providers, especially geriatric nurses, should obtain knowledge of mentalities and beliefs of elderly people and identify the harmful situations by establishing continuous and intimate relations and communications with elderly people to prevent situations that lead to feeling loneliness and anxiety. It is recommended that increased awareness of the elderly people families and encouraging them to establish increasing relation and communication with elderly people to be included in the plans to improve the elderly people interactions. In addition, findings of this study can be used in designing educational plans developed by nursing care providers. The most important limitation of the study is that it is cross-sectional type of study, so results of this study cannot be generalized to all elderly people.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

This paper was derived from a master thesis in the field of elderly people nursing. Hereby, we appreciate sincerely of all people participated in this study

FINANCIAL DISCLOSURE

None

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SUPPLEMENT ISSUE

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ARTICLE

INVESTIGATING THE FREQUENCY OF PENETRATING AND BLUNT CHEST TRAUMAS AND THEIR EFFECTS ON THE MORTALITY OF PATIENTS VISITING PEIMANIEH HOSPITAL IN JAHROM FROM 2006 TO 2015

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ABSTRACT

Introduction: Nowadays trauma has become one of the most important, dangerous and prevalent causes of damage to humans in all communities. A trauma can inflict serious injuries and harms on an individual. It may also cause death or disability. Regarding damaged organs, there are some categorizations among which traumas to head and chest require more attention by medical staff. Chest trauma is associated with a high mortality rate, and the majority of traumatic cases affect young men who are the main labor force in a community. Therefore, the aim of this study was to determine the mortality rate of penetrating and blunt chest traumas in patients visiting Peimanieh Hospital in Jahrom in the past ten years. **Materials And Methods:** This is a retrospective cohort study in which various cases were investigated. For this purpose, 301 chest trauma cases were collected in compliance with the inclusion and exclusion criteria. A checklist was codified in accordance with the research objectives to collect the data recorded in cases. The research variables included the date of an accident, traumatic organs, X-rays, pathology test results, therapeutic interventions, hospitalization period, and the cause of death. After completing the information, the data were analyzed in SPSS 17. **Findings:** In this study, there were 244 male and 57 female patients, out of whom 19 individuals passed away, and the rest got cured. Moreover, there were 274 blunt trauma cases (12 deaths) and 27 penetrating trauma cases (7 deaths). These two types of trauma had significant effects on the deaths of patients ($P=0.010$). There was a significant association between chest trauma and abdominal trauma in 178 cases ($P=0.001$). **Conclusions:** The majority of chest trauma cases were blunt. However, the penetrating trauma was much more associated with mortality. In addition, abdominal trauma was associated with trauma to the chest in the most cases.

INTRODUCTION

In today's world, trauma is the main cause of death, hospitalization, and disability in all age groups. Perhaps it has the greatest social and economic effect on all the stages of a disease. Therefore, victims of traumas receive more attention and care than other patients these days. Moreover, trauma is a cause of death in the first four decades of life. Death by trauma is not limited to a particular region or country. Given the increasing use of motor vehicles, the statistics for trauma, especially the ones caused by accidents, are on the rise. In addition, 25% of traumatic cases caused by motor vehicle accidents are chest traumas. This type of trauma is the cause of 45% of deaths by trauma per se [1]. According to a report presented by the UN on traumas caused by accidents in some European and Asian countries, Iran is ranked the first in terms of the rate of accidents resulting in traumas. Another study points out that the most prevalent cause of trauma in Iran is vehicular accidents [2]. A trauma damages different organs including the thorax. According to the statistics in the USA, 20-25% of traumatic deaths were chest traumas [1]. Due to the vital importance of the thorax, it can generally be stated that chest trauma is the cause of 20-50% of traumatic deaths [3]. Studying trauma and investigating the type of an accident can be important in preventing, controlling and reducing damages and complications. Trauma has been regarded as an important mental-health issue in the majority of developing communities. It causes more deaths in people who are younger than 30 years old in comparison with other diseases. Chest traumas are divided into two penetrating and blunt groups. Such traumas can cause damages to the chest wall including ribs and the spine or the organs inside the thorax such as the heart, lungs, diaphragm, and large vessels. These damages can cause hemothorax, pneumothorax, rib fractures, heart damages, scapular and sternal fractures, rupture of major vessels such as the aorta and pulmonary artery, and diaphragm rupture. Each of these damages can seriously threaten an injured individual's life and may even cause death [4]. The blunt trauma can be caused by motor vehicle accidents, fall from a height, or non-penetrating injuries. Motor vehicle accidents account for 70% of such traumas. Penetrating chest traumas can be usually caused by a knife strike, a bullet, and similar objects. Chest traumas cause high costs resulting from damages to young people and the loss of productive years of life due to resultant disabilities. The considerable point is that 40% of all traumatic deaths can be prevented; however, the survival of the injured people may be accompanied by disabilities [1]. Nowadays nearly 6000 cases of disability (out of 10000 cases) are caused by chest traumas [1]. The key to the diagnosis of mediastinal damages is to have a solid mentality about the likelihood of chest traumas in the injured. This mentality is obtained from a patient's precise history of the intensity and mechanism of a trauma. A high percentage of damages can be diagnosed using simple paraclinical methods such as a simple radiography of the chest. Since the epidemiology and prevalence of chest trauma can vary in different areas. The statistics for the damages caused by penetrating and blunt chest traumas can be considerable for many reasons including the high use of motor vehicles and the large number of accidents. The necessity of taking

KEY WORDS

trauma, penetrating
trauma, blunt trauma,
chest trauma

Received: 07 Aug. 2016
Accepted: 20 Sept 2016
Published: 17 Nov 2016

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care of patients suffering from chest traumas can save their lives. Therefore, investigating and determining the mortality rates of penetrating and blunt chest traumas can evaluate the success rate and the quality of health services and treatments very well. There is little comprehensive and accurate statistics and information pertaining to the relationships between chest traumas and the mortality rates of patients in Jahrom Country. Thus, this study was conducted to investigate the frequency of penetrating and blunt chest traumas and their effects on the mortality of patients visiting Peimanieh Hospital in Jahrom in the past ten years.

METHOD

This is a retrospective cohort study in which different cases were investigated. The statistical population included the patients visiting Peimanieh Hospital in Jahrom to cure penetrating and blunt chest traumas from 2006 to 2015. To select the cases having necessary information in the study period, the archives of the hospital and contents of patients' cases were searched for chest traumas or other relevant injuries. Therefore, 301 cases were collected in compliance with the inclusion and exclusion criteria. Based on the research objectives and the data recorded in cases, a checklist was codified. The variables of this checklist include the date of an accident, the cause of an accident, traumatic organs, X-rays, pathology test results, therapeutic interventions, hospitalization period, and the cause of death. On this checklist, there are some items provided for each variable to be selected in accordance with each case. The items pertaining to traumatic organs are as follows: head trauma, penetrating chest trauma, blunt chest trauma, abdominal trauma, and pelvic trauma. The X-rays included MRI, CTA, CT scan, CXR and MRA. The pathology test results included rib fractures, sternal fractures, scapular fracture, hemothorax, pneumothorax, aortic rupture, cardio damages, pericarditis, lung injury, esophagus injury, and damages to the chest wall. The therapeutic interventions include supportive, restorative and surgical measures. Regarding the hospitalization period, there were two items: longer than a week and shorter than a week. Finally, the causes of death were divided into chest trauma, other traumas and non-traumatic causes. In addition to research variables, this checklist was used to collect the demographic information of patients (age, gender, and trauma type) as well as the death causes of the deceased patients. The inclusion criteria were the thoroughness of information in a patient's case and the validity of the period in which chest trauma occurred. The exclusion criteria included incompleteness of information in a patient's case and the lack of a chest trauma. The cases were investigated with full confidentiality, and the names and medical records of patients were not used in any results. After collecting data, the descriptive statistics and logistic regression were used to analyze data in SPSS 17.

FINDINGS

This study was conducted on the cases of patients with chest traumas and patients with various traumas accompanied by chest traumas visiting Peimanieh Hospital in Jahrom in the past ten years. After applying the inclusion and exclusion criteria, 301 cases were collected. There were 244 men (81%) and 57 women (19%). Moreover, 17 male and 2 female patients passed away; however, the rest got cured. The average weight and age of patients were 73.28 ± 14.40 and 36.71 ± 11.02 , respectively. [Table 1-4] indicates the number of investigated patients in separate genders. The results of chi-squared test indicated that there was not a significant relationship between gender and death by trauma.

Trauma is more prevalent in men than in women; therefore, the rates of treatment and death are higher in men, too. However, there is not a significant difference between men and women in the relationship between gender and death by chest trauma (p-value:0.334).

Out of 301 chest trauma cases, there were 274 blunt cases (91%) and 27 penetrating cases (9%). Furthermore, 12 blunt cases (63%) and 7 penetrating cases (37%) passed away. [Table 1] shows a comparison.

Table 1: The Treated and deceased cases in two Trauma types

	Treated	Deceased	p-value
Blunt Trauma	262 (92.9%)	12 (63.2%)	0.000
Penetrating Trauma	20 (7.1%)	7 (36.8%)	

According to this [Table 1], 282 patients were cured. There were 262 (92.9%) blunt trauma cases and 20 (7.1%) penetrating trauma cases. In total, there were 19 deaths, 12 of which were caused by blunt traumas (63.2%), and the other 7 deaths were caused by penetrating traumas (36.8%). According to the chi-squared test, penetrating traumas caused significantly more deaths than blunt traumas did (p-value<0.05).

In addition, 121 chest trauma cases were accompanied by pelvic traumas. There were 111 treated and 10 deceased cases. There were 3 head trauma cases, none of which caused deaths. Moreover, 178 cases were accompanied by abdominal traumas, 12 of which were deceased. Two patients suffered only from the chest traumas, and two others were diagnosed with abdominal and pelvic traumas. Table 2 indicates the prevalence of chest traumas and other types of trauma.

Table 2: Chest trauma and other types of trauma

Trauma	Pelvis		Head		Abdomens	
	Yes	No	Yes	No	Yes	No
Quantity	121(40.2%)	180(59.8%)	3(1%)	298(99%)	178(59.1%)	123(40.9%)
Treated	111(39.4%)	171(60.6%)	3(1.1%)	279(98.9%)	166(58.9%)	116(41.1%)
Deceased	10(52.6%)	9(47.4%)	0(0%)	19(100%)	12(63.2%)	7(36.8%)
Total p-value	0.043		0.651		0.039	

The chi-squared test indicated that abdominal and pelvic traumas were accompanied by chest trauma the most (p-value<0.05). Moreover, there was not a significant relationship between chest trauma and head trauma.

Regarding diagnostic measures, 295 patients with chest traumas took chest X-rays (CXR), and 254 patients took CT scans. None of the patients took a CTA, MRI, or MRA. [Table 3] shows the X-rays requested for 301 patients with chest traumas.

Table 3: The X-Rays taken for patients with chest traumas

X-Rays	CXR	CT-scan	CTA	MRI	MRA
Quantity	259(98%)	254(84.4%)	0(0%)	0(0%)	0(0%)

According to [Table 3], CXR and CT-scan were the most common diagnostic methods in patients with chest traumas.

In total, there were 38 patients with hemothorax (12.6%), and 32 patients were cured (84%). There were 22 scapular fracture cases (7%), 12 sternal fracture cases (4%), and 79 rib fractures (26%). None of the patients had pericarditis (0%). Two of them suffered (0.6%) and died (100%) from heart damages. Moreover, there were 7 aortic rupture cases (2.5%), three of whom were cured (43%). There were also 78 pneumothorax cases (26%), 120 chest wall injuries (40%), 4 esophagus injuries (1.3%), and 19 lung injuries (6.3%). Table 4 shows the prevalence of each side effect pertaining to chest traumas and mortality rates.

Table 4: The mortality rates and side effects of chest traumas

Side Effect	Hemothorax		Heart Injury		Aortic Rupture		Pneumothorax		Chest Wall Injury	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Quantity	38 (12.6%)	263 (87.4%)	2 (0.7%)	299 (99.3%)	7 (2.3%)	294 (97.7%)	78 (25.9%)	223 (74.1%)	120 (39.9%)	181 (60.1%)
Treated	32 (11.3%)	250 (88.7%)	0 (0%)	282 (100%)	3 (1.1%)	279 (98.9%)	68 (24.1%)	214 (75.9%)	108 (28.3%)	174 (61.7%)
Deceased	6 (31.6%)	13 (68.4%)	2 (10.5%)	17 (89.5%)	4 (21.1%)	15 (78.9%)	10 (52.6%)	9 (47.4%)	12 (63.2%)	7 (36.8%)
p-value	0.01		0.00		0.02		0.06		0.032	

According to [Table 4], the most prevalent side effect of chest trauma was the chest wall injury (39.9%). The most dangerous side effect of chest trauma was heart injury which increased the mortality rate significantly (p-value<0.05).

Essential health interventions were provided for 140 patients (46%), 135 of whom (96%) were cured. Moreover, 161 patients (53%) received restorative-surgical interventions, and 147 of them (91%) were cured.[Table 5-4] investigates therapeutic methods.

Table 5: Different therapeutic methods and outcomes

Interventions	Supportive	Surgical	P-value
Treated	134 (47.7%)	147 (52.3%)	0.071
Deceased	5 (26.3%)	14 (73.7%)	
Total	139 (46.3%)	161 (53.7%)	

According to [Table 5], the use of supportive measures was nearly equal to the use of restorative-surgical interventions. There was not a significant difference between the success rates of these two methods (p-value>0.05). Moreover, 251 patients (83%) were hospitalized for shorter than a week, and 234 patients (93%) were cured. Only 50 patients (17%) were hospitalized for longer than a week, and 2 of them (4%) passed away.

DISCUSSION

Traumas are very prevalent in everyday life, insofar as many patients visiting the emergency or surgery wards of hospitals are traumatic patients. In more acute traumas, injuries and fractures are more common. Therefore, such traumas cause fewer problems threatening life. Head and chest traumas are regarded as the most dangerous types of trauma because of vital organs in these spots. If rapid and appropriate medical services are not provided for such patients, they will soon face serious hazards. This study indicated that

traumas were more prevalent in men than in women, something which can easily be justified because men are more prone to traumas than women due to their occupational conditions. Apart from few dangers which may happen to women at home or work such as cuts and burns, other types of trauma usually happen to men.

This study also indicated that the majority of chest trauma cases are blunt; however, penetrating traumas were significantly associated with more deaths. As mentioned, many of traumas are not so severe that patients face the risk of an early death. In addition, many traumas do not result from a hit by sharp objects. Therefore, a blunt trauma should be so severe that it can result in serious side effects such as hemothorax, apnea, or coronary artery ruptures. However, a sharp object such as a knife or bullet can easily cause these types of complications. Thus, such penetrating traumas are much more dangerous so that they cause more deaths. The most important conclusion of this study can be stated as follows: blunt traumas are more prevalent; however, they cause fewer deaths. On the other hand, although penetrating traumas are less frequent, they are much deadlier than blunt traumas. The mortality difference between these two types of trauma is clearly obvious. In this study, only 12 patients passed away out of 274 patients with blunt traumas; however, there were 7 deaths among only 27 patients with penetrating traumas. This study also pointed out that chest traumas were associated with abdominal and pelvic injuries in a way that very few chest traumas were not accompanied by any other types of trauma. In this regard, abdominal and pelvic traumas were the most prevalent. Due to the proximity of abdominal organs, especially the upper organs such as the liver and stomach, abdominal traumas are more frequent in chest traumas. Moreover, the mechanism of majority of traumas are in a way that blows are generally struck to the anterior body; therefore, mediastinal, abdominal and pelvic traumas cannot be distinguished. Traffic accidents, being thrown off motorcycles, and falling off heights are different types of such traumas. Results indicated that chest X-rays and CT-scan were the mostly-used X-rays requested by doctors. Their availability and high diagnostic values in the investigation of main mediastinal complications have made these X-rays the most important radiographies. The most dangerous side effects of chest traumas were heart injuries, aortic ruptures and hemothorax which caused the largest number of deaths. In other words, 100% of patients with heart failures passed away. According to the results, every injury to vital mechanisms caused more deaths. Heart injuries caused by traumas result in serious problems in blood circulation and flow through vital organs. They can critically endanger patients very shortly. Moreover, if traumas cause ruptures of heart tissues, the volume of circulated blood decreases greatly, and hemorrhage makes patients prone to hypovolemic and tamponade shocks. Aortic ruptures increase the mortality rates in these patients with a similar mechanism. Another lethal side effect of chest trauma is hemothorax jeopardizing patients by inducing pressure in the pleural layers and preventing the proper expansion of lungs through decreasing arterial oxygen saturation. Previous studies had similar results to this study. In a study conducted by Zargar et al., the majority of traumatic injuries were among men. Moreover, blunt traumas were much more prevalent than penetrating traumas. Both of these results are consistent with the present study. Zargar et al. mentioned that traumas were mainly caused by traffic accidents. They also investigated the participants in terms of literacy. According to their results, the patients were mainly illiterate or lowly literate. Unlike the current study, Zargar did not work on the side effects of trauma, common injured organs and mortality rates [5].

Haratian et al. obtained similar findings. The majority of trauma cases were blunt, and most of the patients were young men. Furthermore, the most prevalent involved part of the mediastinum was the chest wall. The mortality rate of chest trauma was reported 3.8%, something which is slightly different from the results of current study (6.3%). Unlike the current study, Haratian concluded that more than a half of chest traumas were not accompanied by any other types of injuries. However, few patients suffered only from chest trauma in the current study. Perhaps it is because of the higher mortality rate. Like Zargar, Haratian pointed out that the main cause of trauma was traffic accidents [6]. Pool et al. conducted a study on the fracture of the first rib and concluded that there was not a significant difference between the fracture of this rib and other upper ribs in the mediastinum. According to them, precautionary measures should be taken into account for other types of traumas in all cases of chest trauma. The current study did not distinguish ribs. However, it was concluded that if the fracture of each caused hemothorax, mortality would be more possible [7]. Ekpi et al. conducted a five-year study on patients with chest traumas. Their findings are consistent with the findings of this study. According to their study, the majority of patients were young men with blunt traumas. However, there was not a significant difference between blunt and penetrating traumas in terms of mortality rates. Another inconsistency was the use of MEWS (Modified Early Warning Score) system. Since this is a retrospective cohort study, it was not possible to use this system. Ekpi also stated that bilateral injuries to the chest and delay in transferring patients to the hospital could increase the mortality rates. Such factors were paid more attention in the current study. In other words, each factor increasing mortality was investigated separately [8]. Zareh et al. obtained similar results. They found out that the majority of traumatic patients were young men with blunt traumas. Unlike the current study, they focused on pre-hospital factors such as piping and investigating the compliance with the process of maintaining vital signs. However, the current study investigated patients in hospital processes. Like Ekpi, Zareh et al. used the score systems TRISS-B, TRISS-P, RTS and ISS. As mentioned, such systems could not be used in the current study because it is a retrospective cohort study [2]. Farzandipour et al. conducted a study in 2004 to show that the majority of traumatic patients were young men. However, they did not investigate the frequency of blunt and penetrating traumas. It is interesting to know that the statistical sample in their study included 6415 individuals who were selected through interviews with patients and companions or questionnaires. They also mentioned that traffic accidents were the main causes of traumas. According to them, arms were the most injured organs. Another innovation of their study was to calculate the average expenditures of treatment. Their study generally investigated the individuals and social injuries caused by trauma and the causes.

However, the current study investigated and analyzed the quality of traumas, their side effects and the survival of patients [9]. Another study was conducted in Vali-e Asr Hospital in Fasa in 2010. There were similar results in that study. Young men were the majority of patients visiting the hospital to complain about chest traumas which were mostly caused by traffic accidents. In this study, Bijani et al. mentioned that the least prevalent cause of trauma was a blow by cold weapons. Unlike the current study, they did not deal with blunt or penetrating traumas in particular. In their study, head traumas were mainly accompanied by chest traumas. However, the current study pointed out that abdominal traumas were mainly accompanied by chest trauma. Another difference in Bijani's study was the investigation of clinical symptoms in patients with chest trauma as soon as they were admitted into the hospital. In this case, chest pain and tenderness were reported [10].

CONCLUSION

According to the research results and like other similar studies, the majority of patients visiting the surgery wards of hospitals and complaining about chest traumas were young and middle-aged men. Moreover, the majority of cases suffered from blunt traumas. However, patients with penetrating traumas were more prone to death compared with those with blunt traumas. Therefore, it can be concluded that chest trauma is one of the most dangerous types of trauma, especially when it is penetrating. It requires serious care and follow-up in all and even in minor cases because of severe and irreversible injuries. The current study is based on the importance of chest trauma and the necessity of investigating risk factors, jeopardizing conditions and correcting the attitude towards patients with chest traumas. The mortality rate of chest traumas is higher than other types of trauma, and penetrating traumas are more associated with death among other types.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

THE EFFECT OF PREOPERATIVE SINGLE DOSE OF ORAL PREGABALIN ON POSTOPERATIVE PAIN OF ORTHOPEDIC SURGERY OF LOWER LIMBS

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ABSTRACT

Introduction: Postoperative pain is one of the problems in which lack of adequate controls cause many complications. Pregabalin, as gamma-amino-butyric acid, has shown sedative effects on postoperative pain. Therefore, this article aimed to study the effect of preoperative single dose of oral pregabalin on postoperative pain of patients undergoing orthopedic surgery of lower limbs. **Method:** This is a randomized double-blind clinical trial on 34 candidates of orthopedic surgery of lower limbs of Peymanieh Hospital of Jahrom, Iran. The patients were split in two groups. The patients in the first group received one 150-mg pregabalin capsule prior to the surgery. The second group received a placebo. The existence of postoperative pain was assessed at 2, 4, 6, 8, and 10 hours after the surgery and the pain was assessed according to VAS. Data were analyzed using SPSS 21, descriptive statistics, and ANOVA. **Findings:** A total of 34 patients with mean age of 38.53 ± 18.77 were enrolled. 82.4% of the patients were males and the rest were females. Experiment and control groups (pregabalin) were similar concerning the age and gender. No significant difference was found among them. The effect of pain was significant at different times in pregabalin and control groups ($P < 0.001$). Pain reduction was greater in pregabalin group than in control group. **Conclusion:** Prescribing a 150-mg single dose of oral pregabalin one hour prior to the orthopedic surgery of lower limbs undergoing spinal anesthesia reduces the postoperative pain.

KEY WORDS

Pregabalin, Pain,
Orthopedics, Spinal
Anesthesia

INTRODUCTION

Adequate control of postoperative pain has still remained one of major challenges of surgery. Such pain causes physical complications, increased metabolism, underlying disease exacerbation, and hypertension. As a result, increased length of stay, increasing costs, patient dissatisfaction, lack of coordination by patient, and chronic pain are expected [1, 2]. Postoperative pain mechanism includes inflammation, trauma to the tissue due to surgical incision, lacerations, burns, and nerve damage, cut or pulls, or pressure on a nerve [3]. Postoperative pain causes some complications such as tachycardia, hypertension, myocardial ischemia, decreased pulmonary ventilation, and poor wound healing. Acute pain can increase the sensitivity of neurons and the release of inflammatory mediators [4-6]. Proper control of postoperative pain is still one of important topics of postoperative care. Although opiate drugs are the major postoperative pain treatment, using them brings about some complications. That is why numerous efforts have been made in order to prescribe other drugs for improving postoperative pain [7]. Advances in molecular mechanisms caused the development of multi-dimensional painlessness and the use of new medicinal products for postoperative pain control. Pregabalin is one of these new products [8]. Pregabalin, as gamma-amino-butyric acid, is initially used as anticonvulsants. Pregabalin reduces the entry of calcium to the terminals of peripheral and central nervous system and lowers levels of Substance P, glutamate, and noradrenaline, which play a major role in creating a sense of pain. Today, pregabalin is used for neuropathic and even inflammatory pain reduction, tissue stimulation, neurology, and fibromyalgia [6, 9-13]. Considering the importance of pain control especially acute postoperative pain, acute postoperative pain seems not to be effectively controlled [14]. Therefore, it is essential to study and assess different methods to reduce postoperative pain. This article aimed to study the effect of preoperative single dose of oral pregabalin on postoperative pain of orthopedic surgery of lower limbs.

MATERIALS AND METHODS

This is a randomized double-blind clinical trial on 34 candidates of orthopedic surgery of lower limbs of Peymanieh Hospital of Jahrom, Iran. Written inform consent was taken from the participants. The patients were split in two groups (14 Placebo and 20 pregabalin) using convenience sampling. The patients in the first group received one 150-mg pregabalin capsule 2 hours prior to the spinal anesthesia (Pre-anesthetic drug). The second group received a placebo.

Inclusion Criteria

All patients in Peymanieh hospital of Jahrom who underwent the orthopedic surgery of lower limbs were enrolled as the sample. They underwent spinal anesthesia.

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Received: 09 Aug 2016
Accepted: 16 Sept 2016
Published: 17 Nov 2016

Exclusion Criteria

Weight over 100 kg
Older than 75 or younger than 15
A history of drug dependence
History of migraine
Inability to communicate with patients to evaluate the postoperative pain
The need for postoperative ICU hospitalization
ASA 3 or 4 Patients
ASA 2 patients with development of hemodynamic instability, bradycardia or tachycardia and other complications which might be life-threatening.

All patients underwent similar spinal anesthesia. After determining the needle entry site which is generally between the fourth or third lumbar inter-vertebral space, the site was disinfected by betadine and then dried. Then the special needle entered from the inter-vertebral space into spinal subarachnoid space. After the withdrawal of cerebrospinal fluid from the bottom of needles, drugs were injected. Upon the completion of the technique, the patients were left in supine position. The onset of anesthesia was calculated from the patient's inability to feel the painful stimuli such as pinch in the lower extremities. T10 was considered the base. Blood pressure, pulse, and respiration of patients were measured and recorded immediately after the injection and at 5, 10, 20 and 60 minutes. The patients were asked concerning the pain. The onset of pain was recorded. The pain was assessed 2, 4, 6, 8, and 10 hours after the surgery. In case of failure for spinal block, the patients underwent general anesthesia and were excluded. The severity of pain was measured using VAS. The pain was categorized in three: Mild, Medium, and Severe. The data were analyzed using SPSS 21, descriptive statistics, and ANOVA.

RESULTS

A total of 34 patients with mean age of 38.53 ± 18.77 entered the study. 82.4% of the patients were males and the rest were females. Experiment and control groups (pregabalin) were similar concerning age and gender. No significant difference was found among them. [Table 1] shows the ANOVA with repeated measures. The results showed that the effect of pregabalin intervention was not significant on postoperative pain of the patients undergoing orthopedic surgery of lower limbs using spinal anesthesia at different times in both groups ($P=0.610$). Pain reduction was, however, significant at different times in pregabalin and control groups ($P<0.001$). [Fig. 1] shows that pain reduction was greater in pregabalin group than the control group. In pregabalin group, pain increased up to four hours after the surgery and then decreased.

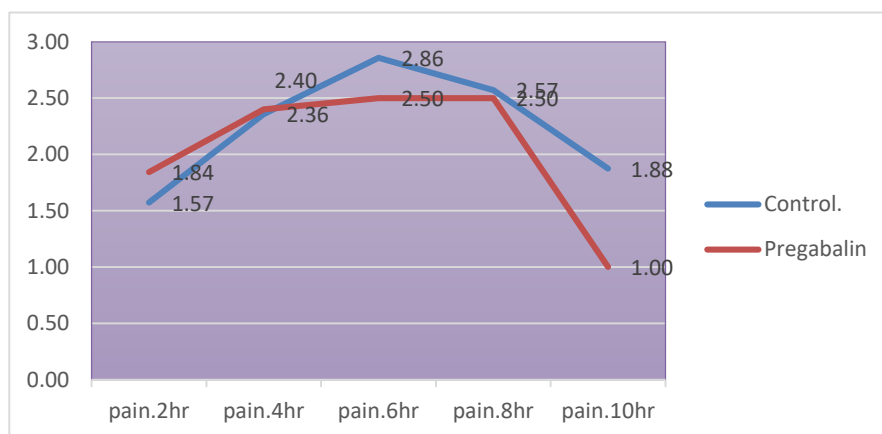


Fig. 1: Comparison of Pain at Different Times in Two Groups (Pregabalin and Control)

A significant difference was found between experiment and control groups concerning respiratory changes. No significant difference was found concerning changes in heart rate, systolic and diastolic blood pressure, heart rate and O₂. The effect of changes in diastolic blood pressure and heart rate was significant at different times in both groups ($P<0.001$). Changes in increasing diastolic blood pressure and heart rate were declining after the surgery [Table 2].

Table 1: Comparison of Pain at Different Times in Two Groups (Pregabalin and Control)

group					Time Effect	Time*group Effect
Control(N=14)			Pregabalin(N=20)			
	Mean	SD	Mean	SD		
pain.2hr	1.57	.65	1.84	0.96	<0.001	0.610
pain.4hr	2.36	1.15	2.40	1.10		
pain.6hr	2.86	1.10	2.50	1.19		
pain.8hr	2.57	1.28	2.50	1.31		
pain.10hr	1.88	.64	1.00			

Table 2: Comparison of Vital Signs at Different Times in Two Groups (Pregabalin and Control)

group					Time Effect	Time*group Effect
	Control(N=14)		Pregabalin(N=20)			
	Mean	SD	Mean	SD		
BP SISTOL Pre	116.23	12.08	113.17	32.99	0.565	0.051
BP SISTOL 5min	110.67	33.72	123.40	20.14		
BP SISTOL 10min	117.79	16.29	118.45	16.92		
BP SISTOL 20min	113.23	15.16	114.40	14.08		
BP SISTOL 60min	115.62	15.32	116.39	13.96		
dystol	69.77	10.83	73.67	11.18	0.018	0.569
dystol5	72.00	12.17	74.30	12.30		
dystol10	71.07	11.38	69.35	11.02		
dystol20	67.92	11.53	66.75	13.02		
dystol60	72.31	13.24	66.89	11.47		
HR.reoperative	83.23	21.71	79.00	8.86	0.001	0.139
HR.5min	78.93	18.79	84.30	15.88		
HR.10min	77.00	16.95	82.80	14.09		
HR.20min	75.36	15.11	76.30	12.66		
HR.60min	70.93	17.56	72.95	13.22		
Breath.reoperative	19.86	1.17	18.56	3.05	0.142	0.027
Breath.5min	19.14	.95	18.80	3.98		
Breath.10min	19.43	1.50	17.70	2.74		
Breath.20min	18.86	1.03	17.75	4.54		
Breath.60min	20.21	2.15	17.18	3.19		
O2.reoperative	96.58	3.12	97.29	1.27	0.052	0.237
O2.5min	97.85	.55	96.20	3.30		
O2.10min	97.29	2.33	97.21	1.87		
O2.20min	98.07	.83	97.70	1.42		
O2.60min	98.07	1.33	98.11	1.13		

DISCUSSION

Pregabalin, as gamma-amino-butyric acid is mainly used in controlling neuropathic pains [15]. Its mechanism is the pre-synaptic connection to voltage-gated calcium channels in the central nervous system. Pregabalin inhibits the over-stimulation of neurons by affecting the calcium channels [6, 16-20]. The results of our study showed that pain reduction was lower in patients who received preoperative pregabalin than those who received placebo. The results are consistent with other studies. The study by *Choubsaz et al.* showed that pain in pregabalin group was lower at 6 and 12 hours after the surgery than the placebo group [21]. The study by *Hazem et al. (2014)* showed that preoperative prescription of pregabalin can well reduce the postoperative LASIK pain [22]. The study by *Naderi et al.* showed that prescribing 150mg oral pregabalin one hour prior to the orthopedic surgery of lower limbs decreased the postoperative pain dramatically [23]. Another study by *Joe Kola and Ahounen* showed that prescribing 150 mg pregabalin decreased the postoperative pain of patients undergoing gynecological laparoscopy [24]. The study by *Backonja et al.* showed that prescribing 300 mg preoperative pregabalin prior to orthopedic surgery controls pain and reduced the drug intake by 50%. A study on small gynecologic surgeries showed that prescribing 150 mg preoperative pregabalin was not effective in pain reduction [25], which might be associated with the type of surgery. Other studies including Jakala and Matthiessen showed that no significant difference was found

between pregabalin and control groups concerning the pain severity, which is inconsistent with our study [26, 27]. According to the results, it is recommended to study higher doses of preoperative pregabalin on postoperative pain and complications. Since the patients were assessed for 10 hours after the operation, longer periods of assessment are advised.

CONCLUSION

According to the findings, prescribing 150 mg oral pregabalin 2 hours before the orthopedic surgery of lower limbs reduced postoperative pain severity.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

THE FREQUENCY OF BACTERIAL INFECTION AFTER TRACHEAL INTUBATION OF PATIENTS VISITING HOSPITALS AFFILIATED TO JAHROM UNIVERSITY OF MEDICAL SCIENCES

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ABSTRACT

Background: Complications associated with the use of tracheal tubes include those during the intubations, following the placement, and after patient's extubation. Accurate and constant control during intubation can reduce these complications. Today, standard sterilization methods of laryngoscope blades are emphasized not to be able to deactivate all existing pathogens. Therefore, laryngoscope is one of potential intermediates of infection transmission among the patients. This article aimed to study the frequency of bacterial infection after intubation of patients visiting the hospitals affiliated to Jahrom University of Medical Science, Iran. **Methods:** This is a cross-sectional descriptive study. A total of 162 surgical candidates were enrolled as the sample using the convenience sampling method. The patients who developed infections after 24-72 hours from the surgery were selected as the sample by infectious disease specialist. Samples were taken using sterilized swabs from mucus around tonsil area. Direct smears were performed for gram stain and culture on blood agar and MacConkey's environment. **Results:** 76 (46.9%) patients were males, while 86 (53.1%) were females. The mean age was 42.8±16.7 and average surgery time was 1.7±0.57. A total of 34 (21%) developed infection. The highest infection frequency was pseudomonas (8%). The mean age of infection development was 43.29±23.24. Concerning the antibiotic resistance, all microorganisms were fortunately sensitive to all post-operative antibiotics prescribed by the surgeon. **Conclusions:** The results showed that the patients developed infection after intubation, quickly resolved by antibiotics prescribed by the surgeons.

INTRODUCTION

Tracheal intubation is the placement of a flexible plastic tube into the trachea. This is done when one needs mechanical ventilation or asphyxiation is aimed to be prevented. Tracheal intubation candidate is not usually alert due to sickness or the use of anesthetic drugs. Here, body reflexes disturb intubation. Then, intubation is performed by the help of laryngoscope with proper endotracheal tubes. After securing the placement of endotracheal tube, the end of the fixed tube is connected to the ventilator or Bag Valve Mask (BVM). This is done in operating room or emergency conditions. Tracheal intubation might be necessary for every patient receiving general anesthesia. Tracheal intubation indications are as follows:

1. Opening an airway
2. Preventing gastric content aspiration
3. Requiring continuous suction
4. Facilitating ventilation with positive pressure of lungs
5. Requiring non-supine position during the surgery
6. When the surgical site is near or has air way
7. When maintaining air way is difficult with face mask [1].

Laryngoscope with reusable metal blade is known as the standard intubation method. Standard sterilization method of laryngoscope blades is emphasized not to be able to deactivate all existing pathogens [2, 3]. Therefore, laryngoscope is one of potential intermediates of infection transmission among the patients [4, 5] including infectious agents such as viridans streptococci and coagulase negative staphylococci [6] and negative organisms such as pseudomonas [7]. According to the Iranian Protocol, endotracheal tube connectors are among disposable devices [8]. However, they are repeatedly used due to financial constraints. Therefore, failure to comply with the standards, hand contamination of the specialist and anesthesia staff, and contamination of the part of inserted endotracheal tube can transmit microorganisms during intubation and cause pharyngitis, pneumonia, and other respiratory tract infections as a hospital-acquired infection (HAI). Since the patient develops such infection in hospitals, it is considered hospital-acquired infection. Hospital-acquired infections are a group of infections caused in hospitals or other health centers provided that the patients do not have it at admission or the infection is not at incubation period [9]. HAIs are said to be acquired as a result of hospital stay. Almost 2 million patients develop HAI in the USA annually which costs 4.5 million dollars. HAIs are the 11th leading cause of death in the US [10]. Hospital staff has an important role in the spread of infection. They are among the key elements of HAI control and management [11]. Urinary system is the most common organ involved in HAI followed by respiratory system, blood circulation, skin, and other organs [12]. Nurses can prevent the infection transmission among the inpatients by disinfecting skin, wearing gloves and a mask, substituting infusion sets, taking precautions into account, separating properly, applying standard precautionary principles, observing hand hygiene, preventing accidental contact with needles, avoiding the exposure to infected respiratory secretions [13].

KEY WORDS

Bacterial Infection,
Tracheal Intubation,
Hospital

Received: 25 Aug. 2016
Accepted: 27 Sept 2016
Published: 18 Nov 2016

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Complete removal of HAI is not possible at the moment. HAI can only be reduced by proper measures. The study by *Fatemeh Omid et al.* on 100 neonates concerning the bacterial and genetic culture of intubated newborns showed that 34 newborns had positive tracheal tube culture. The most common cultures are coagulase positive staphylococci (30%), coagulase negative staphylococci (23%), and *E. coli* (23%), respectively (14). The study by *Karynz et al.* showed that cultivated aerobic micro-organisms were 26×10^4 and 2.16×10^4 cfu/cm² on endotracheal tube [15]. Since the results of the study provides information concerning the frequency of infections after intubation process and potential harmful effects of these infections especially in sensitive patients to complications and injuries caused by infections after intubation, they encourage the authorities to think about solutions to deal with such infections in case of high prevalence. Therefore, the article aimed to study the frequency of such infections after tracheal intubation.

MATERIALS AND METHODS

This is a cross-sectional descriptive study on 162 surgical candidates of two hospitals affiliated to Jahrom University of Medical Science. The study began after the approval of Research Department. The patients who developed infections after 24-72 hours after the surgery were selected as the sample by infectious disease specialist. Samples were taken using sterilized swabs from mucus around tonsil area. The samples were then sent to laboratory for diagnosis in physiology serum. Direct smears were performed for gram stain and culture on blood agar and MacConkey's environment in order to diagnose the type of bacteria. Cultures were kept at 37 ° C for 24 hours. Then, diagnostic tests were performed for identifying bacteria on separated colonies and determining antibiotic resistance model.

RESULTS

Out of 162 patients, 76 (46.9%) patients were males, while 86 (53.1%) were females. The mean age was 42.8 ± 16.7 and average surgery time was 1.7 ± 0.57 . The highest frequency of infection was pseudomonas infection (8%). [Fig. 1]

Infection was reported more among women than men (25.9%). The mean age of infection development was 43.29 ± 23.24 and average surgery time was 1.7 ± 0.57 . The average diameter of endotracheal tube was 7.25 ± 0.41 . Concerning the antibiotic resistance, all microorganisms are fortunately sensitive to all post-operative antibiotics prescribed by the surgeon.

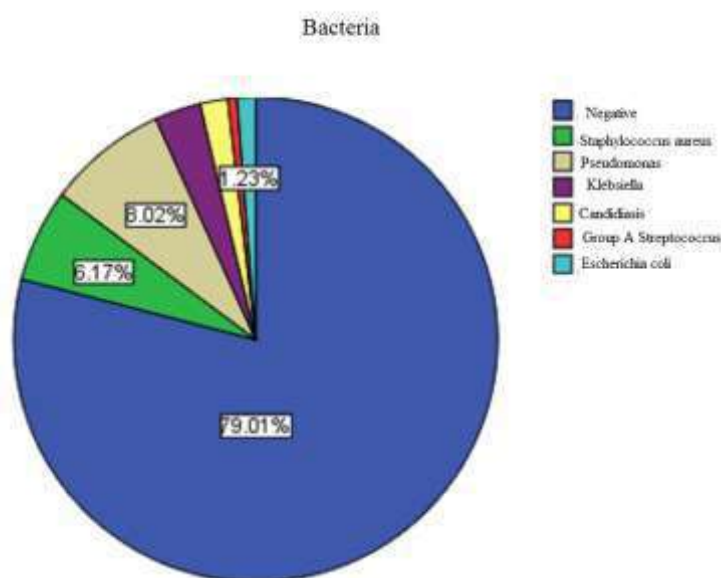


Fig. 1: Frequency of bacterial infection according to type of Micro-Organism.

DISCUSSION

Using laryngoscope for intubation is one of the most common practices in intensive care units and emergency departments during general anesthesia. Lack of a standard method for disinfecting laryngoscope blades might make them a potential source of infection in future. Therefore, studying the frequency and controlling measures can help stop the secondary infection. The results showed that 21% of all samples developed infection, meaning that 34 out of 162 were infected. The most frequent infection was pseudomonas bacterial strains (8.02%) and the least frequent infection was Group A Streptococcus (1.23%).

A descriptive study by *Irlandust et al.* (2010) on different wards of Musa Ebne Jafar Hospital showed that 52.9% of samples were infected. The most frequent infection was bacterial strains of coagulase-negative staphylococci (36.4%) and the least one was enterococci (9.1%) [16]. The frequency was greater than our study (21%). This is mainly associated with the different washing material and laryngoscope blade disinfection. The study by *Chen et al.* (2009) in Taiwanese operating rooms showed that, out of 49 samples for bacterial culture, 75% were infected [17]. This was far greater than ours which might be because the samples were taken in operating rooms. As a result, infection is greater in operating rooms than other wards. No bacteriological consistency was found in all above mentioned studies, which is mainly associated with the geographical conditions of each region. Infection was reported more among women than men, which might be associated with different histology and mucosal conditions. Finally, we found that all micro-organisms were sensitive to all common prescribed post-operative antibiotics. The review study by *Desousa et al.* (2015) on published articles from 1994 to 2012 indicated high risk of infection transmission and disagreement among guidelines concerning disinfection of these tools [18].

CONCLUSION

The results showed that patients develop infection after intubation, quickly resolved by antibiotics prescribed by the surgeons. It is essential to conduct studies for easier and effective standards for disinfecting blades and laryngoscope handles in order to reduce potential risks threatening patients and health officials.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

PREVALENCE AND RISK FACTORS OF *CLOSTRIDIUM DIFFICILE* - ASSOCIATED DIARRHEA IN HOSPITALIZED PATIENTS IN ZAHEDAN

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ABSTRACT

Background: *Clostridium difficile* is a frequently identified cause of nosocomial gastrointestinal disease. It has been proved to be a causative agent in antibiotic-associated diarrhea. **Aims:** This study was aimed to determine the prevalence and risk factors of *Clostridium difficile*-associated diarrhea (CDAD) in hospitalized patients with nosocomial diarrhea in Zahedan, Iran. **Methods:** In this study from June to December 2014, a total of 100 stool samples of patients with nosocomial antibiotic associated diarrhea that were admitted in to the intensive care units (ICUs) (50), surgery (20) and internal medicine wards (30) in Emam Ali hospital, Zahedan, Iran were collected. All stool samples were analyzed by cytotoxicity assay and enzyme immune assay for detection and conformation of toxins. **Results:** The mean $\pm$ standard deviation of age was 40.4 ± 11.8 and 75 (61.5%) of patients were male. Nine (7.4%) cases of nosocomial diarrhea were diagnosed as CDAD that all isolates were toxigenic. Five of 65 organs receive transplant patients and 4/41 hospitalized patients in ICUs ward were developed CDAD. None of samples that obtained from surgery ward infected with *C. difficile*. Ceftazidime and Ampicilline-Sulbactam were the most common antimicrobial drugs used. Multivariate analysis showed that use of diapers, antibiotic and immunosuppressive therapies were significantly associated with CDAD ($P < 0.05$). **Conclusions:** Hospital transmission of *C. difficile* commonly occurred, supporting infection-appropriate measures directed toward the reduction of CDAD.

INTRODUCTION

Nosocomial diarrhea is an important recognize cause of morbidity, mortality and cost for hospital in the developed and developing countries.[1] *Clostridium difficile* is a major cause of antibiotic associated diarrhea.[2] The incidence of infection with this organism is increasing in hospitals world-wide, consequent to the widespread use of broad-spectrum antibiotics.[3] Hospital-acquired *C. difficile* disease is associated with not only antimicrobial use, but also advanced age, laxative use, proton pump inhibitors, antineoplastic chemotherapeutic agents use, renal insufficiency and gastrointestinal surgery or procedures [4-6] are important.

Over the past several years, numerous reports have been published regarding *C. difficile* infection in immunocompromised patients and hospitalized patients.[7-13] Only scanty data is available on the prevalence of *C. difficile* as a cause of diarrhea in Iran. The objective of our study was to examine the importance and risk factors for *Clostridium difficile* associated diarrhea (CDAD) in hospitalized patients, in Zahedan, Iran.

MATERIALS AND METHODS

In this study from June to December 2014, a total of 100 stool specimens of patients with nosocomial antibiotic associated diarrhea that were admitted in to the ICUs (n=50), surgery (n=20) and internal medicine (n=30) wards in Emam Ali hospital related to Zahedan University of Medical Sciences were collected. Specimens were processed immediately (the day of receiving samples) or stored at -20°C until they were tested. Nosocomial diarrhea defined if the onset of the enteric illness occurred $\geq 72\text{h}$ after admission of the patients to the hospital. Inclusion criteria were antimicrobial therapy, long stay hospitalization, and loose or liquid stool. Exclusion criteria were patient without diarrhea, hospitalized patients without antibiotic therapy and children under 2 years of age.

Demographic and basic medical information were collected from the medical records. Bacterial cytotoxicity was assayed on Vero (African green monkey kidney) tissue culture monolayers. A filter-sterilized 1:10 dilution of feces was used to inoculate Vero cell monolayers. Tissue cultures were examined for cytopathic effect at 24 and 48h. The enzyme-linked immunosorbent assay (ELISA) (Wampole kit, TECHLAB Inc., The Netherlands), was used for detection and conformation of *C. difficile* toxin A and B. The procedure was carried out according to manufacture instruction.

Received: 1 Sept 2016
Accepted: 12 Oct 2016
Published: 18 Nov 2016

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Statistical analysis

SPSS version 16 (SPSS Inc., Chicago, IL, USA) was used to analysis data. The study variables were compared between the patients who have CDAD and remaining patients who have nosocomial diarrhea but were negative for fecal *C. difficile* toxins. Student *t*-test and Chi-square test were performed to compare continuous and categorical variables, respectively. For analysis of risk factors for development of CDAD, logistic analysis regression was used. A $P < 0.05$ was deemed as statistically significant.

RESULTS

A total of 100 patients were admitted to ICUs, surgery and Internal medicine wards in Emam Ali hospital during the period from June to December 2014. During this time, 12 (12%) patients acquired CDAD that 8 isolates were toxigenic by cytotoxic assay and ELISA. The demographics and outcomes of these patients are shown in [Table 1]. The mean $\pm$ standard deviation of age was 45.1 ± 11.8 . Seventy five (65%) Of patients were male.

The median interval between admission and diarrhea onset and CDAD diagnosis were 5 (5-9) and 7 (4-11) respectively. There was no significance difference with respect to age, sex, number of days between admission and CDAD diagnosis and clinical features and risk factors except malignancy, immunosuppressive therapy, antibiotic therapy, chemotherapy and use of diapers [Table 1]. The majority of patients (50%) were ICUs ward.

In univariate analysis of risk factors, immunosuppressive therapy, antibiotic therapy, chemotherapy and use of diapers were significantly associated with the development of CDAD [Table 2]. In the multivariate model assessing factors associated with CDAD, use of diapers, antibiotic therapy and immunosuppressive therapy remained significant risk factors [Table 3].

DISCUSSION

C. difficile that can be found in most of peoples without causing symptoms, but in some people it can cause a severe colitis. Predisposing actors include antibiotic therapy. The *C. difficile* toxin damages the fragile lining of the bowel causing loose watery bowel movements.[14]

The organism is usually acquired from the hospital as environmental contamination is common and health care workers may carry it in their hands, or on contaminated instruments.[15]

Prevalence of CDAD in adult inpatients from Saudi Arabia, Iran, India, chile, and Argantina have ranged from 4.6% to 22% respectively.[16-20] Three studies in Iranian hospitalized patients developing acute diarrhea showed prevalence rates of 5.3%, 6.7% and 21% respectively.[13,15,21] We found a prevalence rate of 12% in hospitalize patients. This amount was reported 4.9% for Turkish patients with diarrhea.[22]

CDAD has been reported to more common in women and older patients.[23] Among patients positive for *C. difficile* toxin, fever, cramping abdominal pain and diarrhea have been reported to be more common.[24,25] The mean age of patients in our study was 45.1 ± 11.8 and there were more men (61.5%). Other studies have reported varying male-female ratios.[26] In this study, there was no difference in the occurrence of fever and abdominal pain between CDAD positive and CDAD negative group. Several risk factors associated with patients acquired CDAD have been reported including advanced age (>65 years), length of hospital stay, colonization pressure (the duration of time and number of infections contacts that a susceptible patients is exposure it), antibiotic therapy, immunosuppressive therapy, malignancy and vancomycin resistant enterococci [27]. Few studies [28,29] have evaluated the relative risk of CDAD in hospitalized patients who received antibiotic therapy. In our study, Cefazidime was the most common antibiotic used in patients with CDAD and followed by Ampicillin-Sulbactam. Similar to other reports.[18,27] the third generation of Cephalosporins was the most common antibiotic used. The precise mechanism is unknown, but the most accepted hypothesis is that antibiotics alter the resident flora of the colon, leading the colonization of *C. difficile* with production of its toxins. Recently, outbreaks in the United States and Canada have been strongly related to the use of fluoroquinolones.[30] A prospective study published in 1974 showed that 20% of patients who received clindamycin developed CDAD.[31]

We don't find use of acid-suppression drugs to be significant risk factor for CDAD. 84% and 38% of our patients received acid suppressed medication such as proton pump inhibitor and antihistamine, respectively. Controversy remains about the role of antisecretory medication and CDAD development. Studies of ICU acquired CDAD have thus far failed to show any significant association[32,33] but, other researcher reported that use of proton pump inhibitor doubled the risk of CDAD in patients who received antibiotic treatment while in the hospital.[34] The normal acidity of the stomach is an important host defense against enteric infections[35] and its imbalance from the use of proton pump inhibitor increases the susceptibility of hospitalized patients to colonization and subsequent infection with *C. difficile*.

The important factor related to the development of CDAD in this study was fecal incontinence and the use of diapers. This factor has not been described in other adult settings. Only in a recent study in Peru, 72.7% of patients who infectious with *C. difficile* used of diapers that this was significantly associated with CDAD negative group.[18] A previous study showed an increased incidence of nosocomial diarrhea in a pediatric ward among diapered children and when multiple patients were housed together in the same room.[36] Laxative use has also been linked to CDAD in hospitalized patients, but the strength of this association remains unclear. One study has suggested constipation in the critically ill requiring laxative treatment is a true risk factor[32] while another group inferred that diarrhea could be occurring in asymptomatic carriers as results of laxatives use rather than as result of CDAD.[37] In our study 3(33.3%) infectious patients received lactulose prior to CDAD diagnosis.

We found a 12% (5 patients of 50 hospitalized patients in ICUs) of CDAD in ICUs hospitalized patients. There may be several explanations for the increased susceptibility of CDAD among this patient, including the increased use of antibiotics, immunosuppression, recent surgical procedure and longer and more frequent hospital admission.

The limitation of our study should be acknowledged. First, we performed a descriptive cross-sectional study; second, we only evaluated patients during the hospitalization. Thus, we cannot comment on long-term follow-up, including relapse of diarrhea and mortality. Third, this study was limited only to one center. The small number of infections and limitation to one center make generalization to other centers in Iran difficult.

In conclusion, our study provides evidence that CDAD is an important health problem in our hospital. It will be necessary to evaluate the epidemiology and to implement measure to control nosocomial spread. Use of rapid and sensitive techniques for laboratory diagnosis, a change in antibiotic policy, tight restriction of unnecessary antibiotic use, especially broad-spectrum ones and implementation of standard infection control measure is necessary to reduce morbidity to CDAD infections in hospitalized patients.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

Authors of the present study, appreciate Research and Technology Deputy of Zahedan University of Medical Sciences, for granting financial support. The information provided in this study is related to the Grant approved by the Ethics Committee under no. 7092.

FINANCIAL DISCLOSURE

The project was funded by Research and Technology Deputy of Zahedan University of Medical Sciences, Zahedan, IRAN.

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SUPPLEMENT ISSUE

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Table 1: Demographic and clinical data of patients with nosocomial diarrhea

Variable	Patients with nosocomial diarrhea			P value
	total	<i>C. difficile</i> positive	<i>C. difficile</i> negative	
Total patients	100(100)	12(12)	88 (88)	—
Male sex	65(65)	4(33.4)	61(69.4)	0.42
Age (years) (mean [SD])	45.1(11.8)	46.1(12.5)	47.2(13.0)	0.82
Median number of days between admission and CDAD Dx	7(5-11)	6(5-9)	7(4-11)	0.33
Clinical feature and risk factors				
Smoking	53(53)	10(83.3)	43(48.9)	0.41
Alcohol	4(4)	2(16.7)	2(2.3)	0.89
Fever	55(55)	7(58.4)	48(54.5)	0.10
Abdominal pain	43(43)	5(41.7)	38(43.2)	0.87
Hematochezia	11(11)	2(16.6)	9(10.3)	0.28
Inflammatory bowel disease	31(31)	6(50)	25(28.5)	0.73
Previous gastrointestinal surgery	3(3)	1(8.4)	2(2.3)	0.87
Malignancy	5(5)	3(25)	2(2.2)	0.01
Organ transplant	3(3)	2(16.6)	1(1.2)	0.27
Antibiotic therapy				
Use of one antibiotic	11(11)	5(41.7)	6(6.8)	0.047
Use of two antibiotics	54(54)	10(83.3)	44 (50)	0.021
Use of three or more antibiotics	35(35)	8(66.6)	27(30.6)	0.038
Immunosuppressive therapy	81(81)	11(91.6)	70(79.5)	0.018
Proton pump inhibitor	84(84)	7(58.4)	74(84.1)	0.95
Antihistamines	38(38)	5(41.7)	33(37.5)	0.44
Chemotherapy	5(5)	3(25)	2(2.3)	0.015
Enteral feeding	30(30)	3 (25)	27(30.6)	0.24
Use of diapers	26(26)	7(58.4)	19(21.5)	0.005
Laxative use Laxative use	32(32)	3(25)	29(32.9)	0.71

CI= confidence interval, CDAD= *C. difficile*-associated diarrhea, *C. difficile*= *Clostridium difficile*

Table 2: Result of univariate analysis of risk factors for development CDAD

Factor	Adjusted odds ratio (95% CI)	P value
Age	1.12(0.85-1.08)	0.098
Sex	1.34(0.87-3.65)	0.076
Malignancy	1.73(0.61-5.30)	0.250
Immunosuppressivetherapy	2.30(1.23-4.75)	0.013
Chemotherapy	2.45(0.25-3.77)	0.653
Useofoneantibiotic	2.56(1.21-3.50)	0.023
Useoftwoantibiotics	2.43(1.15-3.81)	0.021
Useofthreeormoreantibiotics	3.65(1.80-4.32)	0.000

CI= confidence interval, CDAD= C. difficile-associated diarrhea, C. difficile= Clostridium difficile

Table 3: Result of multivariate analysis of risk factors for development CDAD

Factor	Adjusted odds ratio (95% CI)	P value
Immunosuppressive therapy	2.12 (1.54-2.89)	0.023
Use of one antibiotic	2.22 (1.23-3.43)	0.045
Use of two antibiotics	2.20 (1.11-4.08)	0.012
Use of three or more antibiotics	3.07 (1.76-5.11)	0.003
Use of diapers	3.65 (1.23-7.97)	0.005

CI= confidence interval, CDAD= C. difficile-associated diarrhea, C. difficile= Clostridium difficile

ARTICLE

IDENTIFICATION, AND RANKING OF MARKETING STRATEGIES IN HANDICRAFT INDUSTRIES OF FARS PROVINCE IRAN WITH AHP ATTITUDE

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ABSTRACT

Handicraft industry is an appropriate means for attracting investment and developing production circle. It is also a part of Iran national wealth that needs major consideration for maintenance and modernization. It seems this industry will be developed through domestic and foreign marketing, advertising, and attracting private sectors' support. Regarding so, this study tries to identify and rank marketing strategies in Fars province, Iran, handicrafts. First of all, these strategies were identified by applying Delphi technique, and then, they were ranked by Analytic hierarchical process in a way that the data could be used as a framework to improve and develop handicraft industry. Samples included 30 workers of handicraft industry from Cultural Heritage Organization and Cooperative Unions of Fars Province, Iran. The present study is conducted based on the descriptive-survey methodology. Questionnaires were considered as tools for collecting the data. After all, five main strategies (product, price, promotion, distribution, artistic protection, and historical authenticity) and also 43 indices were identified. For these five strategies, ranking based on the AHP resulted in the followings. The product strategy owned the first priority, and other strategies such as price, promotion, historic and artistic originality were organized as subsequent ones that they have least significance distribution.

INTRODUCTION

Marketing strategies has become one of the key strategies in competitive business environment for increasing and retainment of the company profitability, and guaranteeing its business future [1]. Marketing strategy looks for decision-making strategies for the type of business that a company should follow in its prospect to see what product, price, promotion and distribution should be taken into the consideration in target markets competitive environments in future [2]. However it is as the result of investigating customers' behaviors that helps marketers in satisfying consumers' needs [3]. Marketing is a comprehensive system of business act designed to plan, price, promote, and distribute the desired and satisfactory products for the target markets to accomplish organizational objectives [4]. Manufacturing, marketing, and distribution of handicrafts requires paying attention to the many complex variables [5]. Over 150 different handicraft fields are recognized in Iran in 24 different groups created by many artists and innovators who are very active, but there is no significant plan for handicraft products advertising and marketing. For the reason that development of sales and success of products seem impossible without advertisement in today's intense competitive market, current situation leads to the isolation of Iranian handicraft products in economical fields. Iranian craftsmen have always had the dream of joining to international markets because of the lack of standard inspections, branding and unsuccessful marketing in international markets [6].

Handicraft industry gives a value to the innate creativity in a society. It is also the "heirlooms" inherited from past. They not only have a cultural significance, also create social and economic growth. They are helpful in keeping valuable heritage alive through providing a reference to the bygone times. Globalization has made it possible for these handicrafts to aim a wider emand [7]. Handicraft industry provides job opportunities to a large section of poor in society. However, the role and importance of such industry to the national development has been declined. In fact, his industry faces a lot of problems such as man power, material, methods, machines, money, marketing and management [8]. Artisans face several problems in marketing. By shortage of financial resources and small scale of operation advertising publicity cannot be undertaken by artisans [9].

The market of Iranian handicrafts is not in proper conditions. In handicraft shops, rather facing beautiful and authentic Iranian handicrafts, you are noticed by low quality foreign goods and handicrafts. Also, there are few innovations in production of handicrafts that lots of them are still produced by methods date back to the decades ago. As a result, it lessens the motivation and interest for domestic and foreign consumers. One of the key factors that has led to a reduction in marketing of these valuable products is known as the lack of attention to the modern marketing and entrepreneurship principles and basics. It has resulted in the loss of competitive advantages of Iranian handicrafts in the national and global level, Iranian market reduction, an increase in prices, sales reduction, reduction of job opportunities and handicrafts drawback as a cultural problem. Afterward, identification of marketing strategies in a way that the achieved results could be used as a framework for improvement of production and selling of handicrafts is a necessity for conducting the present study. prioritizing and applying these strategies, as followed by the same study, can

KEY WORDS

Delphi technique, Handicrafts, Hierarchical method of analysis, Fars Province, Marketing strategies

Received: 11 Sept 2016
Accepted: 13 Oct 2016
Published: 18 Nov 2016

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accelerate the development of this industry. Therefore, the present paper objective is to find the key marketing strategies and its indices in the succession of handicraft industry. Doing so, present study tries to answer three fundamental questions:

1. What are the handicraft marketing strategies in Fars province, Iran, achieved by application of reviewing related literature and Delphi method?
2. What is the ranking of handicraft marketing strategies and their relative importance in Fars province, Iran, through the conducting Analytical Hierarchical Process?
3. What are the solutions for an effective development of marketing strategies in Fars province, Iran, with an emphasize on main principles?

In order to answer the above mentioned questions, we reviewed the related literature, the concept of strategy, and the combined marketing. This study relies on reviewing the experts and elites' feedbacks. The level of importance and effectiveness of existing indices in every one of the combined factors were studied first, and after that, factors and elements of handicraft industry marketing strategies were ranked by utilizing the *analytic hierarchy process* (AHP). Finally, solutions and suggestions were presented for an effective handicrafts industry development.

A lot of studies have been carried out on marketing strategy and handicrafts all over the world.

MATERIALS AND METHODS

This paper is a descriptive study. Considering the objectives, it can be replaced in category of applied studies. The sample and participants were included the employers and staffs in handicraft industries of Cultural Heritage Organization and the members of Handicraft Cooperative Union in Fars Province, Iran. The number of 30 members were selected from the elites among whom 11 members were handicraft experts of Cultural Heritage Organization and the rest were members of the Handicraft Cooperative Union. For collecting data two questionnaires were prepared. One of the questionnaires was designed for identifying the main strategies in handicraft marketing and indexing them on the basis of Delphi method. Applying this questionnaire, the views of experts about identifying main strategies in handicraft marketing and their ranking were collected. The other questionnaire was planned for measuring the importance value of main strategies in handicraft marketing and their criteria based on the Thomas. L. Saaty 9 scale and AHP method. Considering the applied method of data collection in this study the obtained results have rational justifiability (content). In Delphi questionnaire, the nature of Delphi method, the output and input questionnaires, applying views, and the reliability of the questionnaire were performed during the Delphi procedure which was not measured by the relationships. In comparing the questionnaires, all strategies and indices were juxtaposed, and therefore, there was no need to measure the reliability. In the present study, the ratio of inconsistency was measured for certainty of the reliability of data collection tools based on the classic algorithm of AHP and measurements through Crisp numbers. The measured ratio of inconsistency for the questionnaire number 2 was 0.02, and since this value is less than 0.1, it was considered as an acceptable value.

Introduction of the model of handicraft marketing strategy

Marketing is the general system of designing activities of a career for planning, price tagging, promotion, distribution, and production for targeting the market in order to meet organizational objectives [4]. In order to create effective marketing strategies, marketing experts have mostly considered the factors of product, people, promotion, participation, and packaging [10]. Marketing strategy is closely related to the marketing mix strategy [11]. It means that it contains two separated factors, but somehow closely related, that is related to the marketing mix strategy [12].

It can be claimed that one of the important and effective factors considered by planners and producers of this sector in improving and developing of country's handicraft industry is compiling and applying a strategy in concordance with the handicraft industry. In the offered model by the same study, combined marketing consists of five key factors of product, price tagging, promotion, distribution, artistic and historic authenticity. In this model, in addition to the four combined factors, there is a fifth factor called artistic and historical authenticity which will be discussed later. According to the five dimensions of combined marketing model, indices were designed for each one of these factors so that they could be studied. [Fig. 1].

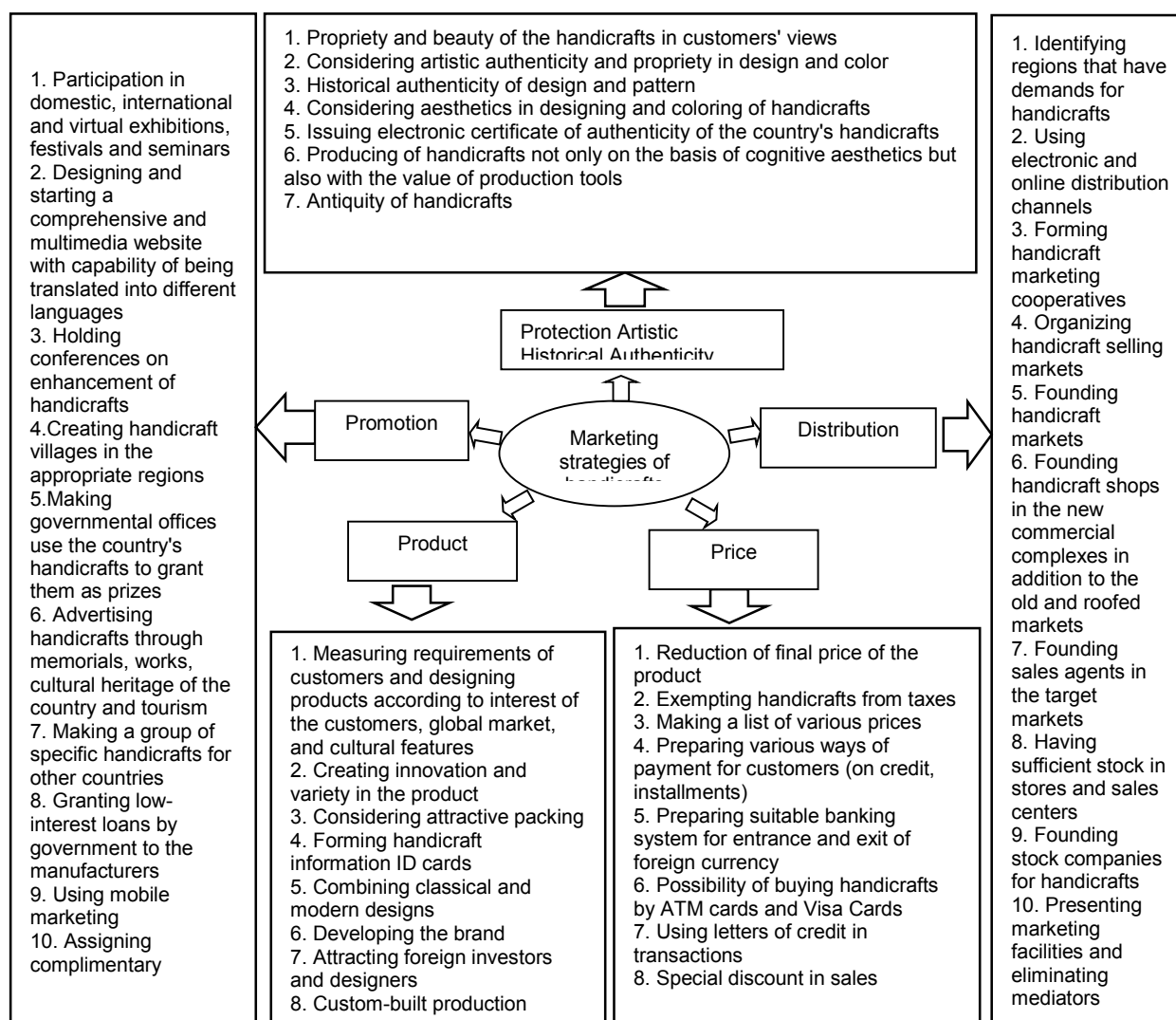


Fig. 1: Conceptual model of the research.

Product strategy

Product marketing decisions varies based on the type of retail outlet you run and your target audience. The factors that affect the perception of quality include packaging design, service plan options, warranty, colors, and materials [13]. A product is a set of tangible and intangible attributes, including packaging, color, price, manufacturer and retailer's prestige, manufacturer and retailer's services that the buyer may accept as the desired satisfaction [14]. Product planning and development can be found even in handicrafts. Handicrafts are the products of creativity and workmanship. Artisans usually strive for excellence in their crafts by undertaking product planning and development [9].

Place (distribution) strategy

A place or distribution channel is a way of transporting the product to the customer and the level of their accessibility to the products. This element of marketing mix strategy is similar to a vehicle for the other elements of marketing (product, price, and promotion). Without a place, customers will not have access to the products [15]. Distribution is an activity in which the company makes the product available for distribution and trade channels. The supplying chain is made of four links of manufacturer, factory, producer, distributor, wholesaler, and retails that offer the product to the consumer [11]. Handicrafts producers may sell their goods directly to their customers. Through the second channel, handicraft producers may sell the products to the private dealers, who in turn sell to the wide range of customers [9].

Promotion strategy

Promotion strategy is a part of a marketing strategy that should be harmoniously organized with marketing objectives and other marketing mix strategies [16]. Promotion refers to a set of activities which deal with expressing and exposing the product and making the customers contented of the product [17]. Promotion means an increase in the product selling through advertisement. It is one of the combined elements of

marketing that has a great role in selling a product or a service. As so, the company should have a precise definition according to the product popularity. Promotion could include activities for introduction or make relationship with the product in the target market for giving information about its features in order to change the attitudes or encouraging people to buy the product. The main purpose of promotion is giving information for persuading the customers to remember the company and marketing [11]. In general, sales promotion is designed to reinforce other factors of the promotion and to improve their short-term effectiveness [9].

Pricing strategy

Price shows the amount of money people pay for the product. According so, price doesn't show the money exchange, but it represents characteristics of services, experience, and culture of the product [18]. Price, as one of the elements in marketing, is important in acceptance or rejection of the product by consumers. In addition, the price is a flexible element of marketing which changes fast. The ways of decision-making and the price tagging have an important role in every company's life [11]. Since price represents a base for what the firm receives for the marketed product or service, it is a main factor in the marketing mix strategy [19]. A bad point about using low price as a marketing strategy is that the customer may consider the low price product as an indication of compromised quality. When we are decided on the price, we must be fully aware of the brand and its integrity. Otherwise, we will reduce the profit margin without increasing the sales [20]. Handicraft articles price is determined by craftsman, master craftsman, dealer and co-operative societies. People's influence in fixing the prices differs from a craft to another. Dealers and co-operative societies are viewed as the majority of the respondents who affects the prices or handicrafts very much [9].

Protection artistic and historical authenticity strategy

Since handicrafts are the products of human talent in marketing and facing their customers, it cannot be considered as industrial products produced machinery. Because of this, their artistic and historical authenticities cannot be ignored. The success of handicrafts depends on how manufacturers can produce a product that is accompanied by the interest and priorities of the consumers. Industrialization in every kind of art and handicraft should be recognized along with an innovation in the consumers' market through the exchange of goods in order to form the artistic and ethnic value [9]. On the other hand, Iran as one of the main producers with a glorious background in this industry can utilize this competitive advantage over other newcomer rivals to the market to create a specific value and attract a greater share of the market through making use of the existing treasures of scientific and intellectual capitals and paying attentions to the historical and artistic authenticities.

RESULTS

In AHP method factors have to be compared two by two. And it has to be done by use of the scale that can be obtained from the same preference to an endless preference. It is designed by selecting numbers one-ninth to nine. While comparing two by two, at the beginning, the equivalent of the importance of two by two has to be carried out through a ranking method. Then, its accordant numerical value should be brought into the comparison table. After formation of a pair comparison matrix, the existing data should be normalized, and the method of measuring should be as the following; first, every datum of the paired comparison column is divided by collection of every column and measuring the average of lines. Hence, the priorities related to the main strategies are achieved [Table 1].

Table 1: Average of relative importance of main strategies

Main Strategies	Relative Weight	consistency Ratio
Product	0.342853907	0.02
Price	0.198685842	
Promotion	0.177771273	
Protection Artistic and historical authenticity	0.165149608	
Distribution	0.115539371	
Total	1	

The product strategy has the first priority among the main strategies. After that, the strategies of price, promotion, and protection artistic and historical authenticity have the following priorities. In the meantime, distribution strategy has the least importance. [Table 1].

After determining the relative weight of main strategies, relative weight of the indices for each strategy has to be determined as well. And at the end, the final weight of every index in the analytic hierarchical process is achieved by weighting the average and mixing the relative weight of criteria with relative weight of main strategies of their head categories [Table 2].

Table 2: Final and relative weight of main strategies and marketing indices in the field of handicrafts

Main Strategies	Indices	Relative Weight	Final Weight	consistency Ratio
Product	Measuring requirements of customers and designing products according to interest of the customers, global market, and cultural features	0.209	0.072	0.07
	Creating innovation and variety in the product	0.158	0.054	
	Considering attractive packing	0.149	0.051	
	Forming handicraft information ID cards	0.109	0.038	
	Combining classical and modern designs	0.104	0.035	
	Developing the brand	0.101	0.034	
	Attracting foreign investors and designers	0.091	0.031	
	Custom-built production	0.079	0.027	
Price	Reducing final price of the product	0.179	0.036	0.06
	Exempting handicrafts from taxes	0.166	0.033	
	Making a list of various prices	0.166	0.033	
	Preparing various ways of payment for customers (on credit, installments)	0.161	0.032	
	Preparing suitable banking system for entrance and exit of foreign currency	0.108	0.021	
	Possibility of buying handicrafts by ATM cards and Visa Cards	0.081	0.016	
	Using letters of credit in transactions	0.075	0.015	
	Special discount in sales	0.064	0.013	
Promotion	Participation in domestic, international and virtual exhibitions, festivals and seminars	0.145	0.026	0.04
	Designing and starting a comprehensive and multimedia website with capability of being translated into different languages	0.145	0.025	
	Holding conferences on enhancement of handicrafts	0.138	0.025	
	Creating handicraft villages in the appropriate regions	0.137	0.024	
	Making governmental offices use the country's handicrafts to grant them as prizes	0.096	0.017	
	Advertising handicrafts through memorials, works, cultural heritage of the country and tourism	0.084	0.015	
	Making a group of specific handicrafts for other countries	0.082	0.015	
	Granting low-interest loans by government to the manufacturers	0.078	0.014	
	Using mobile marketing	0.053	0.009	
	Assigning complimentary	0.044	0.008	
Protection Artistic and Historical Authenticity	Propriety and beauty of the handicrafts in customers' views	0.149	0.0244	0.06
	Considering artistic authenticity and propriety in design and color	0.147	0.0243	
	Historical authenticity of design and pattern	0.143	0.023	
	Considering aesthetics in designing and coloring of handicrafts	0.142	0.024	
	Issuing electronic certificate of authenticity of the country's handicrafts	0.141	0.023	
	Producing of handicrafts not only on the basis of cognitive aesthetics but also with the value of production tools	0.139	0.023	
	Antiquity of handicrafts	0.137	0.023	
Distribution	Identifying regions that have demands for handicrafts	0.178	0.021	0.07
	Using electronic and online distribution channels	0.132	0.015	
	Forming handicraft marketing cooperatives	0.129	0.014	
	Organizing handicraft selling markets	0.109	0.013	
	Founding handicraft markets	0.108	0.012	
	Founding handicraft shops in the new commercial complexes in addition to the old and roofed markets	0.096	0.011	
	Founding sales agents in the target markets	0.075	0.008	
	Having sufficient stock in stores and sales centers	0.064	0.007	
	Founding stock companies for handicrafts	0.059	0.006	
	Presenting marketing facilities and removing mediators	0.049	0.005	

among the indices of product strategy, measuring the requirements of the customers and designing according to their interests, global markets and cultural features are considered as the initial priorities among the indices of price, reduction of final price of the product, strategy promotion, participation in domestic strategy, international, and virtual exhibitions, festivals and seminars. In the of protection artistic and historical authenticity, beauty of handicrafts in customers' views, and in the strategy of distribution, the identification of demands region for handicraft products are also the foremost priorities[Table 2].

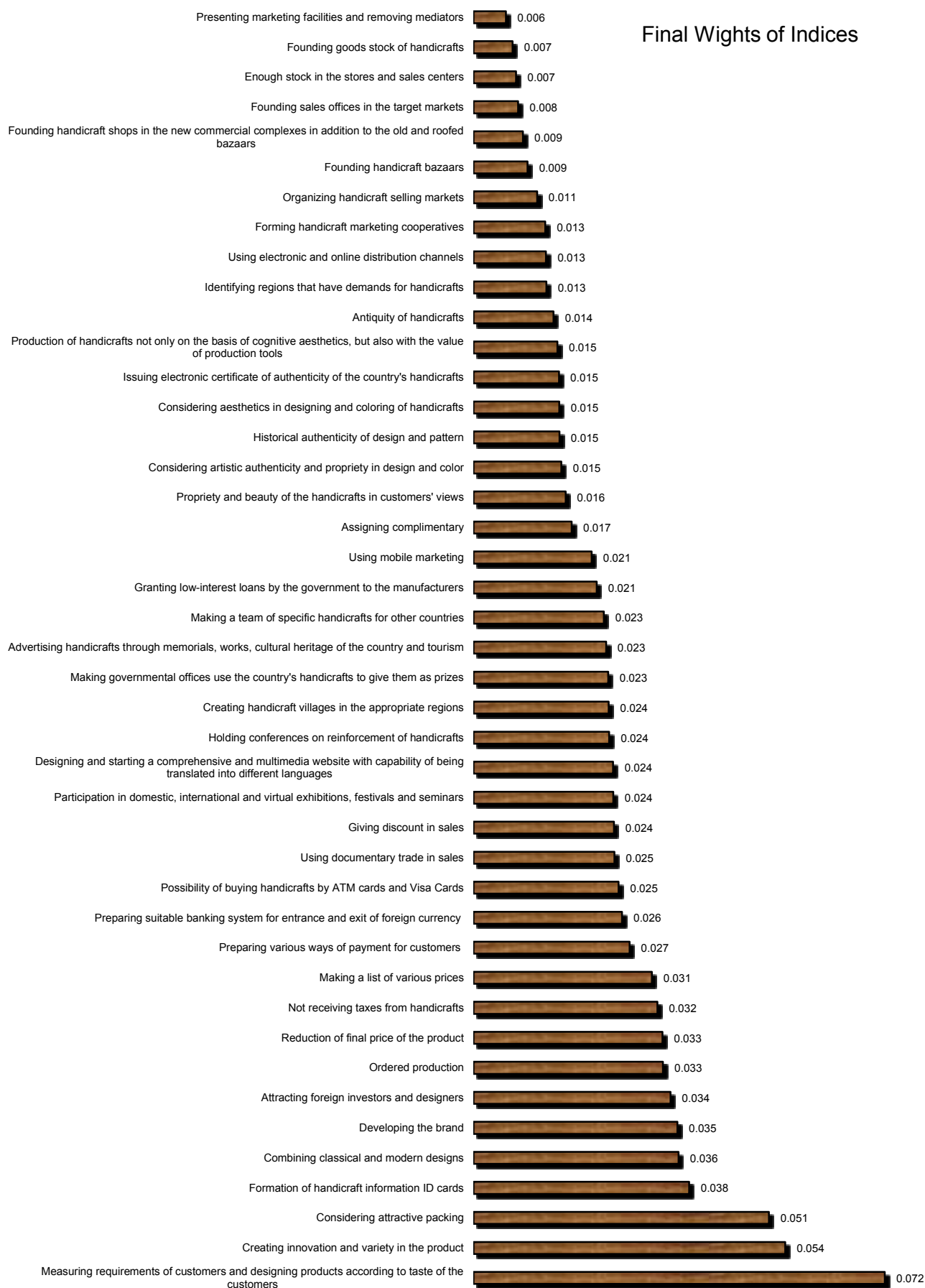


Fig. 2: Final weight of indices in the five main groups.

Measuring customers' requirements and designing the products according to their interests, global markets and cultural features, innovation and variety in products, considering attractive packaging, preparing information ID cards for handicrafts, combining classic and modern designs, reducing the total price of the product, brand development, and exempting handicrafts from taxes are the highest priorities among all indices in the five main groups. All of the above mentioned indices belong to the two main factors of product and price as the most important ones among the five factors. [Fig. 2].

CONCLUSION

Considering the high prices of handicrafts, identifying marketing strategies of handicrafts and identifying higher privileged factors compared to that of the other ones are big and main steps in succession of handicraft industry. Identifying key strategies of handicrafts shows that the elements effective for reaching an acceptable development of the handicraft industry have to be recognized and key decisions have to be made on about. The results from Delphi process in three stages showed that in the studied group there are five strategies and 43 indices for handicrafts. According to the related literature, in addition to the four combined factors of marketing, views of elites and the conducted interviews has introduced a fifth factor called protection artistic and historical authenticity in handicrafts marketing. After that, ranking and analyzing the existing indices in this model were performed. Ranking main strategies of handicrafts showed that strategy of product has the first priority among the main strategies; and among its indices, measuring requirements of customers, designing products according to the interests of customers, global markets and cultural features are the most important indices. Introducing innovation and variety in the product is in the second place and custom-built production has the lowest importance, relatively. The strategy of price stands in the second position. Out of the indices of price, reduction of the final price of the products has the first priority. Exempting handicrafts from taxes is in the second place, and giving a discount during the sale has the least priority. The strategy of promotion stands in the third place among the main strategies; and out of its indices, participation in domestic, international and virtual exhibitions, seminars and conferences owns the first priorities. Designing and starting comprehensive and multimedia websites along with their capability of being translated into different languages stand in the second place. However, assigning complimentary items has the least priority. The strategy of protection artistic and historical authenticity has the fourth rank among the main strategies. Out of the indices of artistic and historical authenticity, propriety and beauty of handicrafts in the customers' perspective have the first rank. Considering the artistic authenticity and the propriety in color and design stand in the second position. The antiquity of handicrafts goes about the last priority. The last strategy is distribution. Out of the indices of distribution, identification of regions that have demands for handicraft products stands as the first priority. Applying electronic and online distribution is in the second priority, and presenting marketing facilities and removing mediators are the last priorities.

Measuring the final weights and ranking key indices of handicraft marketing strategies show that out of 43 identified indices, measuring requirements of customers and designing products according to the interest of customers, global markets and cultural features, creating innovation and variety in the products, considering attractive packing, preparing information ID cards for handicrafts, combining classic and modern designs, reduction of final price of the product, developing the brand, and exempting handicraft industry from paying taxes are the utmost important indices among all indices in the five main groups. All of the mentioned criteria belong to the two strategies of product and price the most important ones among the five main factors.

In an article titled "Strategy and success factors of handicraft section in handicrafts of Mexico" identified the effective factors of success in the handicraft sector of Mexico on the basis of analyzing strategies of marketing as strategies that use P4 which are in the form of product (packing, product variety, product information). 23 factors that the manufacturers use for success are identified as marketing strategies. Analysis showed that manufacturers mostly use product strategy, although promotion and price strategies are almost important, they mostly use the strategy of place [21]. In an article entitled "Studying the strategies of handicraft marketing among the manufacturers of Uttar Pradesh and their consequences" he identified "P4" of marketing i.e. product, price, promotion, and place as the strategies of marketing. This paper is descriptive on its method and the results of information have been presented from the secondary data [14].

Considering the survey results and determined priorities, it is suggested that efforts to be made in relation to the identification of customers' requirements and designing the product according to their interest of customers, global market, and cultural features. It is also suggested that for improvement of the quality of products, a research center is established for modern innovations in production and marketing research. There should be arrangements for reduction of the final price of the product and also exempting handicrafts from paying taxes. It is suggested that handicrafts to be produced affordable for all classes of the society; they shouldn't be accessible for just a specific class. The way out of this problem is that by an increase of production, creation of competition among producers and movement towards mass production, we should decrease the final price of every product. It is only then that cheaper products can enter the baskets of all families and can add to the more flourishing of this industry. Participation in domestic, international and virtual exhibitions, festivals and seminars, and the creation of a comprehensive and multimedia website with the capability of being translated into different languages should be considered and targeted.

SUPPLEMENT ISSUE

CONFLICT OF INTEREST

None

ACKNOWLEDGEMENTS

There is no any form of conflict of interested.

FINANCIAL DISCLOSURE

No financial support was received for this work.

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ARTICLE

ENERGY MANAGEMENT OF A HYBRID MICRO-GRID WITH POWER ELECTRONIC CONVERTERS

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ABSTRACT

The widespread interconnection of distributed generators (DGs) has created possibility of microgrid, both in AC and DC forms. Combining both AC and DC systems, hybrid microgrid has been proposed by many researchers. While a B2B connection between two AC systems could bestow are liable, isolated and efficient coupling, an extra DC bus connection can facilitate use of the DC micro sources. In this paper, a hybrid microgrid structure with DC bus connection at B2B converter is proposed. The main contribution of this paper lies in enabling this new hybrid structure for grid connected microgrid through B2B converters. Control voltage between the microgrid and utility provides a new model system for hybrid microgrid. Different control modes are developed to demonstrate the efficacy of the proposed microgrid structure and associated controls.

INTRODUCTION

The necessity of an AC or DC microgrid is governed by available micro sources and connected loads. A hybrid structure can ensure a sustainable configuration blending both the forms. In this paper, a hybrid microgrid structure or a grid connected microgrid with DC connection at back to back (B2B) converters is proposed [1]–[12]. In [3], an assessment and mitigation strategies for system level dynamic interaction (to achieve tight regulation of load requirement) with control power converters is investigated in a hybrid microgrid. An effective control method to reshape the DC side admittance is proposed to improve the system stability. In [4], a real-time circulating current reduction method, for parallel harmonic-elimination pulse width modulation (HEPWM) inverters used to employ power transfer between AC and DC buses in hybrid microgrid, is proposed. The proposed method can provide an extra 15% modulation index range which is a great benefit for power converter applications in this area. The stability issues in a hybrid microgrid are very well addressed in [5], [6]. The proposed control schemes improve the voltage stability in the DC bus and the efficacy of the controller is verified considering the uncertainty of the generators and loads existed in microgrid. In [7], different effective and simple control strategies for hybrid AC-DC microgrid (both grid-connected and islanded operations) are described. The proposed control can keep the power balance and ensures stable AC/DC bus. A decoupled control framework is developed for the hybrid microgrid and the performances are evaluated. The power electronics interfaces and controls for a microgrid with both DC and AC links are investigated in [8].

The presence of AC and DC sources requires detail investigation of the control aspects in such systems. The coordination control algorithms are proposed in [1] to balance the power flow between the AC and the DC grids and to maintain both the DC and the AC voltages. Another efficient AC/DC microgrid structure is presented in [2]; where the hybrid grid is consist of AC and DC network connected through multi bidirectional converters. The coordination control algorithms are proposed for smooth power transfer between AC and DC links and for stable system operation under various generation and load conditions. A general framework to aggregate a wide range of distributed energy resources at several levels with DC, AC, and synchronous links is proposed with variety of power electronics interfaces and control schemes. The energy management system in an AC and DC bus liked microgrid, is described in [9] for different operating modes. The need of frequency and voltage control is identified along with the DC bus voltage. A centralized power control scheme for a hybrid microgrid is proposed in [10]. The proposed scheme control the power flow of the multiple AC-DC bidirectional converters connected in parallel that connect AC and DC buses. The power management system plays a crucial role in any microgrid and can ensure improved steady state performance [11] [12]. An Energy Management System for the optimal operation of smart grids and microgrids is proposed in [13]. An adaptive algorithm based on advanced control techniques is used to allow energy saving, customers participation in the market etc. A two level architecture for distributed energy resource management for multiple microgrids using multi agent systems (MAS) is proposed in [14]. A central power-management system (PMS) with a decentralized, robust control strategy for autonomous mode of operation of a microgrid is proposed in [15]. AGPS system is used to synchronize the oscillators of the Voltage Source Converter (VSC) DGs.

KEY WORDS

Hybrid Microgrid,
converters back to back
Distributed Generation
Energy Management

Received: 8 Sept. 2016
Accepted: 15 Oct 2016
Published: 18 Nov 2016

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System Structure

The basic system structure is shown in [Fig. 1].

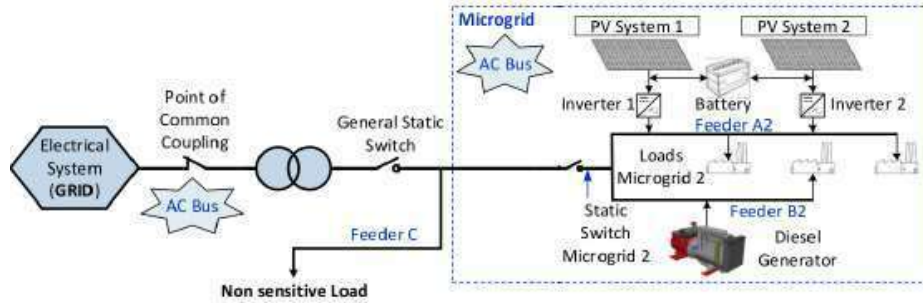


Fig. 1: System structure with AC DC microgrids.

Control of DC microgrid

The control scheme of the DC microgrid is shown in [Fig. 1]. The utility interfacing VSC (VSC-1) controls the DC voltage while the DC micro sources may operate in fixed power control or droop control mode. The current reference of the DC micro sources operating in constant P control can be derived as

$$I_{FCref} = \left(K_{PP} + \frac{K_{iPP}}{s} \right) (P_{dref} - P_{dmeas}) \quad (1)$$

For droop control operation, the current reference is calculated as

$$I_{FCref} = \left(K_{Pd} + \frac{K_{id}}{s} \right) \times (V_{drated} - V_{dmeas} - K_{DRP} (P_{dref} - P_{dmeas})) \quad (2)$$

In this paper fuel cells and PVs are considered as the DC micro sources.

Control of AC microgrid

It is assumed that only VSC interfaced micro sources are present in the AC microgrid. However, the proposed method can also accommodate inertial DGs. It must be noted that the DGs in AC microgrid are VSC interfaced and they are represented by ideal DC sources. In the AC Microgrid the power set points and measured powers are used to calculate the limited power reference. The power errors are fed to the power controller to derive the current references. The voltage reference is then calculated based on the measured current, measured voltage and current reference values. The frequency and voltage regulation are achieved with measured output powers.

The current references are calculated as

$$I_{dref} = \left(K_{pac} + \frac{K_{ipac}}{s} \right) \times (P_{dref} - P_{meas}) \quad (3)$$

$$I_{qref} = \left(K_{qac} + \frac{K_{iqac}}{s} \right) \times (Q_{ref} - Q_{meas}) \quad (4)$$

The voltage references are calculated as

$$V_{dref} = \left(K_{vdac} + \frac{K_{ivdac}}{s} \right) \times (I_{dref} - I_{dmeas}) + V_{dmeas} + I_{dmeas}R_{tr} + I_{qmeas}X_{tr} \quad (5)$$

$$V_{qref} = \left(K_{vqac} + \frac{K_{ivqac}}{s} \right) \times (I_{qref} - I_{qmeas}) + V_{qmeas} + I_{qmeas}R_{tr} + I_{dmeas}X_{tr} \quad (6)$$

The frequency and voltage regulation is implemented as

$$V_{ref} = \sqrt{V_{dref}^2 + V_{qref}^2} - K_{drpv}(Q_{rated} - Q_{meas}) \quad (7)$$

$$\delta_{ref} = \sqrt{\left(\frac{V_{qref}}{V_{dref}}\right)^2} - K_{drpp}(P_{rated} - P_{meas}) \quad (8)$$

Control of back to back converters

There are two VSCs in the B2B connection as shown in [Fig. 1]. Two three phase H bridge converters are connected through the common DC link. It must be noted that the filter design of each VSC depends on the system requirements and converter control. The used IGBTs in back to back converter are controllable switches.

VSC-1 controls the voltage in the DC bus to a predefined magnitude (3.5 kV) and control of VSC-1 output voltage angle is achieved as

$$\delta_{ref} = \left(K_{vdc} + \frac{K_{vidc}}{s}\right) - (V_{dcref} - V_{dcmeas-av}) \quad (9)$$

VSC-2 can be controlled to supply:

- a fixed power from AC microgrid to the DC bus;
- a fixed power to AC microgrid from the DC bus;
- extra power requirement of the AC microgrid in droop control mode.

For supplying fixed power in either direction, the PCC of the AC microgrid is used as the point of reference. The output voltage magnitude and angle references of VSC-2 are calculated as

$$V_T = \frac{V_P^2 + Q_{Tref}X_G}{V_P \cos(\delta_r - \delta_p)} \quad (10)$$

$$\delta_T = \tan^{-1}\left(\frac{P_{Tref}X_G}{V_P^2 + Q_{Tref}X_G}\right) + \delta_p \quad (11)$$

where P_{Tref} and Q_{Tref} are the power references and the PCC voltage is denoted by $V_P < \delta_p$. In droop control mode, the reference voltage is calculated as

$$\delta_r = \delta_{Tmax} - m_T \times (P_T - P_{Tmax})$$

$$V_T = V_{Tmax} - n_T \times (Q_T - Q_{Tmax}) \quad (12)$$

where V_{Tmax} and δ_{Tmax} are the voltage magnitude and angle, respectively, when it is supplying the maximum load. The droop coefficients ensure acceptable voltage and frequency regulations while supplying the powers.

Simulation

The simulation results are presented in this section. Over view of simulation system shown in "Figure 2".

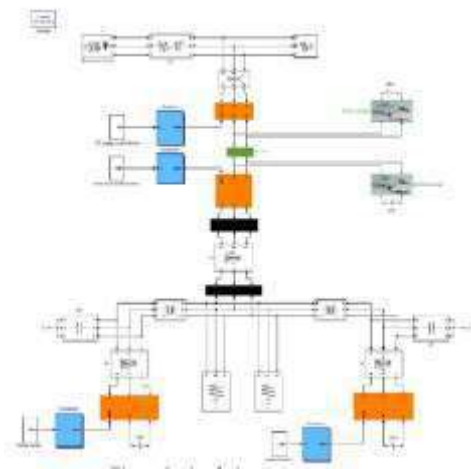


Fig. 2: Simulation system structure.

In this paper, three operating scenarios are considered.

1) Case 1: In this case a fixed power is supplied from the utility to the AC microgrid (or vice versa) and voltage control is achieved for the DC microgrid. As the power from the AC grid is controlled in this case, it is more suitable for a contractual scenario with the AC microgrid.

2) Case 2: In this case, extra power requirement in the AC microgrid is supplied by the utility while the micro sources in the AC microgrid operate on fixed power output. The DC microgrid micro sources may operate with fixed power or droop control.

3) Case 3: The last case considers the possible system contingencies and islanded operation of the microgrid.

The variants of case are as follows.

(a) Fault at the back to back DC bus. With the fault at the DC bus, B2B is blocked and the breakers isolate the systems. Loss of utility connection may need change in control mode and load shedding in the microgrids.

(b) Fault at the utility side. Fault at the utility side initiates connected breakers and VSC-1 is blocked. Power exchange between the microgrids is still possible with VSC-2 control mode changed to voltage control.

(c) Fault in the AC or DC microgrid.

RESULT AND DISCUSSION

In this section, a few of the simulation results (for the cases described in Previous Section) are presented. The system and controller parameters are given in [Table 1–3].

In this case, a load change (1.05 MW to 0.5025 MW at 0.1 s and then back to 1.05 MW at 0.35 s) in AC microgrid is simulated while the power flow through the B2B is kept constant. It is desired that the change in power requirement in AC microgrid is compensated by the DGs in AC microgrid. The system response is shown in "[Fig. 3]". It can be seen that the DC bus voltage remain undisturbed. The DGs in the AC microgrid share the remaining power requirement. In a different scenario, a fixed percentage of the load power requirement in the AC microgrid is supplied through the B2B. The system response is shown in [Fig. 4]. The DC bus voltage show a stable system operation.

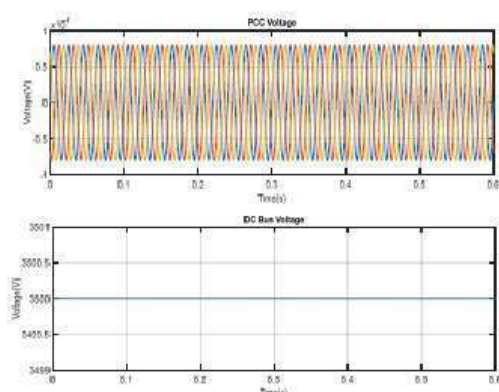


Fig. 3: Case 1: Change in AC microgrid load. PCC point Voltage ; and DC bus voltage.

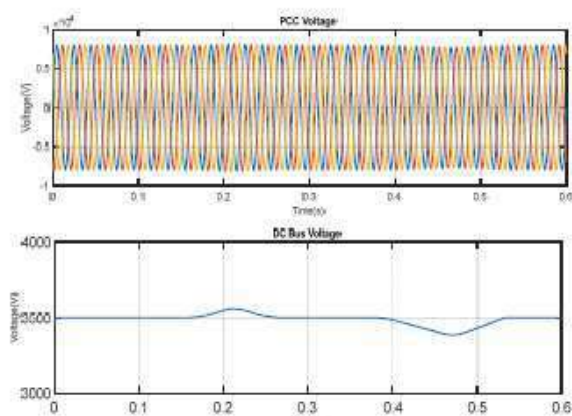


Fig. 4: Case 1: Change in AC microgrid load and power flow from B2B. . PCC point voltage; and DC bus voltage.

CONCLUSIONS

In this paper, a hybrid microgrid structure for grid connected microgrid through B2B is proposed. The proposed control scheme can provide an isolated and reliable system connection. Various control modes of the micro sources in the microgrids are investigated to validate system sustainability in different power flow and system contingencies. A stable system ensures the efficacy of the proposed scheme and control methods.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

ROLE OF ORGANIZATIONAL EXCELLENCE MODEL (EFQM) ON ORGANIZATIONAL PRODUCTIVITY IN ZAHEDAN AZAD UNIVERSITY

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ABSTRACT

Efforts to improve human resource productivity and efficient use of human resources infinite, timeless way. In this way, ups and downs, one of the goals of efficiency, increase the desirability of life with all its dimensions. In this study, researchers is sought to Role of organizational excellence model (EFQM) on organizational productivity in Zahedan Azad University. The research is descriptive and correlational. The target population included 150 staff of the queue Directorate Zahedan Azad University. That uses Morgan table, 108 individuals were selected as sample. Library and field data collection for studies of organizational excellence questionnaire that standard questionnaire (Milner, 2000) and productivity questionnaire is self-made. Its validity and reliability have been approved. For data analysis using SPSS software, descriptive and inferential analysis (linear regression) is used. The results show that the model Suspend the organization and its components have an impact on labor productivity.

INTRODUCTION

Economic, political and social broad developments, and human variety seeking, organizations compete to attract more customers, the development of industrial technology, the complexity of business processes, limited resources, shrinking the universe with the development of communication technology, constant changes, demands and expectations of stakeholders and other items have caused organizations and manufacturing, industrial and service companies be in a hard competitive environment that any neglect of factors including staffing business could remove them from the competition [1].

In these circumstances and taking into account numerous factors, what is important is that managers and corporate leaders with scientific attitude can provide and implement comprehensive strategies, in order to achieve the economic goals of organizations and meet stakeholder satisfaction. Therefore, they should enhance their abilities and appropriate identify and implement scientific solutions to empower the staff under the supervision themselves.

To reach the summit of excellence and eminent, organizations should have the high and excelled manpower. Managers and organizational leaders are responsible for designing and manufacturing the ladder of excellence and the rest of the staff are responsible for traversing the ladder of excellence to achieve the objectives of the organization. Therefore success of any organization is directly related to its perfect and excellent human resources [1].

Organizational excellence model (EFQM) is one of the models that on the one hand implies guidelines and framework for the formulation of policy and strategy and objectives based on the current and future needs and expectations of stakeholders that are the excelled leaders' task and also raises the ways to manage processes, efficient use of resources and achieve the economic goals of the organization that is the excelled staffs' task. What is certain is that implementation of this model without leaders and managers practical beliefs in principles and concepts, is not possible to [2].

EFQM Excellence Model in a systematic and comprehensive way of reviewing and organizing their various aspects of organization and dealing with their performance assessment by a systematic approach, allows the achievement of their strengths and areas for improvement, contribute to identify the best processes executive and is effective to create a platform for organizational learning, innovation, improve efficiency, continuous improvement and utilization of human resources. Since achieving the goals for any organization is not possible without effective human resources; therefore, addressing the issue of labor productivity can bring further promotion for Zahedan Azad University [3].

On the one hand by applying this model, organizations can assess their success rate in improving programs at different levels and on the other hand they can compare their performance with other top organizations. Business excellence models are the answer to this question that what is the superior organization and how does the organization pursue its goals and concepts? These models by relying on production quality (goods and services) and the participation of all members of the organization can gain customer satisfaction and

KEY WORDS

EFQM, performance, excellence, efficiency, Zahedan Azad University

Received: 8 Sept 2016
Accepted: 15 Oct 2016
Published: 18 Nov 2016

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provide stakeholder interests and at the same time encourage individual and organizational learning by relying on creativity and innovation [4].

The human is the goal and productivity factor and this issue doubled the attention to labor productivity. In the meantime, if we consider the management as knowledge, ability, mobilization and optimum use of human staff resources, the role of manager's organizational productivity due to the organizational values is very important and increasing productivity and maintaining its growth and the target are the primary responsibilities of the management [4, 5, and 6].

This study sought to investigate this issue, whether implementation of organizational excellence model to assess employee productivity and promotion of the Zahedan Azad University can have an impact on society or not, and the organization have been able to draw has its main stakeholder satisfaction that the contractor are and educational institutions students and eventually brought about the welfare and progress of society or not?

Research Hypotheses

The main hypothesis:

- Implementation of the EFQM Excellence Model has an impact on productivity of Zahedan Azad University.

Secondary hypotheses

1. Leadership has impact on Organization productivity zahedan Azad University.
2. Policy and strategy has impact on Organization productivity zahedan Azad University.
3. Staff has impact on Organization productivity zahedan Azad University.
4. Partnerships and resources has impact on Organization productivity zahedan Azad University.
5. Processes has impact on Organization productivity zahedan Azad University.
6. Customer Results has impact on Organization productivity zahedan Azad University.
7. Staff Results has impact on Organization productivity zahedan Azad University.
8. Society Results has impact on Organization productivity zahedan Azad University.
9. Key performance results has impact on Organization productivity zahedan Azad University.

Research conceptual model



Fig.1: Research Conceptual Model (Meuller, 2000).

MATERIALS AND METHODS

Due to the nature of issue and intended purposes that we want to evaluate the performance of zahedan Azad University on organizational efficiency (zahedan Azad University), the study will be descriptive and correlational. The target population included 150 staff of the queue Directorate Zahedan Azad University. That uses Morgan table, 108 individuals were selected as sample. Library and field data collection for studies of organizational excellence questionnaire that standard questionnaire [7, 8] and productivity

questionnaire is self-made. Its validity and reliability have been approved. In order to analyze the data of in this research the below statistical methods are used:

Descriptive methods (frequency, percentage, mean and standard deviation).

Inferential statistical methods (linear regression model and also Cronbach's alpha for calculating reliability coefficient). To analyze the collected data software "SPSS" 20 was used.

RESULTS

Research Findings

Hypothesis Testing

Main hypothesis: Implementation of the EFQM Excellence Model has an impact on productivity of Zahedan Azad University.

To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between EFQM Excellence Model (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 1], the model is presented.

Table 1: Goodness of fit of regression model between EFQM Excellence Model and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.844	0.712	0.711	0.179

The relationship between independent variables and the dependent variable equals to .844. R Square is .712 which shows that 71.2 percent of variation in EFQM Excellence Model is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 71.1 in this study. According to the indices, the model was adequate.

Table 2: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	1.64	0.088	0.0844	18.82	0.000
	EFQM Excellence Model	0.625	0.023		27.46	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in [Table 2] the regression equation is provided by unstandardized coefficients.

Productivity = 1.64 + (0.625) EFQM Excellence Model

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in EFQM Excellence Model, the standard deviation 0.625 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to .000, so EFQM Excellence Model has a meaningful effect on productivity.

Sub- hypothesis1: Leadership has impact on Organization productivity zahedan Azad University.

To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between Leadership (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 3], the model is presented.

Table 3: Goodness of fit of regression model between Leadership and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.787	0.619	0.618	0.206

The relationship between independent variables and the dependent variable equals to.787. R Square is.619 which shows that 61.9 percent of variation in Leadership is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 61.8 in this study. According to the indices, the model was adequate.

Table 4: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	2.317	0.078	0.787	29.623	0.000
	Leadership	0.455	0.020		22.278	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in [Table 4] the regression equation is provided by unstandardized coefficients.

Productivity = 2.31 + (0.455) Leadership

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in Leadership , the standard deviation 0.455 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to.000, so Leadership has a meaningful effect on productivity.

Sub- hypothesis2: Policy and strategy has impact on Organization productivity zahedan Azad University. To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between Policy and strategy (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 5], the model is presented.

Table 5: Goodness of fit of regression model between Policy and strategy and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.670	0.450	0.448	0.24839

The relationship between independent variables and the dependent variable equals to.670. R Square is.450 which shows that 45 percent of variation in Policy and strategy is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 44.8 in this study. According to the indices, the model was adequate.

Table 6: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	2.273	0.113	0.670	20.141	0.000
	Policy and strategy	0.465	0.029		15.782	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in [Table 6] the regression equation is provided by unstandardized coefficients.

Productivity = 2.27 + (0.465) Policy and strategy

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in Policy and strategy, the standard deviation 0.465 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to.000, so Policy and strategy has a meaningful effect on productivity.

Sub- hypothesis3: Staff has impact on Organization productivity zahedan Azad University.

To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between Staff (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 7], the model is presented.

Table 7: Goodness of fit of regression model between Staff and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.756	0.571	0.570	0.21930

The relationship between independent variables and the dependent variable equals to.756 R Square is.571 which shows that 57.1 percent of variation in Staff is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 57 in this study. According to the indices, the model was adequate.

Table 8: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	2.004	0.102	0.756	19.672	0.000
	Staff	0.524	0.026		20.146	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in [Table 8] the regression equation is provided by unstandardized coefficients.

Productivity = 2.00 + (0.524) Staff

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in Staff, the

standard deviation 0.524 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to.000, so Staff has a meaningful effect on productivity.

Sub- hypothesis4: Partnerships and resources has impact on Organization productivity zahedan Azad University.

To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between Partnerships and resources (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 9], the model is presented.

Table 9: Goodness of fit of regression model between Partnerships and resources and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.467	0.218	0.215	0.29609

The relationship between independent variables and the dependent variable equals to.467 R Square is.218 which shows that 21.8 percent of variation in Partnerships and resources is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 21.5 in this study. According to the indices, the model was adequate.

Table 10: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	2.717	0.145	0.467	18.789	0.000
	Partnerships and resources	0.369	0.040		9.217	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in [Table 10] the regression equation is provided by unstandardized coefficients.

Productivity = 2.71 + (0.369) Partnerships and resources

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in Partnerships and resources, the standard deviation 0.369 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to.000, so Partnerships and resources has a meaningful effect on productivity.

Sub- hypothesis5: Processes has impact on Organization productivity zahedan Azad University.

To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between Processes (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 11], the model is presented.

Table 11: Goodness of fit of regression model between Processes and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.294	0.086	0.083	0.32001

The relationship between independent variables and the dependent variable equals to.294 R Square is.086 which shows that 8.6 percent of variation in Processes is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 8.3 in this study. According to the indices, the model was adequate.

Table 12: Regression equation of productivity

Table 12: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	3.421	0.117	0.294	29.310	0.000
	Processes	0.183	0.034		5.369	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in [Table 12] the regression equation is provided by unstandardized coefficients.

Productivity = 3.42 + (0.183) Processes

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in Processes , the standard deviation 0.183 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to.000, so Processes has a meaningful effect on productivity.

Sub- hypothesis 6: Customer Results has impact on Organization productivity zahedan Azad University.

To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between Customer (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 13], the model is presented.

Table 13: Goodness of fit of regression model between Customer and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.370	0.137	0.134	0.31100

The relationship between independent variables and the dependent variable equals to.370 R Square is.137 which shows that 13.7 percent of variation in Customer is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 13.4 in this study. According to the indices, the model was adequate.

Table 14: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	3.389	0.095	0.370	35.574	0.000
	Customer	0.185	0.027		6.960	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in [Table 14] the regression equation is provided by unstandardized coefficients.

Productivity = 3.38 + (0.185) Customer

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in Customer , the

standard deviation 0.185 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to.000, so Customer has a meaningful effect on productivity.

Sub- hypothesis 7: Staff Results has impact on Organization productivity zahedan Azad University.

To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between Staff Results (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 15], the model is presented.

Table 15: Goodness of fit of regression model between Staff Results and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.459	0.211	0.208	0.29747

The relationship between independent variables and the dependent variable equals to.459 R Square is.211 which shows that 21.1 percent of variation in Staff Results is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 20.8 in this study. According to the indices, the model was adequate.

Table 16: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	3.077	0.108	0.459	28.472	0.000
	Staff Results	0.268	0.030		9.018	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in [Table 16] the regression equation is provided by unstandardized coefficients.

Productivity = 3.07 + (0.268) Staff Results

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in Staff Results , the standard deviation 0.268 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to.000, so Staff Results has a meaningful effect on productivity.

Sub- hypothesis 8: Society Results has impact on Organization productivity zahedan Azad University.

To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between Society Results (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 17], the model is presented.

Table 17: Goodness of fit of regression model between Society Results and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.210	0.044	0.041	0.32733

The relationship between independent variables and the dependent variable equals to.210 R Square is.044 which shows that 4.4 percent of variation in Society Results is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 4.1 in this study. According to the indices, the model was adequate.

Table 18: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	3.593	0.121	0.210	29.779	0.000
	Society Results	0.120	0.032		3.749	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in [Table 18] the regression equation is provided by unstandardized coefficients.

Productivity = 3.59 + (0.120) Society Results

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in Society Results , the standard deviation 0.120 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to.000, so Society Results has a meaningful effect on productivity.

Sub- hypothesis 9: Key performance results has impact on Organization productivity zahedan Azad University.

To determine the effectiveness, goodness-of-fit in regression model was analyzed which was discussed below. To propose the model of the relationship between Key performance results (Y) and Productivity (X) after investigating its adequacy indicators in below [Table 19], the model is presented.

Table 19: Goodness of fit of regression model between Key performance results and productivity

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.329	0.108	0.105	0.31612

The relationship between independent variables and the dependent variable equals to.329 R Square is.108 which shows that 10.8 percent of variation in Key performance results is predicted by productivity. Because this measure do not consider the degree of freedom, adjusted R Square was used which equals to 10.5 in this study. According to the indices, the model was adequate.

Table 20: Regression equation of productivity

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig
		B	Std. Error	Beta		
1	Constant	3.353	0.114	0.329	29.366	0.000
	Key performance results	0.185	0.030		6.089	
Dependent Variable: productivity						

The inserted variable in regression equation is the core of regression analysis which can be seen in[Table 20] the regression equation is provided by unstandardized coefficients.

Productivity = 3.35 + (0.185) Key performance results

It can be said that with increase of one unit of each independent variable depending on the written coefficient, the dependent variable is increased. In other words with increase of one unit in Key performance results, the standard deviation 0.185 unit of productivity is increased, so they have positive relationship. T-test relating to regression coefficients are displayed in the table for independent variable as well. The sig. value equals to.000, so Key performance results has a meaningful effect on productivity.

CONCLUSION AND SUGGESTIONS

The leading organization is comprised of leading individuals and its existence is dependent on excellence seeker people. Perhaps one of the biggest obstacles in the way of growth and development of Iranian organizations and institutions is that unfortunately, many of us even in our individual and personal life are not excellence seeker. Truly what percentage of us has participatory spirit? At what level of prosperity and aspirations are we? Is work quality important for us? Often it can be seen in small offices and organizations that in terms of quantity, a lot of work is done, but all of these efforts have small impact on the organizational growth and excellence. Whether in such circumstances models like EFQM can be implemented and Even if this happen, can its superficial implementation solve the problems? I believe that as long as seeking for improve, the growing, need for continuous learning, being active instead of being passive get not dominant on thinking and mentality of each one of us, especially leaders and managers, we'll do anything. In the hope that excellence seeking becomes a part of any Iranian thought and all of Iranian public and private organizations become excelled organizations [9, 10, 11].

Due to numerous advantages of this model and due to the state of organizations in our developing country and the ability to localize the EFQM model according to the present investigation And the principles of excellence model which can be generalized for Iranian organization, by changes, the model can be used to create excellence in Iranian organizations. As noted this excellence model has been implemented in several civil organizations and have obtained good results and necessary improvements were achieved in the performance of the organization as well as performance of management And it has been effective step to these organizations progress. This model causes changes in the environment and society in a way that most of Customers and staff are satisfied and happy of the organization and its management performance [12 and 13].

Here it is appropriate to give some suggestions to managers.

- The commitment of management and staff to run, modify and continuous improvement of the organization s key processes by using quality management systems, particularly Excellence Model (EFQM).
- continuous evaluation of the current processes and review of goals and operational programs and align it with the needs and requirements of present and future of the organization and understanding external situation and also interaction and synergies with competitors and business partners.
- Effective interaction with parliament, government (politicians) and business partners in order to increase per capita treatment and sustainable management of the financial resources.
- Spending cuts and optimum use of available resources and investment in staff education to improve and, ultimately, promoting a culture of productively in the level of the organization.
- Compensation management of services and benefits, increasing of welfare services .management of motivating programs, team-building and promote the culture of teamwork and reward and upgrade program based on the team.
- Empowerment employees, preserve their honor and their position and their full participation in matters related to key activities and implementation of the organizations policy.
- In order to enhance the employees; working potential and maturing them in related working fields, they should be entered in the process of formal and non-formal education, professional development.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

EVALUATION METHODS FOR EFFECTS OF NANOMATERIALS ON DIATOM GROWTH

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ABSTRACT

Background: We proposed two evaluation methods to show the effects of nanomaterials on diatom cell growth. Firstly, a “diatom chip” using an adhesive diatom, *Navicula* sp., was prepared on a functionalized glass surface. Further, after culturing the diatom chip with sodium dodecyl sulfate (SDS) or carbon nanotubes (CNTs), a significant decrease in diatom cell division was observed. Secondly, a floating diatom, *Melosira nummuloides*, was used for assessing the cell growth. In this diatom, the increase in the number of cells was not counted; instead, cell growth was calculated by estimating the area covered by the cells in a Petri dish. By using this method, inhibition of cell division by single-walled nanotube (SWNT) suspension was observed. Thus, in the presence of a SWNT aqueous suspension, higher inhibition of cell division was observed than that in a SWNT ethanol suspension. Our results showed that both adhesive and floating diatoms could be used to evaluate the effects of nanomaterials on cell growth.

INTRODUCTION

KEY WORDS
diatom, carbon
nanotube, toxicity,
biochip

Carbon nanotubes (CNTs) are one of promising nanomaterials because of their sophisticated and robust nanostructures [1-3]. However, because the morphology of CNTs resembles that of asbestos, the safety of CNT use has become a subject of debate [4-10]. To evaluate the safety of CNTs, until now, dosage experiments using animals and animal cells have been intensively conducted [11-14]. Recent studies have shown methods for reducing the toxicity of CNTs [15]. On the other hand, such evaluation experiments on microorganisms, especially algae, have been initiated recently [16-23]. Green algae, in particular, have been frequently used to evaluate the effects of CNTs [24-26]. For example, Schwab et al. reported that the growths of *C. vulgaris* and *P. subcapitata* were inhibited in the presence of 1.8 mg and 20 mg CNT/L in well-dispersed suspensions with 50% half maximal effective concentrations (EC50) [25]. A diatom is one of the major photosynthetic planktons [27-29]. Diatom cells are sensitive to water quality, therefore water assessment methods using diatoms have been established [30-31]. However, we found only one study investigating the toxic effects of CNTs on diatoms [32][34][35]. This study used several types of diatom cells to evaluate the toxicity of double-walled carbon nanotubes (DWNTs).

In this paper, we studied the effects of CNTs on diatom growth. Two marine diatoms, *Navicula* sp. and *Melosira nummuloides*, were chosen because of their rapid growth rates. Several types of CNTs such as dispersed single-walled carbon nanotubes (SWNTs) and powder of multi-walled carbon nanotubes (MWNTs) were used.

MATERIALS AND METHODS

Materials: MWNT was purchased from Tokyo Chemical Industry Co. Ltd. (C2149, Tokyo, Japan). SWNT suspension was purchased from Meijo Nano Carbon Co. (FH-P, Aichi, Japan). Sodium dodecyl sulfate (SDS) and other chemicals used were of analytical grade.

Diatom cells: Isolated *Navicula* sp. cells were cultured from seawater using Daigo IMK culture medium (Nihon Pharmaceutical Co., Ltd., Tokyo, Japan) and sodium metasilicate (final concentration, 1 mM) in a Petri dish [33]. Isolated *M. nummuloides* cells were cultured from seawater using f/2 culture medium (G9903; Sigma-Aldrich Inc., St. Louis, MO).

Observations: In the case of *Navicula* sp., the previously reported two-dimensional culture method was employed [33]. A glass slide surface was functionalized using 3-aminopropyltriethoxysilane (APS). A drop of 100-μL diatom cell suspension was pipetted onto the functionalized glass surface. After a 1-h incubation period at 18 °C, the glass slide was rinsed using the culture medium to remove unadsorbed cells. A Petri dish was then filled with 35 mL of the culture medium. Finally, the SDS, or powder or suspension SWNT was added to the Petri dish. Sample culture was performed at 18 °C under fluorescent light. To count the number of cells, the samples were regularly observed by inverse optical microscopy. All experiments using the 3 cultures were replicated using 3 separate Petri dishes. In the case of *M. nummuloides* cells, 100 μL of cell suspension was added to a Petri dish containing 35 mL of the culture medium. Then, powder or suspension SWNT was added to the Petri dish. Sample culture was performed at 18 °C under fluorescent light. The sample surface was regularly observed using an optical microscopy, and the amount of the diatom cells was estimated using ImageJ analysis and reported as the coating ratio. All experiments using the 3 cultures were replicated using 3 separate Petri dishes.

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RESULTS

[Fig. 1] shows scanning electron microscopy (SEM) images of the frustules of *Navicula* sp. and *M. nummuloides*. Each species was isolated and prepared by passage culture prior to the dosage experiments.

[Fig. 2] shows the schematic view of the sample preparation for *Navicula* sp., which is an adhesive diatom. Thus, we could attach *Navicula* cells onto the functionalized glass surface, after which, the increase in cell numbers was observed in the presence and absence of CNT. For this, 100- μ L cell suspension was placed as a drop onto the surface of a glass slide functionalized using APS. Before the previously shown step, the cell suspension was gently shaken for 30 min to obtain uniform distribution of the cells. After 1-h incubation, the sample was rinsed with water. By rinsing, only a few cells remained on the glass surface, thus, it could be referred to as a “diatom chip.”

To evaluate the effects of SDS and CNT on diatom cell growth, 3 pieces of the prepared diatom chips were placed in a Petri dish containing 35 mL of culture medium. Concentrations of either SDS or CNT were added to the dish [Fig 3a]. [Fig. 3b] shows a typical image of diatom cells on the glass surface as observed using an optical microscope. The majority of diatom cells grew two-dimensionally, which enabled precise counting of mature cells.

[Fig. 4] shows the effects of SDS on *Navicula* sp. growth. SDS was selected as a test compound, because of it being a typical surfactant that is widely used in laboratories and at home. The data clearly showed that diatom cell growth was inhibited in the presence of SDS. Further, 0.01% SDS was particularly effective at inhibiting diatom growth, which was observed when the cells on the glass surface became white. Typically, living and dead cells are identified based on their colors, namely, brown and white, respectively. There were several advantages to the toxicity evaluation method in this study. The diatoms used in the experiment, for instance, matured rapidly and the results were quickly obtained over the course of 1 week. Furthermore, because culturing was easy and costless, averaged data of many samples could be obtained. Figure 5 shows the effects of powder MWNT on *Navicula* sp. growth. When 1 mg of MWNT was added to the sample, increase in cell numbers was clearly inhibited. However, the inhibition effect remained constant even after increasing the amount of powder MWNT to 10 mg. It is possible that the inhibition effect of the CNT powder was limited because the powder was insoluble in the culture medium. Most of the MWNT was precipitated in the Petri dish.

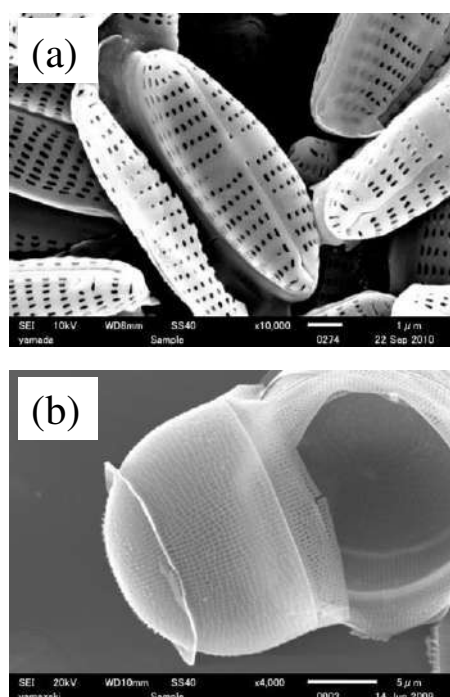


Fig. 1: Scanning electron microscopy (SEM) images of diatom frustules. (a) *Navicula* sp.; scale bar, 1 μ m. (b) *Melosira nummuloides*; scale bar, 5 μ m.

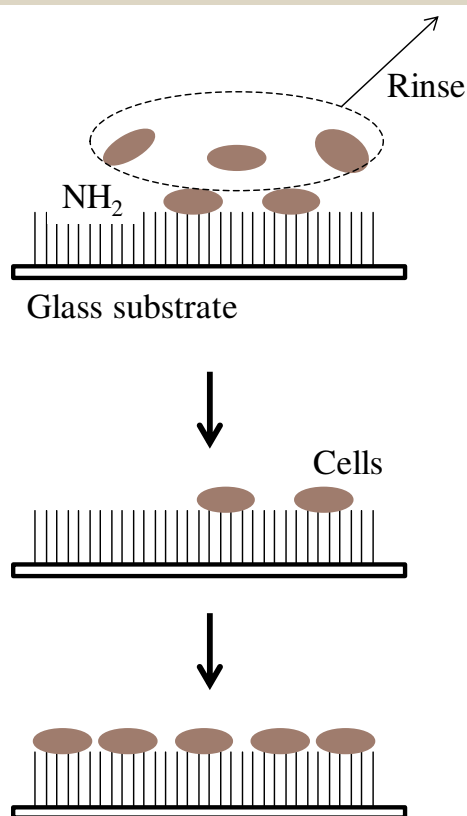
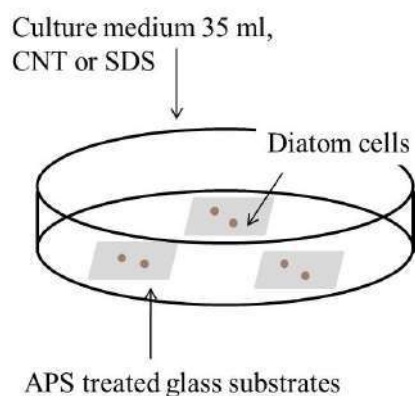


Fig. 2: Schematic view of the preparation procedure of a "diatom chip." Cell suspension was placed as drop onto the surface of a functionalized glass slide. After a 1-h incubation period, unadsorbed cells were removed by rinsing. Thus, diatom cells were cultured on the functionalized glass surface.

(a)



(b)

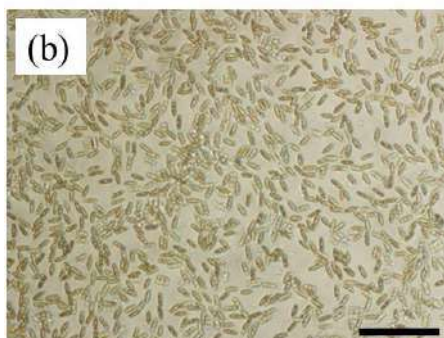


Fig. 3: Evaluation procedure using a "diatom chip" (*Navicula* sp.). (a) Three chips were placed in a Petri dish and increase in the cell numbers was observed using an optical microscope. (b) A typical image of diatom cells cultured on a glass surface; the scale bar is 1 mm.

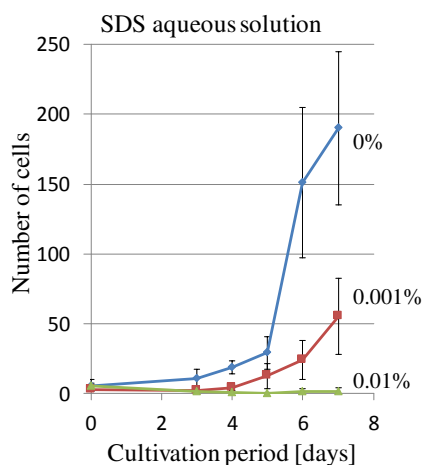


Fig. 4: Effects of sodium dodecyl sulfate (SDS) aqueous solution on *Navicula* sp. growth. Diamond, square, and triangle markers represent 0%, 0.001%, and 0.01% SDS concentrations, respectively.

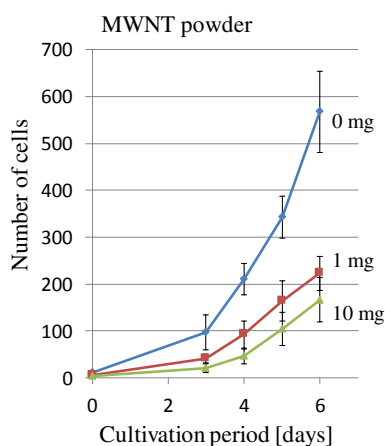


Fig. 5: Effects of multi-walled carbon nanotube (MWNT) powder on *Navicula* sp. growth. Diamond, square, and triangle markers represent 0 mg, 1 mg, and 10 mg of MWNT, respectively.

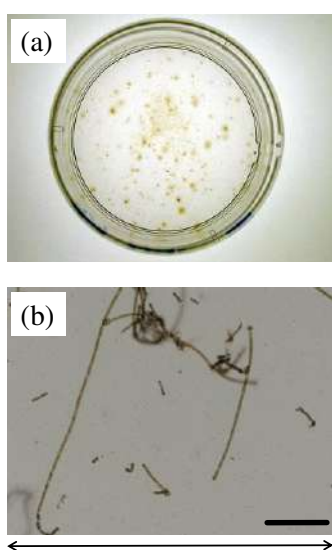


Fig. 6: *Melosira nummuloides* cells cultured in a Petri dish. (a) A photograph of a Petri dish during the cultivation. Brown objects in the dish show the diatom cells. Diameter of the Petri dish was 90 mm. (b) A typical image of diatom cells cultured in the Petri dish; the scale bar is 1 mm.

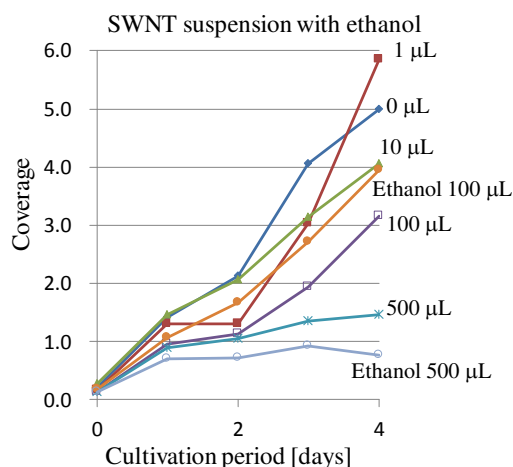


Fig. 7: Effects of single-walled nanotube (SWNT)-ethanol suspension (FH-P) on *Melosira nummuloides* growth. Diamond, square, triangle, white square, and star represent the addition of 0, 1, 10, 100, and 500 μL of the suspension, respectively. Circle and white circle, respectively, represent the addition of 100 and 500 μL of ethanol without SWNT.

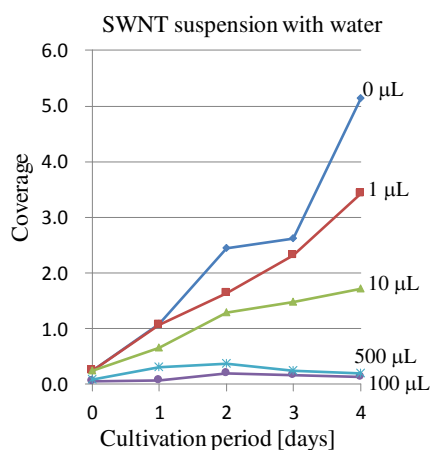


Fig. 8: Effects of single-walled nanotube (SWNT)-aqueous suspension (FH-P) on *Melosira nummuloides* growth. Diamond, square, triangle, circle, and star represent the addition of 0, 1, 10, 100, and 500 μL of the suspension, respectively.

In the current study, we showed a method, which is different from those previously shown, for evaluating the effects of SWNT suspension on diatom cell growth. We used *M. nummuloides* that associate similar to fibers and do not adhere to solid surfaces. Therefore, the glass substrate method used in the case of *Navicula* sp. would be ineffective in this diatom. Instead, we used a 100- μL cell suspension of *M. nummuloides* and cell growth was monitored by continuously observing the surface of the culture Petri dish using an optical microscope. The photographs were binarized using ImageJ software and cell coverage on the Petri dish surface was calculated. [Fig. 6(b)] shows a typical photograph of *M. nummuloides* cells in a Petri dish.

The effects of SWNT were evaluated using the second method with *M. nummuloides* cells. [Fig. 7 and 8], respectively, show the diatom cell growths after adding SWNT suspension using ethanol and water. Although inhibition of diatom growth was observed in both the cases, the effect was stronger in SWNT suspension using water than that using ethanol. The addition of more than 100- μL SWNT water suspension completely inhibited cell growth. In contrast, diatom cell growth was not completely inhibited even after the addition of 500- μL SWNT ethanol suspension. This difference in results might be because of precipitation of SWNT when dispersed using ethanol after adding to the culture medium, whereas the aqueous suspension of SWNT might have been retained in the dispersed state in the culture medium.

CONCLUSION

We proposed two methods for evaluating the toxicity of nanomaterials (e.g. CNT) using two types of diatom cells. In all instances, the effects of SDS and CNT on cell division were clearly observed. An aqueous suspension of SWNT significantly inhibited cell growth. We believe the methodology used in this study will be recognized as a convenient and effective technique for evaluating the safety of nanomaterials.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

CHEMOSENSITIZING EFFECTS OF FIVE PHYTOCHEMICAL COMPOUNDS ON CANCER CELLS

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ABSTRACT

Background: Increasing number of natural products have been used for cancer treatment. More and more pure components from natural products have identified with beneficial effect including both direct cytotoxic effect and chemosensitizing effect (CE). The cytotoxicity indicates a potential use for inhibiting tumor growth, while CE can be applied to overcome the chemoresistance. **Methods:** In this study, five active components including gallic acid, tannic acid, quercetin, myrecitin and serotonin widely studied for their activity in improving human health, were tested for the cytotoxicity as well as CE against prostate, leukemic and breast cancer cells. **Results:** These compounds were cytotoxic effect if administered alone, while they showed chemosensitizing effect (CE) on current chemotherapeutic drugs. **Conclusions:** This may represent a new pharmacological strategy to treat several types of cancer cells by providing mono- or multi-therapies that are significantly reduces the risk of anticancer side effect.

INTRODUCTION

Cancer is a leading cause of death worldwide and can be induced by many factors [1], such as exposure to exogenous sources including the reactive oxygen species, nitrogen oxide pollutants, smoking, certain drugs (e.g. acetaminophen, bleomycin), and radiation. Other components affecting signal transduction pathways leading to uncontrolled cell proliferation may also increase the risk of cancer [2, 3]. Herbal medicines have been frequently used for cancer treatment as well as prevention [4,5,6].

Chemotherapy is one of the most frequently used approaches for cancer treatment. However 90% of patients would experience chemoresistance leading to therapeutically failure. The drug combination of a chemotherapeutic agent with or a few natural products has been widely studied to achieve synergistic effect which may enhance the drug efficacy but reduce side effect [7,8].

In this study, we focused on tannic acid, quercetin, myrecitin, gallic acid and serotonin which are phytochemical compounds. Their toxicity as well as combination effect with marketed therapeutic agents (docetaxel and daunorubicin) in various cancer cells were determined.

MATERIALS AND METHODS

Reagents and Cell Lines

The human prostate cancer cell line, PC3 and the corresponding docetaxel resistant cell line PC3-TxR were kindly provided by Department of Medicine, University of Pittsburgh and Partners Healthcare (Pittsburgh, PA, USA). The human leukemic cancer cell line K562 and its daunorubicin resistant cell line (K562/Dox) were obtained from Western University of Health Science, College of Pharmacy (Pomona, CA USA). The breast cancer cell line (MCF7) was purchased from ATCC (ATCC, Manassas, VA, USA). RPMI 1640 medium, glutamine, trypsin-EDTA, and fetal bovine serum were obtained from Cellgro (Manassas, VA, US) and Invitrogen (Grand Island, NY, US). Sulforhodamine B, trichloroacetate acid, and Tris base were bought from Sigma-Aldrich (St. Louis, MA, US). Quercetin, myrecitin, tannic acid, gallic acid and serotonin obtained from Sigma-Aldrich (St. Louis, MA, US).

Cell lines and Cell Culture

The human prostate cancer cell lines PC3 and PC3-TxR, human Leukemic cancer cell lines K562 and K562-Dox and breast cancer cell line (MCF7), were cultured in a humidified atmosphere 5 % CO₂ at 37 °C in RPMI-1640, supplemented with 10% heat inactivated fetal bovine serum, and 100 IU/ml of penicillin and 100 µg/ml of streptomycin. Cells were kept in the logarithmic phase by routine passage every 2-3 days using 0.05% trypsin-EDTA treatment.

Cells were then seeded into 96-well plate at densities of 3x10³ cell/well for PC3, PC3-TxR and MCF7, while 10x10³ cell/well for K562 and K562-Dox. The cells were incubated at 37 °C (5% CO₂) overnight to allow

KEY WORDS
Cytotoxicity, Tannic acid, Quercetin, Myrecitin, Gallic acid, Serotonine and Chemosensitizing Effect.

Received: 21 Nov 2016
Accepted: 14 Nov 2016
Published: 1 Dec 2016

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attachment onto the wells [9], after 24 hr added 100 μ L of different phytochemical compounds concentrations in range (1×10^{-3} - 2×10^{-3}) mg/ml for quercetin, tannic acid, gallic acid and serotonin, while (0.5×10^{-3} - 1×10^{-3}) mg/ml for myrecitin, following incubation at 37 °C in an atmosphere of 5% CO₂ for 72hr, then SRB assay was performed. Briefly, the cells were fixed with 10% trichloroacetic acid solution for prostate and breast cancer cell lines while leukemic cancer cell lines were fixed with 80% trichloroacetic acid. All cell lines incubated for one hour at 4 °C, washed 3-4 times with tap water, and dried in the air. Cells were stained with 0.4% SRB, and then washed with 1% acetic acid solution after dry; dissolve the cell stain with 10mM Tris (PH 10.0) and absorbance was measured at 565nm and 515nm by UV-plate reader [10][25].

IC₅₀ was calculated using Emax sigmoid method with aid of computer software, Graphpad prism (San Diego, CA, USA).

Chemosensitizing study

Prostate cancer cells which sensitive and resistant to docetaxel (PC3 and PC3-TxR), and leukemic cancer cells sensitive and resistant to daunorubicin (K562 and K562-Dox) cell lines were cultured in volume 100 μ L culture medium and incubated for 24 hr of incubated at 37 °C in 5% CO₂ (In replicate). Afterwards, 50 μ L of phytochemical compounds at concentration range (0.35×10^{-3} - 5.7×10^{-3}) mg/ml was added to top half of 96-well plate, after one hour incubated, docetaxel or daunorubicin in different concentrations were added to final concentration ranged from 0 to 100 nM and 0-100 μ M for docetaxel and daunorubicine respectively. All plates incubated at 37 °C in (5% CO₂), after incubation for another 72 hours, the cell viability was determined using an SRB assay and Inhibition Concentration (IC₅₀) calculated using a sigmoid Emax model [11][26]. The CE was calculated using the following equation [12].

$$\text{Chemosensitizing Effect (CE)} = \text{IC}_{50}(\text{Drug}) / \text{IC}_{50}(\text{drug combination}).$$

Where IC₅₀(Drug) is the IC₅₀ of drug (docetaxel or daunorubicin) alone; IC₅₀ (drug combination) is the corresponding IC₅₀ of drug in combination with herbal substance).

RESULTS

The IC₅₀ of phytochemicals compounds in human cancer cells lines are shown in [Table 1]

The cytotoxicity of quercetin, myrecitin, tannic acid, gallic acid and serotonin is varied in these five cell lines. Among these compounds, tannic acid, myrecitin, serotonin, and gallic acid are relative toxic to prostate cancer and leukemia cell lines. All of these compounds are not effective in inhibition of breast cancer cells with IC₅₀>50 μ g/ml.

Table 1: Inhibitory Concentration (IC₅₀) of different phytochemicals compounds on cancer cell lines

compounds	IC ₅₀ (μ g/ml)				
	MCF7	PC3	PC3-TxR	K562	K562-Dox
Quercetin	677.0 $\pm$ 32.52	19.7 $\pm$ 1.31	95.5 $\pm$ 9.19	65.05 $\pm$ 7.14	57 $\pm$ 12.72
Myrecitin	475.5 $\pm$ 36.06	21.0 $\pm$ 1.41	19.65 $\pm$ 2.05	19.8 $\pm$ 3.11	10.2 $\pm$ 1.55
Tannic acid	262.5 $\pm$ 55.86	2.15 $\pm$ 0.21	9.85 $\pm$ 2.05	1.00 $\pm$ 0.56	0.75 $\pm$ 0.21
Gallic acid	142.77 $\pm$ 279.52	2.15 $\pm$ 0.07	20.05 $\pm$ 4.31	18.90 $\pm$ 1.55	2.75 $\pm$ 0.49
Serotonin	86.33 $\pm$ 164.96	1.00 $\pm$ 0.28	10.15 $\pm$ 1.48	20 $\pm$ 4.38	1.51 $\pm$ 0.69

Chemosensitizing effect of phytochemical compounds on cancer cells line

Activity of gallic acid, serotonin, quercetin, myrecitin and tannic acid showed significant effect on prostate cancer cell which are resistant to docetaxel (PC3-TxR) with CE values (1.19 $\pm$ 0.0262, 1.397 $\pm$ 0.0211, 1.679 $\pm$ 0.0242, 1.125 $\pm$ 0.058 and 1.091 $\pm$ 0.0262) nM respectively, as [Fig. 1].

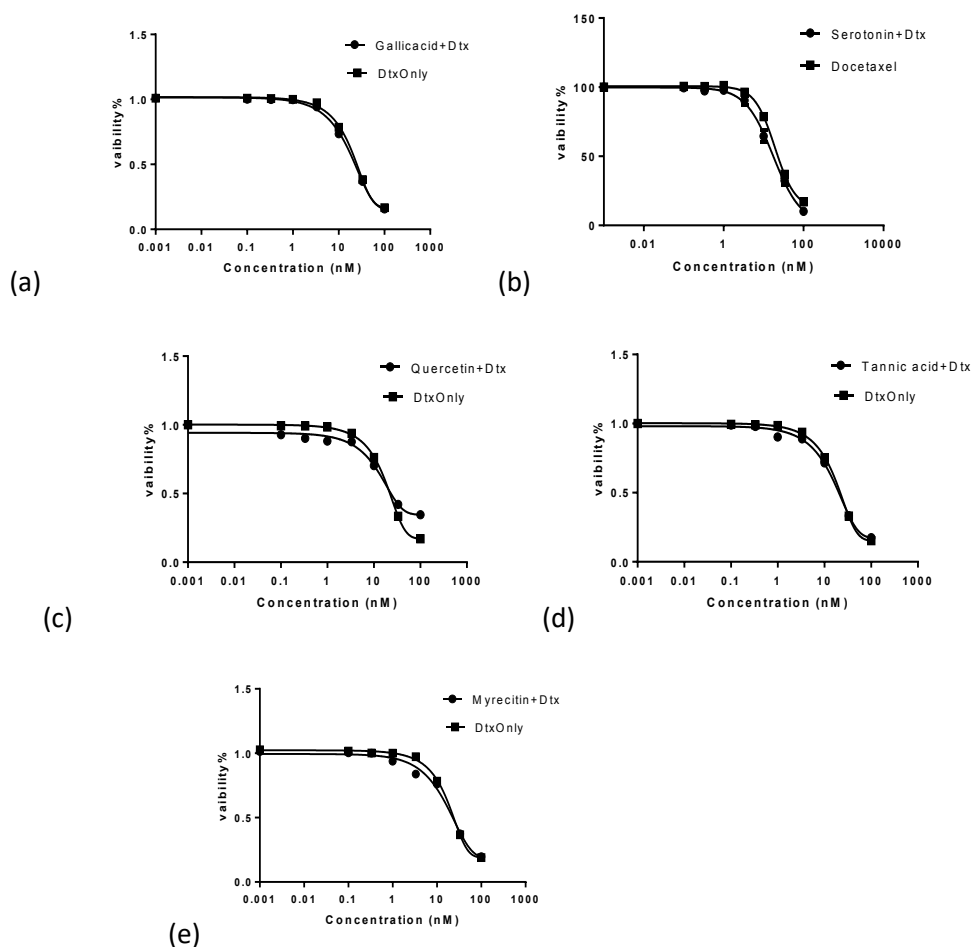
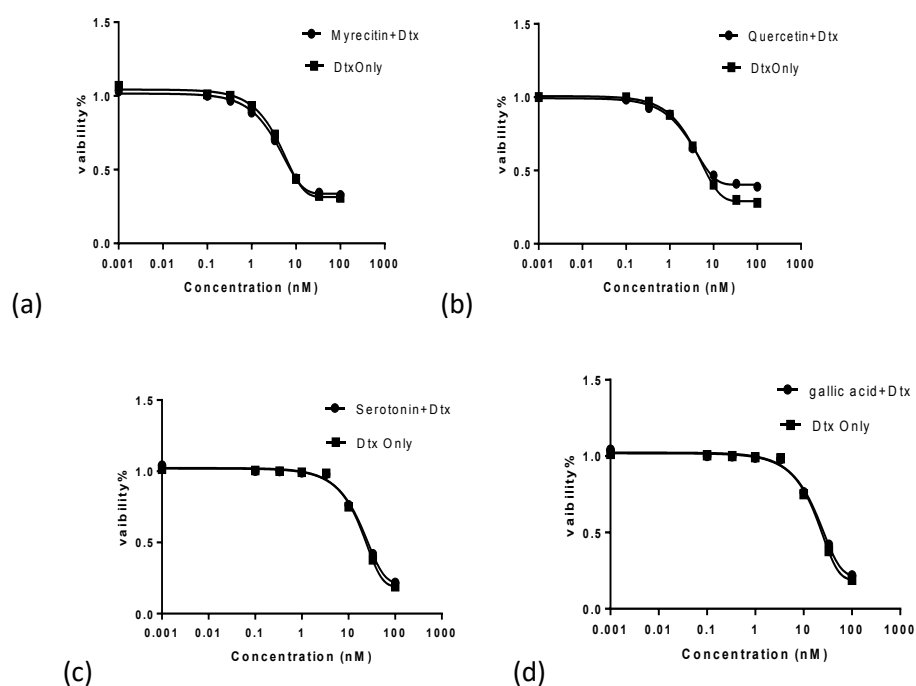
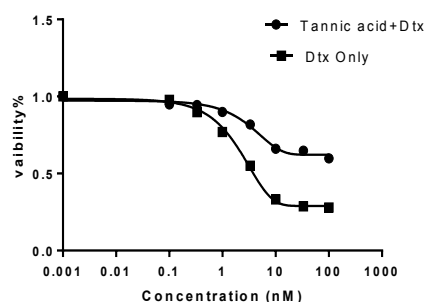


Fig. 1: Chemosensitizing effect of phytochemical compounds (a) Gallic acid, (b) Serotonin, (c) quercetin, (d) Tannic acid and (e) Myricetin, on prostate cancer cells resistance to docetaxel (PC3-TxR).

While chemosensitizing effect on sensitive prostate cancer cell lines have shown no significant effects, as shown in [Fig. 2].

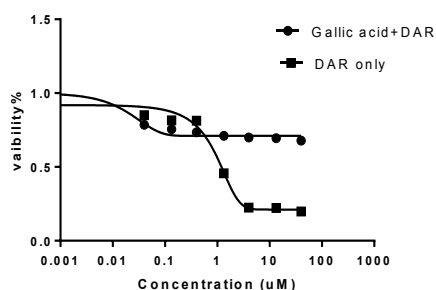




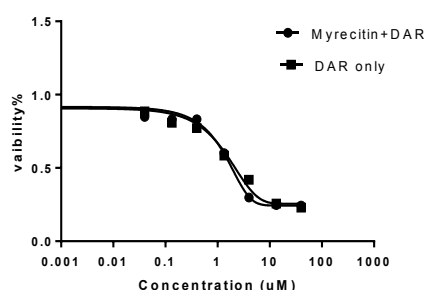
(e)

Fig. 2: Chemosensitizing effect of phytochemical compounds (a) Myricetin, (b) Quercetin, (c) Serotonin, (d) Gallic acid and (e) Tannic acid, on sensitive prostate cancer cell lines (PC3).

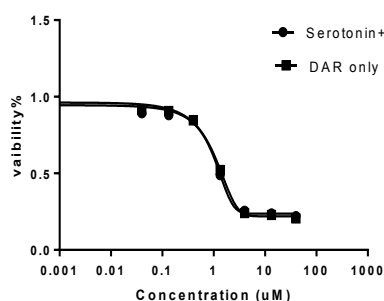
The chemosensitizing effect of serotonin, myricetin, gallic acid, quercetin and tannic acid are shown in [Fig. 3]. No significant effect on sensitive leukemic cancer cells (K562) was observed. However for the resistant cell lines, K562/Dox resistant to daunorubicin, serotonin ($CE = 4.006 \pm 0.119 \mu M$) displayed a substantial chemosensitizing effect in comparison to tannic acid ($CE = 0.926 \pm 0.081 \mu M$), gallic acid ($CE = 0.895 \pm 0.111 \mu M$), myricetin ($CE = 1.035 \pm 0.07 \mu M$) and quercetin ($CE = 1.076 \pm 0.045 \mu M$), [Fig. 4].



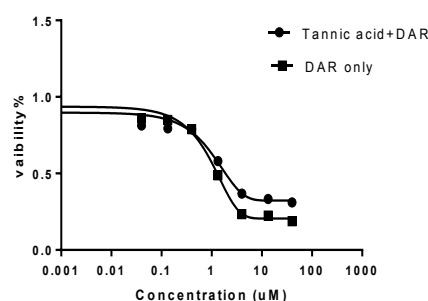
(a)



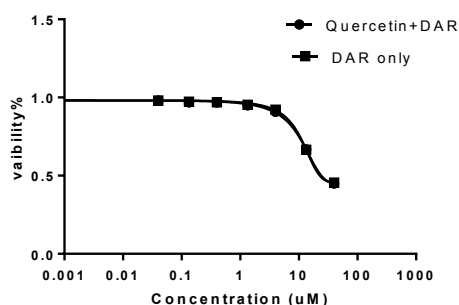
(b)



(c)



(d)



(e)

Fig. 3: Chemosensitizing effect of phytochemical compounds (a) gallic acid (b) myricetin, (c) serotonin, (d) tannic acid, and (e) quercetin, on leukemic cancer cell lines which are sensitive to daunorubicin (K562).

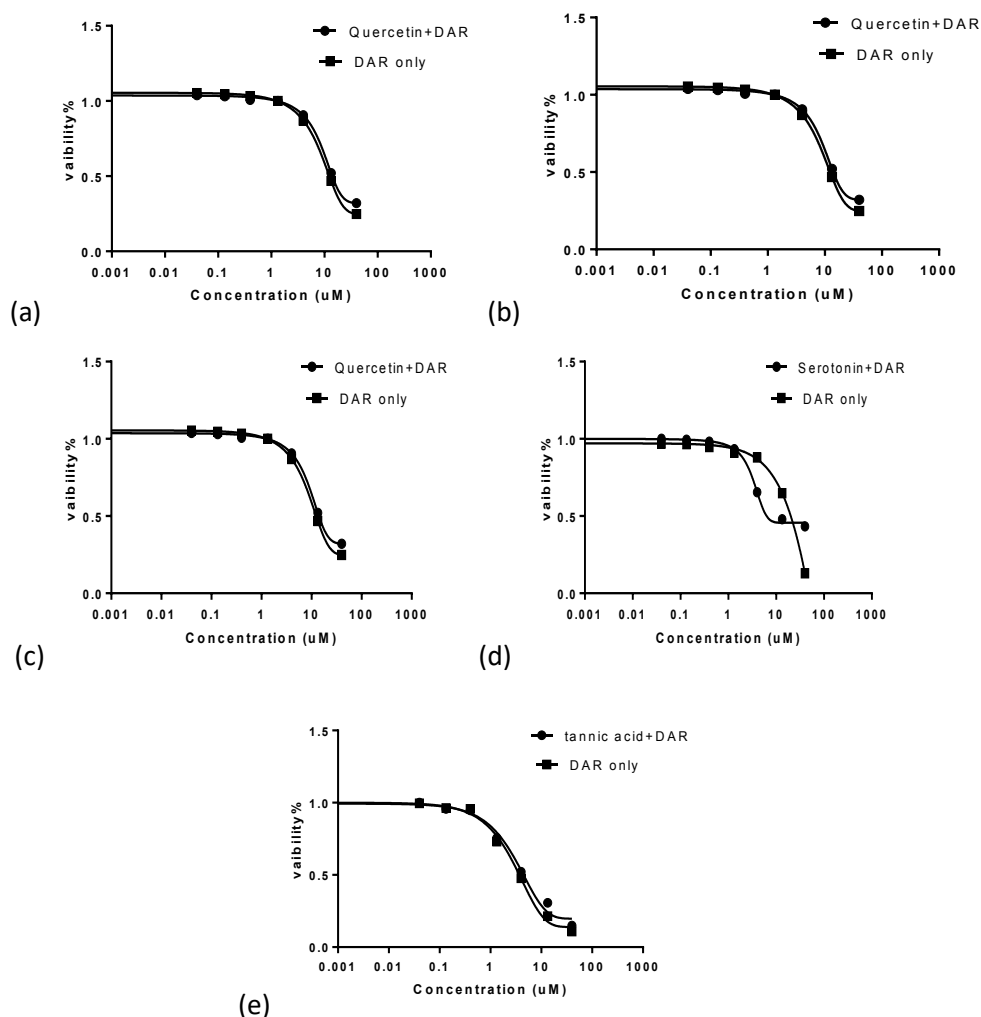


Fig. 4: Chemosensitizing effect of phytochemical compounds (a) myricetin, (b) gallic acid, (c) quercetin, (d) serotonin and (e) tannic acid, on leukemic cancer cell lines which are resistant to daunorubicin (K562/Dox).

When combining phytochemical compounds (gallic acid, tannic acid, myricetin, quercetin and serotonin) together, the combination did not show any chemosensitizing effect on leukemic cancer cell that are resistant to daunorubicin (K562/Dox) ($CE = 0.885 \pm 0.032$) μ M and prostate cancer cell that are resistant to docetaxel (PC3-TxR) ($CE = 0.901 \pm 0.011$) μ M, as [Fig. 5].

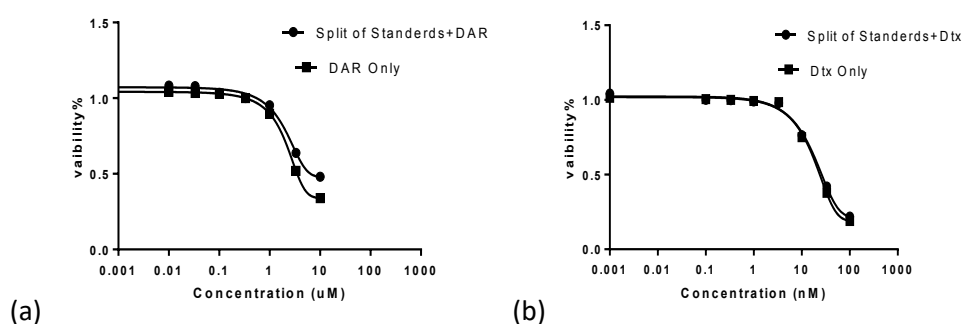


Fig. 5: Chemosensitizing of Split standards pure compounds on (a) K562dox and (b) PC3TxR cancer cells.

DISCUSSION

In this study, we had demonstrated the cytotoxic and chemosensitizing effects of five phytochemical compounds (myricetin, quercetin, gallic acid, tannic acid and serotonin) on prostate cancer cells (PC3 and

PC3TxR), leukemic cancer cells (K562 and K562Dox) and breast cancer cells, which showed significant inhibition of growth cancer cells if they were administrated alone or when combined with chemotherapeutic drug, specially on resistance cancer cells.

These phytochemical compounds have been reported a broad range of pharmacological effects, including anti-oxidant and anti-inflammatory activities [13], as well as, have been associated with anti-proliferative effects [14] and anti-cancer agent for current cancer therapies [15].

The antioxidant mechanisms of these phytochemical compounds are the induction of apoptosis in cancer cells and prevention of ongiogenesis and metastatic spread. These effects are suggesting a potential role for antioxidants as adjuvant in cancer therapy and have pharmacological actions like prooxidant toxicity and apoptosis, with reducing painful side effect associated with treatment [16,17], as well as, possessing the potential role to scavenge and quench various radicals (oxygen-centered, carbon-centered, alkoxyl, peroxy, or phenoxyl redicals) and ROS [18,19,20].

Sara *et al.*, 2012, suggested the natural products which derived from plants may provide solve for many problems like; lack of success with targeted mono- therapy and drug resistance which result from continuing use of chemotherapeutic agents.

The drug resistant mechanisms of cancer cells are the existence of subpopulations of cancer cell through the cellular interactions that impaired drug delivery to the cancerous cells. Chemosensitizing effects of phytochemical compounds to regimens chemotherapeutic drugs would be the way to go in order to increase the cytotoxic effect at a given dosage concentration while minimizing side effect [22,23]. However, most of the cells do not showed resistance to natural plant products, therefore, they may provide alternative modality of treatment for multidrug resistant tumors [24].

CONCLUSION

In summary, the safety and independent anticancer effect of these compounds support the use of them as an adjunct to chemotherapy which could be used as mono- or multi-therapies in the treatment of cancer cells.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGMENTS

The work presented here was performed at the Laboratory of Pharmacology, Department of Pharmacy, and Western University of Health Science, California, USA. I have been lucky to work with an amazing group of people and I am very grateful to the members of Pharmacy. Indeed, I express my sincere gratitude to all the other colleagues, who were working at the institute especially Mr. Steven Wang for their help and support over the duration of the research.

FINANCIAL DISCLOSURE

None

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ARTICLE

HEPATOTOXICITY EVALUATION OF METHANOL LEAVES EXTRACT OF *ARUM MACULATUM*

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ABSTRACT

Background: *Arum maculatum* is one of Araceae family, commonly known as Kardi. This plant is used medically to treat various diseases such as rheumatic pain, cardiovascular and anti-inflammatory diseases. However, prolong consumption may cause harmful side-effects. This study aimed to investigate the hepatic toxicological effects of leave extract in albino male mice. **Methods:** Hepatotoxicity effects were assessed in albino male mice after inducing hepatic damage with carbon tetrachloride (CCl₄). The liver function enzymes in serum, and histopathological were evaluated. **Results:** Histopathological study showed loss of hepatic architecture normal appearance associated with hepatocytes vacuolated cytoplasm. Serum enzymes level showed significant increase in GPT, GOT and ALP in homogenized liver tissue in group treated with methanol extract comparable with CCL₄ treated group (positive control) induced hepatotoxicity and negative control group treated with distilled water. **Conclusion:** Methanol leaves extract of *Arum maculatum* possess significant histological and biochemical damage in mice liver tissue.

INTRODUCTION

The vast majority of people on this planet still rely on their traditional *materia medica* (medicinal plants and other materials) for their everyday health care needs. It is also a fact that one quarter of all medical prescriptions are formulations based on substances derived from plants or plant-derived synthetic analogs, and according to the World Health Organization (WHO), 80% of the world's population, primarily those of developing countries, rely on plant- derived medicines for their healthcare [1]. This is reasoned by the fact that medicinal plants typically contain mixtures of different chemical compounds that may act individually, additively or in synergy to improve health, and accordingly, they have been subjected to an intensive investigation to reveal their pharmaceutical potentials [2].

Arum maculatum is one of Araceae family, widely distributed in many countries in European and Middle East [3]. It is also can found in the north of Iraq where commonly known as Kardi. Traditionally *A. maculatum* used as a folk medicine to treated rheumatic pain, kidney stone disease, colitis, liver disease and hyperacidities [4]. Furthermore it has been clinically demonstrated to have an anti-inflammatory activity in the intestinal and respiratory tract. In addition *A. maculatum* has antimicrobial and antifungal activity [5]. However, this plant can be a double adage sword herb. Researchers have been reported the harmful side effects, Nabeel et al. 2008, investigated the cytological damage of water leave extract in bone marrow cell of mice and suggested a range of damages in all mitosis stage.

In a bid to better understand the impact of *A. maculatum* consumption, this study aimed to investigate the enzymatic and histopathological damages of the methanol leave extract in mice liver. For our knowledge this is the first study described the detrimental effects of this plant in Iraq.

MATERIALS AND METHODS

Arum maculatum

The *A. maculatum* was grown and collection in spring. The (whole plant) obtained from local markets in Erbil, and classified at the Herbarium of Biology Department (College of Education for Pure sciences/Ibn Al-Haitham, University of Baghdad). It was left at room temperature to dry and supplied as powdered dried material.

Plant extract

The leaves powder was extracted with methanol 80%; 10 grams of the powder were extracted with 100 ml of solvent at 60°C for six hours using the Soxhlet apparatus. Then, the resulted extract solution was evaporated by a rotary evaporation. The collected crude deposit extract was frozen at -20°C until use to prepare the required doses [6]. One dose was prepare (100mg/Kg) based on [7].

Laboratory animals

The study was carried out on Albino male mice (*Mus musculus*) obtained from Pharmaceutical Control Department (Health Ministry). Twenty four mice weighing 23 – 27 g, of 8-9 week age were housed in conventional conditions at animal house laboratory in Ibn Al-Haitham College and fed on a standard pellet and sterilized distilled water.

KEY WORDS

Arum maculatum,
Methanol extract,
Liver enzymes, CCL₄.

Received: 10 Oct 2016
Accepted: 12 Nov 2016
Published: 1 Dec 2016

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Experimental design

Hepatotoxicity effects were assessed in albino male mice after inducing hepatic damage with carbon tetrachloride (CCl₄). The liver function enzymes in serum, and histopathological were evaluated. Four groups of mice (each of six mice and the total was 26 animals), but with a different experimental design.

Animals were divided into four groups of six mice each and IP injected as follows:

First group: The negative control group was mice administrated with distilled water for 7 days once daily.

Second group: Mice were administered with a single dose of 0.2% CCl₄ in olive oil (0.1ml) in day 1 and 2, and then received distilled water (0.1 ml) as a single daily dose for 7 days (positive control).

Third group: Mice were administered with a single dose of *A. maculatum* extract (100 mg/kg), once daily for 7 days.

Forth group: Mice were administered with a single dose of 0.2% CCl₄ in olive oil (0.1ml) in day 1 and 2, and then received 0.1 ml of the dose (100 mg/kg) of *A. maculatum* methanol extract once daily for 7 days.

Blood collection

After 8 days of experiment and before sacrificing the animals, blood was collected by heart puncture, transferred to Eppendorf tube and allowed to clot at room temperature for 15 minutes. Then serum was separated by centrifugation at 3000 rpm for 10 minutes. The serum was used for the assessment of liver function enzymes Glutamic-pyruvic transaminase (GPT), Glutamate oxaloacetate transaminase (GOT), and alkaline phosphatase (ALP). After blood collection, the mouse was sacrificed and dissected to obtain the liver.

Determination of liver function enzyme

The enzyme activity of GPT and GOT were determined in mouse serum following the enzymatic colorimetric method [8], where Randox Company kit was used. While Alkaline Phosphatase (ALP) was assessed in mouse serum using a commercial kit produced by Bio Merieux Company and the most commonly used method is that [9], in which di-sodium phenyl phosphate is hydrolyzed with liberation of phenol and formation of sodium phosphate. The amount of phenol formed is estimated colorimetrically. The following equation was employed to assess the activity of ALP.

$$\frac{\text{Sample Absorbance} - \text{Control Absorbance}}{\text{Standard Absorbance} - \text{Blank Absorbance}}$$

Histo pathological evaluation of liver

The liver tissue prepared for histopathological study as described by [10, 11]. Samples were fixed in 10% formalin for 24 h, followed by dehydration with a gradual series of alcohol (30 – 100%) for 5 min each. Then the samples cleared in two changes of xylene before embedded in paraffin wax for sectioning. Cross sections of 5 µm thickness were prepared and stained with hematoxylin (Harison) and eosin according to standard method. Histopathological changes were performed under light microscopy as compared to control group.

Statistical analyses

The values of the investigated parameters were given in terms of mean ± standard error, and differences between means were assessed by analysis of variance (ANOVA) and Duncan test, using the computer programme SPSS version13. The difference was considered significant when the probability value was equal or less than 0.05.

RESULTS

The hepatotoxicity evaluation include assessment of liver functional enzymes (GPT, GOT and ALP), in serum, as well as histopathological evaluation of liver tissue, in albino male mice.

Liver functional enzymes

As shown in [Table 1], treatment with CCl₄ were significantly increased the activity of enzymes (18.00±0.58, 50.00±0.57 and 83.00±0.58) U/L, compared with negative control (15.33±0.88, 37.00±0.57 and 57.00±0.58) U/L, respectively. As well as, significantly increased the means of enzymes level (20.00±0.57, 65.00±0.58 and 101.00±0.57) U/L, in mice treated with methanol extract of *A. maculatum* compared with negative and positive controls, respectively, (P≤0.05) [Fig. 1].

Table 1: Effects of *A. maculatum* methanol extract on GPT, GOT and ALP in sera of carbon tetrachloride (CCl₄)-treated albino male mice

Groups	GPT(M±SE)	GOT(M±SE)	ALP(M±SE)

Negative control	37.00±0.57 ^A	15.33±0.88 ^A	57.00±0.58 ^A
<i>Arum maculatum</i>	65.00±0.58 ^D	20.00±0.57 ^B	101.00±0.57 ^D
CCL ₄ (positive control)	50.00±0.57 ^B	18.00±0.58 ^B	83.00±0.58 ^B
Arum+CCL ₄	61.00±0.54 ^C	20.00±0.56 ^B	95.00±0.55 ^C

*Different letters represent significant difference ($P \leq 0.05$) between means of columns (Duncan test).

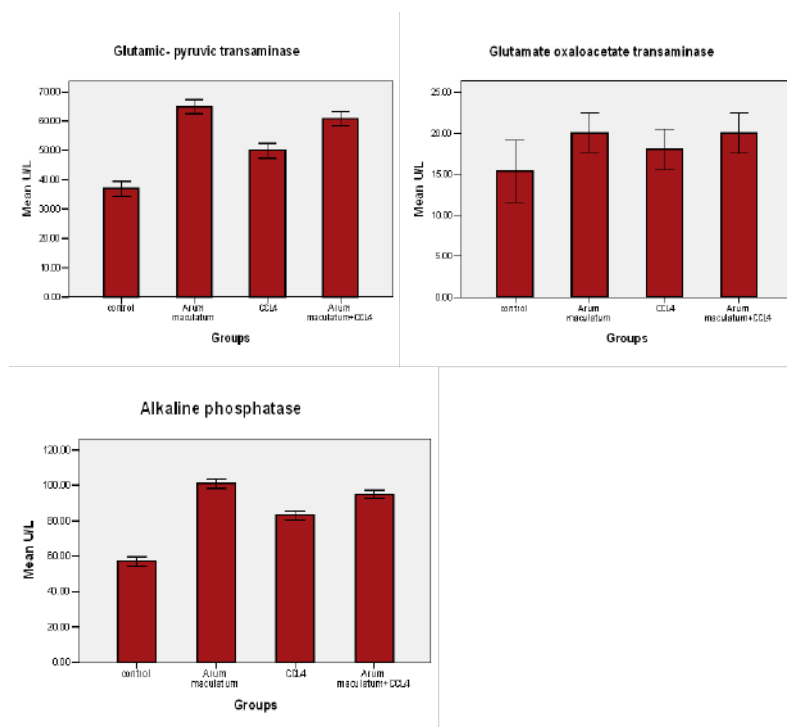


Fig.1: Graphics show effects of *A. maculatum* methanol extract on GPT, GOT and ALP in sera of carbon tetrachloride (CCL₄)-treated albino male mice.

Histopathological evaluation of liver

Liver sections from control group I revealed normal architecture with central vein with radiating cords of liver cells, the hepatocytes had vesicular nuclei and granular cytoplasm and blood sinusoids were evident between the cords of hepatocytes [Fig. 2 and 3]. Treated with CCL₄ showed Karyomegaly, enlargement of hepatocyte cytoplasm and nucleus, angular with fragmented and condensed nuclear material within the cytoplasm [Fig. 4 and 5]. However, treatment with methanol extraction showed dilated central vein (CV), loss of normal hepatic architecture and the cytoplasm of hepatocytes is vacuolated [Fig. 6].

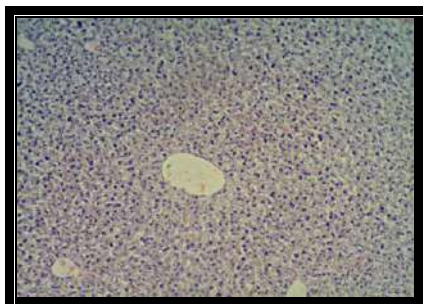


Fig.2: Cross section of the liver of albino mice (negative control), (H & E, 10X).

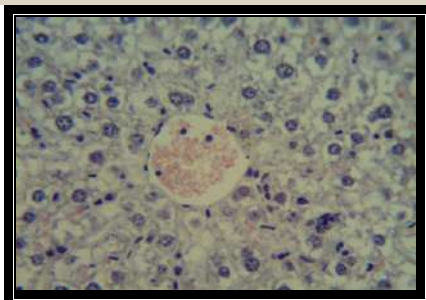


Fig.3: Cross section of the liver of albino mice (negative control) showed Glycogen accumulation (normal accumulation in hepatocytes), (H & E, 100X).

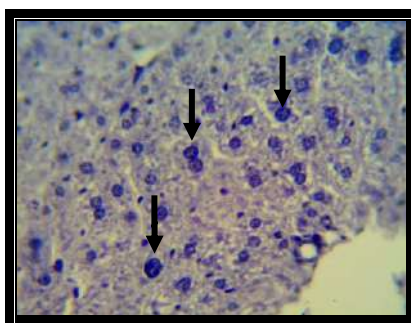


Fig.4: Cross section of the liver of albino mice treated with CCL₄. Arrow indicates enlargement of hepatocyte cytoplasm and nucleus, (H & E, 400X).

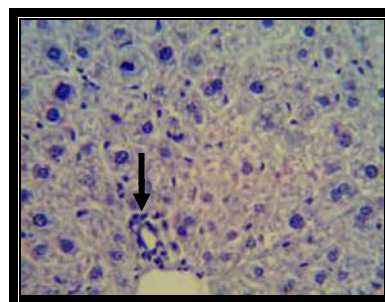
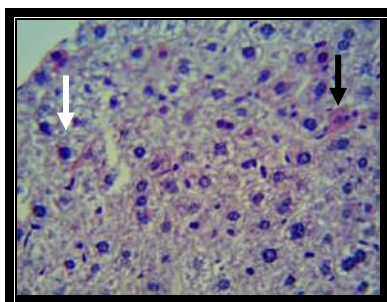


Fig.5: Cross section of the liver of albino mice treated with CCL₄. Affected hepatocytes are hypereosinophilic and angular with fragmented and condensed nuclear material within the cytoplasm. (black arrow), pyknotic nuclei (white arrow), (Hx & E, 400X).

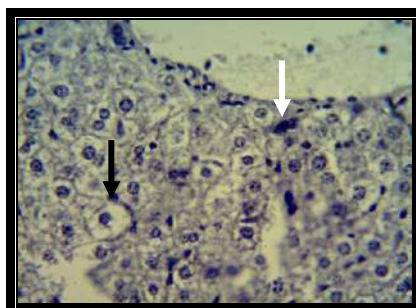


Fig.6: Cross section of the liver of albino mice treated with methanol extraction of *A. maculatum*. showing: dilated central vein (CV), loss of normal hepatic architecture. The cytoplasm of hepatocytes is vacuolated (black arrow) pyknotic nuclei (white arrow), (Hx & E, 400 X).

DISCUSSION

Liver is the major site of detoxification and the primary target of drug exposure in the body. High levels of drugs cause various hepatic disorders by producing pro-oxidants/reactive oxygen species (ROS), which are able to induce cellular damage in a variety of ways by affecting the cellular biomolecules, such as lipids, DNA and proteins [12]. In this study, the results showed increase in functional liver enzymes (GPT, GOT and ALP), and damages in histopathological changes of liver section in mice treated with CCL₄. The hepatotoxicity induced by CCL₄ is mainly due to its metabolite CCL₃·, which is a free radical that alkylates cellular proteins and other macromolecules with a simultaneous attack on polyunsaturated fatty acids. In the presence of oxygen, lipid peroxides are produced, leading to liver damage, which is characterized by fatty liver, cirrhosis and necrosis [13][22]. In addition, in CCL₄-induced hepatotoxicity, the extent of hepatic damage is assessed by the increased level of cytoplasmic enzymes (GPT, GOT and ALP), which leads to leakage of large quantities of the enzymes into the blood circulation and could be regarded as an index of the liver parenchymal cells damage [14]. Carbon tetrachloride-induced hepatotoxicity in mice caused a severe centrilobular necrosis, steatosis and damage to the structural integrity of liver and was reflected by increase in the liver hepato-specific enzymes in the serum, because they are cytoplasmic in location and are released into circulation after cellular damage causes the destruction of cell components, then cell death [15, 16].

Arum maculatum is medical plant used to treatment rheumatic pain [4][21], which contain many active compounds such as, alkaloid, saponin, cyanogenic, glycosides and lectin [17], but the research revealed that lectin isolated from *A. maculatum* effected on immune system, which found agglutinin presents in pro-inflammatory activity inducing neutrophil migration [18]. So many precaution from prolong consumption of this plant possible caused harmful side effects.

Moreover, the results revealed that methanol extract of *A. maculatum* at dose (100mg/Kg) caused hepatotoxicity by increased functional liver enzymes (GPT, GOT and ALP), as well as damage in liver tissue of mice treated with extract.

Nabeel and his colleagues [2008] illustrated that *A. maculatum* extract at lowest dose (125 mg/Kg), had cytotoxic effects on the bone marrow cells in albino male mice by induced abnormalities in restitution and multinuclei, abnormal prophase, C-metaphase, sticky chromosomes fragments, bridges, non-congression and laggards. However, disturbed metaphase, anaphase and telophase may be due to disturbance of spindle apparatus which allows that the chromosomes to spread irregularly over the cell; results c-mitosis, star-anaphase and star-telophase respectively [19], or may be attributed to the inhibitory effect of *A. maculatum* extract on DNA, RNA and protein synthesis on culture mammalian cells [20].

CONCLUSION

As results, hepatotoxicity effects of the extract were overwhelmed by their in increasing the hepatic damage in mice group treated with methanol extract of *A. maculatum*.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

IMPACT OF BOLTED SHEAR CONNECTOR SPACING IN COMPOSITE BEAM INCORPORATING COLD-FORMED STEEL OF CHANNEL LIPPED SECTION

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ABSTRACT

Background: Composite construction with traditional Hot Rolled Steel (HRS) sections has been known to perform much better than with Cold-Formed Steel (CFS) sections for decades; as observed by extensive rules and requirements for their design as prescribed in current design codes. However, only few technical information available about the use of composite systems that incorporates the use of light gauge steel sections, despite the potentials of the system in residential and light industrial constructions. However, composite construction of CFS with Self-Compacting Concrete (SCC) using bolted shear connector has not been established yet. Therefore, this paper presents the behavior of bolted shear connector used with SCC and CFS to form a composite beam system where the impact of longitudinal spacing was studied. Full-scale test specimens of longitudinal spacing of 250 mm and 300 mm with bolted shear connector of grade 8.8 installed with single nut and washer on the CFS flange and beneath were fabricated, cast and tested till failure occurred. The experimental test results showed that the bolted shear connector possessed good ultimate strength and ultimate moment capacities with an increase in the longitudinal spacing of the bolted shear connector from 250 mm and to 300 mm respectively. It was therefore concluded that longitudinal spacing between bolted shear connectors had significantly influenced the shear connector strength capacities.

INTRODUCTION

Construction practices and philosophies at present time has becoming more advance in which innovation in construction industries played an important role [1-3]. In construction, main constituents of materials are concrete and steel with steel is more vulnerable to corrosion. Corrosion in steel could be resisted by using corrosion inhibitors [4,5]. Corrosion in the reinforcing steel could cause concrete to crack thus, leading to crushing of the whole concrete mass in the structure [6,7]. Therefore, to prevent the cracking in concrete structures, self-healing agents are incorporated in the mixing of concrete prior to its application in the construction process [8]. But, in light-weight composite construction the Cold-Formed Steel (CFS) section used is prevented from corrosion by coating. CFS sections are lightweight materials that are produced by bending of a flat steel sheet at a room temperature [9] into a desired shape that can withstand more load than the flat sheet itself; and are suitable for building construction owing to their high structural performance [10-13]. The most common sections of CFS are channel lipped C and Z sections, and the typical thickness ranged from 1.2 to 6.4 mm with a depth range of 51 mm to 305 mm [14]. In steel and construction industry, Hot-Rolled Steel (HRS) and CFS are two distinguished known steel sections that are used. But, among the two steel sections, HRS is the most familiar among the building contractors and engineers. Some studies reported on the potentials of using CFS sections in composite construction and significant improvements in terms of strength were demonstrated. An extensive study was conducted by [15,16] on the use of CFS section as a composite beam in cast-in situ and precast concrete slabs. Tests were conducted on push-out and full-scale flexural tests. Varied in the push-out test using the in situ concrete were the shear enhancements consisted of screwed channel (CS), welded channel (CW) and screwed deck (DS) connectors of the same CFS section embedded in the concrete slab. For the precast specimens, screwed bolt connections and through bolted connections were used. The results showed that the connection methods were effective for attaining the desired capacity and the CFS composite slabs responses were ductile. [17] [18] [20] Investigated on the strength capacity of different types of shear transfer enhancement which consisted of pre-drilled holes, pre-fabricated bent-up tabs created on the flange surface of the CFS section, self-drilling screws and surface bond between the CFS section and the concrete. The results showed that reduce in deflection and significant increase in strength capacity were notably observed in specimens with shear transfer enhancements when compared with the specimens relying only on the surface bonding between the steel and the concrete to provide the shear resistance. In this paper, the use of CFS channel lipped section is reported with bolted shear connector used at designated longitudinal intervals of 250 mm and 300 mm and spaced laterally at 75 mm to possibly establish the influence longitudinal spacing could have on the shear connector ultimate strength capacity. The shear connection system is not suggested for welding of stud on thin flanges of CFS as it is not practically feasible. Therefore, this study aimed at addressing the concept of using CFS section in composite construction, although very few technical information is available on composite system that

KEY WORDS

Cold-formed steel,
composite construction,
bolted shear
connection, push-out
test, longitudinal

Received: 15 October 2016
Accepted: 14 November 2016
Published: 1 Dec 2016

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incorporates the use of CFS section. It can be concluded that the shorter the distance between the bolted connection, the higher the moment resistance of the composite beam.

EXPERIMENTAL PROGRAM

Full-scale composite beam specimens

The composite beam specimens were 4500 mm length, effectively spanned at 4200 mm between supports. The effective width of the slab was 1500 mm with a depth of 75 mm. The fabrication and installation process are the same as in the push-out test program. [Fig. 1] shows the preparation of the test specimens.



(a)



(b)



(c)

Fig. 1: (a) Samples formwork, (b) Samples casting, (c) Finished samples.

Test set-up and procedure

All composite beam specimens were tested using DARTEC jack machine with a load cell capacity of 2000kN. Test specimens were subjected to four point bending test where the load from the jack machine was applied at 1050 mm (shear span) from the supports. The specimen was placed as simply supported beam as shown in [Fig. 2]. Deflections of the specimens were monitored at the mid-span and at the quarter spans underneath the bottom flanges of the CFS section using linear variable displacement transducers (LVDT's). Strains in the specimens were monitored on the concrete slab and under the bottom flanges of the CFS section using strain gauges. All LVDT's and strain gauges were connected to the data logger. Due to high concentration of stresses at the supports, premature failure of the CFS may occur; therefore, it was prevented by fitting the supports with a CFS section of dimensions 150 mm x 65 mm x 18 mm of thickness 2.3 mm [see Fig. 2]. Load from the jack machine was applied on the specimen at a constant rate of 0.2 kN/s through the distribution beam which transfer it to the concrete slab through the line load beams. The line load beams were rested on a steel spreader plates of 200 mm x 150 mm x 12 mm thick, to spread the load as a point load on the concrete slab. The specimen was loaded up to 15% of its predicted failure capacity and then zeroed. This was to ensure that the instrumentation process was okay and that the specimen was in equilibrium state prior to the proper testing. The specimen was loaded again this time not to 15% of its predicted capacity. Load was further increased until failure of the specimen occurred. The failure of the specimen was considered when there was a significant drop in the applied load or when a large deformation of the test specimen was observed. Lateral restrains were provided during the test, this was to prevent the specimen from having lateral torsional buckling failure prematurely.



Fig. 2: Full-scale test arrangement.

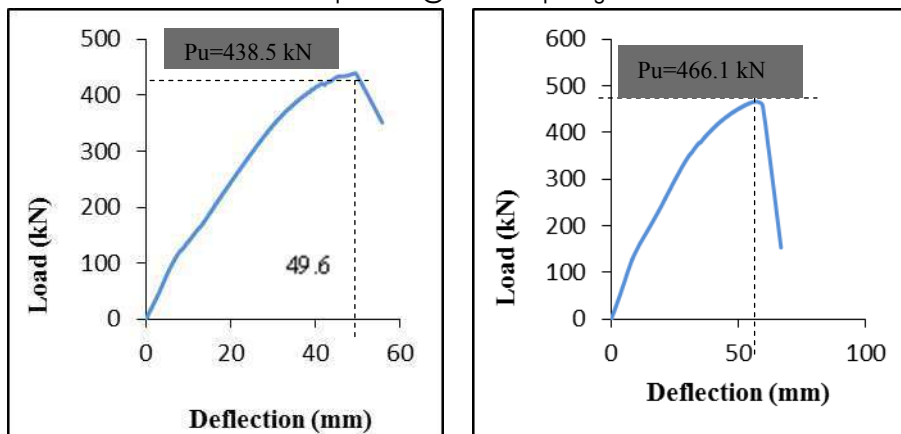
RESULTS AND DISCUSSIONS

The experimental test result of the composite beam specimens is presented in [Table 1]. [Fig. 3] shows the load against mid-span deflections of the composite beam specimens. From [Table 1] and [Fig. 3], the ultimate loads (P_u , exp.) attained for specimens FS250-12 and FS300-12 were 438.5 kN and 466.1 kN with an initial crack observed at loads level of 185 kN and 200 kN respectively. Mid-span deflections at ultimate loads level were recorded as 49.6 mm and 56.9 mm for FS250-12 and FS300-12 specimens respectively. The specimens exhibited the same failure modes by flexure which initiated by longitudinal cracks along the line of shear connector on the slab surface transverse cracks underneath the concrete slab as well as shear connector pull-out from the slab. The shear connector pull-out from the concrete slab could be attributed to the smaller head diameter of the shear connector. The specimens failed as a result of torsional buckling of the CFS section when the ultimate was reached. From the results, specimen with bolt connector at 250 mm attained an ultimate moment capacity of 6.3% higher than that at 300 mm longitudinal spacing. However, this shows that, the moment carrying capacity between the specimens does not differ much. Therefore, this is an indication that the specimens could provide the required composite action, considering the load resisted by the specimens [Table 1]. It can be clearly observed that, as the shear connector longitudinal spacing was increased from 250 mm to 300 mm, the ultimate moment capacity attained also increased. This shows that, the shear connector longitudinal spacing influenced the load and moment carrying capacity of the specimens. The influence of the longitudinal spacing of the shear connector on the ultimate moment capacity agrees well with investigation carried out by [17][19] [Fig. 4 (a-c)] shows the failure modes of the test specimens and the shear connector condition after the test.

Table 1: Flexural test result of composite beam specimens

Specimen ID	f_{ck} at test day (N/mm^2)	Ultimate load, P_u , exp. (kN)	Deflection at P_u , exp. δ_u , exp. (mm)	Ultimate moment, M_u , exp. (kNm)
FS300-12	32.6	438.5	49.6	230.3
FS250-12	35.3	466.1	56.9	244.8

FS250-12: Full-specimen @ 250 mm spacing with M12 bolt diameter



(a) FS300-12

(b) FS250-12

Fig. 3: Load-mid-span deflection of composite beam specimens.

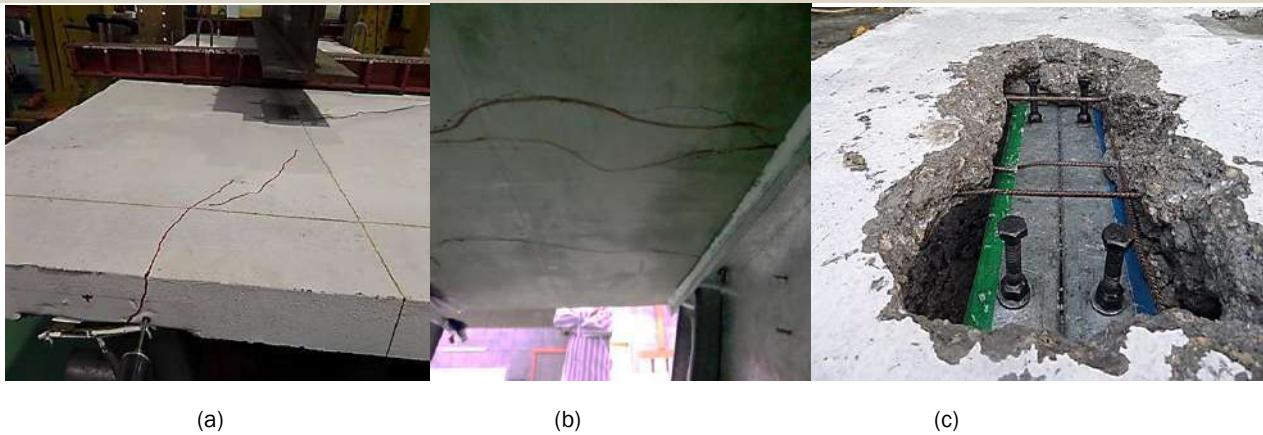


Fig. 4: (a) Concrete cracks on slab surface, (b) Transverse cracks beneath the slab, (c) Non-deformed shear connector.

CONCLUSIONS

From the results of the experimental tests, the following conclusions can be drawn.

- The shear connector showed that the moment capacity of composite action between concrete slab and the steel section was very good as no deformation can be observed on the proposed shear connector.
- The test results showed that the longitudinal spacing of the proposed bolted connectors with self-compacting concrete did not show much difference.
- The use of bolted connector can be used as shear connector to replace the typical shear stud as the composite action between steel and concrete is very promising.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The work was supported by Universiti Teknologi Malaysia Construction Research Centre (UTM-CRC) with grant vote number Q.J130000.3009.01M00 and R.J130000.7309.4B235. The authors gratefully acknowledge the support provided.

FINANCIAL DISCLOSURE

None

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ARTICLE

EXPERIMENTAL STUDY ON BOLTED SHEAR CONNECTOR ENHANCEMENT IN PRECAST COLD-FORMED STEEL-FERROCEMENT FOR COMPOSITE BEAM SYSTEM

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ABSTRACT

Background: This work presents the experimental tests carried out to evaluate the behaviour of shear connectors between cold formed steel (CFS) beam and ferrocement slab. The proposed section is an innovative pre-cast slab of ferrocement integrated together with CFS by means of shear connector to form a composite beam system. Six push-out test specimens of cold-formed steel lipped channel sections connected with ferrocement slab were tested. Two different types of shear connectors comprised of 10mm and 12mm diameter of bolts were used in the experimental tests. The standard push-out test, as defined in Eurocode 4 [1], was adopted. The connection behavior was analysed in terms of its load-slip relationship and the failure mode. The effect of varying parameters such as the number of layers of wire mesh in ferrocement slab and the size of bolt diameter used is presented and discussed. An analytical analysis using ANSYS (version 11) program and theoretical analysis (Eurocode 4) were carried out to validate the experiment results. The results of comparing the experimental, theoretical and numerical values proved to have good agreement.

INTRODUCTION

Composite construction in which steel beams and girders act compositely with concrete slabs have been used in bridge engineering [2] and building construction [3, 4] for several decades. The most widely employed composite construction system referred to as hot-rolled steel sections with shear studs as connectors between slab and beam [5-7]. Concrete is usually poured onto a corrugated cold-formed steel sheet, which is in turn connected to the supporting beams through shear studs as connectors. The use of this type of cold-formed steel as composite slab system with shear stud connectors has been well established in North America where details of design guidelines are available in both American and Canadian design codes. The use of cold-formed steel sections such as an I-section as composite floor joists in slab systems has been limited despite the advantages of reduced slab thickness as compared with the typical concrete slab alone [8]. One essential element of these composite systems is the shear connection between steel and concrete. Since the steel sections are light gauge, the welding of shear studs is not recommended [9]. The main objective of this study to choose the best available shear connector proposed in this study for the possible use in pre-cast composite beam of cold formed-ferrocement system. This study also intends to model the tested specimens as a three-dimensional finite element model using ANSYS 11 by simulating the behavior of the bolted shear connectors [10-14] [21]. A push-out test arrangement was modeled for linear and nonlinearity behavior for all tested specimens by taking into consideration the modes of failure, the ultimate strength, and the load-slip behavior of the shear connectors. The results of the present FE model are compared with experimental push-out tests and agreed well.

MATERIALS AND METHODS

[Fig. 1] shows the details of cross-section for the push-out test specimen. The basic specimen configuration and construction are based on Eurocode 4 [1] and BS5400 [15] [20] [22]. The width of the ferrocement slab was 400 mm, 400 mm height and the thickness was 50 mm. The I-section of the CFS beam was formed by placing lipped C-channels back-to-back with the top flanges attached to ferrocement slab by the proposed bolted shear connector as shown in [Fig.2]. The bolt was fixed by two nuts; the first was installed on the inside whereas the second was installed on the outside surface of the top flange of CFS section. The top flange of CFS section firmly holds together by the two nuts as shown in [Fig.2]. The welded wire fabric reinforcement (Skeletal) consists of 5 mm diameter bar with spacing of 80 mm x 80 mm were installed between 2, 4 and 6 layer of wire mesh (1.2 mm diameter) as shown in [Fig. 1] and illustrated in [Table 1]. A recess of 50 mm in height was provided between the bottom of the Ferrocement slab and lower end of the cold-formed steel section to allow for slip during testing. Both sides of the flanges of the I-beam for each specimen were connected with Ferrocement slab to form a composite system. The test procedure was based on EC4. The locations of transducers and instrumentation setup are shown in [Fig. 3].

KEY WORDS

Cold-formed steel, Composite beams, Ferrocement, Finite Element Method, Push-out test, Shear connector

Received: 10 Oct 2016
Accepted: 12 Nov 2016
Published: 1 Dec 2016

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Material properties

The main components of materials used in the tested specimens comprised of cold-formed steel section, wire mesh and bolts. The results of these tests are given in Table 2. The ferrocement slab was designed to meet the compressive strength of 35N/mm2 of grade C35.

DESIGN EQUATION

The tested specimens are expected to fail by two types of failure modes. The specimen is expected to fail by ferrocement crushing into embedded area where stresses in ferrocement due to applied load exceeded the design stresses of the ferrocement. However, when the ferrocement is very strong, the shear connector may possible to fail due to bolts bearing or shearing-off. The shear connector is expected to fail when section of the shear connector failed to resist the stress developed due to the applied load. For shear connectors with headed studs, the predicted strength capacity was calculated based on the equations given by Eurocode (EC4). However, in this study the same formula are used to predict the expected load failure for the proposed bolted shear connector.

Table 1: Specimens for push-out test

Specimen	Type of shear connector	Diameter (mm)	Number of layer
S1	Bolts	10	2
S2			4
S3			6
S4		12	2
S5			4
S6			6

Table 2: Material properties

Material	Yield Strength, N/mm ²	Ultimate Strength, N/mm ²
CFS	329.7	429.2
Wire mesh	418.0	522.7
Bolt	704.3	906.3

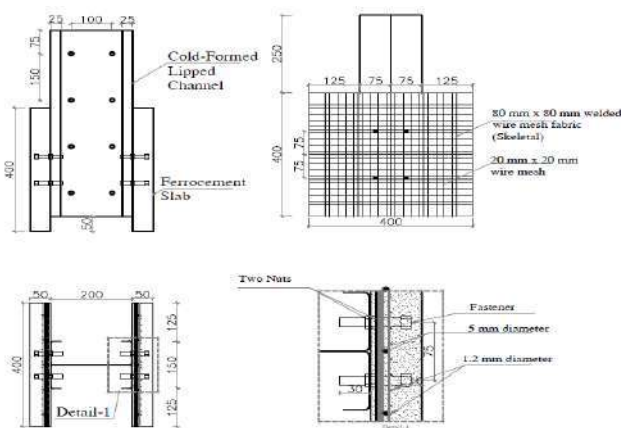


Fig. 1: Layout for push-out test specimen.



Fig. 2: Fixing shear connectors.



Fig. 3: Instrumentation setup.

FINITE ELEMENT ANALYSIS

The numerical simulation using FEM as a tool to simulate the behavior of the tested specimens have been used by many researchers [16-19] to validate the results of the experimental tests. In this paper, the tested shear connectors of composite beams have been analyzed using three dimensional finite element models. The main objectives of the analysis are to validate the accuracy of the load capacity of the experimental tests results. The tested specimens are modeled as finite element analysis by adopting the following assumptions. The steel section and the concrete slab are modeled as elastic-plastic shell (SHELL 43 and SOLID 65) elements. The reinforcing bars both longitudinal and transverse are modeled as smeared in layers throughout the solid 65 (concrete slab) finite elements. A non-linear spring element (COMBIN39 in ANSYS) and (Link8) were used to represent the shear connectors behavior. COMBIN39 was used to resist the normal force between the ferrocement and CFS beam while Link8 works as stirrups in resisting the vertical shear at concrete layer. COMBIN39 was taken as unidirectional element (or nonlinear spring) with nonlinear generalized force-deflection capability that can be used in any analysis. The geometrical modeling of shear connectors is shown in [Fig. 4] and [Fig. 5] where the finite elements mesh for the tested specimen are clearly shown.

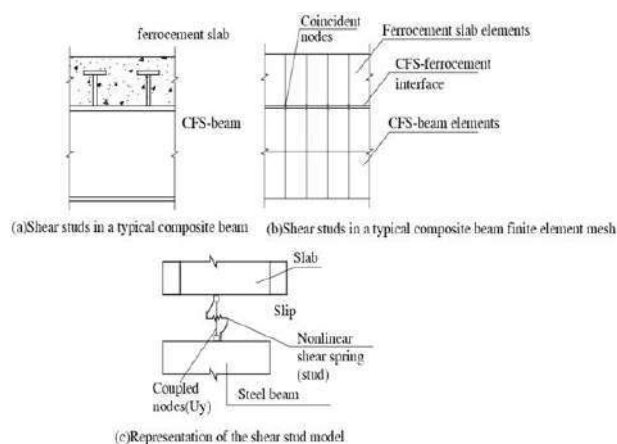


Fig. 4: Modelling of shear connectors.

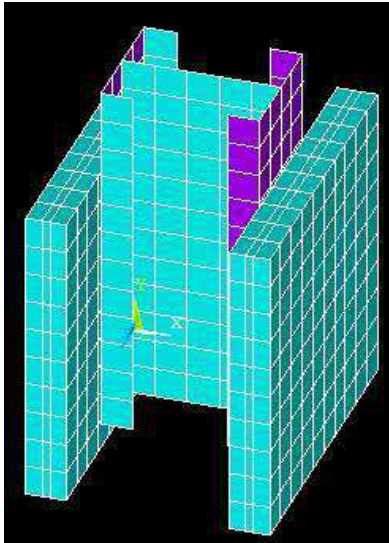


Fig. 5: Typical composite beam FE mesh .

RESULTS AND DISCUSSIONS

Failure mechanism test specimen S1, S2 and S3 (bolts 10 mm Diam)

For test specimens S1, S2 and S3, the failure load from the push-out test were recorded as 71.2 , 72.9 and 75.2 kN per shear connector respectively. The first crack occurred at load 155.5 kN for S1, 170.5 kN for S2 and 174.7 kN for S3. Yielding of the stud element was noticed near the bolts followed by maximum compressive stress reached by ferrocement elements around the bolts. The shear connection failed due bolts yielding and ferrocement crushed. The development of bent to the shear bolts and cracks in ferrocement slab after test are shown in [Fig. 6(a) and 6(b)].

Failure mechanism test specimen S4, S5 and S6 (bolts 12mm Diam)

The test was terminated when the connected slabs are separated from the CFS-beam, all bolts were still intact and a conical concrete failure was noticed around the bolts. The first crack occurred at load 175.3 kN for S4, 180.4 kN for S5 and 181.7 kN for S6. Longitudinal cracks are likely to occur due to high splitting forces caused by shear force. Maximum loads were 74.9, 77.6 and 79.6 kN per shear connector for specimens S4, S5 and S6 respectively. [Fig. 6(b)] shows the conical failure of concrete in compression around the stud and the mode failure in ferrocement slab. It was found that the shear connector has no deformation and rotation as well as no yielding around the bolts hole. This showed that the shear connector was strong enough to provide composite action and to transfer the longitudinal shear force from the ferrocement slab to CFS beam without showing any abrupt failure.



Fig. 6(a): Bending of the bolts.



Fig. 6(b): Crack on slabs.



Fig. 6(c): Failure in concrete around the bolts.

Comparison between experimental, theoretical and FE results

[Table 3] shows the comparison between experimental, theoretical analysis and finite element results. The results in [Table 3] indicate that the theoretical analysis is closer to the experimental and finite element analysis values. The comparison was made for ultimate load carrying capacity of all shear connectors. The ratios of experimental to predicted ultimate load are in the range between 0.9 to 1.4 while the ratio of the results of finite element analysis to predicted ultimate loads are in the range between 1.0 to 1.2. The slip in finite elements results as shown in [Fig. 7] appears larger than the experimental due to the contact stress between the steel section and the ferrocement slab could not be represented in finite elements model.

Table 3: Comparison of theoretical results with experimental and fea results

Specimen	Test age (day)	f_{cu} at test date (MPa)	$P_{u,theo}$ (kN)	slip at ultimate load (mm)	$P_{u,exp}$ (kN)	$\frac{P_{u,exp}}{P_{u,theo}}$	$P_{u,FE}$ (kN)	$\frac{P_{u,FE}}{P_{u,theo}}$
S1	36	34.8	284.8	1.9	255	1.1	220.4	1.3
S2	36	35.1	290.2	1.3	292.5	1.0	220.4	1.3
S3	36	33.6	300.6	1.2	272.4	1.1	220.4	1.4
S4	42	34.8	299.5	2.5	282.4	1.1	317.4	0.9
S5	42	34.1	310.1	1.2	267.4	1.2	317.4	1.0
S6	42	33.3	341.4	1.4	328.5	1.0	317.4	1.1

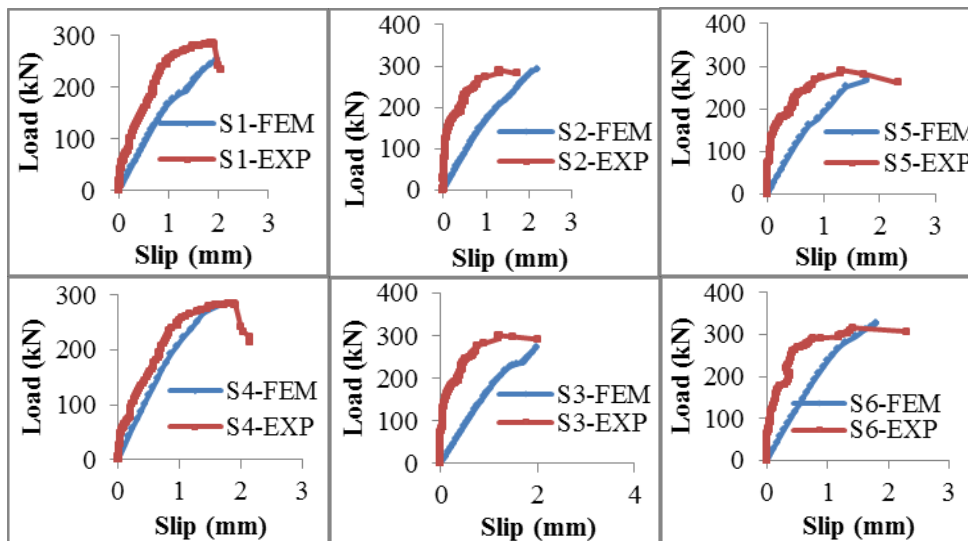


Fig. 7: The comparison between the experimental and FE results.

CONCLUSIONS

From the observations and results of 6 push test specimens, the following conclusions can be drawn:

- The effect of increasing the number of layers of wire mesh in ferrocement slab has not significantly improved the load capacity of shear connectors.
- The FE model and theoretical results agreed well with the results obtained from the experimental push-out tests. The comparison proved to have good agreement with each other.
- The capacity of shear connector in which bolts with 12 mm diameter was the best shear connector considered in transferring shear force into CFS-ferrocement slab interface.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The work was supported by Universiti Teknologi Malaysia Construction Research Centre (UTM-CRC) with grant vote number Q.J130000.3009.01M00 and R.J130000.7309.4B235. The authors gratefully acknowledge the support provided.

FINANCIAL DISCLOSURE

None

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ARTICLE

ECO-FRIENDLY HIGH-PERFORMANCE PAVEMENT MATERIALS

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ABSTRACT

Background: Prolonging the service life of construction units allows reduces the consumption of natural resources; thus, building material that is both more durable than conventional ones and does not induce negative environmental impacts is eco-friendly. Considering road construction, the primary drawback of sulfur-extended asphalt concrete is the emission of toxic gases. **Methods:** We have performed the necessary measurement of the emission of toxic gases (with ANKAD 7664 Micro-06 analyzer) and examined the primary operational properties of sulfur-extended asphalt concrete (AASHTO TP 63 and AASHTO T 324 tests). **Results:** It is revealed that proposed complex admixture significantly reduces emission of toxic gases, especially the emission of hydrogen sulfide. Moreover, the proposed sulfur-based admixture increases resistance to rutting (in 1.3-3.7 times), compressive strength, splitting tensile strength and fatigue limit. The anomalous (negative) correlations between strain capacity, fatigue life and fracture toughness are also revealed; such correlations are beneficial for building material. **Conclusions:** In the present work we have proposed the complex modifier that addresses the primary drawback of sulfur-extended asphalt concrete; it is also shown that admixture of such modifier contributes the increase of most operational properties.

INTRODUCTION

KEY WORDS
 sulfur-extended asphalt,
 green construction,
 high-performance
 pavement

The social concept of sustainability means living in such a way as to meet the needs of the present without compromising the ability of future generations [1]. Sustainability is about building a society in which a proper balance is created between economic, social and ecological aims [2]. The sustainability concept now became to appear on constant basis, especially in those areas of industry which are the most energy-intensive. The construction, obviously, is one of such areas.

The building material can be considered as eco-friendly if its energy, economic, and environmental performance are better than for traditional ones [1]. Prolonging the service life of buildings and construction units allows to safeguard the natural resources against depletion. Together with keeping the environmental impact at low level, usage of high-performance building materials is one of the ways to sustainable construction [3-6].

Due to the growth of load on automotive roads, modern construction industry needs efficient materials for pavements. Advantages of the concretes that are based on sulfur-extended asphalts (SEA) are the natural effects caused by physicochemical properties, availability and low cost of technical sulfur [7]. Because of numerous alterations in chemical and phase composition of bitumen, and also due to relatively intensive interaction at the phase interface, SEA-based pavements are characterized by improved operational properties. However, widespread use of ordinary SEA is not possible because of environmental impacts. The emission of hydrogen sulfide and sulfur dioxide takes place both during the concrete mix preparation and pavement production stages [7-10].

The goals of the present work are to address the primary SEA drawback and also to discuss the properties of SEA concretes that demonstrate the operational performance and durability of such materials.

MATERIALS AND METHODS

The emission of toxic gases was measured by ANKAD 7664 Micro-06 analyzer. During measurements, special procedures were used for keeping the evaporation area constant. Duration of measurements depends on production, transportation and placement conditions of the mix and should be at least one hour.

The specimens of SEA were prepared from gabbro-dabase chipping of fraction 5–20 mm (77% by mass in mineral part), granite screenings of fraction 0.315–5 mm (11% by mass in mineral part), diatomite powder of average particle size 7 μ m (12% by mass in mineral part), bitumen and sulfur modifier in form of pellets [Fig. 1]. The amount of sulfur in complex binder ranges from 0 to 40% by mass [Table 1].

Table 1: Formulae of SEA concrete specimens

Component	Mix #1	Mix #2	Mix #3	Mix #4
Bitumen, % above mineral part	5.50	4.87	4.49	4.05
Sulfur modifier, % above mineral part	0	1.37	2.21	3.18
Amount of sulfur in binder, %	0	20	30	40

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Fig. 1: Pellets of the SEA modifier.

Cylindrical specimens of diameter 150 mm and height 75 mm (AASHTO TP 63 test) and 65 mm (AASHTO T 324 test) were compacted for the tests.

To examine the resistance to rutting, we have performed two tests according to AASHTO TP 63 "Determining Rutting Susceptibility of Asphalt Paving Mixtures Using the Asphalt Pavement Analyzer" and AASHTO T 324 "Hamburg Testing". Modified APA asphalt pavement analyzer that allows to carry out both tests is used. The APA is a thermostatically controlled device designed to determine the properties of hot mix asphalt by applying repetitive linear loads to compacted test specimens through a loaded wheel [11].

The measurements of the mechanical properties were performed according to RU GOST 31015.

The examination of fatigue life and several other operational properties related to the resistance to dynamic loads were performed according to the EN 12697-24 "Bituminous mixtures. Test methods for hot mix asphalt. Resistance to fatigue," and "Pavement Technology" (hereafter PT) methods. Both these methods are adequately representing the loads of the real traffic flow. In addition, fracture toughness (splitting tensile strength) was determined in accordance with RU GOST 12801-98.

The EN 12697-24 indirect tensile tests were carried out with Dynapave 78-B7130 servo-hydraulic dynamic testing system [12]. Cylindrical SEA concrete samples with diameter of 150 mm and height of 70 mm were tested at 20 °C. The samples were exposed to repetitive sinusoidal load [Fig. 2]; such load is causing tensile stress in the direction that is perpendicular to the load axis. The test completes at the moment of vertical crack growth. The fatigue limit is determined as the total number of load cycles that precede the destruction of the sample. Total horizontal deformation is also registered during the test.

The PT fatigue test method was designed by Pavement Technology, Inc to be performed by asphalt pavement analyzer [12][19][21]. The samples for the test are beams of 75 mm by 125 mm by 300 mm in size (during the test, three beams are simultaneously examined [Fig. 3]. After compaction, test specimens were aged for 120 hours at a temperature of 85 °C. The test itself consists of repetitive wheel tracking [Fig. 4]. The wheel load was 1113 N, test temperature was 20 °C. The test completes if at least one of the following conditions is met: some predefined number of cycles is reached; the beam breaks; beam deflection rate of change in vertical direction is above 1.0 mm after 10 cycles.

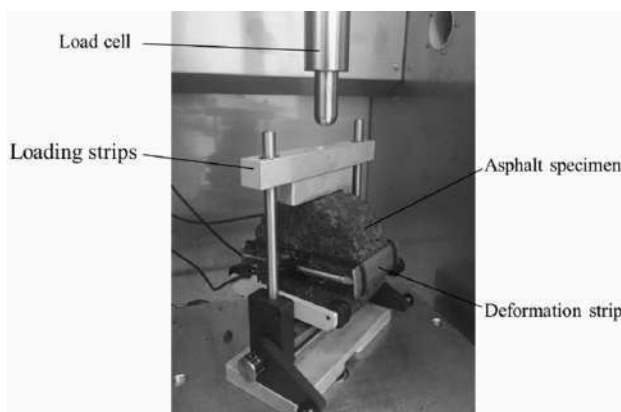


Fig. 2: Sample load for EN 12697-24 indirect tensile test.



Fig. 3: Experimental setup for PT fatigue test method.

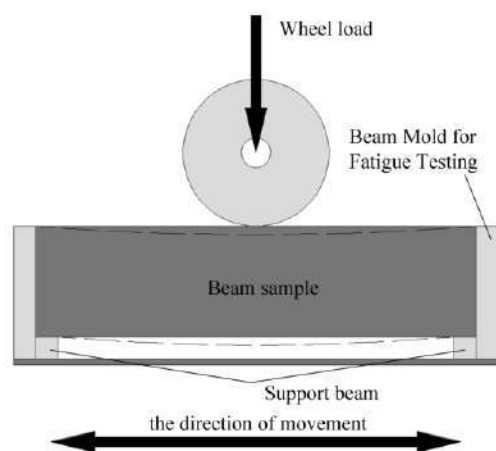


Fig. 4: Sample load for PT fatigue test method.

RESULTS

Suppressing the emission of toxic gases

To ascertain the influence between SEA composition, technology and emission of toxic gases we have to examine the processes [Fig. 5] that are occurring during preparation and placement of pavements.

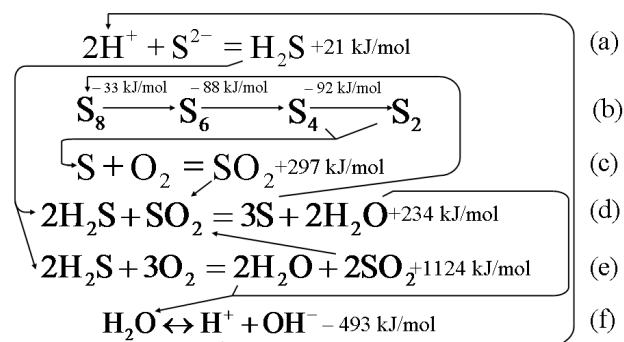


Fig. 5: Chemical processes occurring in SEA.

Dehydrogenation of bitumen leads to the formation of hydrogen sulfide [Fig. 5(a)]. At the same time, S_8 ring transforms to radicals. Excess in content of unstable S_2 and S_4 molecules leads to high reactivity [Fig. 5(b)] and formation of sulfur dioxide [Fig. 5(c)]. The reactions between sulfur dioxide and hydrogen sulfide [Fig. 5d], and also oxidation of hydrogen sulfide [Fig. 5(e)] are also possible. The hydrogen that is formed by dissociation of water (f) can react with sulfur ions, forming hydrogen sulfide (a). Analysis of the energy balance for various paths of H_2S and SO_2 formation shows that the lowest level of energy consumption corresponds to trajectory "reaction (a) $\rightarrow$ reaction (e) $\rightarrow$ reaction (f)."

To suppress the emission of toxic gases, it is possible to use complex sulfur-based modifier consisting of sulfur and chemical neutralizers, e.g. iron salts [9, 10, 13] [20].

We propose to use complex neutralizer that consists of component “A” for preventing the dehydrogenation of bitumen, and component “B” for bonding the hydrogen sulfide and sulfur dioxide into complexes. The availability and local cost of components were taken into account during the selection of particular substances as components “A” and “B”. In our research such substances are mixtures of oxides of amphoteric metals. The amount of neutralizer in sulfur is 10% by mass. The measurement results are summarized in [Table 2].

Table 2: Emission of sulfur dioxide and hydrogen sulfide

Parameter	After 15 min.	After 30 min.	After 60 min.
Value of SO ₂ emission, mg/m ³	2.0	6.0	8.6
Multiplicity of reduction for SO ₂	9.8	4.3	2.6
Value of H ₂ S emission, mg/m ³	0.6	2.1	3.0
Multiplicity of reduction for H ₂ S	11.0	7.1	6.1

As it follows from the results, the proposed complex admixture significantly reduces emission of toxic gases, especially the emission of hydrogen sulfide (about order of magnitude).

Resistance to rutting

Six specimens for each composition of asphalt concrete were tested. The value of rut depth for each composition is calculated as an average for the six specimens. The experimental dependencies are presented on [Fig. 6] and [Fig. 7].

As it follows from the obtained results, resistance to rutting of the SEA concrete is significantly higher than for ordinary asphalt concrete (reference mix #1). For the AASHTO TP 63 test method, rutting resistance is 1.7, 2.4 and 3.7 times higher for the mixes 2–4, respectively.

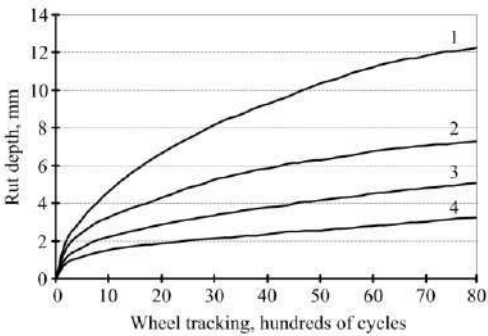


Fig. 6: AASHTO TP 63 results: rut depth for mixes from #1 to #4.

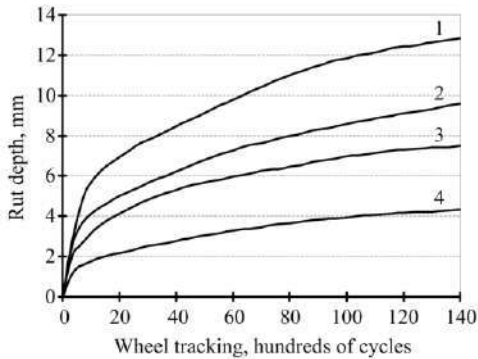


Fig. 7: AASHTO T 324 results: rut depth for mixes from #1 to #4.

According to AASHTO TP 63, the allowable rut depth should be no more than 12 mm after 8000 wheel cycles. For the control specimen such rut depth has reached after the 7800 wheel cycles. For the SEA such rut depth does not reached even after the 10000 wheel cycles; the maximum depths are 7.38, 5.58 and 3.64 mm for the mixes 2–4, respectively.

For the AASHTO T 324 test, rutting resistance of the SEA concrete is 1.3, 1.7 and 3.0 times higher if compared with reference samples. AASHTO T 324 states that allowable rut depth should be no more than 12 mm after 12000 wheel cycles; for the control specimen of asphalt concrete such rut depth has reached after the 14000 wheel cycles. For the SEA concrete such rut depth does not reached even after 20000 wheel cycles: the maximum depths are 10.8, 8.1 and 4.5 mm, for the mixes 2–4, respectively.

Mechanical properties

We have determined the values of mechanical properties for the previously described samples. Results are summarized in [Table 3].

Table 3: Mechanical properties of sea concretes

Property	Mix #1	Mix #2	Mix #3	Mix #4
Compressive strength at 20 °C, MPa	3.34	3.35	4.15	5.30
Compressive strength at 50 °C, MPa	1.67	1.72	2.19	2.82
Clutch shear at 50 °C, MPa	0.29	0.29	0.38	0.54

As it can be seen from [Table 3], compressive strength of SEA concrete both at 20 °C and at 50 °C is considerably higher that of reference Mix #1; depending on the sulfur content, the excess can be as high as 68%.

Resistance to dynamic loads

During operation of asphalt pavements the gradual decline of their strength and other physical and mechanical properties takes place. Such decline is because of the irreversible destruction process of the material structure. The destruction of asphalt concrete under repeated cyclic loading is caused by the fatigue processes, i.e. formation and accumulation of micro-scale defects and the subsequent formation of macroscopic defects [13-18].

The fatigue life is one of the primary parameters that determine the duration of the maintenance-free period of pavement. For the SEA concretes, still there is not enough data concerning the fatigue life. It is obvious, though, that discovering the sulfur effect on the fatigue life of the asphalt concrete is necessary for the design of longer-lasting and durable material.

For the previously described four series of SEA concretes we have carried out the assessment of the fatigue life parameters according to the methods that are described in previous section. The experimental results are summarized in [Table 4].

Table 4: Fatigue life parameters of SEA concretes

Property	Mix #1	Mix #2	Mix #3	Mix #4
EN 12697–24 cycles	1066	1280	4123	6315
EN 12697–24 deformation, mm	1.96	0.63	0.60	0.54
PT cycles	933	814	2807	4620
PT beam deflection, mm	7.6	2.98	2.45	1.40
Splitting tensile strength, MPa	3.21	3.89	3.82	3.71

The formation of spatial cross-linked network may take place when the amount of sulfur in complex binder is in range from 20% to 40%. Such a network contributes the increase of almost all operational properties, including fatigue strength.

As it can be seen from [Table 4], fatigue life parameters increase together with the amount of sulfur in SEA concrete. Starting from Mix #2, for both test methods there are linear dependencies between amount of sulfur and number of load cycles before failure. The corresponding regression models are:

$$N_1(c) = -3646 + 252c, \quad (1)$$

$$N_2(c) = -2962 + 190c, \quad (1)$$

where N_1 and N_2 are numbers of load cycles before failure for EN 12697–24 and PT methods, respectively; c is the amount of sulfur in complex binder, %.

These models can only be used for $20 \leq c \leq 40$. The corresponding parameters of both models are near to each other; this reflects the fact that both methods give consistent results. For series #4, the number of cycles preceding the start of irreversible deformation and main crack growth, if compared with values for reference series #1, is about 5 and 6 times higher, depending on the test method. Both methods are also indicating that increase of the content of sulfur leads to decrease of deformability. Deformations at the failure point are lowered in 3.3 and 3.6 times (EN 12697–24) and in 3.1 and 5.4 times (PT method), for series #3 and #4, respectively.

However, as it is evident from the last row of [Table 4], the excess of sulfur may also lead to negative effects. In particular, the values of low-temperature properties (e.g., tensile strength at 0 °C) of SEA concretes slightly decline. Yet, this decline is relatively small (about 5% for series #2 and #4) and even for series #4 the absolute value of tensile strength is still higher than for reference series. Thus, whilst most materials demonstrate positive correlation between strain capacity and fracture toughness, SEA concrete demonstrate negative one. The correlation between fatigue life and strain capacity is also negative.

CONCLUSION

Prolonging the service life of the roads reduces the consumption of natural resources, thus any building material that is more durable and without environmental impacts should be considered as eco-friendly. Both advantages and drawbacks of SEA concretes are currently well known; from the ecological point of view, the primary drawback is the emission of toxic gases during production and placement.

In the present work we have proposed the complex sulfur modifier that eliminates such drawback. It is shown that admixture of this modifier contributes the increase of almost all operational properties, including resistance to rutting, compressive strength, splitting tensile strength and fatigue limit. In particular, resistance to rutting can be in 1.3-3.7 times higher. The anomalous (negative) correlations between strain capacity, fatigue life and fracture toughness are also revealed; such correlations are beneficial for building material.

CONFLICT OF INTEREST

The authors declare no competing interests in relation to the work.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

This work is supported by the Ministry of Science and Education of Russian Federation, Project #2014/107 "Structure formation of sulfur composites: phenomenological and ab initio models".

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ARTICLE

RESPONSE SURFACE METHODOLOGY FOR OPTIMISATION OF PARAMETERS FOR EXTRACTION OF *STEVIA REBAUDIANA* USING WATER, H₂O

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ABSTRACT

The sweet diterpene glycosides extracted from the leaves of *Stevia rebaudiana* (Bert) Bertoni are of increasing interest in recent years as possible sugar substitutes. The objectives of this study were to investigate the application of Response Surface Methodology (RSM) in determination of optimum condition of stevia extraction using water, H₂O. Initially, *Stevia* leaves variety of China was extracted using water. The extraction process treated with water at different immersion temperatures, immersion duration and particle sizes according to the experimental design which was recommended by RSM of MINITAB software version 16. The MINITAB software Version 16 was used to optimise the stevia extraction using water, H₂O. The determination coefficient R² was 98.72% meaning that the experimental data were acceptable. It was found that the crude extract of *Stevia* could be optimised 2.1521 % at the optimum condition at immersion temperature of 92 °C, particle size 0.7 mm and immersion duration of 4.7 minutes. 2.1 % was the verification value obtained from *Stevia* extraction at the feasible optimum condition. Since there is not much difference between the verification and predicted values, therefore, MINITAB software Version 16 could be used for prediction of the optimum condition for the *Stevia* extraction using water.

INTRODUCTION

Based on the International Diabetes Federation (IDF) report, it was stated that Malaysia is one of the 21 countries and territories of the IDF Western Pacific region. In the year 2015, there were 3.3 million cases of diabetes were recorded in Malaysia from the total population which was 31.2 million. Although the percentage of cases of diabetes is not very high with 10.54 %, however it should be taken seriously so that these percentage could be decreased [1, 2]. Hence, *Stevia* is a perfect answer to the needs of consumers, combining the qualities of a sweetener, which also constituting a source of many substances with a nutritional effect on the human organism. New types of food products enriched with *Stevia* bring many benefits [3]. *Stevia* has been widely used in Japan, China, Russia, USA and UK for food, beverage and tea preparation. These plant which act as a natural sweetener also well known as sugar leaf, candy leaf and sweet leaf due to its sweet taste that estimate 300 times sweeter than cane sugar [4].

In order to minimize the usage of organic solvents, water was selected as the medium for the extraction which offers a feasible green option of biomarker compounds in botanicals [5-7]. It is the conventional extraction method that mostly used [8]. Response Surface Methodology (RSM) is a collection of mathematical and statistical techniques useful for improving, developing, and optimizing processes. RSM it is possible to observe the interaction effect of the independent parameters on the response [9].

MATERIALS AND METHODS

Stevia from variety of China was obtained from *Stevia* Sugar Corporation in Malaysia. Filtered distilled water, dH₂O. Refractometer was purchased from Surechem Sdn Bhd (Sri Petaling, Malaysia).

Method

Optimisation of *Stevia* extraction involved the combination of RSM with central composite design (CCD). Since there are large numbers of variables controlling the yield of *Stevia* extraction, a few mathematical models are required to represent the process. Nevertheless, rather than including all the parameters, these models have to be developed using only significant parameters that influencing the extraction process. Therefore, in order to achieve this, the data were subjected to analysis of variance (ANOVA). RSM and second-order CCD for three-variables which were immersion temperature X₁, particle size X₂, and immersion duration X₃. Besides, five level combination coded value -2.000, -1, 0, +1, and +2.000 [Table 1] was applied to determine the effects of the independent variables on the *Stevia* extraction [10].

Table 1 : Design of experiment for coded and uncoded factors

	-2.000 (-α)	-1	0	1	2.000(α)
X ₁	0	25	50	75	100
X ₂	0.5	1	1.5	2	2.5
X ₃	1	2	3	4	5

KEY WORDS
Stevia, Water, Extraction,
Response Surface
Methodology (RSM)

Received: 15 Octr 2016
Accepted: 14 Nov 2016
Published: 1 Dec 2016

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Where: X_1 = Immersion temperature ($^{\circ}\text{C}$), X_2 = Particle size (mm), X_3 = Immersion duration (min)

Table 2: Experimental design suggested by MINITAB software Version 16

No. Of Sample	X_1	X_2	X_3
1	25	1	2
2	75	1	2
3	25	2	2
4	75	2	2
5	25	1	4
6	75	1	4
7	25	2	4
8	75	2	4
9	8.0	1.5	3
10	92	1.5	3
11	50	0.66	3
12	50	2.34	3
13	50	1.5	1.3
14	50	1.5	4.7
15	50	1.5	3
16	50	1.5	3
17	50	1.5	3
18	50	1.5	3
19	50	1.5	3
20	50	1.5	3

Where: X_1 = Immersion temperature ($^{\circ}\text{C}$), X_2 = Particle size (mm), X_3 = Immersion duration (min)

The Stevia was extracted by following three parameters that has been choosed which were immersion temperature ($^{\circ}\text{C}$), Particle size (mm), and Immersion duration (min). An amount of 1 g of dried leaves was extracted with 100 mL distilled water using steeping method. Water bath and thermometer are used to control the temperature of extract. The crude extract was then filtered using Whatman filter paper no. 1. Distilled water act as a control in this experiment.

The 3D plot is a graphical representation of the regression equation, and is often plotted to aid the understanding of the interaction of the independent variables and locate the optimal level of each variable for maximum response. 3D response surface plot was plotted by different combinations to two test variables at one time and maintaining the other variable at zero level [11, 12]. Three variables are considered in the Stevia extraction, the value of one variable was fixed to obtain the contours. The non-variant parameters were therefore set at optimum level and a new relationship was developed and plotted between the independent and dependent variables [11].

RESULTS AND DISCUSSION

Result in [Table 3] shows that the predicted responses and highest actual were 1.56061 % and 1.8 % respectively at factors whereby immersion temperature ($^{\circ}\text{C}$) was 92 $^{\circ}\text{C}$, particle size (mm) was 1.5 mm and immersion duration (min) was 3 mins. Meanwhile, the predicted responses and lowest actual were 0.42027 % and 0.5 % respectively at factors in which immersion temperature ($^{\circ}\text{C}$) at 25 $^{\circ}\text{C}$, particle size (mm) was 2.0 mm and immersion duration (min) was 2 mins.

[Table 4] shows that the linear factors such as immersion temperature (X_1), particle sizes (X_2) and immersion duration (X_3) indicated a positive coefficients. Square factors such as immersion temperature (X_1X_1), particle sizes (X_2X_2) and immersion duration (X_3X_3) indicated a negative coefficients. Quadratic or interaction factors such as immersion temperature and particle sizes (X_1X_2), particle sizes and immersion duration (X_1X_3) showed positive coefficient respectively, meanwhile immersion temperature and immersion duration (X_2X_3) showed negative coefficient. Analysis of response surface regression was performed and results of estimated regression coefficients of second-order polynomial model for optimisation of Stevia extraction using water, H_2O are shown in [Table 4]. By referring [Table 4], the second-order polynomial model equation for Stevia extraction using water, H_2O optimisation was given in equation :

$$Y = 2.68391 + 0.03375 X_1 + 1.77223 X_2 + 0.90630 X_3 - 0.00017 X_1X_1 - 0.42469 X_2X_2 - 0.10532 X_3X_3 + 0.05966 X_1X_2 + 0.00197 X_1X_3 - 0.24298 X_2X_3 \quad (1)$$

Where: X_1 = Immersion temperature ($^{\circ}\text{C}$), X_2 = Particle size (mm), X_3 = Immersion duration (min).

Table 3: Comparison of factors between predicted (FITS) and actual (Y) responses

No	Test variables			Responses	
	X ₁	X ₂	X ₃	FITS	Y
1	25	1	2	1.08933	1.0
2	75	1	2	1.40352	1.2
3	25	2	2	0.42027	0.5
4	75	2	2	0.91507	0.8
5	25	1	4	1.34642	1.2
6	75	1	4	1.47930	1.3
7	25	2	4	0.65798	0.6
8	75	2	4	0.97217	0.8
9	8.0	1.5	3	0.95089	1.0
10	92	1.5	3	1.56061	1.8
11	50	0.66	3	1.40991	1.7
12	50	2.34	3	0.50088	0.5
13	50	1.5	1.3	0.98299	1.1
14	50	1.5	4.7	1.24720	1.5
15	50	1.5	3	1.51057	1.5
16	50	1.5	3	1.51057	1.5
17	50	1.5	3	1.51057	1.5
18	50	1.5	3	1.51057	1.5
19	50	1.5	3	1.51057	1.5
20	50	1.5	3	1.51057	1.5

Where: X₁ = Immersion temperature (°C), X₂ = Particle size (mm), X₃ = Immersion duration (min)

Table 4: Optimisation of Stevia, China extraction using water, H₂O by estimated regression coefficients of second-order polynomial model

Term	Coefficient	SE Coefficient	t	p
Constant	2.68391	0.915387	2.932	0.000
X ₁	0.03375	0.011835	2.852	0.000
X ₂	1.77223	0.654201	2.709	0.000
X ₃	0.90630	0.327100	2.771	0.020
X ₁ X ₁	-0.00017	0.000067	-2.524	0.030
X ₂ X ₂	-0.42469	0.168251	-2.524	0.030
X ₃ X ₃	-0.10532	0.042063	-2.504	0.020
X ₁ X ₂	0.05966	0.004516	1.321	0.000
X ₁ X ₃	0.00197	0.002258	0.874	0.020
X ₂ X ₃	-0.24298	0.112911	-2.152	0.040
R ² = 98.72 %		R ² (adj) = 97.85 %		

The significance of each co-efficient was determined by student's t-test and p-values which are listed in [Table 4]. Determination of the significance for estimated coefficient of the regression model equation [eq. 1] was using the student t. Division of each coefficient by its SE results in the student t test value [13]. The larger the magnitude of the t-value and the smaller the P value, the more significant is the corresponding coefficient [14, 15]. Based on the [Table 4], it shows that the large number of t value, meanwhile the p value for each interaction was less than 0.05. Hence, the present study resulted that linear factors (X₁, X₂, X₃), square factors (X₁², X₂², X₃²) and quadratic or interaction factors (X₁X₂, X₁X₃, X₂X₃) terms were highly significant. It suggests that all linear, square and quadratic or interaction factors gave significant (p<0.05) effects on Stevia extraction. The p values were act as a tool to assess the significance and contribution of each factor and the statistical polynomial model equation [16].

The coefficient of determination [R²] and the significance of lack-of-fit indicates the fitness and adequacy of the model. Definition of R² was the ratio of the explained variation to the total variation, used as a calculate of the degree of fit [17]. The coefficient of determination R² which was calculated to be 98.72 % of variability in the response could be explained by the model. The closer the R² value to unity, the better the empirical model fits the actual data [18]. Meanwhile, the variability in the observed response values cannot be explained by the model only 1.28 %. Probably, 1.28 % of the total variations would be due to other factors which were excluded in the model. The adjusted R² represents a rectified value for R² after the riddance of unnecessary model terms. Moreover, if there were massive influx of non-significant terms in the model, the adjusted R² would be outstandingly smaller than the R² [19]. In this study, the adjusted R² was close to the R² value.

Table 5: ANOVA for optimisation of Stevia extraction using water, H₂O

Source	DF	Seq SS	Adj SS	Adj MS	f	p
Regression	9	2.82502	2.82502	0.313892	12.31	0.000
Residual Error	10	0.25498	0.25498	0.025498		
Lack of fit	5	0.25498	0.25498	0.050995	1.59	0.501
Pure Error	5	0.16000	0.16000	0.032000		

Evaluation of f and p values using Fischer's and null-hypothesis tests was to determine the significance of regression. The quality prediction of the entire model considering all design factors at a time was through the f value. The p value defined the probability of the factors having insignificant or very small effect on the response. The RSM model will signifies better fit to the experimental data when the f value was large [20]. High significance of the regression model when the f value with low p value [21]. However, the p value should be lower than 0.05 [$p < 0.05$] for the model to be statistically significant [22]. Based on above discussion, the large f and low p values with 12.31 and 0.000, respectively indicates that the regression model found in this study was very significant [Table 5].

The test for Lack of fit was also conducted. It explains the variation in the data around the fitted model [23]. Indication of a good model as there might be contributions in the regresses-response relationship that are not accounted for by the model was via the insignificant lack of fit [22]. By dividing the lack of fit mean square by its pure error mean square will results in the f value for the lack of fit . [Table 5] shows the results of the lack of fit and it was found that the f and p values for the lack of fit were 1.59 and 0.501, respectively. Besides, the absence of any lack of fit ($p > 0.05$) also strengthened the reliability of the models. Thus, it exhibits that the model was fitted well to the experimental data [24][28].

[Fig. 1 (a)], [Fig. 1 (b)] and [Fig. 1 (c)] shows the results for target, maximum and minimum goals are shown in respectively at optimum condition that performed by response optimiser. Determination of the feasibility of experiment for target, maximum and minimum goals was from the overlaid contour plot which are shown in [Fig. 2 (a)], [Fig. 2 (b)] and [Fig. 2 (c)], respectively. Results of different goals of actual and predicted responses and the feasibility of experiments at the optimum conditions were obtained from response optimiser of MINITAB software Version 16 are shown in [Table 6].

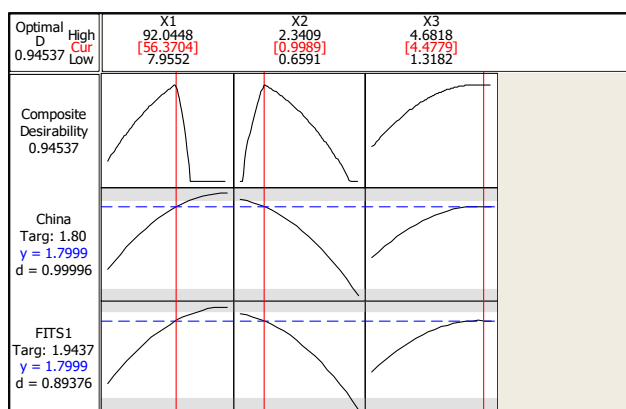


Fig. 1 (a) : Response optimiser for target goal at optimum condition.

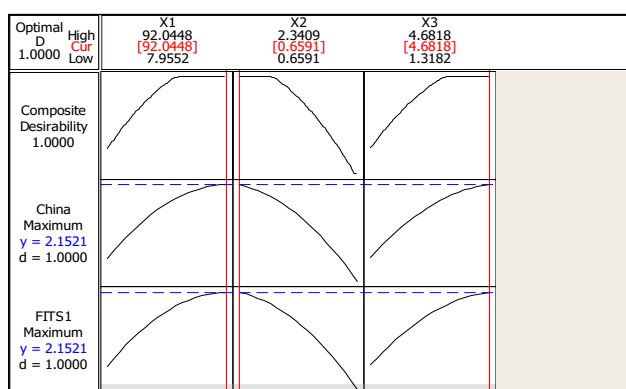


Fig. 1 (b): Response optimiser for target maximum at optimum condition.

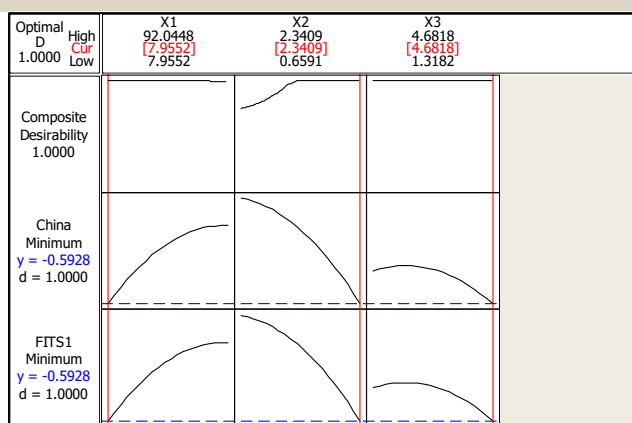


Fig. 1 (c): Response optimiser for minimum goal at optimum condition .

It shows that the target goal for optimum conditions with immersion temperature of 56 °C, particle size of 1 mm and immersion duration of 4.5 minutes, and maximum goal with immersion temperature of 92 °C, particle size of 0.7 mm and immersion duration of 4.7 minutes were feasible to be carried out. Meanwhile, for minimum goal at optimum condition with immersion temperature of 8 °C, particle size of 2 mm and immersion duration of 4.7 minutes was not feasible to be carried out. According to the overlaid contour plots for target and maximum goals as shown in [Fig. 2 (a)] and [Fig. 2 (b)] respectively, the optimum conditions of target and maximum goals situated at a feasible region which in white. Meanwhile, the overlaid contour plot of minimum goal as shown in [Fig. 2 (c)] situated at a not-feasible region which in grey. However, the optimum condition from maximum goal was selected due to the target and FITS values was much closer.

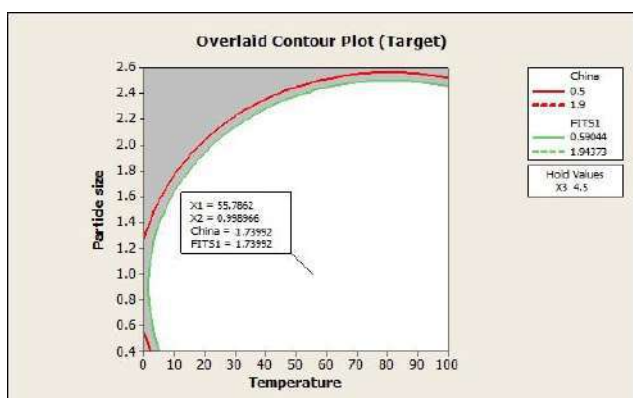


Fig. 2 (a): Overlaid contour plot for target goal at optimum condition; immersion temperature of 56 °C, particle size of 1.0 mm and immersion duration of 4.5 minutes.

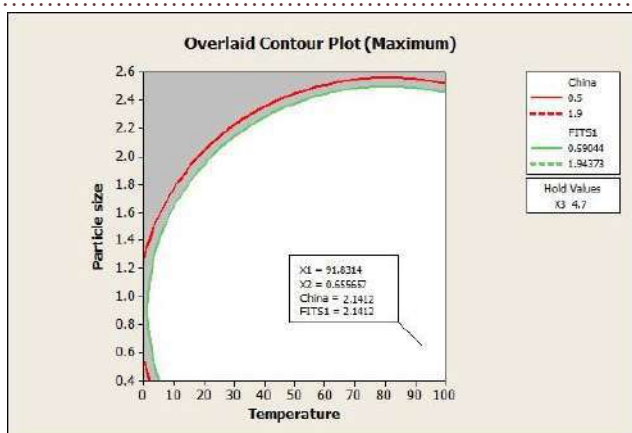


Fig. 2 (b): Overlaid contour plot for maximum goal at optimum condition; immersion temperature of 92 °C, particle size of 0.7 mm and immersion duration of 4.7 minutes.

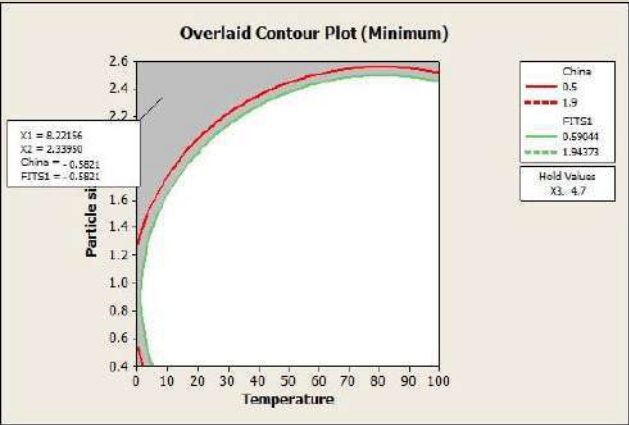


Fig. 2 (c) : Overlaid contour plot for minimum goal at optimum condition; immersion temperature of 8 °C, particle size of 2.0 mm and immersion duration of 4.7 minutes.

Table 6: The values comparison of target and predicted responses at different optimum conditions and feasibilities of experiment

Goal		Lower	Target	Upper
Target	Y	0.5	1.8	1.9
	FITS	0.59044	1.94372	1.94373
Max	Y	0.5	1.9	1.9
	FITS	0.59044	1.94373	1.94373
Min	Y	0.5	0.5	1.9
	FITS	0.59044	0.59044	1.94373

Goal	Optimum Condition			FITS (%)	F/NF
	X1	X2	X3		
Target	56	1	4.5	1.7999	F
Max	92	0.7	4.7	2.1521	F
Min	8	2	4.7	-0.5928	NF

Where: X₁ = Immersion temperature (°C), X₂ = Particle size (mm), X₃ = Immersion duration (min)

The 2D contour plots and 3D surface plots for Stevia, China extraction using water at feasible optimum condition are shown in[Fig. 3] and [Fig. 4], respectively that showed the immersion temperature (°C), particle size (mm) and immersion duration (min). 2D contour and 3D surface plots were defined as the graphical representatives of the regression equation portraying the function of two factors at a time while holding other factors at a fixed level [21][27]. The plots illustrating the values for immersion temperature and particle sizes while holding the value of immersion duration at 4.7 min.

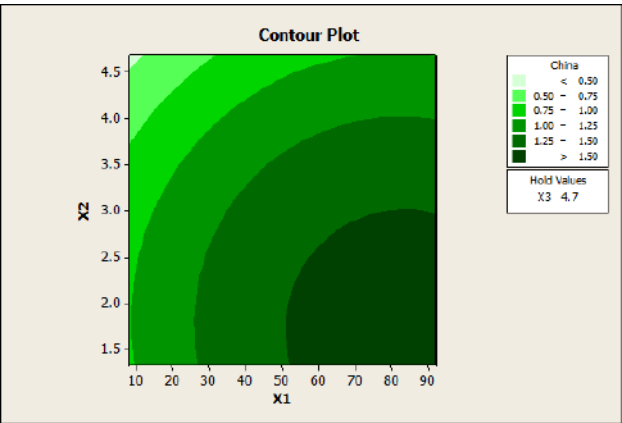


Fig. 3: Contour plot at Stevia, China extraction using water at feasible optimum condition; immersion temperature of 92 °C, particle size of 0.7 mm and immersion duration of 4.7 minutes (holding value: immersion duration 4.7 min).

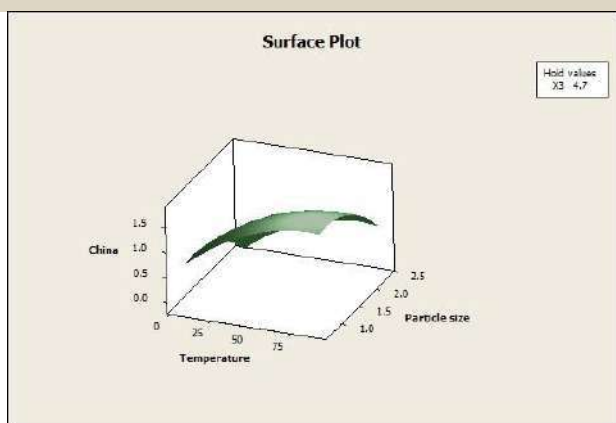


Fig. 4: Surface plot at Stevia, China extraction using water at feasible optimum condition; immersion temperature of 92 °C, and particle size of 0.7 mm and immersion duration of 4.7 minutes (holding value: immersion duration 4.7 min).

Table 7: Comparison of verification and predicted values of Stevia, China extraction using water, H₂O at a feasible optimum condition

Optimum condition			V (%)	P (%)
X ₁	X ₂	X ₃		
92	0.7	4.7	2.1	2.1521

Where: X₁ = Immersion temperature (°C), X₂ = Particle size (mm), X₃ = Immersion duration (min)

The interactions between corresponding factors describes by the circular contour plot are negligible, meanwhile elliptical contour plot are significant. Hence, both shapes of contour plot describes whether the reciprocal interactions between the factors are significant or insignificant [14, 25]. Results of the present study showed that the contour plot was elliptical shape. Hence, it indicates significant interaction effect between pH of beef and immersion temperature on beef tenderization [26]. Therefore Figure 3 indicated the significant interaction between immersion temperature and particle size of Stevia, since the contour plot showed the elliptical shape. The surface plot showed that the Stevia extraction escalated at the higher immersion temperature, meanwhile at the higher particle sizes, the extraction of Stevia declined.

Verification of Stevia extraction using water at the feasible optimum condition was performed and the result is shown in [Table 7]. The verification value of Stevia extraction using water at the feasible optimum condition was 2.1 % which was very close to the predicted value with 2.1521 %. Since there is not much difference between the verification and predicted values, hence the feasible optimum condition of the Stevia extraction predicted by MINITAB Software Version 16 was acceptable.

CONCLUSION

As we can see, the experimental results obtained confirming that the RSM could be effectively used to optimize the process parameters in complex process using the statistical design of experiments. The ascertainment coefficient R² (98.72 %) was high, thus the experimental data was acceptable. Optimum condition for the extraction of Stevia (China) using water via RSM had been determined. It was found that Stevia extraction could be optimised at the immersion temperature of 92 °C, particle size of 0.7 mm and immersion duration of 4.7 minutes. It was also found that the difference between the verification and predicted values was small, therefore, the optimum condition for the Stevia (China) extraction using water predicted by MINITAB Software Version 16 could be accepted.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The author wish to express their gratitude to Faculty of Plantation and Agro technology, UiTM for providing laboratory facilities.

FINANCIAL DISCLOSURE

Financial support from Faculty of Plantation and Agrotechnology for this research.

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ARTICLE

GREEN SUPPLY CHAIN MANAGEMENT IN GREEN HOSPITAL OPERATIONS

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ABSTRACT

Green buildings also known as green construction or sustainable building are environmentally responsible and resource-efficient throughout a building's life-cycle. Today the environmental issues and the concern for sustainability is encouraging more effective and efficient usage of energy, water and material currently used, ensure the prevention of any kind of waste, perform environmentally sensible and eco-friendly building design and be environmentally friendly in the process of construction. This requires close cooperation of the design team, the architects, the engineers, and the client at all project stages. Green Supply Chain Management (GSCM) reduces energy usage and waste, so it prevents any problem that will occur in human health and environment. Hospitals ensure a gapless sanitary care for the population in this network and they have a significant social, economic and environmental responsibility. In the last few years a new environmental trend in the field of bigger buildings occurred, green buildings. The aim of this paper is to explore the social-benefit reflections by combining GSCM and green hospital design, based on the literature review and EU directives for Turkey, to build and propose a model regarding Green Hospital operations using GSCM and reverse logistics.

INTRODUCTION

Today growing industries are causing pollution that affect our lives directly. It gives harm to our health and is a big threat for the next generation. In this case green products and services are becoming more popular. Production systems are being customer focused to meet their requirements on time, with high quality. Even in construction industry, it is important to manage every step, beginning with the building design to the demolition. Not just the aesthetics or the usage of the building is considered but also resource efficiency has to be reached. As a solution, green building design is a way to reduce usage of raw materials at the beginning and to use high percentage of recyclable materials to make sustainable structures. When the design phase is considered, only architectures and civil engineers will have role to make the building "green". But as a whole construction industry, suppliers and other subcontractors are also in the whole supply chain. For this reason, to make the whole production line sustainable, green supply chain models will be useful to connect every step to each other with every kind of actors in the supply chain.

As a new topic, GSCM makes sustainable systems with the help of waste management directives. Both European Union and Turkey published regulations to manage construction and demolition waste. First aim is to reduce the raw material in the source and if it cannot be reduced, than the second aim is to recover those materials as much as it can be. To be able to reduce the raw material such as the materials that are directly used in the structure, water and energy resources it can be designed as green building at the beginning. It is possible to take green building certification with the required properties that will be given more detailed in the following sections.

LITERATURE REVIEW

Green supply chain management

Supply chain management definition changes day by day according to its broadening scope [1]. SCM includes logistics and trade while operating both customers and suppliers [2]. Supply chain is a cycle that starts from suppliers and ends at customers as the product or service flow [3]. Another definition is that supply chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer [4].

Supply chain traditionally starts from the cradle to the grave, which means from raw material state till the end product reaching the customer. However today environmental issues force processes to change and comes up with new operations such as recovery options. For this reason, closed loop supply chain, a new definition, allows the finished good collected from customers which are end-of-life products now, and go in to some other processes for recovering them [5]. The aim of the end-of-life recovery options are to recover material, energy and avoid landfill. This recovery is a value that if it is managed properly, high profits will be gain for both producers and customers [6].

Today companies are aware of their responsibilities about the environment depending on regulations. This leads to sustainable systems that will continue their processes without giving any harm to the environment. Environmental issues are seen at every step of supply chain that starts from getting the raw

KEY WORDS

Construction waste managements, green hospital, green supply chain management, waste management

Received: 10 Oct 2016
Accepted: 12 Nov 2016
Published: 1 Dec 2016

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material and ends with reuse or recycle or disposal [7]. This causes a requirement for companies to have a green supply chain management (GSCM). A study in India, found that there are different pressures for different sectors to be able to adopt GSCM in their own traditional supply chains [8]. To integrate GSCM to a company five different applications can be used as environmental management systems, green purchasing and design, investment recovery and strong relations with customers [7]. In common green activities and sustainability have an intersection in practice which is 4R: reduction, redesign, reuse and remanufacture [2].

Constructions cause air, water and noise pollution and today with global warming environmental issues became very important. Even in construction design, green materials are being preferred to minimize waste and construction firms are starting to use green supply chain management to make their work sustainable. Green buildings, sustainable design and constructions, construction waste management are some of the sustainability topics that are being used by producers [9]. The best way to minimize the construction waste generation is disposal. Also material types have to be selected very carefully to get rid of recycling limitations that means recyclable materials should be preferred [10].

To leave a healthy environment with high level of social, economic and environmental conditions to future generations, sustainability is important which leads to improved quality of systems [9]. Supply chain management has four specific roles in construction; improving the interface between site activities and the supply chain, improving the supply chain, transferring activities from the site to the supply chain, integration of site and supply chain. SCM helps to understand construction problems and shows a direction to solve them but practical methods for SCM should be improved to implement for specific situation of construction [10].

Green building design

Like any other industry, green production is very popular today at construction sites. At the design phase, architectures are considering different types of shapes and materials to provide energy saving. Green building design provides savings in different scopes: nearly 30% energy, 35% carbon, 30-50% water usage, 50-90% waste cost savings will be reached [11]. "World Green Building Trends Smart Market Report" which was published at 2013, shows the importance of the reason for building green structures according to different locations [Fig. 1].

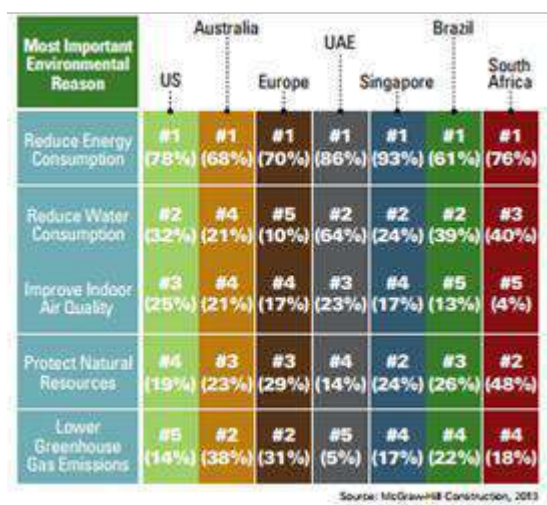


Fig. 1: Most important environmental reason for building green by locations.

There are different definitions of green building in literature. A green building is better designed than a traditional building in case of its effect to the environment. Another definition is the building that provides an important development and innovation within its environment. Green building is not only the consumer but also a manufacturer of energy and water. During its life cycle, it presents the healthiest environment while using water, energy and land sources efficiently [12].

Green hospital and its key elements

Green building operations is vital for both environment and people. The growing trend of environmental awareness and practice in management (especially supply chain) systems has had its effect on many sectors, including healthcare and hospitals. Having touched upon Green supply chain and Green management in general, turning towards Green practices in hospitals, starting with the, again US focused, "Hospitals 2020" initiative, which aims "to accelerate the development, use, and diffusion of environmentally preferable products, practices, and construction of Green buildings in hospitals and medical practices worldwide". The seven key elements include hospitals' food, water, and (alternative) energy consumption, waste production, and related factors of building design, energy efficiency, and

transportation in and around the hospital. World Health Organizations seven key elements for green hospital are as follows[13]:

1. With efficiency measures, reducing cost and energy consumption
2. Building to reduce resource and energy demand and being sensitive to climate conditions
3. Producing/consuming clean, renewable energy
4. Make personnel and people coming to the hospital prefer walking and cycling
5. Sustainability of producing/consuming green food for personnel and patients
6. Reducing waste and using alternative disposal techniques
7. Finding safe alternatives to save water instead of bottled ones

Waste management principles related to Turkish and EU Council directives

Regulations about common waste management at Turkey, are improved according to waste variation. EU directives and country based guidelines are published and put into practice. In this scope, different types of waste are being stored regularly such as domestic solid waste, excavation soil, construction and demolition waste, waste batteries and accumulators, hazardous waste, herbal waste oils, medical waste, end-of-life tires, packaging waste, polychlorinated biphenyl and polychlorinated terphenyl, waste electrical and electronic equipment, waste oil, end-of-life vehicles, maintenance and repairment equipment of vehicles [14].

One of the most important principles of Turkey's waste management strategy is to prevent waste at source, otherwise reduce waste and finally if waste is unavoidable recycle it. Collecting all terms related to waste management directive under a common structure, simplifying regulations and adjusting them according to the EU waste management directive updates are being maintained by Ministry of Environment and Urban Planning.

There are two issues on recycling in the 10th development plan for years 2014-2018:

- Industries will give attention to applications such as recycling and recovery.
- Recycling performance is negatively affected by some topics such as lack of knowledge about recycling benefits which is one of the important issues in the solid waste management, lack of standardization of the recovered secondary products, deficiency of incentives and orientation system.

According to the national data about recycling; at 2003, at 46 recovery centers nearly 4 thousand people were employed and as a result of recovery operations 62 million TL added value provided. At 2011, at 898 recovery facility nearly 60 thousand people were employed and as a result of recovery operations the provided added value exceeded 1 billion TL [14][24].

"Regulation on Excavation Soil, Construction and Ruin Waste Control" is law in force that was promulgated at 18.03.2004. Following goals are given in the regulation: Reduce excavation, construction and ruin waste without giving harm to the environment at the place where they are produced, collect, store temporarily, transport, recover, use and dispose them.

Waste generation is increasing day by day at many countries due to the growth of towns and cities. Many regulations about construction and demolition waste management are developed to prevent the environment [15][23].

Directive 2008/98/EC starts with waste, recycling and recovery definitions. It also explains how waste can be classified to be a secondary material or product. The aim of the waste management is protecting the environment without giving harm to human health, animals or plants, water, air and soil.

In terms of waste management European Union has published a directive (2008/98/EC) which gives details about goals for EU countries according to different types of waste. After giving the definition of waste, to standardize waste management at EU countries, the directive mentions the objectives as follows: "In order to comply with the objectives of this Directive, and move towards a European recycling society with a high level of resource efficiency, Member States shall take the necessary measures designed to achieve the following targets:

- (a) by 2020, the preparing for re-use and the recycling of waste materials such as at least paper, metal, plastic and glass from households and possibly from other origins as far as these waste streams are similar to waste from households, shall be increased to a minimum of overall 50 % by weight;
- (b) by 2020, the preparing for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 70 % by weight." [16].

Turkey is not a member of EU but as a candidate ministries are trying to edit regulations according to the EU standards. In 2008, ministry of environment and forestry published a waste management action plan that includes 4 years for each cities in Turkey. It stated goals for cities to manage solid and hazardous waste types in order to protect environment and human health.

There is no goal like gaining 70% of materials with recycling at 2020 which is mentioned in the EU Directive, for Turkey in the related regulation. At Turkey, every year 125 million tons excavation soil is evaluated to regain. At the current situation construction and demolition waste amount is nearly 4-5 million tons per year. With the new regulation of rehabilitation of areas that are under risk of disasters for

the first 3 years, annual goal will be 40% that is 10 million tons/year and 6 million tons/year for regaining materials [14].

It is difficult to manage construction and demolition waste in EU because of strict goals which is mentioned before. A study showed that Southern Europe countries need development in their measures, and Central and Northern countries need new models to integrate waste management technologies locally, so that waste management systems will work efficiently to be able to reach those governmental goals [17].

INTEGRATING GREEN HOSPITAL DESIGN TO GSCM

To reach the waste management goals with using GSCM starts with the reduction of the raw material that is thought to be used in the structure body. It is hard to make the balance between the strength and the amount of the material at the design phase according to different material types. It is possible to use “green” materials while reducing the amount and make the structure as strong as it was with the traditional materials. There are new types of materials that can be used as substitutes. With the advantage of being light and durable, they are also recyclable so that can be connected to GSCM. If a closed loop is designed to make the system sustainable, manufacturer will be able to use waste materials in the other construction projects as second quality materials. To reach regulation goals both in Turkey and EU, waste amount has to be reduced and most of them has to be recovered at the end of the life cycle. Green hospitals will already help the reduction of the materials and will also provide energy savings. The Green Hospital is defined as a hospital that has taken the initiative to do the one or more of the following: choose an environmentally friendly site, utilizes sustainable and efficient designs, uses green building materials and products, thinks green during construction and keeps the greening process going. A Green Hospital is constructed around a facility that recycles, reuses materials, reduces waste, and produces cleaner air [18]. In 2002, the American Society for Healthcare Engineering (ASHE) published the Green Healthcare Construction Guidance Statement, the first sustainable design guidance document emphasizing a health based approach (ASHE, 2002). The Green Guide for Health Care, the healthcare industry’s first best-practices, voluntary green building tool, modeled with permission after the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) rating system, was initiated in 2002, followed by periodic updates and the registering of pilot projects to bolster participation [19]. While emphasizing the importance of integrated design, the Green Guide is organized in two sections—construction and operations—to facilitate its use. Using the Green Guide for Health Care as a foundational reference document, the LEED for Healthcare Application Guide development process began in 2004. With its release anticipated in 2007, LEED-Healthcare will represent the first third-party green building certification tool customized for the healthcare sector. The rapid market uptake of these tools and resources is manifested today in more than 40 million square feet of green healthcare facilities, representing about 180 healthcare projects. These include more than 100 Green Guide pilots, six LEED certified projects, and about eighty LEED-registered projects. By embracing a life-cycle view of human health and environmental stewardship as strategic definers of success, this new generation of healthcare tools—and the buildings they guide—is poised to accelerate the adoption of health-based green building standards in other sectors [20].

Hospitals and healthcare represent an essential societal function, with a fundamental mission to care for and heal the sick. In many respects, healthcare institutions are held to a higher ethical standard than virtually any other enterprise, as to do good, not merely to do well [21].

Green Hospital promotes the following [22]:

- Sustainable building materials
- Products free of mercury, latex, PVC, and DEHP
- Energy and water conservation
- Tools and resources for environmentally preferable purchasing
- Greener cleaners
- Integrated pest management
- Waste Reduction and Recycling
- Green Electronics
- Managing pharmaceuticals
- Environmentally Preferable Medical Waste Treatment and Disposal
- Safer alternatives to PBDEs: products in health care settings
- Nutritious, Sustainable Foods and Food Systems

It is hard to implement a new system in a whole project. For this reason architectures should think of the green building principles at the beginning of the design phase. Both green building design and GSCM will result with the economic and social benefits while fitting the governmental requirements.

Developed supply chain model

A closed loop supply chain will be sustainable for construction industry that will also suit the definition of green supply chain management explained above. The following model will reduce the disposal amount of waste material with the help of recycle, repair and remanufacture operations.

A supply chain model is developed, with green building design integration, for a construction firm in Turkey [Fig. 2]. By this model, construction firm will able to sell their recovered materials to the secondary markets and get profit from them. In the previous model, firm was not able to know what is happening to their

waste after sending them to the landfill. Thus, this new model will be sustainable for the environment that materials will not left on the ground while giving harm to the environment. Also at the beginning of the design phase, raw material usage will be minimum according to green building principles. Usage of recyclable materials will be increased and energy efficiency technology will be preferred.

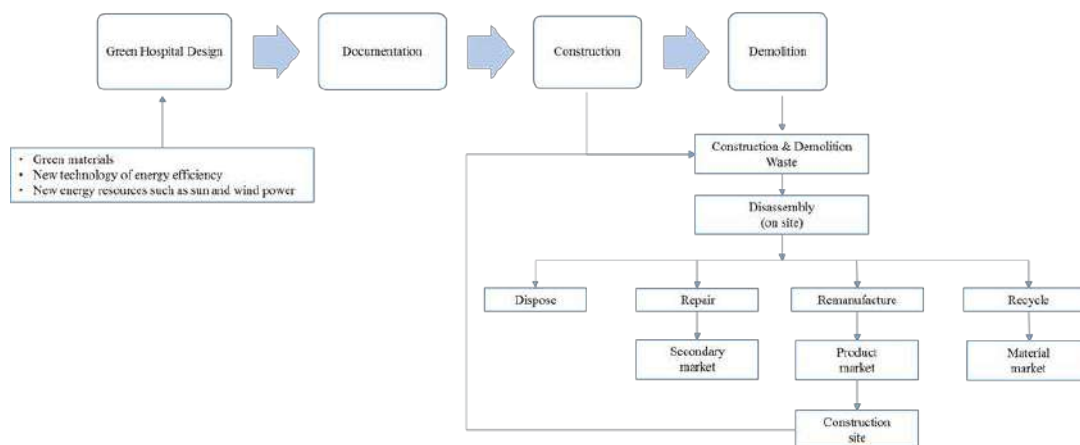


Fig. 2: Developed supply chain model with green hospital design integration.

Benefits of GSCM in green hospitals

By using green supply chain management, at the beginning of the design phase “green” requirements of a hospital is already being provided. As mentioned in the second part, green hospital requires every kind of efficient energy sources, helping people to reach easily and –usually- by walk or bicycles. With GSCM, raw materials have to less used and also be mostly recyclable. If the waste cannot be recovered with any kind of techniques, then the most proper disposing should be done. This issue is more important for green hospitals because of patients that are already in the building. This view has to be considered for also every kind of materials and food that will be consumed inside the hospital. Although GSCM model shows only the beginning and the end of the chain that green issues are implemented, the management has to be sustainable for the whole life cycle of the green hospital to keep environment and people safe.

CONCLUSIONS AND RECOMMENDATIONS

The aim of this paper is to explore the social-benefit reflections by combining GSCM and green hospital design, based on the literature review and EU directives for Turkey, to build and propose a model regarding Green Hospital operations using GSCM and reverse logistics. A green supply chain management flow chart for a green hospital was established to understand the waste management system clearly in Turkey. Based on the literature review, Green Building principles and EU directives from Turkey a model was built and propositions regarding green supply chain management and reverse logistics were formulated for a green hospital. Benefits of GSCM is considered for especially for green hospitals which is one of the popular topics in the world. To make the supply chain sustainable, in the design phase of a construction, the materials may be used less and green materials may be preferred. As mentioned in the regulations first aim has to be to reduce waste, so it may be done with using less raw material if it is possible. This development can be provided with “green building design” principles at the beginning of the construction project.

Finally it can be said that if these above mentioned improvements are applied as integrating green building design to GSCM, setting a supply chain for a hospital construction, the system will be sustainable and the construction firm will be able to minimize the cost while making profit from their own waste and the most important it will be environmentally friendly and less harmful for the human health.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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CHARACTERIZATION OF COPPER(II)-ZIRCONIUM(IV)-IMIDAZOLATE FRAMEWORK SYNTHESIZED BY HYDROTHERMAL METHOD

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ABSTRACT

Copper(II) imidazolate and two different mass ratio of copper(II) - zirconium(IV) bimetallic imidazolate (2Cu:1Zr and 1Cu:2Zr) were synthesized by hydrothermal method using metal sulphates in aqueous solution. The metal imidazolate frameworks were characterized by field emission scanning electron microscope (FESEM), thermogravimetry (TG), ultraviolet-visible spectroscopy (UV-Vis) and N₂ adsorption-desorption. The addition of zirconia increased the surface area of the metal organic frameworks and also makes it thermally stable up to 250 °C. The incorporation of zirconia into the copper(II) imidazolate improves the visible light absorbance. The band gap of 2:1 and 1:2 mass ratio of copper(II) - zirconium(IV) imidazolate increased to 2.70 eV and 3.28 eV, respectively, with more absorbance in the visible region compared to copper(II) imidazolate with 1.65 eV.

INTRODUCTION

KEY WORDS

Photocatalyst, Copper, Zirconia, Hydrothermal, Imidazolate Framework

The metal-organic frameworks (MOFs), which are self-assembled by the coordination of metal cations/groups with organic linkers, have potential applications in catalysis, gas storage, sensors, nonlinear optics, and separation. Due to the high surface area of MOFs, high metallic deposits are observed, and the limited micropore circulation leads to monodisperse nanometric metallic groups [1][16]. Contrasted with different sorts of metal-organic structure materials, ZIFs frequently exhibited better thermal and chemical stabilities [2-4]. Today's main issue is worldwide ecological increasing temperature, which is due to burning of fossil fuels causes rising CO₂ level in the atmosphere. Photocatalytic transformation of CO₂ under ambient conditions offers an attractive solution to reduce greenhouse gasses. Numerous metal oxide semiconductors, for example, ZnO, CdS [5], TiO₂ [6] and Zn₂GeO₄ [7] etc. have been explored for photoreduction of CO₂ into fuels. However, the economics of the CO₂ conversion process is low. This is mainly due to the recombination of photogenerated electron-hole, low usage proficiency of sun-powered vitality and low adsorption of CO₂ [8, 9]. Specifically, expanding the surface area of photocatalysts is a powerful approach to provide more receptive sites and superior adsorption properties and therefore enhance the photocatalytic reaction. Metal-organic frameworks(MOFs) have drawn great attention for their potential use as adsorbents and catalysts because of the high surface area, huge pore size, tunable nanometer-scale holes, and chemically modify ability [10][15].

Copper(II) imidazolate has been developed by hydrothermal method [11]. In this study, the same method was used to synthesize copper(II) imidazolate and copper(II) - zirconium(IV) imidazolate (CuZrIm 2:1 and CuZrIm 1:2) to study the influence of zirconia on the physiochemical properties of copper(II) imidazolate (CuIm). The physiochemical properties were studied by using a field emission scanning electron microscope (FESEM), thermogravimetry (TG), ultraviolet-visible spectroscopy (UV-Vis) and N₂ adsorption-desorption.

EXPERIMENTAL

Synthesis of copper(II) imidazolate (CuIm)

0.25 g imidazole (3.67 mmol) in 15 mL H₂O was added to 0.5 g CuSO₄.5H₂O (2 mmol) in 3 mL of H₂O, and then 4M NH₃ (aq) was added to produce a 25 mL of solution. The mixture was poured into Teflon-lined stainless steel autoclave and hydrothermally treated at 110 °C for 48 h. The solid product collected by filtration and washed with deionized water for 3-4 times. The sample was finally dried at 80 °C overnight in an oven.

Synthesis of copper(II)-zirconium(IV) imidazolate (CuZrIm 2:1 and 1:2)

In synthesizing, CuZrIm 2:1, imidazole (0.25 g, 3.67 mmol) in 15 mL water was added to stirred suspension of CuSO₄.5H₂O (0.5 g, 2 mmol) and Zr(SO₄)₂.H₂O (0.25 g, 0.83 mmol) in 3 mL of H₂O. As for CuZrIm 1:2, 15 ml of imidazole solution (0.25 g, 3.67 mmol) was mixed to mixture of CuSO₄.5H₂O (0.25 g, 1 mmol) and Zr(SO₄)₂.H₂O (0.50 g, 1.65 mmol) and bringing the volume up to 25 mL with 4 M NH₃ of both solutions. The mixture was hydrothermally treated into the Teflon autoclave, which keeps it in an oven at 110 °C for 48 h. The product filtered, washed with deionized water for 3-4 times, and then dried overnight in an oven at 80 °C.

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CHARACTERIZATION

The morphology, and elemental compositions of the catalyst were studied using field emission scanning electron microscope-energy dispersive X-ray (JEOL6340). The surface area, and pore volume were analyzed using gas adsorption device ASAP 2020 (Micrometrics Instrument). The materials were degassed at 200 °C for 2h under 50mTorr vacuum. The surface area calculation was explained by Brunauer-Emmett-Teller (BET) isotherm method, while for micro and mesopores evaluation utilized Horwarth-Kavazoe, and BJH methods, respectively [12]. The UV-Vis spectroscopy in the 200-800 nm was measured with an Agilent Cary 100 UV-Vis Spectrophotometer and diffuse reflectance spectroscopy is used to determine the optical absorption in the visible light region. A thermogravimetric analyzer (TGA) was used to measure weight changes of the sample, when heated under nitrogen flow with a heating rate of 20 °C/min from room temperature to 500 °C. The examining TGA was done on a Perkin Elmer Pyris 1, which exhibits the thermal stability of the materials.

RESULTS AND DISCUSSION

The thermal stability of the synthesized materials are shown in [Fig. 1]. The comparing results appeared in [Fig. 1]. The weight loss started at 280 °C and continued up to 600 °C in Culm.

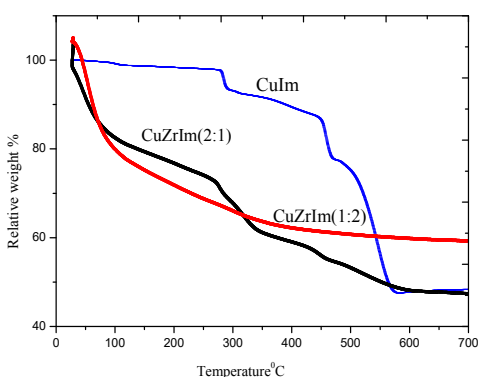


Fig. 1: Thermo gravimetric analysis of metal imidazolate frameworks.

Addition of zirconia into Culm, shows higher thermal stability. CuZrIm 2:1 shows weight loss at 80 °C, which means sample contains water molecule, continued to 600 °C, and then 49% remain same as Culm. Beside this, an increment of zirconia (CuZrIm 1:2) exhibits weight loss from 80 °C to 100 °C water loss from sample and then weight loss up to 300 °C and then 65% remains. All the above results show that CuZrIm 1:2 indicates higher thermal stability.

The diffuse reflectance UV-vis spectra were used to determine optical properties of the three metal imidazolate frameworks. [Fig. 2] illustrates the optical absorbance of the three metal imidazolate. Band gap energies were determined by the DR-UV-vis. For materials, the band gap energy in this investigation could be assessed from a plot of $(\alpha h\nu)^2$ versus photon energy $h\nu$ /eV. As presented in [Fig. 3], the immediate band gap for Culm, CuZrIm 2:1 and CuZrIm 1:2 are found to be 1.65, 2.70, and 3.28 eV, respectively.

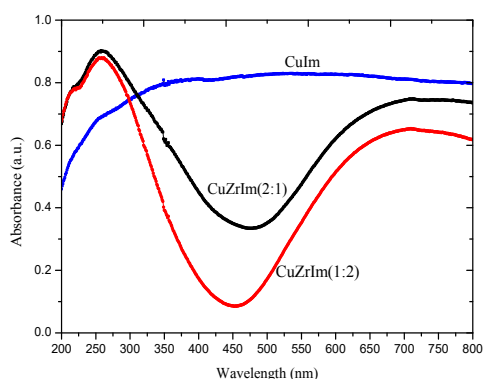


Fig. 2: Diffuse reflectance UV-vis spectra of Culm, CuZrIm 2:1 and CuZrIm 1:2.

The band gap of zirconia is larger (5-7 eV). Therefore, an incorporation of a larger band gap of zirconia into Culm results in shifting of the band gap to lower energies. As can be seen, both CuZrIm show their optical absorbance edges between 400 and 550 nm, which indicates absorbance in the visible light region. The results suggest that CuZrIm 2:1 and CuZrIm 1:2 can be photoexcited to create more electron-hole pairs than Culm under visible light absorbance which could leads to higher photocatalytic efficiency.

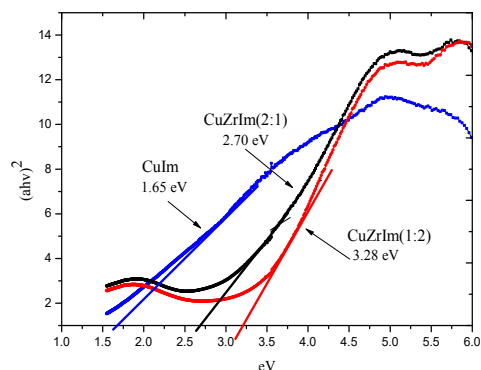


Fig. 3: Diffuse reflectance spectra for band gap measurement of Culm, CuZrIm 2:1 and CuZrIm 1:2.

The impact of zirconia on the morphology of the Culm was studied using FESEM. The FESEM micrograph of the samples are shown in [Fig. 4]. It can be seen from [Fig. 4], that the surface characteristics of Culm were significantly changed with the addition of Zr. The surface morphological exhibits different particle shapes as illustrated in [Fig. 4]. CuZrIm 2:1 and 1:2 exhibit smaller and uniform particle size. However, more particles agglomerated to form crystal-like structure with the addition of more Zr.

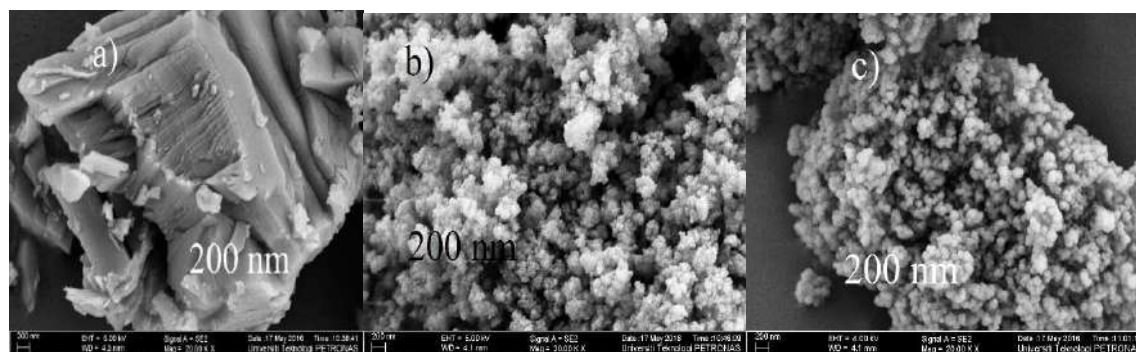


Fig. 4: FESEM images of (a) Culm (b) CuZrIm 2:1 and (c) CuZrIm 1:2.

The average diameters increased from ca. 120 to 170 nm by increasing the Zr^{4+} doping percentage in the nanocrystals. This confirms that fewer nuclei were formed upon addition of imidazole. Cu and Zr-doped imidazolate crystals initially formed grew further with increase addition of single monomeric imidazole, solvating Zr^{4+} , and Cu^{2+} species until the framework is formed. Regardless of the doping percentage, FESEM images showed rather small and monodispersed nanoparticles with a well-defined truncated rhombic dodecahedron structure, which is the typical imidazolate framework morphology.

[Fig. 5] outlines the FESEM mapping, and EDX of the Culm and CuZrIm 1:2 sample demonstrating the metal distribution on the surface of support. Every component present in the sample structure is finely distributed by dots with a specific color. It can be seen from the [Fig. 5], that Cu species are homogeneously distributed. The EDX examination of CuZrIm 1:2 showed that Cu, Zr, C, and O were the main 4 components observed on the surface of sample.

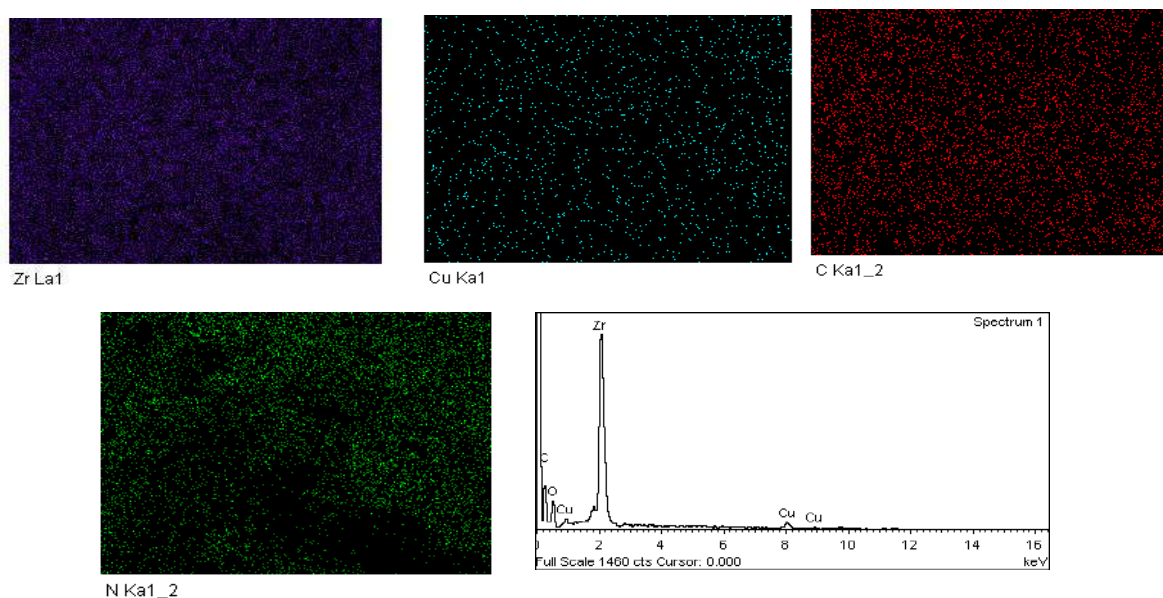


Fig. 5: Representative elemental mapping of Culm and CuZrIm 1:2.

As shown in [Fig. 6], Culm presents a combination of type III and IV isotherm [13] at relative pressures below 0.9. This is due to the low surface area, where isotherm relates to samples with a low affinity for the adsorbate (N_2) which exhibits a mixture of macroporous and mesoporous characteristics. This exhibit type IV at high relative pressure.

Both CuZrIm 2:1 and CuZrIm 1:2 give the characteristic of mesoporous solids because it shows hysteresis loop type H-1 adsorption isotherms with type IV [Fig. 6]. Each isotherm shows a distinct hysteresis loop, which is associated with capillary condensation taking place in the mesoporous. It shows that the photocatalyst is mainly mesopores. Sharp inflections in-between P/P^0 of 0.9–1.0 and typical H-1 type hysteresis loop are observed for both CuZrIm [12].

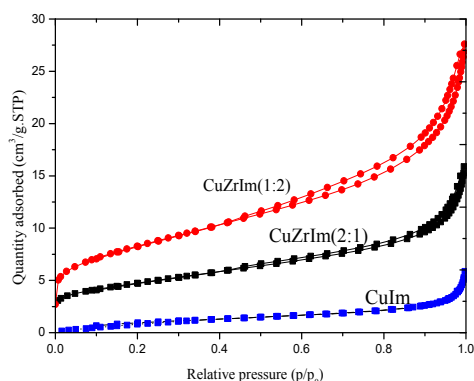


Fig. 6: Hysteresis loops of different catalyst.

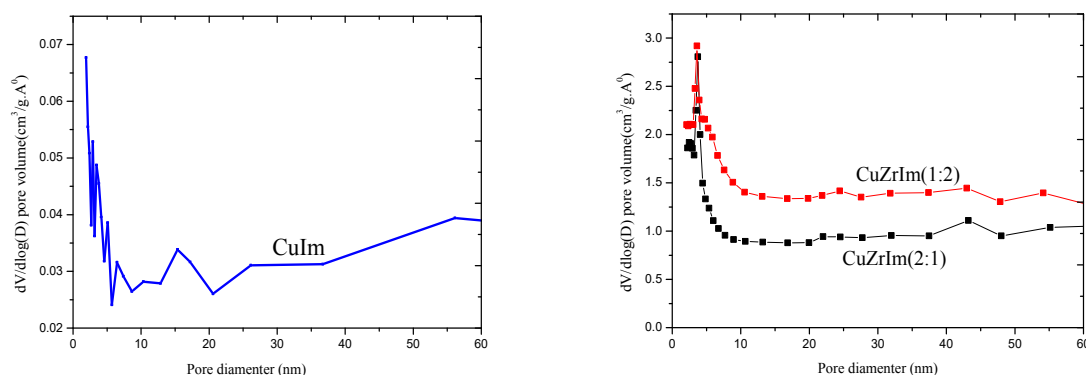


Fig. 7: Pore-size distributions with average pore sizes.

The surface area of the materials was executed by nitrogen adsorption. [Table 1] shows nitrogen adsorption properties of the three metal organic frameworks. As indicated by the Brunauer–Emmett–Teller (BET), the BET surface ranges of Culm, CuZrIm 2:1 and CuZrIm 1:2 were computed to be 4.11, 120.33 and 234.15 m²/g, respectively. It gives proof that increment of zirconia loading shows the highest surface area and pore volume of the sample but the average diameter of pores is smaller. It is evident from [Fig. 7] that Culm and both CuZrIm (2:1 and 1:2) has a narrow pore size distribution. Culm has average pore size distribution at 2.0 nm and both CuZrIm has average pore-size distribution at 5.0 nm. Most of the pores are in mesoporous region (2 nm - 10 nm). It is suggested that the high surface:volume ratio of the CuZrIm results in higher surface-energy stabilisation as opposed to the Culm phase [14].

Table 1: Specific area and pore volume

Catalyst	Surface Area (m ² /g)	Pore Volume (cm ³ /g)	Average Diameter of Pore (nm)
Culm	4.1197	0.007848	7.61987
2:1CuZrIm	120.3357	0.201338	6.50423
1:2CuZrIm	234.1586	0.365294	6.06503

CONCLUSION

Copper(II) imidazolate and copper(II)-zirconia(IV) bimetallic imidazolate (2:1 and 1:2 mass ratios) were synthesized by hydrothermal method using metal sulphates in mild aqueous conditions with high yields. The physicochemical properties of the photocatalysts were examined by different characterization techniques. The thermal stability, surface area and pore volume of both CuZrIm is higher than Culm. It is found that the band gap of CuZrIm 2:1 and CuZrIm 1:2 increased to 2.70 eV and 3.28 eV, respectively with more absorbance in the visible region compared to copper(II) imidazolate framework.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

Financial assistant from Universiti Teknologi PETRONAS (UTP) and Ministry of Higher Education Malaysia, FRGS No: FRGS/2/2013/SG01/UTP/02/2 is gratefully acknowledged. The authors acknowledge use of facilities within the UTP Centralized Analytical Laboratory (CAL).

FINANCIAL DISCLOSURE

None

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ARTICLE

A SECURE DEEP BELIEF NETWORK ARCHITECTURE FOR INTRUSION DETECTION IN SMART GRID HOME AREA NETWORK

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ABSTRACT

The Deployment of Smart Grid requires consideration of all the security parameters in the entire architecture of Smart Grid. Data Security and Communication Security are the major milestones in security that need to be addressed in the present scenario in Smart Grid. In this paper we model a Deep Belief Network to detect the normal and abnormal behaviors in the traffic pattern of Smart Grid data. Deep belief Network has been deployed to identify the anomalies in the Smart Grid data traffic thereby detecting intrusion. Support Vector Machine has been used for intrusion classification after creating the Deep Belief Network Model. Using SVM model with deep belief networks has helped in reduction of data complexity and also in identifying the core features to be considered for the implementation of Intrusion detection in Smart Grid Model.

INTRODUCTION

Security is gaining high focus in the Smart Grid deployment in the recent years[1]. New strategies for implementation of security in data communication in the Smart grid network remains an expensive task. Primary issue in security can be override by the detection of third party intruders in the Smart Grid Network. Hence intrusion Detection needs to be tackled at every level of communication in Smart grid before the deployment of Secure Smart Grid[2]. Smart Grid Architecture model contains mainly three phases: Generation, Transmission and Distribution. Our work is mainly concentrated in providing communication security in the Distribution end of Smart Grid. Here we analyse the traffic patterns in the Last mile communication at the distribution side. The rate of data traffic at the distribution side is higher when compared to other phases in Smart Grid Architecture Model. Deploying security at this phase poses high challenges due to the massive data traffic. A better analysis of Smart Grid traffic data needs to be done to identify the anomaly and to detect intrusions. Consequently Big Data and Machine Learning solutions need to be considered while working with Smart Grid traffic data. Big Data Analytics and Machine learning has become promising areas while deploying security in major areas of research [3]. Smart Grid traffic has massive data for analysis and hence we need to extract meaningful features from these massive input data for decision making context in identifying the normal and abnormal behaviours. Feature extraction requires efficient methods since these features are used for classification of data as well as for creating prediction model. The Input data from the Smart Grid poses many format variations and large amount of noise. It may also be of greater dimensions which makes it harder to analyse. Deep learning algorithms offer solutions to these analysis of massive Big data [4].

DEEP BELIEF NETWORKS FOR SMART GRID DATA TRAFFIC

In this section we have presented a theoretical background of Deep Belief Networks. Design Architecture of our proposed Deep Belief Networks have been presented here. The key concept in Deep learning algorithms is the extraction of key features from the numerous features in the Big Data which may have both wanted and unwanted elements[5]. Deep Belief Networks generates a small amount of data for classification from unlabeled big data thus making it faster. Since these models are largely motivated from artificial intelligence and neural networks they follow a hierarchical pattern for analysis[6].

A multi layer architecture is deployed in Deep Belief Networks with each layer identifying features and relationships which are beyond immediate neighbours from previous layers. Each layer of DBN is constructed by Restricted Boltzmann Machines(RBM)[7,8]. Restricted Boltzmann machine (RBM) can learn probability distribution from a set of input data. The core block networks of the DBN are Restricted Boltzmann Machines (RBMs), which consists of a visible layer and a hidden layer[9-11]. The visible variables in the layer are described as the features of the input data. RBM uses Contrastive Divergence algorithm to approximate samples of data was proposed by Hinton[12,3]. Deep Belief Networks takes as input a matrix representation of data set and identifies patterns which are used to identify relevant features in each layer of the DBN architecture[13,14][16,17].

KEY WORDS

Smart Grid,
Deep Belief
Network
Intrusion
Detection,
Home Area
Network

Received: 10 October 2016
Accepted: 12 November 2016
Published: 1 Dec 2016

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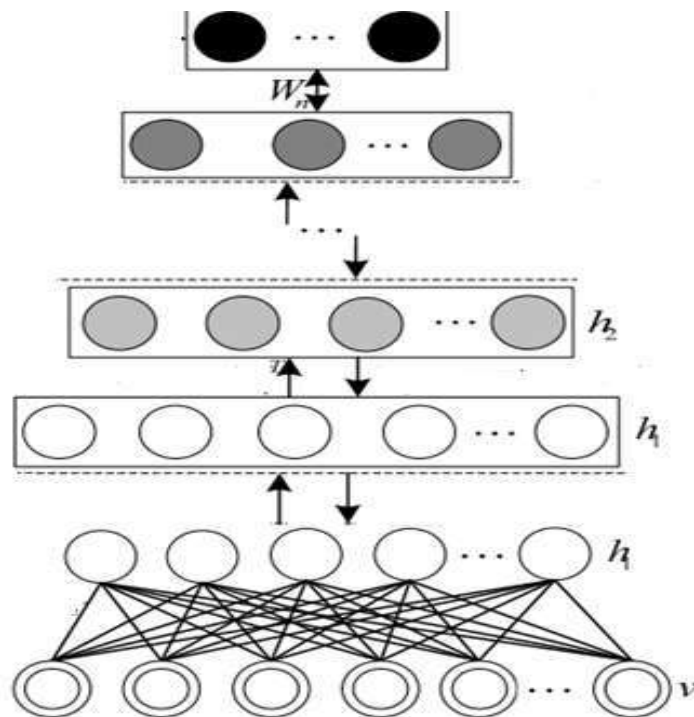


Fig. 1: Deep belief network representation.

RBM consists of a matrix of size $m \times n$ having weights W between hidden units h and visible units v , and offsets x, y for the visible units and hidden units respectively. The general Energy representation of RBM is denoted by $E(v, h)$,

$$E(v, h) = -xTv - yTh - vTw h \quad (2.1)$$

By using the Energy function Marginal probability of visible vector is calculated. The features having probability less than this marginal probability are removed to extract relevant features. The Marginal Probability of visible vector is the sum of configurations of hidden layers.

$$P(v) = (1/Z) \sum_h e^{-E(v, h)} \quad (2.2)$$

Here Z represents Partition function.

Algorithm for deep belief network architecture

Procedure for DBN Architecture

D: Data

RBM: Restricted Boltzmann Machine

RV: Set of RBMs

TD: Training Data

TRBM: Train RBM

NFRBM: Not Final RBM

LRBM: Last RBM

MAV: A Boolean variable to identify whether to use Mean Activation Value or not when moving to other values in RBM layers.

QF: A Boolean variable to identify whether or not to query L_h (Hidden layer).

1. Input Data to training data set
2. For all RBM in RV perform

RBM $\leftarrow$ TRBM(TD)

 until LRBM
3. If (NFRBM) || (LRBM & QF) then

D $\leftarrow$ Move(RBM, D, MAV)

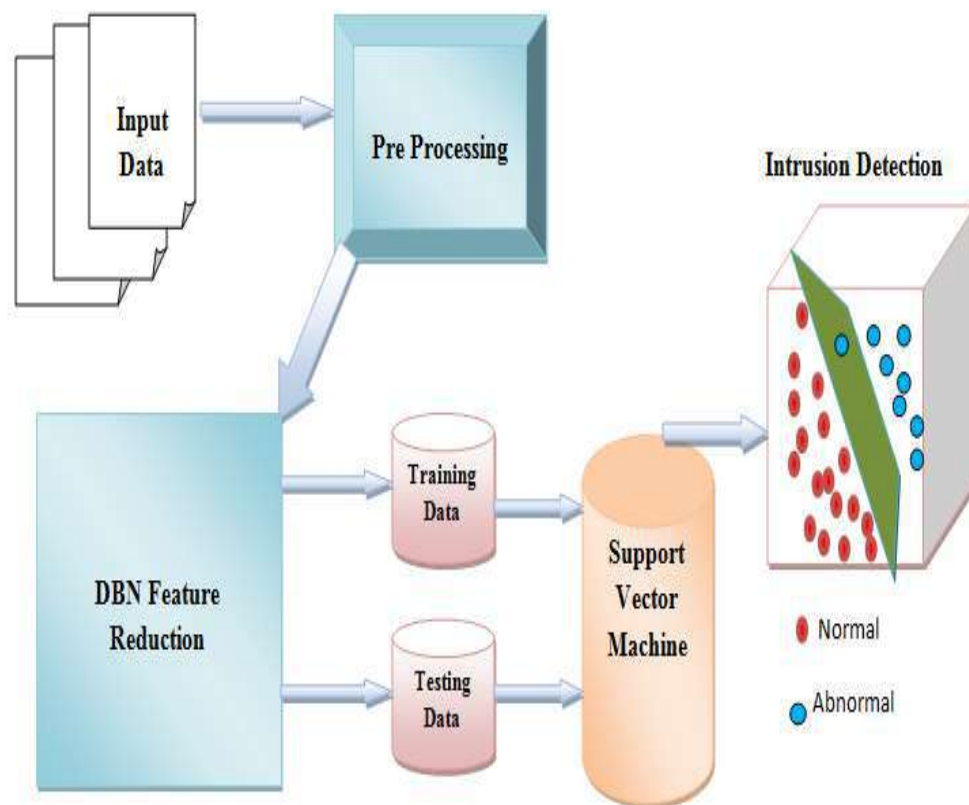


Fig. 2: Intrusion detection architecture model using DBN.

IMPLEMENTATION OF ANOMALY DETECTION USING DEEP BELIEF NETWORKS

Deep Belief Network Learning is semi supervised machine learning algorithm which identifies sudden behavioural changes called anomalies in data behaviour. The steps involved in Intrusion Detection using RBM :

1. Remove Noise from input data.
2. Input N:No of Layers
3. For all L_i
 - (i)Applying training for the first layer L_i of preprocessed data.
 - (ii)Input Mean Activations as training data to second layer L_{i+1} .
4. Repeat (3) for N no of layers in ascending order moving through layers in upward direction until layer L_N is reached.
5. Apply SVM Classifier for Reduced DBN Data.
6. Calculate threshold value to identify whether data is normal or abnormal cluster centres until no reassigning is needed.

In this paper we use Deep Belief Networks to extract relevant features from the large traffic data in Smart Grid. Input data from traffic is pre-processed to remove noises and unwanted elements. The pre-processed data is fed into Deep Belief Network to reduce the features and to identify important features. The output of DBN will have same number of rows for data set and the number of columns indicating features will be reduced. The output of DBN is given to Support Vector Machine Classifier. SVM classifier identify whether each row in the data set represents a normal or abnormal behaviour based on the training data. We have implemented Deep Belief Networks using R Programming with the help of package deep net. For the purpose of Visualization Weka has been used. [Fig. 3] depicts the graph obtained to demonstrate the normal and abnormal behaviour. The blue points normal data and red points represent abnormal data

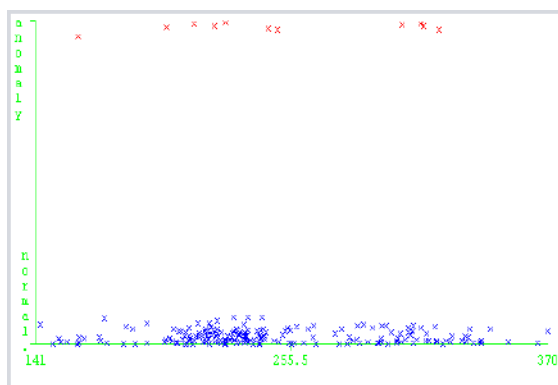


Fig. 3:

Table 1: Evaluation on training set in weka

SI No	Parameters	Values
1	Total No of Instances	199
2	Correctly Classified Instances	188 - 94.47%
3	Incorrectly Classified Instances	11 - 5.52%
4	Mean Absolute Error	0.1084
5	Root Mean Squared Error	0.2286
6	Time taken to test model on training data	0.01 seconds

Here we have taken 199 instances and the result showed 188 correctly classified instances and 11 incorrectly classified instances.

=== Confusion Matrix ===

```

a  b  <-- classified as
188  0 |  a = normal.
11   0 |  b = anomaly

```

Fig. 4: Confusion matrix of normal and anomaly instances.

[Table 1] shows the evaluation conducted. Mean Absolute Error measures the average errors in a data set[15]. Root Mean Squared Error uses quadratic calculation for determining the average magnitude of error in a data set. Both these values are used together to identify the variations in errors. [Table 2] shows detailed class accuracy for the testing data. TP rate, FP Rate denotes the rate of correctly classified instances and incorrectly classified instances respectively. Precision is calculated by dividing the true instances with the total instances (TP+FP). F-Measure is calculated using the equation, $F\text{-Measure} = 2 * P * R / (P + R)$, where P represents Precision and R represents Recall. Receiver operating characteristic (ROC) plots TP rate against FP Rate. PRC represents Precision Recall Curve Area. [Fig. 4] represents the Confusion Matrix which identifies 188 normal instances and 11 anomaly in the data set.

Table 2: Detailed Class Accuracy in Weka

TP Rate (TP)	FP Rate (FP)	Precision (P)	Recall (R)	F-Measure	ROC Area	PRC Area	Class
1.000	1.000	0.945	1.000	0.972	0.500	0.945	Normal

0.000	0.000	0.000	0.000	0.000	0.500	0.055	Anomaly
0.945	0.945	0.893	0.945	0.918	0.500	0.896	Weighted Avg

CONCLUSION

In this paper we have implemented anomaly detection for Smart Grid traffic data using Deep Belief Network algorithm which extracts relevant data from Big Data. A Deep Architecture has been deployed using DBN along with Support Vector Machine Classifier. A stack of Restricted Boltzmann Machines (RBM) networks are used to deploy DBN. The evaluation has been done in R programming and the anomalies hidden in dataset were identified. Results found for anomaly detection identified all the injected anomalies in the Smart grid traffic. Weka tool has been used to plot graphs to identify anomaly in traffic for better visualization.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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ARTICLE

STUDIES WITH THE HEAT PUMP COMPRESSOR AUTO REFRIGERATED

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ABSTRACT

The paper proposed to change the principle of linking the basic elements of TN, replace traditional expensive, overall and metal-plate heat exchanger evaporator and condenser on flexible tubular heat exchangers, compressor placed inside stacked in a circle around the flexible evaporator coils. Ensure thus self-regulated compressor cooling and heat absorption is released from the surface of the compressor during operation. Was made model sample of a new heat pump, conducted his experimental research. Measures the temperature of the compressor modes, evaporator, condenser, and heating and cooling. We studied three options: first, when the compressor is located in the center of the evaporator; Second, when the compressor is located off center, closer to the wall of the evaporator and the third when the compressor is located at the center of the evaporator, but was excluded from the evaporator heat radiation by installing cutoff walls of the cylindrical partition. Experiments have shown that the surface temperature of the walls of the evaporator was 120C, the air around the compressor being located inside the evaporator coil was about 200C. Moreover, with the increase of the compressor temperature, evaporator surface temperature and air temperature around the compressor is reduced. Such a regime confirms compressor cooling effect of the evaporator and a partial absorption of the evaporator heat generated by the compressor.

INTRODUCTION

Contamination of the environment, climate change has become a real threat to the planet. The Kyoto Protocol of 1997 and the final of the 21st UN Conference in Paris in 2015 [1] set a goal - to accelerate the transition to a society and economy, consuming little carbon technologies by changing the energy policy and the existing infrastructure. The only way is the gradual replacement of traditional systems with new technologies involving energy balance of renewable energy sources (RES). Kazakhstan actively participates in international programs, organized by the World Exhibition EXPO 2017 on "green" energy [2]. According to forecasts by the year 2030 can be increased to 30% renewable energy share of the world, where one of the leading seats for heat pump technology and heat pumps (HP) [3]. With enormous energy-saving potential, the technology has become a rapidly developing field. Spending 1 kilowatt of electricity to pump drive, get 3-4 kW of heat energy. Annual sales volume VT in the world reached \$ 125 billion. The main area of application energy use low-grade energy sources (LGES). The technology does not cause environmental damage, and the potential is huge and LGES renew. These include: solar energy, heat dissipation, which is contained in the ambient air, earth, water. VT are most effective when there is a simultaneous cooling and storage products, air-conditioning air space with the disposal of excess heat cooled products, residential and industrial premises.

Based on this principle of integration of solar energy technology, other LGES [4], [5], [6]. The article suggests the technical and technological solution HP increases technical and economic indicators. In the solution in contrast to known analogs made self-regulating cooling compressor, maintaining its temperature with the heat released from the absorption surface of the compressor during its operation [7]. New technical solutions and internal communications led the study laws HP, which previously no one investigated.

Currently, the intensity of CO₂ emissions from electricity generation is 0.507 kg CO₂ / kW • h. According to the International Energy Agency (IEA), the figure for 2050 could be reduced to 0.067 kg CO₂ / kW • h due to the rapid growth of renewable energy and improve power generation technologies. It is also known that conventional energy prices are rising and will continue to grow due to the exhaustion of resources [8].

The only economically and environmentally acceptable alternative must be HP[9]. For comparison, traditional energy give less thermal energy units per unit of energy expended. Heat pumps, on average per year, capable of kWh of electricity consumed to provide up to six kilowatt-hours of thermal energy. This indicator is called the average annual efficiency factor (SPF) [10], [11], [12], [13]. The modular form allows for power to hundreds of MW, with high reliability. Known mega-project - the Stockholm heat pump station with a capacity of 520 MW, which heats 63% of consumers of the capital of Sweden, and the heat source is seawater with an average annual temperature of about + 50° C [14].

KEY WORDS

Heat pump, compressor, condenser, evaporator, control

Received: 15 Oct 2016
Accepted: 14 Nov 2016
Published: 1 Dec 2016

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Analysis IEA studied the effectiveness of primary energy consumption in the production of electric energy, its influence on the selection using CO₂ heat pump as compared with the gas heating[15].

Table1: Comparative indicators of the use of heat pumps and the traditional system with a gas boiler [15].

Technical Equipment		Heat pump SPF=4	Heat pump SPF=6	Gasfired heater
Load (kWh)		100		
Efficiency (a)		4.00	6.00	0.95
Secondary energy use, (kWh)		25	17	105
Primary energy use (kWh) for different power generation efficiency (%) (b)	20%	125	83	105
	30%	83	56	105
	40%	63	42	105
	50%	50	33	105
	60%	42	28	105
CO ₂ emissions (kg) for different CO ₂ intensity, (c, d, e) in (kg/kWh)	0.507 (c)	12.7	8.5	—
	0.459 (d)	11.5	7.7	—
	0.067 (e)	1.7	1.1	—
Kr CO ₂ /m ³	0.208 (f)	—	—	17.1
Heat from ren. energy (kWh)		75	83	—
a) SPF for heat pumps and COP for gas-fired heaters b) Power generation efficiency including transmission losses c) CO ₂ intensity of electricity generation in 2007 d) CO ₂ intensity of electricity generation in 2050 (IEA ETP 2010 Base) e) CO ₂ intensity of electricity generation in 2050 (IEA ETP 2010 Blue) f) CO ₂ intensity of liquid natural gas (LNG) in Japan				

Two variants were studied heat pump - with CPE to 4 and 6 and with the efficiency of the gas heater 0.95. The condition of the problem is to provide the consumer 100 conditional units of energy. At the same time, gas heater will consume 105 units of primary energy as 5 units lost.

Heat pumps for these purposes, 25 and 17 consume power units (secondary power), respectively. A necessary amount of primary energy (coal gas) depends on the power generation efficiency (%). For example, if the efficiency of 20% of primary energy consumption of heat pumps with 4 and 6, taking into account the losses in transmission and distribution of electricity, are respectively 125 and 83 units. Gas heater consumes 105. That is, its performance is higher than the first HP, but lower than the second HP. When the efficiency of 30%, both the heat pump, with the indicators 83 and 56 units, superior gas heater. Later, until 2050, it is projected to bring the efficiency of primary energy use to 60%. Then the corresponding primary energy consumption of heat pumps will be reduced to 42 and 28 units[16].

When conditions are predicted taken a corresponding reduction in CO₂ emissions intensity for electricity generation and emissions from the use of a gas heater (table 1, position a, d, e, f). By 2050 projected emissions reduction to 0.459 kgCO₂ / kW • h. At the same time for heat pumps, they constitute 11.5 and 7.7 kg. When optimistic forecast kgCO₂ 0,067 / kW • h for heat pumps emissions amount to 1.7 and 1.1 kg. While the gas boiler for 17.1 kg.

As can be seen, from an environmental point of view, with all assumptions, heat pumps offer significant advantages. The projected decline over time carbon intensity of electricity production by boilers of new generation further increase the benefits of heat pumps [16]

MATERIALS AND METHODS

The compressors are one of the most important parts of the refrigeration cycle. The compressor compresses the refrigerant that flows into the condenser where it is cooled. It then passes to the expansion valve, evaporates, and finally sucked into the compressor again. Power conditioning refrigeration or air completely depends on the power of the compressor [17]. In the 90s of the last century to drive the compressor, instead of asynchronous motors, brushless DC motors have been used where the permanent magnets are installed around the perimeter of the rotor. Thus, the problem of flexible regulation and control of the engine speed has been solved. Subsequently, their characteristics have been improved by the use of special magnets based on rare earth materials [18][21,22].

The new system of automatic control and management modes of compressors, fans and heat exchangers, depending on the air temperature inside and outside the premises, served as a new impulse for the further development of heat pumps. The most significant results were obtained through the use of scroll compressors

and inverter control refrigerant flow (VFR variable flow refrigerant) [19], [20].

With this in mind, we proposed a new structural and technological solution that takes into account the shortcomings of the known analogues. Driving the new solution is shown in [Fig. 1].

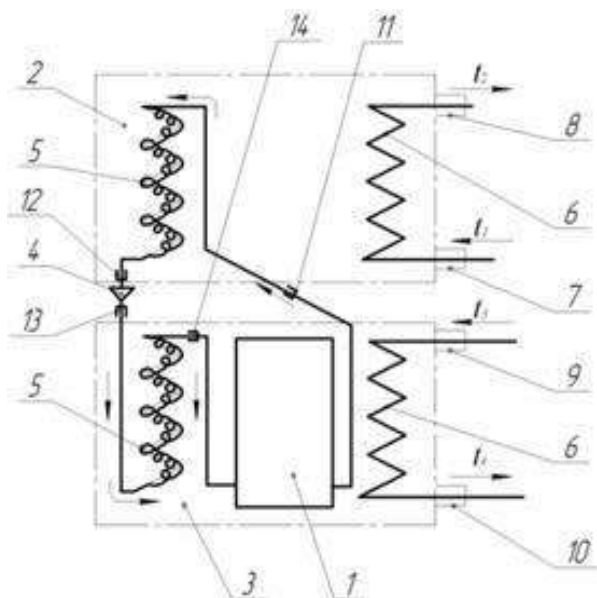


Fig.1: Scheme of structural unit of the new HP.

The heat pump includes: a compressor 1, a condenser 2, an evaporator 3, a throttle device 4, which made structurally a like as coil heat exchangers of the condenser and the evaporator "pipe in pipe", comprise an inner pipe 5 through which circulates the coolant and the external conduit 6 which, namely the annulus, circulates coolant bathing the conduit 5. In this case, the inner pipe 5 is arranged in a spiral pattern to create a helical channel for circulating the coolant in the annulus. External piping equipped with condenser and evaporator entry spigots 7, 8, 9 and the output 10 of coolant, with the proviso that the nozzles are arranged to enter the refrigerant outlet side, and output from the refrigerant inlet. Structurally, the condenser and evaporator piping heat exchanger coils stacked one above the other, along a helical path with the same average diameter and pitch of turns, forming a cylindrical shape, with the placement of the condenser above the evaporator and the compressor within the evaporator. Sequential connection compressor to the condenser, a throttling device with condenser, throttling device and an evaporator with an evaporator to a compressor formed respectively by means of choke connectors 11, 12, 13 and 14

In operation, the refrigerant circulating in a closed circuit from the compressor 1 travels through the inner tube 6 of the heat exchanger of the condenser 2, expansion device 4, the inner pipe of the evaporator 3 and is returned to the compressor in the vapor state. In the process of passing through the condenser coil heated refrigerant gives up its heat to the heat carrier, and the condensed. Passing through the evaporator conduit absorbs heat from the coolant flowing from the low temperature source. Then, the refrigerant is fed back into the condenser and the cycle is repeated.

[Fig. 2] shows a diagram of the experimental stand where HP (1) is set in the middle. As NPTE source for HP used milk cooler (2), as well as a consumer of energy storage vessel (3). The circulation of the coolant in the cooling circuits of milk and provide a buffer tank circulation pumps.

Milk cooler is filled to a predetermined volume of water is heated to a temperature of fresh milk (35 ... 36°C). The initial temperature of the water in the buffer tank is maintained at a level of 200 °C. After establishing the required temperature distributions when temperature variations do not exceed $\pm 0,1^{\circ}\text{C}$ for 10 min, the work turns HP which begins to cool the milk and heat the water in the buffer tank.

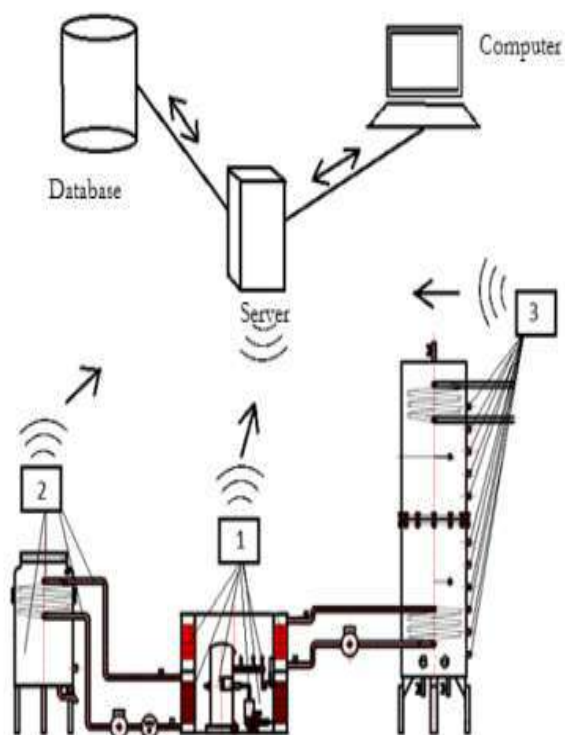


Fig. 2: Process monitoring system.

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1 - Heat pump module, 2 - module cooling milk, 3 - module storing space..

Cooling capacity and thermal recorded heat meters, which are set by the evaporator and condenser fixed microcontroller. According to these parameters is given the value of the integrated cooling capacity and thermal performance over time.

[Fig. 3] schematically displayed the collection, transmission, processing and storage of data in research. The basis of the information system constitute the central unit (server), database, personal computers, software, and data acquisition modules with heat pump (1) Coolers of milk (2) and buffer tank(3). Heat pump module collects data from these sensors 12, temperature sensors (DS18B20 encapsulated) two fluid flow sensors (G1WFM) and two pressure sensors (Wika-R1). milk cooler module is connected to the 4th temperature sensor (DS18B20) and one flow rate sensor (G1WFM). battery module collects data from 15 temperature sensors (DS18B20), successively arranged along the vertical direction. The process of collecting information triggers the central unit by sending a request to each module separately. After receiving the request, each module begins sensors survey and collect data in a single package, which is subsequently sent back to the central unit. Server receives packets with the "raw" data processes them according to the relevant algorithms for easy storage. The server then sends the data to the database for storage. You can view the current values, using special software from the user PC.[Fig. 4] shows a fragment of the experimental studies.



Fig. 3: Detail of experimental studies HP,

Experimental studies conducted HP for 3 variants:

1st variant - the compressor is located in the center of the evaporator.

2nd option - the compressor is off-center, close to the wall of the evaporator.

3rd option - the compressor is located in the center of the evaporator, but ruled out heat exchange by radiation from the walls of the evaporator.

Each experiment is carried out at temperatures corresponding entry points T_h . The circuit arrangement of the temperature sensors and the pressure is shown in [Fig. 4].

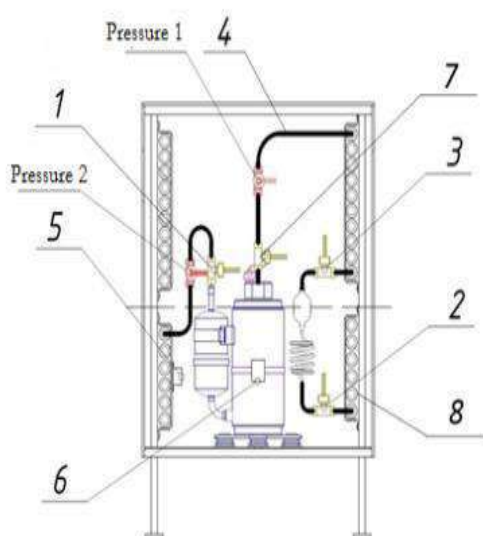


Fig.4: Arrangement of the sensors in HP.

Work evaporator is characterized by four other sensors 1 and 2 and sensors at the inlet and outlet of the evaporator coil [Fig.4]. They also show the temperature of milk in the milk cooler.

Work capacitor characterize four sensors 3 and 4, and sensors at the inlet and outlet of the condenser exchanger [Fig.4]. They also show the water temperature in the accumulating tank.

The temperature of the compressor show mode sensor 6 attached to the side wall and the sensor 7 is attached to the compressor cover. Sensor 6 indirectly indicates the temperature state of the motor, which is located inside the compressor 6. opposite point temperature sensor 7 characterized by a cap which is directly compressing refrigerant. The temperature condition in the space between the compressor and the evaporator show sensors 5 and 8.

Temperature recording schedules, the refrigerant pressure in these points in [Fig. 5], and power characteristics are shown in [Fig. 5 ... 14].

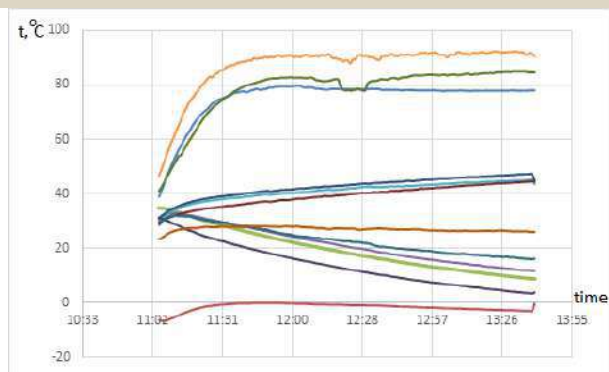


Fig. 5 (a): Temperature characteristics of heat pump.
 (Option 1 - the compressor is located in the center of the evaporator)

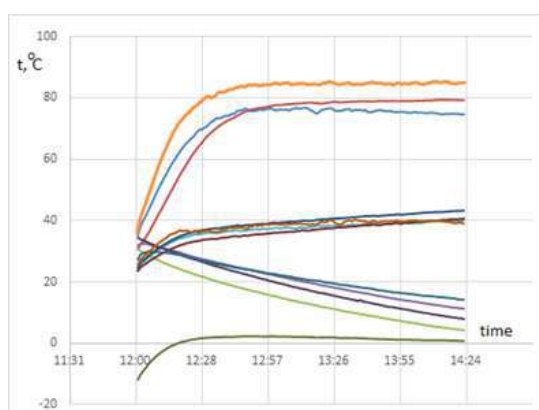


Fig. 5 (b): Temperature characteristics of heat pump.
 (Option 2 - the compressor close to the wall of the evaporator)

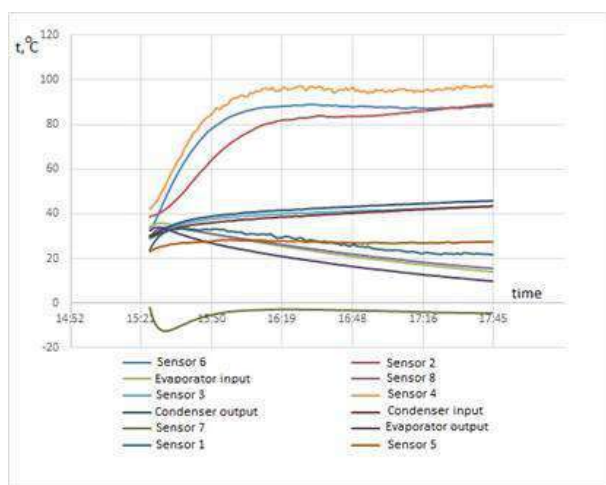


Fig. 5 (c): Temperature characteristics of heat pump (Option 3 - the compressor is isolated from the screen of the evaporator).

Analysis of the graphs of [Fig. 5 (a), (b) and (c)] shows that the temperature characteristics of the heat pump in all 3 variants are within acceptable operating levels.

the refrigerant temperature at the outlet of the compressor is the highest in the system HP, formed as a result of compression of the refrigerant (sensor 4). It rises to a maximum 950°C (option 3), the minimum up to 850 °C (option 2).

With a temperature of the refrigerant supplied to the input capacitor. As a result of passing through the condenser, the refrigerant cools and condenses at the condenser outlet (sensor 3) has 44-450S temperature [Fig. 5]. In the 2nd embodiment, as compared with embodiments 1 and 3, it comes out at a temperature below 50C.

The temperature difference between the inlet and the outlet of the condenser approximately 400 °C (third option) and 460°C in the 2nd version. Such differences between input and output is stored over the steady state (90 minutes).

As can be seen, for 43 minutes the temperature of the refrigerant out at steady state. In this case, the in let temperature to the condenser 3 installed on a stabilized value, 85-950°C. At the condenser outlet temperature continues to rise linearly from 35-40°C to 40-450°C. This is explained by an increase in temperature in the heat-sink capacity, respectively, decrease in the intensity of heat transfer agent.

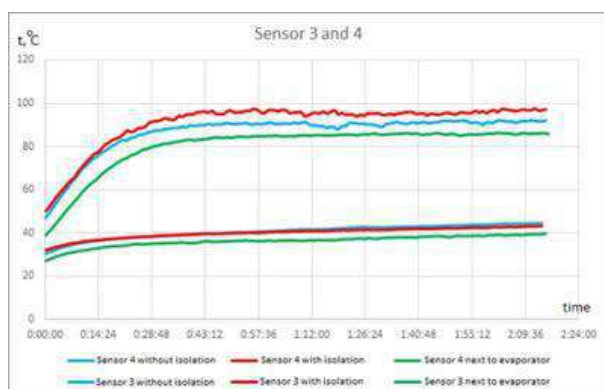


Fig.6: Graphs refrigerant inlet temperature (upper graphs) and the outlet of the condenser, with 3 options.

Comparison shows the embodiment that the temperature characteristics vary. In the 2nd embodiment, the refrigerant inlet temperature 3-400°. Clower than in the first embodiment and 7-80 °C than in the 3rd embodiment. This can be explained by the fact that, in the 3rd embodiment, due to lower cooling temperature of the above compressor. However, the temperature of the refrigerant leaving the condenser in the 2nd embodiment, below 50 °C, than in other embodiments.

RESULTS

The refrigerant temperature at the evaporator inlet is (probe 2) is the lowest in the whole system formed as a result of low-temperature boiling if it enters the vacuum zone. As the sensor 1, passing through the evaporator and absorbs heat milk, it increases.

[Fig.7] shows the temperature characteristics of the comparative "heating" of the refrigerant in the evaporator. As can be seen, at the inlet of the evaporator, the refrigerant flows at a temperature of -50 °C (option 1) to -120 °C (option 2) (lower graph). At the beginning of the process, before entering the operating mode, temperatures are sub-zero values. Then, as the ramp-up, the temperature stabilizes.

During the passage through the evaporator and the "heating" of the refrigerant temperature at the evaporator outlet increases to 280 °C, in the 3rd embodiment, and up to 330 °C in the 2nd embodiment.

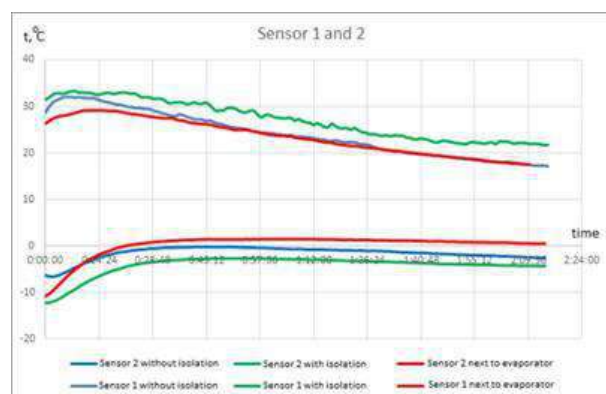


Fig.7: Graphs refrigerant inlet temperature (upper graphs) and the evaporator outlet at 3 variants.

Comparison shows the embodiment that the temperature characteristics vary. The lower inlet temperature (sensor 2) has the 2nd option, then 1 and 3rd options. When reaching the steady state, a higher temperature has a second option (220 °C), 1 and 2 options around 170°C. Accordingly, it is indicative of a higher cooling capacity, which can be observed on the testimony of the thermal energy meter. The temperature of the milk during the experiment is reduced from 35 to 100 °C.

According to the testimony of the sensor 7 [Fig. 8] of the compressor temperature in the steady state on the surface of the cap is between 800 °C (option 2) to 880°C (option 3). On the side wall surface (sensor 6) rises to 780°C [Fig.9]. The difference is small (around 20 °C), indicating a lack of engine overheating. Otherwise, it was possible to observe the sensor temperature exceeded 6, where the motor is installed in over.

Over



Fig.8: Temperature Charts compressor cap with 3 versions.

The temperature distribution in the 1 st embodiment is about 850 °C at the 2nd embodiment at 50 °C is lower indicating better cooling of the compressor with the 2nd embodiment. Judging by the performance characteristics shown in [Fig. 8], apparently, when the displacement of the compressor to the evaporator, the evaporator absorbs heat better compressor.

The highest temperature of the compressor 3 rd embodiment reaches 900 °C. However, the permissible temperature of the compressor heating to 1100°C is quite acceptable temperature zone for normal operation of the compressor.

Figure 9 shows the temperature characteristics of the comparative compressor side wall (sensor 6).

As shown, the compressor is heated strongly during the 3rd embodiment, when almost no heat exchange with the evaporator in the form of radiation and deteriorating its cooling. As mentioned above, this has some effect on the heat output of the compressor. The temperature difference between the 1 st and 2 embodiments is practically not observed.

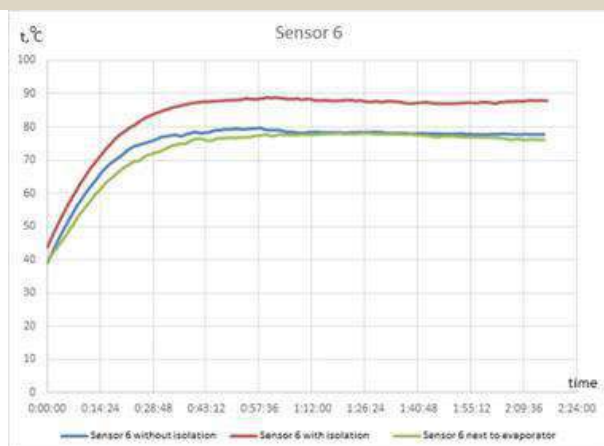


Fig.9: Temperature Charts compressor side wall in 3 versions.

The air temperature around the compressor (sensor 5) is stable at around 200 ° C [Fig. 10]. The surface temperature of the evaporator coil is about 120 ° C [Fig. 11]. Moreover, with the increase of the compressor temperature (sensors 6 and 7), the evaporator surface temperature and air temperature around the compressor is reduced. This mode confirms the effect of cooling the compressor and evaporator partial absorption of the evaporator heat generated by the compressor. favorable regime for the operation of the compressor.

[Fig. 10] shows comparative characteristics of the air temperature in the space between the evaporator and the compressor in 3 variants. Temperature characteristics of 1 and 3rd options are practically identical and equal 25-270 °C. In the 2nd embodiment, the temperature is in the range 20-230 °C. Features options indicate that the compressor is in good conditions. However, when the compressor displacement from the center of the air temperature around the compressor 4-50 °C below. This can be explained by the finding that when the compressor is in the approximate area to the evaporator, it is cooled better, below the surface temperature (sensor 6), and accordingly, it is less heats the surrounding air.



Fig.10: Temperature plots in the space between the evaporator and the compressor in embodiments 3.



Fig.11: Graphs the surface temperature of the evaporator in embodiments 3.

A comparative analysis of heat output and power consumption graphs for the study of 3 options [Fig. 12]. To analyze the use area with steady state operation after 30 minutes. operation. Starting the [process is discarded since there is the range of the independent reasons.

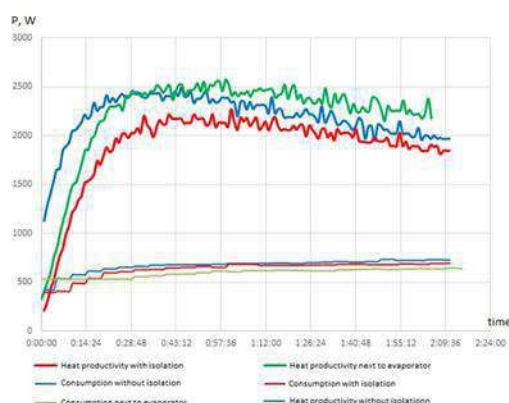


Fig.12: Charts heat output and power consumption under 3 versions.

As can be seen, the heating capacity options differ. Low rates are observed in the 3rd embodiment where heat output is 1800-2200 Watts. Indicators 1st option range from 2000-2300 Watts. The best performance in the 2nd variant, 2300-2500 Watts. It is 8% higher than that of the 1st embodiment, and 17% higher than that of the third embodiment.

The results show that the arrangement of the compressor in the evaporator zone of impact to Th. The evaporator absorbs the heat emitted from the surface of the compressor which is added to the main flow. In view of the fact that the temperature difference between the compressor Stack (about 800 °C) and the evaporator (about 180 °C) is 600 °C strand, it suggests that the main flow is radioactive heat transfer between the surfaces. As is known, in the 3rd embodiment, heat radiation is eliminated between the compressor and the evaporator, by setting the screen there between. Accordingly, there has been some decrease in performance. However, even under these conditions the compressor does not overheat because its convective cooling is maintained. Electricity consumption in all cases practically the same (bottom three depending [Fig.12]).

Energy conversion efficiency (ECE) are between 2.5 and 4.5 units [Fig. 13]. Thus, in the second embodiment, it is higher than the first by about 10% than in the 3rd embodiment, up to 15%.



Fig.13: Charts of ECE at 3 versions.

Graphs cooling options shown in [Fig.14], correlate with the heating performance graphs. Performance of the 1st and 3rd options are practically the same. In the 2nd embodiment, it is above. If the 1st and 3rd embodiments, the end of the process, it is poryadka 1200 W in the 2nd embodiment rises up to 1600 Watts. That is, above 25%.

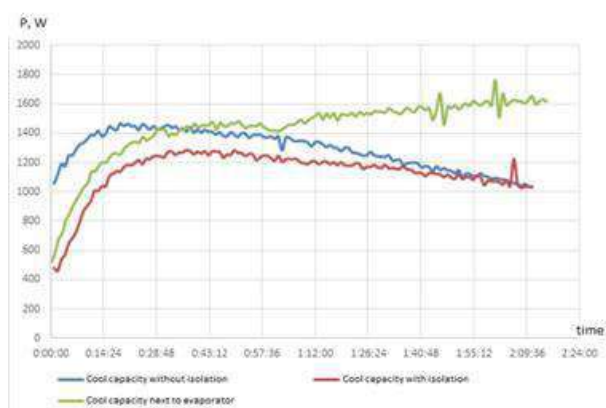


Fig.14: Charts cooling with 3 versions.

[Fig. 15] shows comparative characteristics of the pressure (bar) Refrigerant inlet (bottom graphs) and at the outlet of the compressor 3 variants.

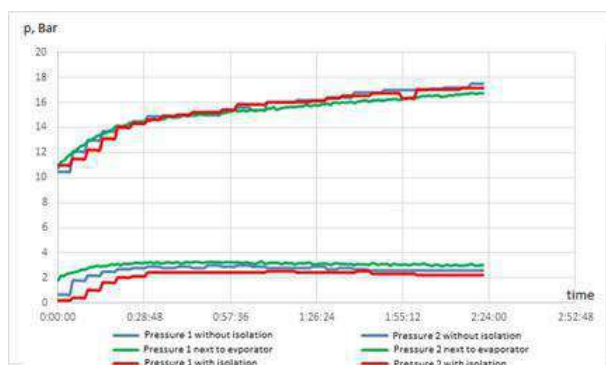


Fig.15: Graphs pressure (bar) Refrigerant inlet and outlet of the compressor in embodiments 3.

As can be seen, the pressure at the outlet of the compressor tends to continuously increase from 10 to 17 bar. This is explained by an increase in water temperature in the buffer tank, lowering the temperature of the milk. Maintaining increasing temperature difference between the condenser and the evaporator, increases power consumption and pressure influences.

CONCLUSION

The air temperature around the compressor, the evaporator is located inside the heat exchanger is maintained at a stable level of about 200 °C. The surface temperature of the evaporator coil is about 120 °C. Moreover, with the increase of the compressor temperature, evaporator surface temperature and air temperature around the compressor is reduced. Such a regime confirms compressor cooling effect of the evaporator and a partial absorption of the evaporator heat generated by the compressor, favorable regime for the operation of the compressor. However, when the compressor displacement from the center of the air temperature around the compressor 4-50°C below. This can be explained by the finding that when the compressor is in the approximate area to the evaporator, it is better cooled surface temperature and below, respectively, the less it heats the surrounding air.

CONFLICT OF INTEREST

The authors of the article will not conflict

ACKNOWLEDGEMENTS

The authors would like to be obliged to Kazakh Scientific Research Institute of Mechanization and Electrification of Agriculture for providing laboratory

FINANCIAL DISCLOSURE

The authors of the articles do not have problems with funding

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ARTICLE

MODELING THE BUILDING MATERIALS: APPLICATIONS OF PARTICLE DYNAMICS

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ABSTRACT

Background: In material science, the selection of the appropriate modeling method is usually performed on the basis of spatial scale. The particle dynamics, if properly combined with essential concepts of specific scale, overlaps a lot of spatial scales. Yet, for many dispersions in construction material science, the pair and external forces can be quite complex. **Methods:** Particle dynamics is combined with specific scalar criteria that allow to describe the kinetics of structure formation of building materials. **Results:** The representation of dispersion as particle system is formulated and standalone computation software is developed. We have demonstrated that time dependencies of criteria similar to average distance from the surface of each particle to the surfaces of four nearest particles allow to derive substantial data concerning structure formation at micro-scale level. **Conclusions:** In the present work we have proposed the model, discussed simulation software, and highlighted some modeling results that demonstrate the capabilities of said model and software. It is shown that the developed software can facilitate the insight that reduces time required for the design of novel materials.

INTRODUCTION

KEY WORDS
dispersions, particle
dynamics, building
materials

Rapid design of high-performance and cost-effective building materials is not possible without numerical experiments. At present, many methods are available for modeling the structure and formation of materials that are to be used in construction industry. Depending on spatial scale, the important among these methods are:

- (I) Exact, density functional, and semiempirical quantum calculations of atomic and molecular structure (lowest level, up to about 1 nm; these methods are often used for modeling polymeric, bituminous and sulfur binders [1]).
- (II) Particle dynamics – quantum molecular dynamics (nanoscale level, up to 100 nm; modeling the properties of mineral binders [2]–[6]), classical (Newtonian) particle dynamics (structure forming of building materials at micro- and macrostructure levels, [7], [8]), dissipative particle dynamics (rheology of liquid phases and fresh mixes, [9]), multibody dynamics (micro- and macrostructure of building materials, assessment of mechanical properties, [10]).
- (III) Smoothed-particle dynamics (rheology of liquid phases [11] and fresh mixes [12], fracture mechanics of macrostructure and construction units [13]) that, being meshless, is still often considered as finite element method.
- (IV) Conventional finite element methods (macrostructure of materials, construction units).
- (V) Geometric methods, that (again, depending on scale) are often combined with Monte-Carlo method [14], fracture mechanics [15], physical chemistry [16], percolation theory [14], [17], [18], particle dynamics and binder chemistry [19], [20].

Here, as before [21], we define the microstructure of building material as the spatial level where structure forming is mainly affected by surface effects (free surface energy, surface tension, wetting); the macrostructure is the level where structure forming is primarily affected by gravity and technological actions (pressure, vibration). The spatial boundary between macro- and microstructure depends on viscosity and specific surface energies; it is near to 100 μm .

It becomes obvious from the literature survey that particle dynamics – if it is properly combined with quantum chemistry, chemical physics, physical chemistry, chemistry, rigid body dynamics, etc. – overlaps wide range of scales; this is not surprising as the particle dynamics initially originated within celestial mechanics. Particle dynamics can be considered the best candidate for use as foundation for multiscale modeling that, by separating levels of descriptions and bridging them together within a framework of a single computational approach [22], permits computation of large scale systems while still yielding accurate results. For instance [5], results obtained by quantum molecular dynamics can be used for further assessment of mechanical values.

At the same time, every application of particle dynamics, including computational material science, requires careful selection of force fields and simulation algorithms. Considering the scales of primary interest – micro- and macrostructure – it have to be stated that particle dynamics models for these levels are always of semiempirical nature. Both the type and parameters of force field are usually selected on the base of thermodynamics of wetting, surface energies and rheology of dispersion. Whereas intermolecular pair forces are almost always attractive for long distances and repulsive for short ones, pair forces between particles of fine filler in many cases can assumed to be either always attractive (some lyophobic

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Received: 10 Oct 2016
Accepted: 12 Nov 2016
Published: 1 Dec 2016

systems) or always repulsive (any lyophilic systems). Moreover, in case of solvation shells around filler and/or viscosity gradient near the surface of aggregates, the pair force can not longer be assumed to be directed along the line between the centers of particles. Thus, despite the fact that there is currently a lot of software suitable for particle dynamics simulations, many existing software is only of limited use in material science.

The aim of the present work is to tersely discuss the model and simulation software that can be used for multiscale modeling of building materials, and also to present some modeling results.

MATERIALS AND METHODS

We have already mentioned the model in [5], and further explained it in more detail in [23]. Thus, here it is appropriate only to highlight the key points and to describe the statistical values that are going to be monitored during simulation.

The motion law of particles in dispersion:

$$, \quad i = \overline{1, N}, \quad (1)$$

where m_i is the mass of i -th particle, $\mathbf{r}_i = (x_i, y_i, z_i)$ is the position of particle, k_i is the parameter that depends on form of the particle and viscosity of the dispersion medium, u_i is the velocity of the dispersion medium at point $\mathbf{r}_i$, U_i is the scalar force potential at the point $\mathbf{r}_i$, and N is the number of particles.

The potential in right side of (1) can be the sum

$$U_i = U_b(\mathbf{r}_i) + U_g(\mathbf{r}_i) + \sum_{\substack{j=1 \\ j \neq i}}^N U_p(r_{ij}), \quad (2)$$

of potential U_b of boundary interaction, gravitational potential U_g , and the pair potential $U_p(r_{ij})$ (here r_{ij} is the distance between surfaces of the particles). Unfortunately, such simple representation does not allow to take into account the extra viscous forces that are caused by crossed solvation shells.

The (1) can be rewritten in equivalent form

$$\begin{cases} \dot{\mathbf{r}}_i = \mathbf{v}_i \\ \dot{\mathbf{v}}_i = \mathbf{g} + \frac{1}{m_i} \left(\sum_{\substack{j=1 \\ j \neq i}}^N \mathbf{F}_{ij} + \mathbf{F}_{i,b} + \mathbf{F}_{i,e} \right) \end{cases}, \quad (3)$$

where

$$\mathbf{F}_{ij} = -\mathbf{F}_{ji} = \frac{\mathbf{r}_{ij}}{r_{ij}^3} F_{ij} (r_{ij} - R_i - R_j)$$

is the pair force, F_{ij} is the modulus of this force:

$$F_{ij} = \frac{\partial}{\partial r} U_p(r_{ij}),$$

R_i is the radius of particle,

$$\mathbf{F}_{i,b} = \frac{\mathbf{n}_{i,b}}{n_{i,b}} F_{i,b} (n_{i,b} - R_i)$$

is the boundary force, $F_{i,b}$ is the modulus of this force:

$$F_{i,b} = \frac{\partial}{\partial n_{i,b}} U_b(n_{i,b}),$$

$\mathbf{n}_{i,b}$ is the vector drawn from the center of the particle to the nearest point of the boundary, m_i is the mass of the particle, $\mathbf{g}$ is the gravitational acceleration,

$$\mathbf{F}_{i,e} = 6\pi\eta R_i (\mathbf{u}_i - \mathbf{v}_i)$$

is the force of viscous friction, and $\mathbf{v}_i$ is the velocity of the particle.

The latter form allows to introduce arbitrary extra nonconservative force. In particular, the force that are due to solvation shells can be assumed to be proportional to the area of the cross section; the direction of such force are along the $\mathbf{v}_i$ that is projected to the plane of the cross section [23].

There can be three primary types of pair potential. For the lyophilic systems, this potential correspond to repulsion; thus, it can be taken in form

$$U_p(r_{ij}) = U_0 \left(\frac{r_0}{r_{ij}} \right)^k, \quad (4)$$

where U_0 is the characteristic energy, r_0 is the characteristic distance, k is the empirical parameter (for intermolecular forces, it is conventional to assume $k = 12$).

In general case, the pair potential in lyophobic systems has to represent both repulsion and attraction:

$$U_p(r_{ij}) = U_0 \left(\left(\frac{r_0}{r_{ij}} \right)^k - 2 \left(\frac{r_0}{r_{ij}} \right)^l \right), \quad (5)$$

where l is the empirical parameter ($l = 6$ for intermolecular interaction).

For dispersions with solvation shells, the pair potential can be taken in form of sum of Mie and Morse terms:

$$U(r_{ij}) = U_0 \left(\left(\frac{r_0}{r_{ij}} \right)^k - 2 \left(\frac{r_0}{r_{ij}} \right)^l + \exp \left(- (r_{ij} - r_0)^2 \right) \right). \quad (6)$$

To properly analyze the results, it necessary not only to visualize the particle positions, but also to monitor some statistical parameters during the simulation of the dispersion. We propose to monitor the following parameters:

(I) Average distance from the surface of each particle to the surfaces of four nearest particles (along with standard deviation):

$$R_{4av} = \frac{1}{N} \sum_{i=1}^N R_{4i}, \quad (7)$$

$$R_{4std} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (R_{4i} - R_{4av})^2}, \quad (8)$$

where R_{4i} is the distance from the surface of i -th particle to the surfaces of four nearest particles.

(II) Average number of particles, distances to surfaces of which are less than some predetermined value, e.g. radius of the current particle (along with standard deviation):

$$Nn_{av} = \frac{1}{N} \sum_{i=1}^N Nn_i, \quad (9)$$

$$Nn_{std} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (Nn_i - Nn_{av})^2}, \quad (10)$$

where Nn_i is the number of particles, distances to surfaces of which from i -th particle are less than some predetermined value.

(III) Average number of particles in k -th parallelepiped subdomain of bounding box of all particles (along with standard deviation):

$$Ns_{av} = \frac{1}{N} \sum_{k=1}^K Ns_k, \quad (11)$$

$$Ns_{std} = \sqrt{\frac{1}{K-1} \sum_{k=1}^K (Ns_k - Ns_{av})^2}, \quad (12)$$

where Ns_k is the number of particles in k -th parallelepiped subdomain of bounding box of all particles, K is the number of equal subdomains (in most cases it is enough to subdivide the bounding box into $K = 27$ subdomains).

(IV) Average absolute value of velocity of the particles (along with standard deviation):

$$v_{av} = \frac{1}{N} \sum_{i=1}^N |v_i|, \quad (13)$$

$$v_{std} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (v_i - v_{av})^2}, \quad (14)$$

where v_i is the velocity of i -th particle.

The proposed parameters (7)–(14) allow to make decisions about local (7)–(10) and global (11), (12) homogeneity of the dispersion. Parameters (13) and (14) can be used as indicators of stationary state.

RESULTS

Simulation software

The proposed model (including (3)–(6)) along with routines for (7)–(14) is implemented as standalone portable software [24] that is controlled by command files of specific format. At any moment during simulation it is possible to export representation of the system into MaxScript (built-in language of Autodesk 3DS MAX package) program that can be used for visualization.

The boundary of the modeling volume can be almost arbitrary in shape (though, if it is not a box, than parameters (11) and (12) are useless) due to its constructive solid geometry (CSG) representation; currently, planes, cylinders and spheres can be used in CSG tree. The fragments that define the CSG trees are embedded in the command file. Within the domain defined by any CSG tree, particles can be distributed either on equidistant basis or in according with some 1D, 2D, and 3D probability distribution (currently, uniform and normal distributions are implemented for any number of dimensions). In latter case, the trial-and-error approach is used to preserve minimum particle-to-particle separation distance. The examples of initial distributions are presented in [Fig. 1].

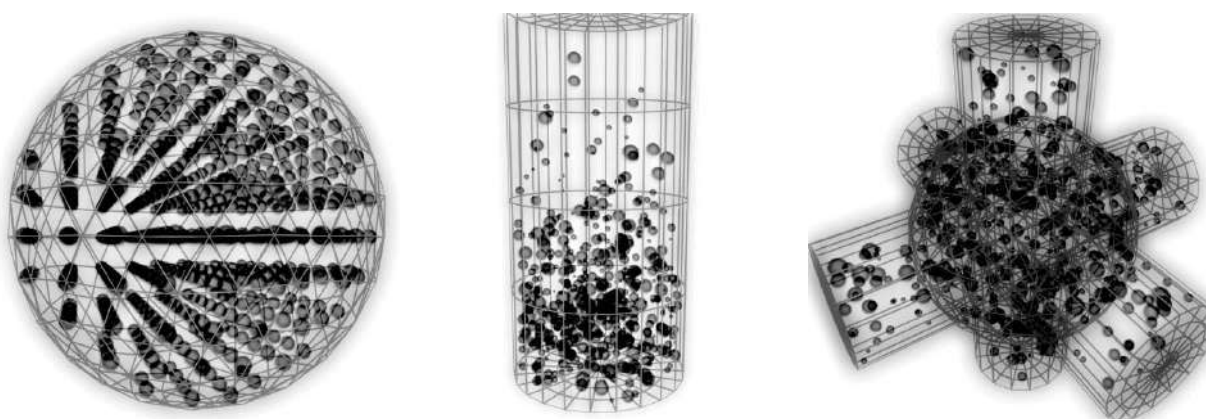


Fig. 1: Examples of initial particle distributions, left to right: simple cubic lattice of particles inside spherical boundary; 1D-normal, 2D-uniform distribution of particles inside cylinder; 3D-uniform distribution of particles inside complex CSG object.

Solution of (3) is performed by embedded Runge-Kutta method of order 4.5. Obviously, this method is not tailored specifically for particle dynamics, but – for real world dispersions – requirements for stability and consistent way to control the time step are often the primary arguments that determine the choice of integration algorithm. For now, we are considering the improvement of integration scheme as further work. Real-time visualization is also implemented in solver, though quality of the produced images are still far from typographic. Such visualization is only suitable for monitoring of the solution process.

The simulation software [24] is distributed under BSD license, but currently available only in source form. For some extra details, the paper [21] can also be referred.

Example of simulation

As an illustration we have performed comparative analysis of four lyophobic systems. The (5) was used as pair potential. Conventional values of 12 and 6 are used as k and l , respectively. The orders of magnitude for characteristic energy U_0 and characteristic distance r_0 were estimated earlier [25][26,27] during analysis of surface effects in the microstructure of disperse filled polymer matrix composites of different type and volume fraction v_f of the fine filler. The parameters of the systems are summarized in [Table 1]. All particles were uniformly distributed inside the sphere; diameters of particles were equal to 10 μm .

Table 1: Parameters of the lyophobic systems

Number of system	v_f	U_0, J	r_0, nm
1	0.1	10^{-23}	100

2	0.1	10^{-23}	1000
3	0.1	10^{-26}	1000
4	0.01	10^{-23}	1000

Time dependencies for local homogeneity parameters (7) and (8) are presented in [Fig. 2-5]. Final configurations of particles are presented in [Fig. 6].

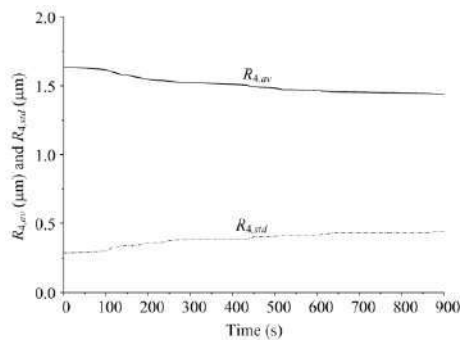


Fig. 2: Time dependencies for (7) and (8), system #1.

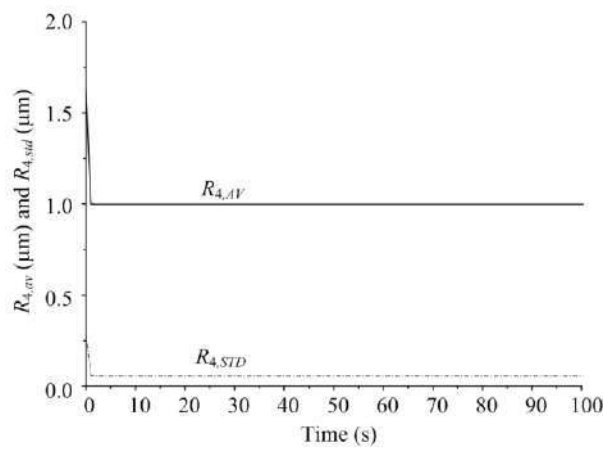


Fig. 3: Time dependencies for (7) and (8), system #2.

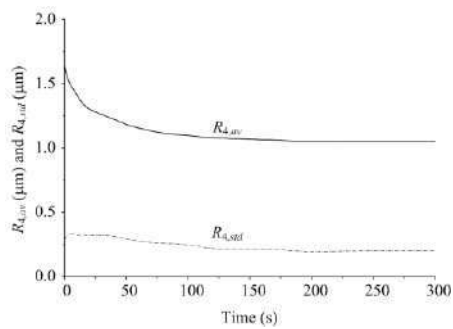


Fig. 4: Time dependencies for (7) and (8), system #3.

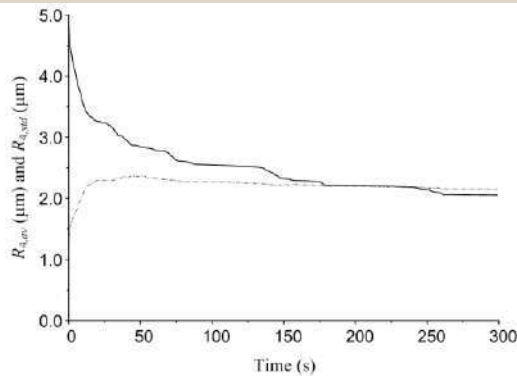


Fig. 5: Time dependencies for (7) and (8), system #4.

At the level of microstructure, the primary factors of influence are surface forces. It was stated [18] that such forces can lead to the forming of clusters, which influence significantly both on rheological properties of mixes and on the operational properties of the building materials.

As it follows from [Fig. 2], during the structure forming in system #1, the average R_{4av} slowly decreases. This can point to the fact that there can be cluster formation. However, such clusters are comprised from relatively small fraction of filler's particles [Fig. 6(a)]. Because of this, local homogeneity of the system #1 decreases over time ([Fig. 2], R_{4std}).

For system #2 the characteristic distance r_0 becomes the same order of magnitude as the size of the particles. In this case the rate of structure forming increases dramatically. During several seconds the entire system moves to the nearest local minima of potential energy. And, since the R_{4av} becomes almost exactly equal to characteristic distance r_0 [Fig. 3], this minima can even be considered as global. Most particles become parts of one percolation cluster [Fig. 6b]; this is also reflected by fast increase of local homogeneity ([Fig. 3], sharp decline of R_{4std}).

The characteristic distance r_0 is the primary factor that controls the cluster forming. For the system #3, value of characteristic energy is lowered by three orders of magnitude. Nevertheless, there are no principal changes in the peculiarities of cluster formation [Fig. 6c]: the R_{4std} is still decreases over time [Fig. 4]. The only difference is in that the rate of cluster forming is also slowed down by three orders of magnitude.

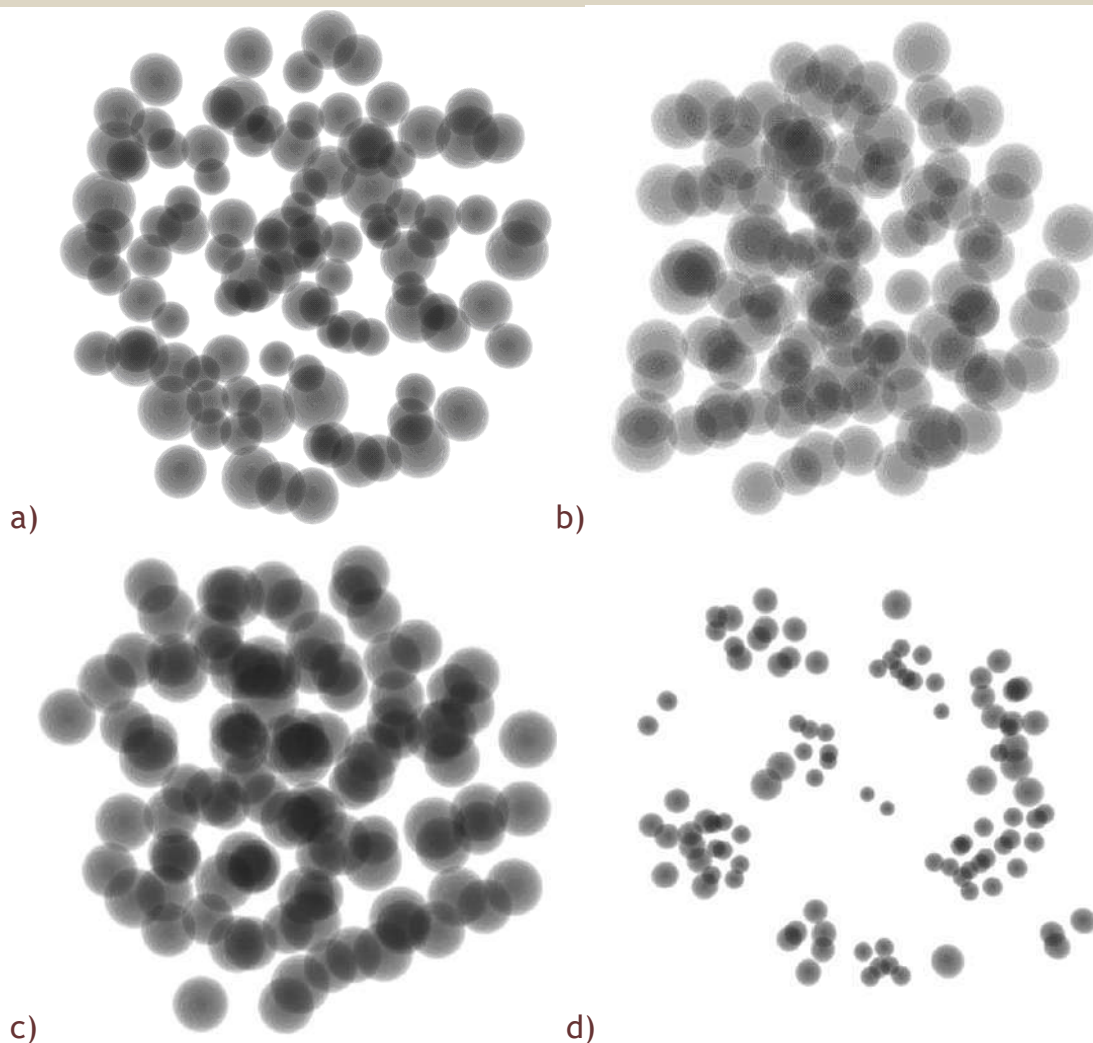


Fig. 6: Final configuration of particles, for systems: a – #1, b – #2, c – #3, d – #4.

And, finally, the essential feature of system #4 is the significantly lower volume rate of the filler. For this system, initial values of average distances between particles become considerably large as compared to ones for previous two systems. This, to some extent, can be viewed as the decrease of characteristic distance r_0 : as for the first system, the local homogeneity decreases if compared with the initial value ([Fig. 5], R_{4std}). There are, albeit, distinctions. The cluster forming process can be divided into stages (the boundary is near to 150 s, [Fig. 5]). During the first stage numerous isolated clusters are formed from particles that were initially near to each other. Forming of such clusters is reflected by substantial decrease of R_{4av} ; but it must be noted that even to the end moment the R_{4av} is twice as large as characteristic distance r_0 . During the second stage the R_{4av} slowly decreases, whereas R_{4std} remains practically constant. No percolation cluster is formed in the system #4; there are only isolated clusters [Fig. 6(d)].

CONCLUSION

Till present, no theoretical description of building material allows to derive a model for certain prediction of key operational properties.

Yet, the advantage of the particle dynamics is its both micro- and macroscale considerations, which allow to apply different levels of resolution, from microstructure up to coarse-grained macrostructure. It is shown in the present work that particle dynamics is the promising approach for simulating the microstructure of building materials, in particular – disperse filled polymer matrix composites. The performed simulations are useful for understanding the peculiarities of cluster forming in dispersions and facilitate the insight that can significantly reduce time required for the design of novel high-performance building materials.

The directions of further efforts will be extensive verification of simulation software, parallelization, code cleanup and implementation of the advanced visualization features.

CONFLICT OF INTEREST

The authors declare no competing interests in relation to the work.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

This work is supported by the Ministry of Science and Education of Russian Federation, Project #2014/107 "Structure formation of sulfur composites: phenomenological and ab initio models".

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ARTICLE

ROLLING ELEMENT BEARING SPALL DETECTION AND DIAGNOSIS USING A SIMPLIFIED APPROACH

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ABSTRACT

In recent years a number of advanced algorithms and techniques for diagnosing localized faults in rolling element bearings have been developed. These proposed algorithms and techniques are, in general, highly mathematically based and require a signal processing expert to understand the steps involved in this processing. In this paper a simple and effective surveillance and diagnosis means for detecting a defective component in a rolling element bearing from the measured vibration signal is presented. The approach is based on applying a smoothing filter to the absolute values of a first or higher derivative of the vibration signal before transforming it to the frequency domain to inspect its content. This gives a very useful first measure for detecting localized faults in rolling element bearings, without much complexity. This paper serves the purpose of presenting the algorithm and more work is being undertaken to expand the number of tested signals and compare it with highly developed algorithms in complex situations.

INTRODUCTION

Rolling element bearings (REBs) are main components in almost all rotary machines. Monitoring their health and preventing their failure is crucial for machines reliability and safety. REBs fail in a number of modes such as excessive loading, brinelling, overheating, lubricant failure, contamination, fatigue, etc. Fatigue failure results in spalls (pitting) which starts as localized faults and extends to become a distributed fault. When measuring the vibration signal from a defective bearing using an accelerometer, the signal contains a series of pseudo periodic (second order cyclostationary) bursts, which tend to excite natural frequencies of the structure [1]. The bursts are spaced at the frequency at which the ball passes over the defect (ball pass frequency: inner race, outer race or ball). Bearing fault bursts are normally weak, in particular for incipient faults, and are masked in the low frequency region by the presence of deterministic components and noise from other components in the system such as gears, blades, unbalance, misalignment, electrical noise, etc. Experimental ball pass frequencies are 1-2 % in deviation from the theoretical calculated frequencies due to the slippage of the rolling elements as a result of the variation of the load angle [2]. Slippage in rolling element bearings causes a fluctuation (smearing) in the defect frequencies and the direct detection using frequency analysis (raw Spectrum of the measured vibration signal) becomes difficult. For this a technique known as envelope analysis [2 and 3] is used for fault diagnosis. Envelope analysis is the basis of fault diagnosis in rolling element bearings. It was first introduced in 1974 by Mechanical Technology Inc. [3]. This technique was originally known as “the high frequency resonance technique” (HFRT), and is now denoted by other names such as “amplitude demodulation”, “demodulated resonance analysis”, “narrow band envelope analysis” or only as “envelope analysis”.

Localized defect in a rolling element bearing will result in an impulse response each it is in contact (under load) with another surface. These impulses will have an extremely short duration compared to the interval between them, and so their energy will be distributed across a very wide frequency range. The result is that various resonances of the bearing and the surrounding structure will be excited by the impacts. The essence of the HFRT is to perform an amplitude demodulation over an excited band and to calculate the frequency of the enveloped demodulated signal. This used to be carried out classically using an analogue circuit to band-pass filter the analogue vibration signal around a structural resonance (defined by spectrum comparisons) and then to use full or half wave rectification followed by a smoothing circuit to recover the approximate envelope signal. Recently [2] a digital approach for envelope analysis using the Hilbert transform has been proposed by Ho and Randall. In order to improve the detectability of bearing faults, signal pre-processing is usually carried out to separate the bearing signal from other deterministic components, which mask the bearing effect. The separation is possible by a number of algorithms such as angular resampling and synchronous average, discrete random separation (DRS), Autoregressive models, etc. [4]). To select the best band for amplitude, the power spectrum density of the defective signal is usually compared with the healthy signal and the band of the highest dB difference is selected as the optimum band. In the recent advances in bearing diagnosis, a number of auto-band selection methods have been proposed. Among these are the Kurtogram [5] and the Protrugram [6]. A comprehensive tutorial on a number of the state of art technique has been published recently by Antoni and Randall [1].

In this paper, a simple, effective and easy to use envelop analysis is proposed to enable detecting the presence of spalls in bearing and diagnose the source of these faults. The proposed algorithm is tested on a signal from a defective inner race bearing measured from a single stage gearbox. The paper is organized as follows. After this introductory section, the processing algorithm is presented in the next section. This is followed by the results section and conclusions. It is worth mentioning here that this paper introduces the basics of the algorithm and shows its successes on one case. Further work will be carried out to set criteria

KEY WORDS

Bearings, Diagnosis,
Spalls, Simplified
Approach

Received: 13 Octr 2016
Accepted: 16 Nov 2016
Published: 4 Dec 2016

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selection, expand the testing base with more complex signal and compare the results of this algorithm to established well accepted algorithms.

PROCESSING ALGORITHM

The proposed algorithm encompasses three main operations to obtain an envelope spectrum for bearing diagnosis. The processing flow is presented in [Fig. 1]. The first step of processing involves *whitening the signal using signal differencing* (signal differentiation). The second step is done simple by *taking the absolute value of the differentiated signal and smoothen it* using a smoothing filter. The third step is done by *performing a Fast Fourier transform (FFT)* to obtain the spectrum.

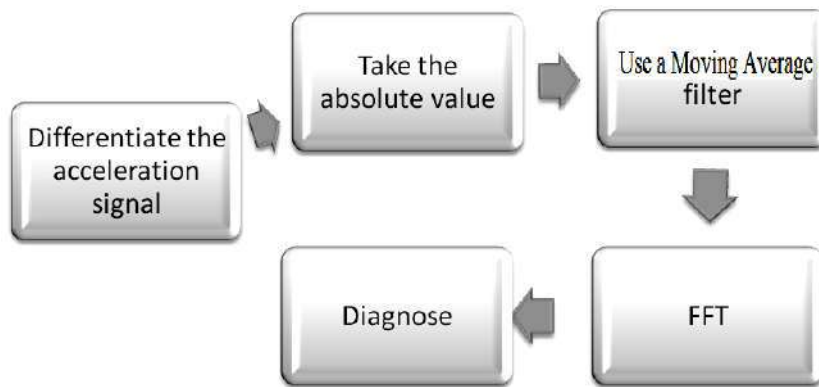


Fig. 1: Schematic presentation of the steps of the proposed simple envelope analysis.

In this proposed simple the band-pass filter around the structural resonance is replaced by differentiating the signal, which acts as a high pass filter. The full/half wave rectification is the process of taking the absolute values of the differenced signal. The smoothing circuit is replaced by a moving average filter, which acts as a low pass filter. The proposed procedure is quite simple, quick and easy to use. It utilizes basic functions and requires minimal parameters. [Fig. 1] shows a schematic presentation of the steps of the proposed simple envelope analysis.

Signal differencing

For a digitized signal, differencing (differentiation) refers simply to the process of taking the difference between two consecutive samples. In ref [7], it is shown that for a time series of length n :

$$x_1, x_2, x_1, x_2, \dots, x_n$$

First differencing (∇) as can be seen from (1), leads to a series of length $n-1$ such that:

$$\nabla x_i = x_i - x_{i-1} \quad \dots i = 2 : n \quad (1)$$

First-differencing has the effect of removing the linear trend from the series and thus reduces the correlation between the samples.

Signal differencing can then be thought of as a "high-pass filtering" for the time series; as it passes and enhances the high frequency variations and attenuates those low-frequencies. In ref [8][14], the first differencing has been recognized as the residual of an Autoregressive (AR) process of an order 1 (AR (1)). Sawalhi and Randall [9] showed that signal differencing and in particular the 4th derivative was found to give the highest kurtosis and clarity of detecting impulses. Bozchalooi and Liang [10] give a very detailed analysis and description to the enhancement of the signal to interference ratio (SIR) that can be obtained by the successive differentiations of the vibration signal in the case of detecting faults in rolling element bearings. They proposed a differentiation method to enhance the fault detectability. It is reported that the iterative application of a differentiation step can enhance the relative strength of the impulsive faulty bearing signal component with respect to the vibration interferences. This has the effect of preserving the effectiveness of amplitude demodulation and hence leads to more accurate fault detection. As a means to decide on the number of optimum number of differentiations, the percentage of kurtosis increase between one differentiation process and the other can be used as a guide; as the ultimate aim is to enhance the impulsiveness of the signal and to enhance the detection ability of impacts in the high frequency region.

Moving average smoothening filter

As the importance of detecting the faulty component in a bearing resides in finding the periodicity/frequency of the impulses, rather than the impulse high frequency content, it is recommended

to low pass filter the enveloped signal (absolute value of the high pass filtered signal, which was found by the differencing method). This can be achieved simply through a smoothing (Moving average filter). A moving average (MA) filter [11][13] in the simplest means implies replacing of each sample in the time domain by an average value of M samples. As the length of the filter (M) increases, the signal becomes smoother and the sharp events are reduced. Thus, it is usually considered as a good filter in the time domain, but not in the frequency domain. Smoothing is the opposite of the differencing/whitening process; as it removes the high frequency content of the signal rather than the low frequency variation. Smoothing can be achieved by setting a moving average window of a certain length (M samples), where the values of the new series represent the averaging of the M samples. In the simplest case (samples), this process gives a series (2):

$$Y(i) = \frac{1}{M} \sum_{j=0}^{M-1} x[i+j] \quad (2)$$

where:

x : Absolute values of differenced signal

Y : Smoothed signal

M : Filter length

The order of the smoothing process can be guided by the average length (duration) of the enveloped impulses, which can be examined visually to make this decision. This is discussed in the experimental results to set an example.

RESULTS

The vibration signal collected from a single stage gearbox (spur gear) [12] with a defective (seeded fault) inner race bearing has been used to illustrate the effectiveness of the processing algorithm discussed in the previous section. The gearbox was run at 10 Hz and under a torque of 50 Nm. An accelerometer was placed on the top of a defective bearing and vibration signal was collected at a sampling rate of 48 kHz. The theoretical ball pass frequency of the inner race (BPFI) was estimated at 71.2 Hz. The raw time domain signal and its frequency content (resolution of 5.86 Hz/line) are presented in [Fig. 2].

The third and twentieth derivatives are plotted in [Fig. 3(b)] and [Fig. 3(c)] respectively and compared to the raw signal [Fig. 3(a)]. The fault impacts can be seen clearly in the differentiated signals. No further advantage was recorded when using the higher order.

In [Fig. 4(a)], the absolute value of the third derivative is plotted. The Moving average filter used to smoothen the envelope signal was based on 100 samples (i.e. half the duration of the impulse response), The result of smoothening the envelope is plotted in [Fig. 4(b)] where the low pass effect can be seen clearly. Finally the spectrum (envelope spectrum) of the signal presented in [Fig. 4(b)] was obtained and is presented in [Fig. 5]. The envelope spectrum shows the harmonics of 71.04 Hz, which is the ball, pass frequency of the inner race (BPFI). The modulation by the shaft speed is not clear, which may be the case when the load on the bearing is small.

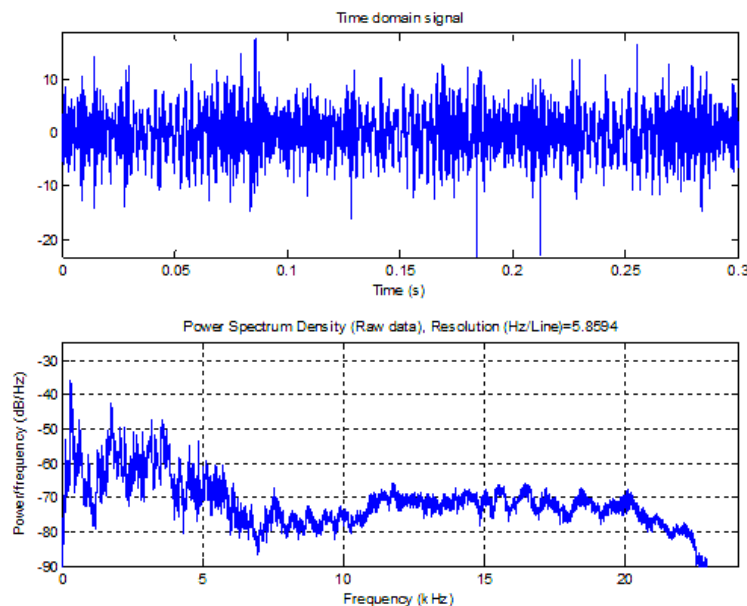


Fig. 2: Top: Raw time domain signal (0.3 seconds, which correspond to 3 shaft rotations). Bottom: Power Spectrum density.

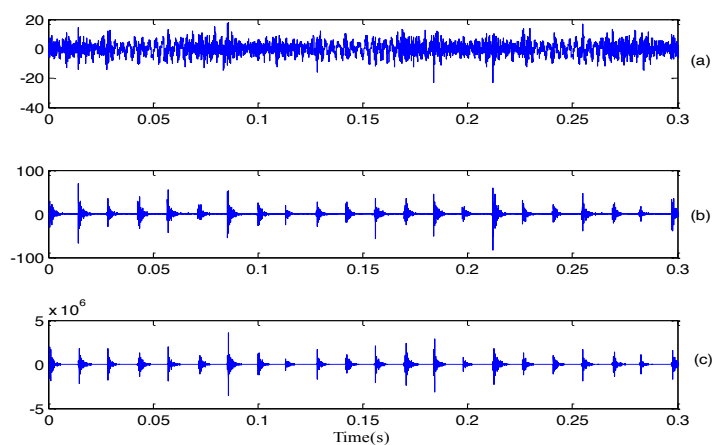


Fig. 3: (a) Raw signal (b) Third differentiation (c) twentieth differentiation.

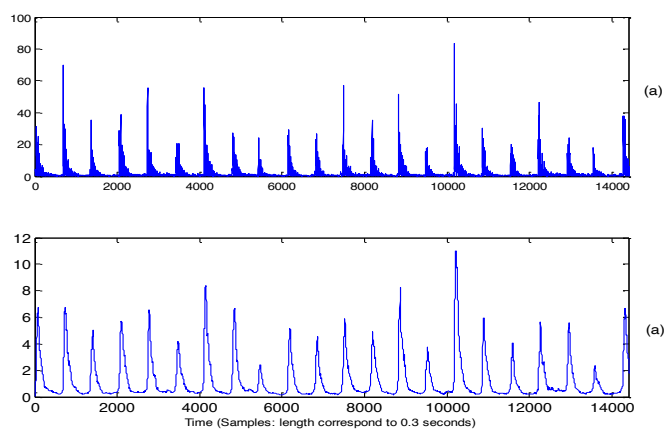


Fig. 4: Top: Enveloped (Absolute value) of signal 6.b. Bottom: after using a median filter of order 100.

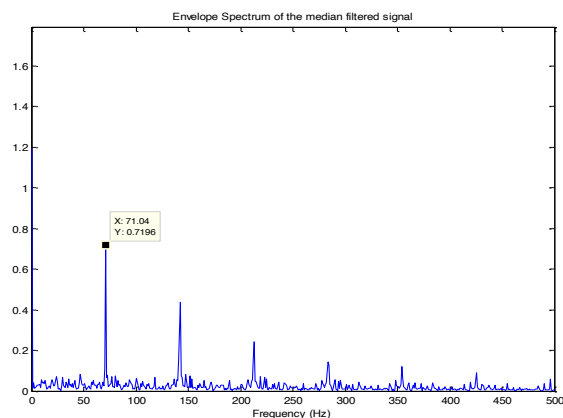


Fig. 5: Envelope spectrum.

CONCLUSION

This paper discusses the use of signal differencing and Moving average filtration as a simple means of obtaining the envelope spectrum for the purpose of detecting and diagnosing the presence of a localized fault in rolling element bearings. It has been shown, using an example from a faulty bearing of a single stage gearbox, that this method is quite simple to use and requires a minimal intervention from the analyst. This paper serves the purpose of presenting the algorithm and more work is being undertaken to expand the number of tested signals and compare it with highly developed algorithms in complex situations.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest regarding the publication of this paper.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

This work received no financial support

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ARTICLE

PROBLEM-BASED LEARNING (PBL) CASE-DESIGN TRAINING AND MODEL FOR LANGUAGE PRACTITIONERS

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ABSTRACT

Background: Case/Problem is the core element for Problem-Based Learning (PBL). However, due to lack of knowledge and experience in crafting cases, practitioners often find it challenging to employ PBL approach in their classrooms. The purpose of this study was to train English language practitioners to craft their own PBL cases for a General English Course using 3C3R Case-Design Model (Hung, 2006) as the basis. The 3C3R model consists of two classes of components: core and processing components. **Methods:** This study employed the Action Research approach in which the four steps (planning, action, observation and reflect) were closely followed within two cycles of the action research procedure. Data were collected through observation checklist and focus group interviews with 8 participants who are English language practitioners. **Results:** The findings were two-fold: an emerging PBL case-design model for language courses (PBL Language Case-design Model) and the practitioners' experiences on the trainings. Some of the findings that led to the emerging PBL Language Case-design Model: a) issues on the content component in the 3C3R case design model (Hung, 2006); content was not the main aim when teaching language, b) the inclusion of affective angle in the model. **Conclusion:** In conclusion, the importance of the emerging PBL Language Case-design Model for language teaching and the valuable gains of the trainings in preparing PBL case crafters for language courses were the significant findings. The emerging model is not only expected to guide English Language practitioners with limited case-design knowledge but also practitioners teaching other languages, to craft PBL cases to meet their learners' language learning aims.

INTRODUCTION

KEY WORDS
Problem-Based
Learning (PBL), PBL
Case-Design
Model, Action

The essence of PBL is learning around problems / cases rather than discrete subjects [1]. Students work in groups/teams to solve an ill-structured problem/case and not required to acquire a predetermined series of 'right answers'. The ill-structured problem presented in PBL requires learners to engage with a complex situation presented to them and decide what information they need to learn and what skills they need to gain to manage the situation effectively. Thus, PBL reflects the real-world scenario because the ill-structured problems encountered by learners are the potential type of problems learners might encounter in the real world where there will not be any predetermined solution or right answer. All that matters in this kind of learning is the ability to produce the most viable/possible solutions or options for the presented problem.

In examining the research on PBL, a majority of studies have focused on various implementation and learning outcome issues, such as the roles of tutors [2], students' perceptions [3], group size [4], group processing skills [5] and the rate of board exam passage [6] [7] [8].

Somehow, the concerns surrounding the design of cases seem to have received little attention. A few researchers [9] have discussed the design of PBL cases. Yet, the discussions are rather general and, therefore, inadequate in providing educators and practitioners with the conceptual framework needed to design effective PBL cases. Duch (2001) contended that the case itself is the key to the success of PBL [10]. To investigate the effectiveness of PBL problems/cases, Dolmans, Gijssels, Schmidt, and van der Meer [11] analyzed the correspondence between the instructors' intended objectives and the student-generated learning issues based on their interpretations of the PBL cases. They found that only 64% of intended content was identified in the student-generated learning issues. Hence, without assurance of the quality of problem or intended aims being met, the effects of PBL are unpredictable and questionable. Drummond-Young and Mohide (2001) proposed an eight-step PBL problem development process specifically designed for nursing education, which unfortunately rendered the process too domain specific to be used in a wider range of contexts [12].

Within the area of second language learning and teaching, problem-based learning aligns with approaches in which students learn the target language by using it, rather than being presented with and then practicing predetermined language structures [13]. To maximize language learning outcomes, ESL practitioners need to prepare students for the language demands of the problem-solving activity. Activities to prepare students vary depending on their proficiency levels. These may include pre-reading or prewriting exercises, discussions to link the problem with the students' knowledge and experiences, or pre-teaching vocabulary and structures that will be useful in finding solutions to the problem. However, not many language practitioners have the knowledge on crafting activities (cases / problems). To craft PBL cases, one needs training or guide to become case crafters. Lack of available resources on PBL cases for language and trainings compounded by the issue of using suitable PBL case-design models for language courses, have driven researchers to embark on the current study with these research questions:

Thus, this study seeks to answer the following research questions:

Received: 10 Oct 2016
Accepted: 12 Nov 2016
Published: 4 Dec 2016

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1. What are the English Language practitioners' experiences in the PBL case-design training?
2. How does the 3C3R PBL Case-Design Model (Hung, 2006) assist the English Language practitioners to craft PBL cases for General English Proficiency (GEP) Course?

Hung (2006) has developed a 3C3R PBL case design model [Fig. 1] which is expected to be a framework to design effective, precise and reliable PBL cases and this model is used as the theoretical framework for the current study [14]. The 3C3R model consists of two classes of components: core components and processing components. Core components include content, context, and connection, and are used to support content/concept learning; processing components, composed of researching, reasoning, and reflecting, concern the learners' cognitive processes of learning and problem-solving skills. The core components of the 3C3R model—content, context, and connection—are primarily concerned with the issues of appropriateness and sufficiency of content knowledge, knowledge contextualization, and knowledge integration. Thus, this case design is used as the basis for training the research participants on the PBL case design to discover their experiences in the training and the feasibility of the model for crafting PBL cases for language courses.

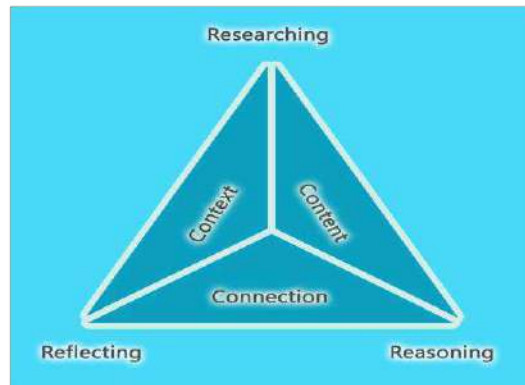


Fig. 1: The 3C3R case design model (Hung, 2006).

MATERIALS AND METHODS

This study was carried out using the Action Research approach in which the four steps (planning, action, observation and reflect) were closely followed within two cycles of the action research procedure. A total of 8 participants who are experienced English language practitioners with little or no PBL knowledge, took part in this study. These participants have been in the ESL teaching field at tertiary level between 10 to 15 years. These participants teach the university's English Language course, i.e. General English Course (GEP). GEP course is a foundation course that equips students with basic language skills and geared towards developing students to achieve a satisfactory level in the language.

Instruments used to collect data include observation checklist and focus groups interviews. *Observation checklist* consists of the items to be observed: the challenges experienced by the participants to craft the PBL cases and the feasibility of the components in the 3C3R case-design Model in assisting the practitioners to craft PBL cases. Data from the observation checklist provided useful prompts for the focus group interviews. The interviews were meant to explore the participants' experiences in the training sessions and the feasibility of the 3C3R case-design model in helping the novice PBL practitioners to craft cases for a language course i.e. GEP course. Open-ended questions were used in the interviews because this type of interviews provides parameters within which interviewees can formulate answers in their own words [15][17,18].

Data collection and analysis procedure

The participants underwent two trainings (two cycles in the action research procedure) on PBL Case-design model using the 3C3R case-design model (Hung, 2006). Following the action research procedure, Training 1 was conducted in Cycle One and Training 2 was carried out in Cycle Two. However, this paper is focused on data from Training 1 only.

In training 1, participants were exposed to PBL approach, the 3C3R PBL Case-Design Model (Hung, 2006), case crafting for GEP and reflecting session. The case crafting was done in small groups using the 3C3R case-design model. The participants were given access to computers and internet to assist with materials search for crafting cases and they were also encouraged to refer to their Course Textbook or Course Outline/Information to align the PBL cases with the intended GEP syllabus. The researchers were present in the crafting teams as participant observers with the observation checklist to tick the checklist accordingly and document the challenges and chasms experienced by the participants to craft the PBL cases and the use of the 3C3R case-design model.

After Training 1, the observation checklists were gathered from researchers and analyzed to be used as prompts for focus group interviews. The interviews were recorded and transcribed. Content analysis was done on the transcripts to arrive at themes. The data from the observation checklist and interviews were used to interpret the experiences of the language practitioners in crafting PBL cases for GEP with the aim to provide a better guide for them for crafting PBL cases in future.

RESULTS

In this section, the findings are presented and discussed based on the following research questions:

1. What are the English Language practitioners' experiences in the PBL case-design training?
2. How does the 3C3R PBL Case-Design Model (Hung, 2006) assist the English Language practitioners to craft PBL cases for General English Proficiency (GEP) Course?

The findings for the research question are termed as themes. The discussion of each theme is accompanied by extracts from the participants' answers for the prompts and open-ended questions in the interviews. The source of the extract is indicated by the use of 'P', so 'P2' refers to participant number 2.

As for research question 1, two themes that emerged from the data are discussed. They are *new knowledge and flexibility in case design steps*. In terms new knowledge, data show that the language practitioners expressed the worthiness of participating in the training. P2 stated that she did not know that PBL cases can be used to teach languages. Similar response was made by P6 that PBL is usually used in science and business courses. P3 was delighted with the new knowledge learnt and expressed her enthusiasm to use PBL cases in her classes. These themes are evidenced in the extracts below (Extract 1: P2; Extract 2: P6; Extract 3: P3).

Only after attending this training I knew that PBL cases can be used to teach English

(Extract 1: P2)

I have always thought that PBL cases are applicable for science and Business subjects

(Extract 2: P6)

It is really worth while attending this training and I am excited to use PBL cases to teach my English course

(Extract 3: P3)

Similar view was shared by P1 and P5 on the importance of PBL case-design training due to scarcity of available cases to be used for general English courses and thus, the training given was useful to craft cases for their English course. These points are illustrated in the following extracts (Extract 4: P1; Extract 5: P5).

I have heard about using cases to teach English but I could not find PBL cases that were suitable for my English course...learnt new things in this training

(Extract 4: P1)

The training was good; I discovered how to craft PBL

(Extract 5: P5)

Based on Extract 1-5, it is imperative that the language practitioners discovered new knowledge which is crafting PBL cases. They also further highlighted the importance of the new knowledge e.i. crafting PBL cases, specifically for teaching English language courses.

The second theme is flexibility in the case-design steps. Some general steps in case crafting were explained during the training and they were meant as a guide to get started with the crafting process for

novice PBL practitioners. However, the language practitioners expressed their concerns about using the case crafting steps as a guide. P8 mentioned that the steps in case crafting should be recursive instead of sequences. P7 and P4 expressed that they went back and forth when they were crafting cases because they were not much content to think about. These are the extracts (Extract 6: P8; Extract 7: P2; Extract 8: P4).

I think it is more helpful if the steps for case crafting have arrows to show they are recursive because it is all about language and not content

(Extract 6: P8)

The steps should be listed and not numbered because we are not building content but a case for language practice

(Extract 7: P2)

I did not follow the sequence in the steps for crafting cases because it is about language practice; I was moving back and forth when crafting

(Extract 8: P4)

The responses above reflected the participants concerns on wanting some flexibility when they are crafting the cases for an English language course. An interesting point that can be deduced here is that the practitioners were expecting more flexibility in the steps to craft cases since the emphasis for PBL cases for language teaching should be on the skills and not content. Based on Extracts 6-8, it can be surmised that the practitioners were thinking from language practitioners' perspective on the issue of content vs. language skills in teaching English Language which are elucidated in the next themes on the emerging PBL Language case-design model.

As for research question two, data from observation checklist and focus group interviews are included. The researchers documented their observation during the team PBL case crafting and interviewed the participants by using the data from observation as prompts. During the focus group interviews, the language practitioners were asked to reflect on the feasibility of the 3C3R case-design model when they crafted PBL cases for General English Proficiency Course. Several themes emerged from the data which are expected to arrive at an emerging *PBL Language Case-design Model* (specifically for Language Courses). However, only two themes are discussed in this section: issues on the content component in the 3C3R model and the inclusion of affective angle to the 3C3R model.

In terms of the content component in the 3C3R case design model, the language practitioners expressed the confusion they had in relating the term 'content' with language teaching. During the team PBL case crafting, the researchers documented in the observation that P3, P6 and P7 discussed on the confusion they had on the issue which brings about argument that the word 'content' should not be in the model if it is to be used for language case crafting. This point was further explored during the interviews. Extracts below are the responses from P3, P5, P6 and P7:

We are teaching general language, what is our content?; do we have any? I mean our focus should not be on content

(Extract 8: P3)

What is the content that we want to achieve in English Language, we are not teaching content subjects

(Extract 9: P5)

The word content should be changed to something related to language subject

(Extract 10: P6)

Content should be replaced; perhaps language skills would better suit

(Extract 11: P7)

The extracts above represented a paradigm from language practitioners on the use of the term 'content' which they believe as irrelevant in language teaching context; the emphasis is on the language skills.

The second theme is on the inclusion of the affective angle in the model. Based on the observation checklist and notes from the researchers, there were discussions, during the case crafting among P6, P7 and P8 about the possible ways to arouse learners' motivation. However, they did not find context component to boost the motivational aspect because there is no context for a General English Course. This issue was further explored during the interviews to gain more in depth insights. These are the extracts of the responses:

For example cases on biology, the context of a hospital can be of use with some motivational elements included...what context to include for teaching language skills? We might need to think about motivation as a component?

(Extract 12: P6)

We need to motivate students; maybe we can include their home town or topic of their interest

(Extract 13: P7)

It is important to have something close to their emotion; could be a different component coz there is no specific context for general English

(Extract 14: P8)

In the 3C3R model, the context component calls for an inclusion of the motivational element through context of the case. However, based on responses from P6, the context component can be connected with any motivation aspect since biology subject is content-based i.e. hospital context, which is not the context specific to language subjects. It is evidenced from the extracts above, language practitioners proposed for an inclusion of a separate motivational component. Despite the fact motivational aspect or affective angle is not a component by itself in the 3C3R Model, the importance of affective angle [16] has been highlighted as a new component in the PBL case-design model. Real life problems alone do not promote sense of belonging and engagement rather the cases that promote the psychological needs: subject presence, location proximity, personal interest, etc., can increase connection and ownership to involve in the case (Hung, 2006). In other words, if affective angle is crucial in content subjects where the content and context can be linked to create the motivational aspect what more with non-content subjects i.e. English language. P1 and P2 talked about placing the affective angle by itself and in the center of the model which signaled that this component is the most crucial for them in case crafting for language courses. These are the extracts:

I think affective or emotional aspect is the most important component in the model...maybe should be placed in the center

(Extract 15: P1)

Motivational aspect important and I think it is the most important to attract student attention for general English subject

(Extract 16: P2)

Thus, the themes suggest that case-design model for General English may need some adaptations to cater for the specific need of a language subject which is a non-content subject. Based on the preliminary findings presented in this paper, the emerging model is illustrated in [Fig. 2] below.

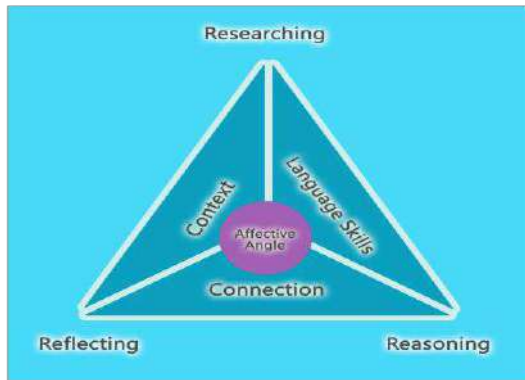


Fig. 2: The emerging PBL Language case-design model.

CONCLUSION

In conclusion, the practitioners' feedback on the training highlights the importance of PBL case-design training for novice PBL practitioners specifically for General English teaching because crafting cases for language subjects are slightly different compared to crafting cases for content subjects. There are two themes discussed on the PBL case design training experiences namely new knowledge and flexibility in the case design steps. These two themes reflect that the language practitioners were not aware that PBL cases can be employed in non-content subjects i.e. English Language. The themes related to the case design model: issues on the content and the inclusion of affective angel explicated the need for an emerging PBL case design model for language courses (PBL Language Case-Design Model). The findings further conclude the importance of the emerging *PBL Language Case-design Model* for language teaching and the valuable gains of the trainings in preparing PBL case crafters to teach language courses using PBL cases. It is also anticipated that this study compounded with the data from Training two of the case design model (on-going research), would yield a better explanation of the emerging case design model. However, more conclusive studies might be needed before establishing the possible emerging model specifically for language subjects. Hence, the emerging *PBL Language Case-design Model* is not only expected to guide English Language practitioners with limited case-design knowledge but also practitioners teaching other languages, to craft PBL cases to meet their learners' language learning aims.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

My acknowledgement is for my research participants and colleagues who have given me ideas and support in conducting the research.

FINANCIAL DISCLOSURE

The data used in this manuscript is part of an on-going an Action Research Grant project funded by Universiti Sains Islam Malaysia.

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ARTICLE

OSCILLATING WATER COLUMN (OWC) BUILDING PERFORMANCE ANALYSIS AS BEACH ABRASION REDUCING

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ABSTRACT

Ocean waves is a new renewable energy that is rarely explored. It has a great chance to reduce carbon pollution in the world. In spite of that, the ocean waves responsible for the beach abrasion that occurs in some county in the world. Using Oscillating Water Column (OWC) building reducing the impact of waves against abrasion become populer. In this research is to analyze the performance of OWC power conversion as water building for abrasion reducing and as well as electrical energy resource from ocean wave energy conversion. The OWC made in laboratory scale with 4-meter of length, 0.6-meter of width, and 0.6 m height. Wide of chamber in OWC is 0.24-meter square. The OWC has manual wave generator system and breakwater system for reduce wave feedback effect in chamber. High variation wavelength used is 10, 15, and 20 cm for the operation starting time of 0-20 seconds. The results from this study showed that energy conversion has linear relationship to wave characteristic, the higher the wave produced, the higher the power generated by OWC. In the wave height of 10 cm, power generated is 3.5563 watt. While the wave height of 20 cm, power generated is 5.586 watt.

INTRODUCTION

Breakwater designed for reducing the abrasion [1], reduce abrasion, but actually, many cases explained that the breakwater cause fishing vessels become damaged and cause fishermen trouble catching fish, because fishing nets snagged or damaged by the breakwater.

The magnitude of western Java sea waves brings serious problems of abrasion. However, efforts are needed to reduce coastal erosion or abrasion. There are two ways can be implemented. First way is to divide the wave energy into small waves, so the waves did not make coastal erosion or abrasion. The second way is to collect and gathering the wave energy, then convert it into another form of energy. The second way will give the double result. First reducing the abrasion and as well obtain the electrical energy. Ocean in western Java had the high waves and sustainable, provide an opportunity to transform wave energy into electrical energy, thus sea south western Java had the high sea waves and sustainable, provide an opportunity to transform wave energy into electrical energy, thus reducing abrasion [2], whereas the electrical power science believes that energy collecting received in OWC can be used fatherly rotating the turbine and then generate electrical energy.

OWC has a working principle gather to convert ocean wave energy into mechanical energy [3], the mechanical energy in OWC can then be converted into electrical energy [4]. OWC has a working principle gather to convert ocean wave energy into mechanical energy [3]. The mechanical energy can then be converted into electrical energy through a turbine [4].

The waves southern regions of western Java had high waves with a frequency of 0-10% [5], while the potential of ocean waves at Jimbaran of Bali has a potential of between 176 kW – 4 MW [6]. Some researchers believe that the global potential for electrical energy from sea waves at the beach estimated is 1TW [7]. The energy generated by ocean waves is 5 times of what is produced by wind energy at the same rate [8].

Wave Energy Converter (WEC)

There are many concepts of Wave Energy Converter (WEC) and more than 1000 patents on techniques WEC made in Japan, North America and Europe [9]. Despite having varied designs, WEC can be categorized based on the place and type. WEC Type Attenuator (A) by Salter [10], Point absorber and the type of Terminator [11], while according to [9]. WEC operating model can be divided into several, namely: Submerged pressure differential, Oscillating wave surge converter, Oscillating Water Column (OWC) and overtopping devices. According to [6]. OWC is one of the systems and equipment that can transform wave energy into electrical energy using oscillating column (chamber) as Fig 1 below.

The OWC technology concept in Fig. 1, the air pressure of the chamber air pressure to the turbine. The turbine will move the turbines which will produce electrical energy, as in Figure 1. The room's watertight be fixed with the bottom structure is open to the sea. The air pressure in the room's watertight caused by the movement of the rise and fall of the surface of the sea waves. The movement is a movement compresses and decompresses the motion that is on the level of water in the room. This resulted in the movement, generates an alternating high velocity stream of air. This air flow is driven through a pipe to a turbine generator that is used to generate electricity.

KEY WORDS

Oscillating, water, column, wave, abrasion

Received: 15 Oct 2016
Accepted: 14 Nov 2016
Published: 4 Dec 2016

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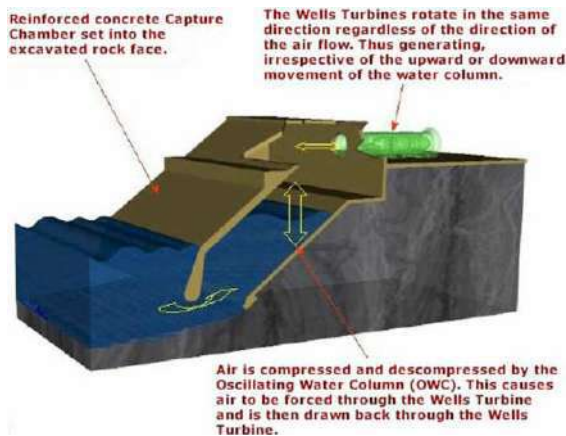


Fig 1. OWC [10]

Wind Effect

Fig 2. Shows the relationships between wave speed and period for various depths (left), and wave length and period (right), for periodic, progressive surface waves [12]. Higher wind speed and deeper the ocean, lower wave period. Note that the term phase velocity is more precise than wave speed.

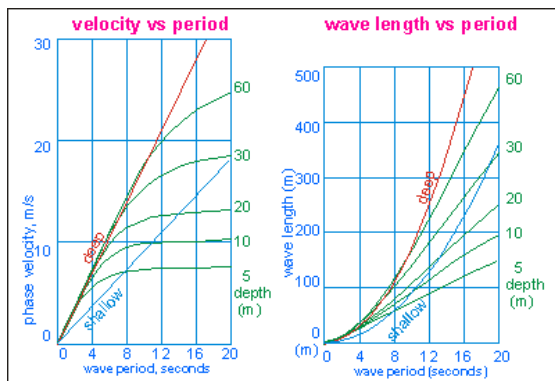


Fig 2. The spectrum of the wave period for different wind speeds [12]

Oscillation water column Conversion

Calculation of the wave energy from OWC. The amount of potential energy of ocean waves can be calculated by (1)

$$P.E. = mg \frac{y(x,t)}{2} (J) \quad (1)$$

Equation (1) can be write to the other form that involve densities value as (2).

$$P.E. = wpg \frac{y^2}{2} \quad (2)$$

$$PE = wpg \frac{a^2}{2} \sin^2(kx - \omega t) \quad (3)$$

The magnitude of the potential energy of the wave, it is assumed that the wave is a function of "x" with respect to time, so we get the equation $y(x, t) = y(x)$.

$$dP.E. = 0,5 wpg a^2 \sin^2(kx - \omega t) dx(J) \quad (4)$$

The other form of $k = 2\pi/\lambda$ and $\omega = 2\pi/T$, so the simple form of (3) is represented by (5).

$$P.E. = \frac{1}{4} wpg a^2 \lambda \quad (Joule) \quad (5)$$

The kinetic energy that produce from wave for one period of wave is represented by (6) and total energy of wave (7) is sum of potential energy and kinetic energy.

$$K.E. = \frac{1}{4} wpg a^2 \lambda \quad (6)$$

$$Ew. = P.E. + K.E. = \frac{1}{2} wpg a^2 \lambda \quad (7)$$

Substitution from (6) and (7) to find the energy density (EWD) of wave as (8) and energy in electrical (PW) can be find out by (9). The power density (PWD) is power of wave in watt per meter square (10).

$$E_{WD} = \frac{E_W}{\lambda_W} = \frac{1}{2} \rho g a^2 \quad (J/m^2) \quad (8)$$

$$P_W = \frac{E_W}{T} \quad (Watt) \quad (9)$$

$$P_{WD} = \frac{P_W}{\lambda_W} = \frac{1}{2T} \rho g a^2 \quad (Watt/m^2) \quad (10)$$

Where the “ ρ ” is water density (kg/m³), “ w ” is wave width in meter (assumed equal to chamber of OWC).

“ a ” is Wave amplitud ($h/2$), “ h ” is wave high in meter, “ k ” is wave constanta $\frac{2\pi}{\lambda}$, “ λ ” is wave lenght in meter, “ ω ” is wave frequency in rad/s represented by $\frac{2\pi}{T}$ divide by periode (T).

MATERIALS AND METHODS

In this research, OWC designed in small scale with 4 meters of length, 0.6 meters of high and 0.6 meter width as Fig. 3, While Fig. 4 is chamber of OWC with 0.48 meter of length and 0.5 meter of width, so the chamber is 0.24 m² of wide. Water wave generated by manual wave generator system. Air speed in chamber measured by mini electrical generator with tubin. This anemometer will sense the air flow through the chamber that representing the speed of electrical generator turbin.

Test of OWC is applied by different In the wave height of 10 cm, 15 cm and 20 cm. Measurment of testing is Wind speed of oscillation in chamber, Wind Power in Chamber, electrical power of turbin. These results will be the conclusion of the OWC performance in reducing the wave energy.

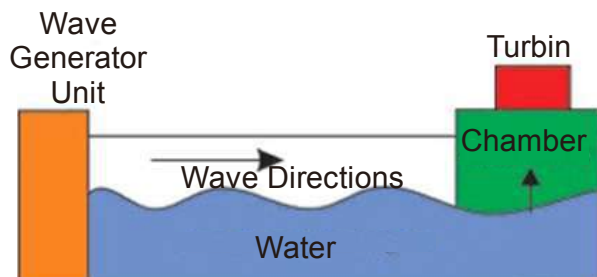


Fig 3. OWC Model with wave small scale

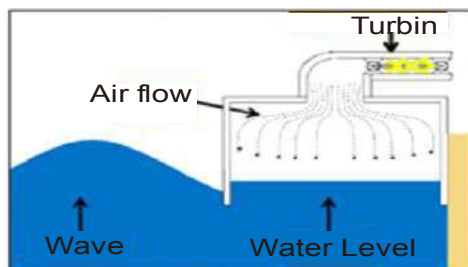


Fig 4. Chamber model with electrical generator system

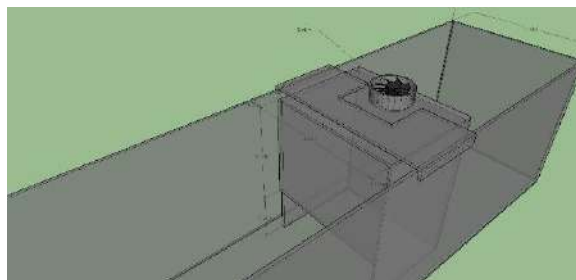


Fig 5. Design of Chamber in OWC system

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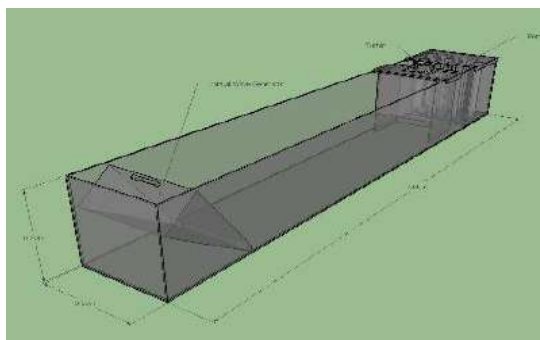


Fig 6. Design of Laboratory scale OWC

RESULTS

Fig 7 shows relation between oscillation of wind speed in chamber at different wave height. The chamber applied with various wave high 10 cm, 15 cm and 20 cm. Higher wave applied in OWC, more rapid the frequency of chamber oscillation. Particularly at In the wave height of 10 cm, the wind speed graphic sinusoidal form. The air speed in the chamber on the different wave height, it is known that the waves can be mitigated by changing the wave potential energy into kinetic energy in the turbine and chamber. The speed of the wave height of the water outside the OWC change linearly with the speed of air in the chamber to variations in wave height. The air fluctuations pressure has the ability to rotate the turbine generator. This change has potential reducing or even eliminate the abrasion.

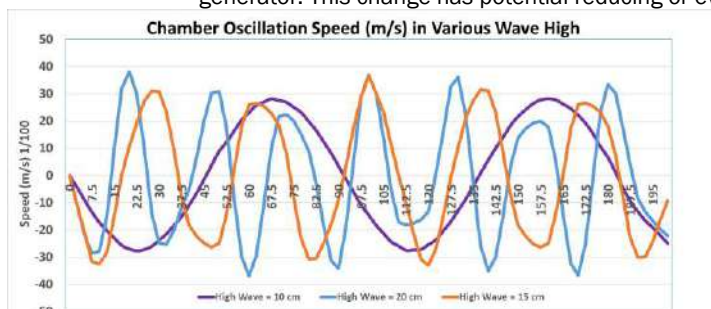


Fig 7. Wind speed oscillation in chamber on different wave height

Fig.7 shows the testing result of wave into wind speed oscillation in chamber. On the 10 cm of wave height produce the wind speed maximum is 0.282 m/s while on the 15 cm of wave height creat the wind speed maximum is 0.3684 m/s and 20 wave height result the maximum wind speed 0.3811 m/s.

Fig. 8 is result energy conversion from wave of OWC into wind power that creat from oscillation in chamber. On the 10 cm of wave height produces the wind power maximum is 13.755 watt, while on the 15 cm of high wave creat the wind speed maximum is 24.029 watt and 20 cm wave height result the maximum wind speed 37.743 watt.

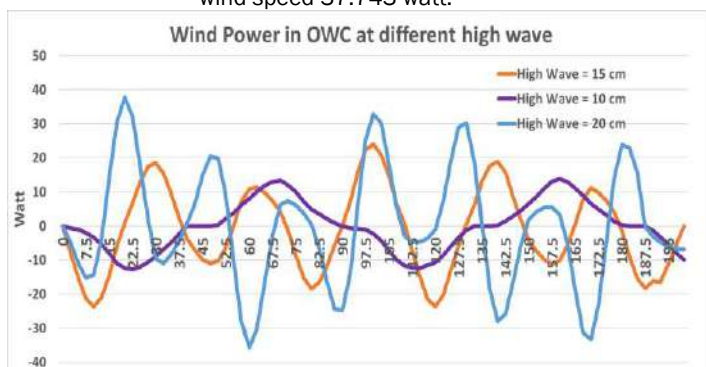


Fig 8. Wind Power of OWC on different wave height

Fig. 9 show the electrical power of OWC on different wave height. 10 cm of wave height produces the electrical power as 2.0357 watt, 15 cm of wave height produce the electrical power as 3.5563 watt, while

on the 20 cm high wave produce 5.586 watt. From Fig. 8 And Fig. 9 can be concluded that the smaller waves in OWC, the less energy is generated and the slower the frequency of oscillation in the chamber.

From Fig. 8 And Fig. 9 can be concluded that the smaller waves on OWC, the less energy is generated. Otherwise if the higher waves heading to OWC, the energy generated increasingly large. This condition is the advantage of OWC in overcoming the abrasion caused by the ocean waves.

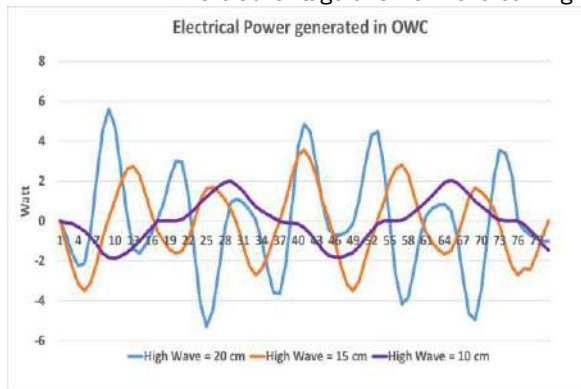


Fig 9. Electrical power generated in owc with on different high wave

CONCLUSION

The conclusion from this research that the oscillation model of water column (OWC) showed the potential for abrasion reducing by conversion the energy of ocean wave into electrical energy. OWC has a dual function, in addition to reducing abrasion and also be used as an alternative energy resources. High waves that heading in OWC has linearity relationship to the electrical energy generated. The higher the ocean waves in OWC, higher electrical energy will be produced. Result of OWC test is by OWC, the 10 cm of high wave produce the electrical power as 2.0357 watt, 15 cm of high wave produce the electrical power as 3.5563 watt, while on the 20-cm high wave produce 5.586 watt

CONFLICT OF INTEREST

All authors have completed the IIOAB uniform disclosure form and stated: all writers have the financial support of KEMENRISTEK-DIKTI for the submitted work; no financial relationships with organizations that may have an interest in the submitted work in the previous three years; there is no relationship or activities that could appear to have influenced the work submitted

ACKNOWLEDGEMENTS

This work was supported in part by the Kemenristekdikti RI. Department of research under Grant of "Skim Bersaing (Penelitian Produk Terapan/PPT) 2015 by www.simlitabmas.dikti.go.id". Thanks to KEMENRISTEK-DIKTI Republik Indonesia and Siliwangi University for supporting this research.

FINANCIAL DISCLOSURE

This research has finance support from KEMENRISTEK-DIKTI Republik Indonesia from 2015-2016 from reseach grant (skim bersaing) programme.

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ARTICLE

INFLUENCE OF BOLTED SHEAR CONNECTOR SIZE IN PUSH-OUT TEST FOR COMPOSITE CONSTRUCTION WITH COLD-FORMED STEEL SECTION

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ABSTRACT

Background: In conventional composite construction for buildings and bridges using Hot-Rolled Steel (HRS) section has been well known. The composite action is usually achieved by using conventional headed stud shear connectors welded to the top flange of hot-rolled steel beam. However, in Cold-Formed Steel (CFS) section, the use of headed studs shear connectors is not feasible as the section is very thin and not be able to be welded. Therefore, a suitable shear connection system of bolt and nut is proposed in this study by varying the size of the bolted shear connectors. This paper presents the prospect of using a bolt and nut as shear connector that could be well-suited with CFS section when integrated in Self-Compacting Concrete (SCC). The experimental test comprised of push-out and was conducted to determine the strength and ductility of the proposed bolted shear connectors as used in composite construction. Eight push-out test specimens of bolted shear connector size consist of M12, M14 and M16 of grade 8.8 were fabricated and tested to failure. The experimental results shows that the bolted shear connectors possessed good shear resistance capacity. Influence of varying the size of the bolted shear connectors was investigated and presented. The results showed that the size of bolted shear connectors increase the ultimate strength capacity of the shear connectors significantly.

INTRODUCTION

The application of Cold-Formed Steel (CFS) sections started in the United States of America (USA) and Great Britain for quite decades, mainly for non-structural purposes. Although, the use of CFS is expanding in the present era of building constructions [1,2]. However, in the mid- 20th century, the structural use of CFS sections began especially for commercial and industrial building constructions [3,4]. The use of CFS sections as an alternative material for roof structure keep increasing due to the quality assurance of steel structures [5-9]. Composite construction using CFS section and concrete began in Europe in the mid-1940s for used as floor system [10]. The composite action is categorized by an interactive behavior between structural steel and the concrete designed to utilize the best load resistance capability. For the concrete and steel to act compositely, a mechanical means of shear connection must be provided [11], and the most widely used shear connection system is welding of conventional headed studs on the flanges of the steel section to resist the longitudinal shear that will be transferred between concrete slab and the steel section [2].

CFS sections are used with concrete as composite structural component as applied to Hot Rolled Steel (HRS) section, and the resulting performances were found to be encouraging. CFS structural members have several benefits over their conventional counterpart HRS, such as lightness, reduced thickness, high strength and stiffness, accurate detailing, non-shrinking and non-creeping at ambient temperature, non-combustibility, fast and easy erection, ease of fabrication and mass production and easy to install [5,12]. However, with the advantages demonstrated by CFS for use in composite construction, welding of the conventional headed shear studs is not feasible [13,14]. Therefore, the development of feasible shear connector to be compatible with the CFS section and the concrete as a composite entity is of paramount significance. The use of CFS sections in composite with concrete is still very few reported. However, a number of studies reported on the use of CFS section with concrete and different types of shear connectors in composite construction.

Irwan et al., studied shear transfer enhancement in steel and concrete composite beam system using CFS section. In the study, shear transfer enhancement of bent-up triangular tab shear transfer (BTTST) were created on the flanges of the CFS section to provide the shear connection mechanism [15-17]. Varied in the study and their influence investigated were dimension and angle of BTTST, concrete compressive strength and CFS section thickness. Push-out and full-scale specimens were fabricated and tested to

KEY WORDS

Shear connector size, cold-formed steel lipped section, composite construction, strength capacity, push-out test

Received: 10 Oct 2016
Accepted: 12 Nov 2016
Published: 4 Dec 2016

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establish the strength and ductility of the shear transfer enhancement and flexural capacity of the composite beam specimens. The results showed that the ultimate capacity of specimens employed with BTTST significantly increased with an increase in the angle and dimension of the BTTST, thickness of the CFS beam and concrete compressive strength. They concluded that better performance in the ultimate resistance was provided by BTTST shear enhancement.

Alenezi, et al. conducted push-out test on 8 specimens that consisted of CFS lipped channel section assembled with ferro-cement jacket [18,19]. The study was conducted to improve the compressive capability of a CFS composite column by means of shear connection mechanism comprised of bolts (10 mm and 12 mm diameters), self-drilling screw (6.3 mm diameter x 12 mm long) and a bar angle bolt (10 mm diameter). Varied in the study was the layers of the wire mesh used. The results showed that load carrying capacity of the composite column section increased as the size of the shear connector and number of the wire mesh layer were increased from 2 to 4 and to 6; with a better results obtained with 12 mm diameter bolt connector. From their findings it can be categorically observed that the size and number of mesh layers influenced the ultimate load carrying capacity of the composite section. They concluded that experimental results agreed well when compared with a simulated results by finite element modelling. In this paper, the use of CFS channel lipped section is reported with variety of bolted shear connectors to investigate the influence of shear connector size on ultimate strength capacity.

METHODOLOGY

Push-out test

Eight push-out specimens were fabricated by orienting the CFS back-to-back to form an I-section beam, using self-drilling screws of 5.8 mm diameter. Bolted shear connectors of M12x75 mm, M14x75 mm and M16x75 mm of grade 8.8 were installed with nut and washer through bolt-holes of 13 mm, 15 mm and 17 mm diameters respectively. Bolt holes were drilled to accommodate the bolted shear connectors. The bolts were embedded in the concrete slabs made of Self-Compacting Concrete (SCC) placed at 60 mm height above the CFS flanges and were spaced laterally at 75 mm. Among the test specimens, six specimens are installed with eight number bolted connectors and the other two specimens are installed with four number of bolted connectors. The slabs were cast in horizontal fashion as recommended by Eurocode 4 [20] in order to simulate the actual casting situation of a composite beam in practice. The concrete slabs had a recess of 80 mm between bottom of the concrete slab and lower end of the steel beam to allow for slip during testing. The push-out test specimens were 800 mm x 600 mm x 75 mm. Fig. 1 shows the test specimen was prepared for push tests.

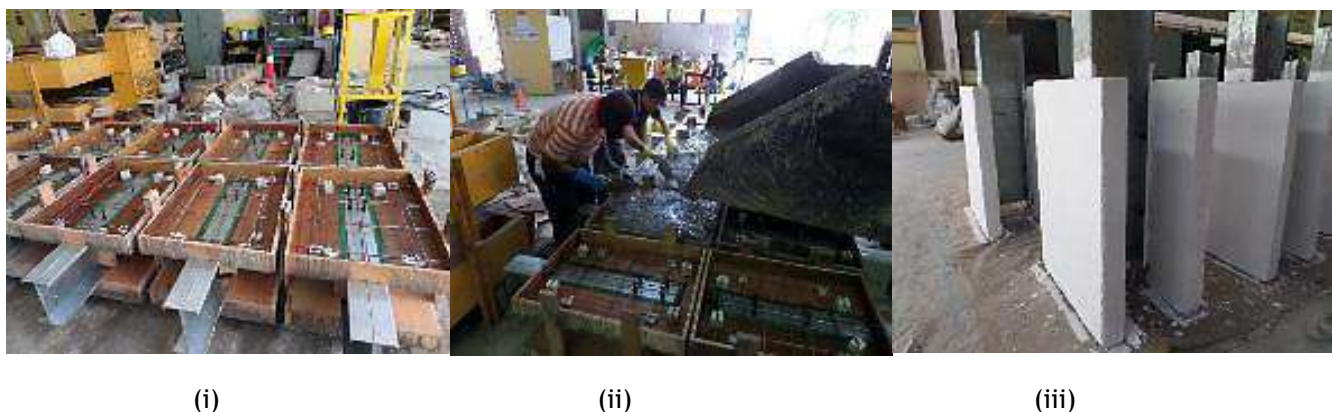


Fig. 1: Preparation of test specimens (i) Formwork, (ii) Casting, (iii) Finished samples

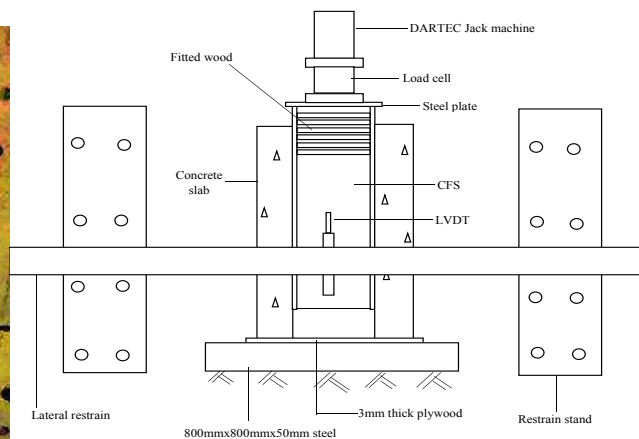
Test Set-Up, Instrumentation and Procedures

The push-out test set-up is shown in Fig. 2, and all specimens were tested in the same manner. Each specimen was placed on 3mm thick plywood and on a steel section (800mm x 800mm x 50mm thick) to vertically aligned the concrete slabs. An angle steel iron of 2000mm length and 10mm thick was provided to restrain the movement of the test sample when load was applied from the Jack machine. The capacity of the Jack machine load cell was 2000 kN and it was applied on the upper vertical side of the CFS beam section. Each specimen was equipped with two linear variable displacement transducers (LVDT's) on the sides of the CFS beam section to monitor the vertical slip between the concrete and the CFS section. The load cell and the LVDT's were connected to a data logger for data collection and subsequent analysis. The load was applied at a constant rate of 0.2 kN/s up to 40% of the predicted failure load. The loading was cycled three times (loading and unloading) between 5% and 40% of the expected failure load. After the cyclic loading, the load was then applied until

failure occurred. The loading was stopped when a drop of 20% from the maximum load of the specimen occurred or the specimen failed to resist any additional load as stated in (EN1994-1-1, 2004).



(a) Set up and instrumentation



(b) Schematic diagram

Fig. 2: Push-out test arrangement

RESULTS AND DISCUSSIONS

The push-out test result is presented in Table 1. Fig. 3 (a-d) shows some of the load-slip relationships of tested specimens. Details of the rest of load-slip curves can be referred elsewhere. The failure modes experienced by the tested specimen can be categorized as:

- i. Concrete cracking and crushing (Fig. 4 a)
- ii. Steel flange buckling (Fig. 4b)
- iii. Connector sheared-off (Fig. 4c)

The failure modes of specimens with 8 number M16 bolted shear connectors could be attributed to the cracks developed on the surface and underneath the concrete slabs. The flange buckling of CFS occurred due to high stress from the applied load at the ultimate load level. Failure loads recorded per shear connector were 62.14 kN and 62.06 kN, for specimens PS8-30-16 and PS8-25-16 respectively. For specimen with 4 number M16 bolted shear connector (S4M16) the failure modes initiated with observance of minor cracks on the slab surface. The CFS flange buckling failure was not observed. The recorded load per shear connector was 91.27 kN.

For specimens with 8 number M14 bolted shear connector, the failure observed in this category of test specimens were almost similar to that suffered by the specimens with M16 bolted shear connector. A part from the cracks on the concrete slab surface, crushing of concrete was also noticed in the specimens. Failure due to CFS flange buckling was observed at the ultimate load level. The recorded load at failure of the test specimens were 61.94 kN and 54.38 kN for specimens PS8-30-14 and PS8-25-14 respectively. But, for specimen with 4 number M14 bolted shear connector (S4M14), the failure observed was crushing of concrete slab with a recorded failure load at ultimate load level of 71.52 kN. Failure modes of specimens with M12 bolted shear connector was attributed to connector sheared-off. However, the specimens demonstrated a remarkable resistance capacity of 44.06 kN and 43.38 kN per shear connector for specimens PS8-30-12 and PS8-25-12 respectively. Neither cracks nor crushing of concrete slab were observed on the test specimens in this category. Influence of shear connector size was investigated and the results is shown in Table 2. From Table 2, it could be observed that PS8-30-16 is 0.3% and 41% higher in strength than PS8-30-14 and PS8-30-12, respectively. Again, PS8-25-16 is 14% and 43% higher than PS8-25-14 and PS8-25-12 respectively. Between PS8-30-14 and PS8-30-12 an increase of 41% is observed, and between PS8-25-14 and PS8-25-12 an increase of 25% is noted. But, S4M16 specimen is 47% higher than PS8-30-16 and PS8-25-16 in strength capacity respectively. Furthermore, it is also 47% and 68% higher than PS8-30-14 and PS8-25-14 respectively. Also an increase of 107% is observed between S4M16 and PS8-30-12, and of 110% is observed between S4M16 and PS8-25-12 respectively. But, an increase of 28% is registered between S4M16 and S4M14 specimen.

An increase of 41% and 25% is observed between PS8-30-14 and PS8-30-12, and between PS8-25-14 and PS8-25-12 respectively. However, an increase in ultimate capacity of 15%, 15% and 62% is noted between S4M14 and PS8-30-16, S4M14 and PS8-30-14, and S4M14 and PS8-30-12 respectively. Again, an

increase of 15%, 32% and 65% is registered between S4M14 and PS8-25-16, S4M14 and PS8-25-14, and S4M14 and PS8-25-12 respectively. Although, no much difference is observed between specimens with 8 number shear connector of M16 and M14. This is due to the buckling failure that occurred on the CFS flange. However, experimental results were compared with theoretical results based on Eurocode 4, and good agreement was achieved as shown in Table 1. Therefore, it could be deduced from the various increase in ultimate strength that shear connector size has significantly influenced the ultimate strength capacity of the specimens.

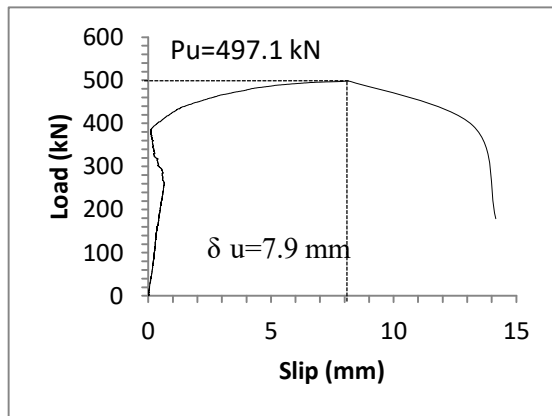
Table 1: Push-out test result

Specimen ID	$P_{u, exp.}$ per connector (kN)	$P_{u, pre.}$ per connector (kN)	$P_{u, exp.}/P_{u, pre.}$	δ_u (mm)	δ_{uk} (mm)
PS8-30-16	62.14	59.41	1.05	7.9	7.1
PS8-25-16	62.06	64.01	0.97	10.2	9.2
PS8-30-14	61.94	50.24	1.23	10.4	9.4
PS8-25-14	54.38	50.10	1.09	10.8	9.7
PS8-30-12	44.06	37.59	1.17	6.3	6.0
PS8-25-12	43.38	38.26	1.13	10.7	9.6
S4M16	91.27	64.18	1.42	24.0	21.6
S4M14	71.52	51.73	1.38	18.5	16.7

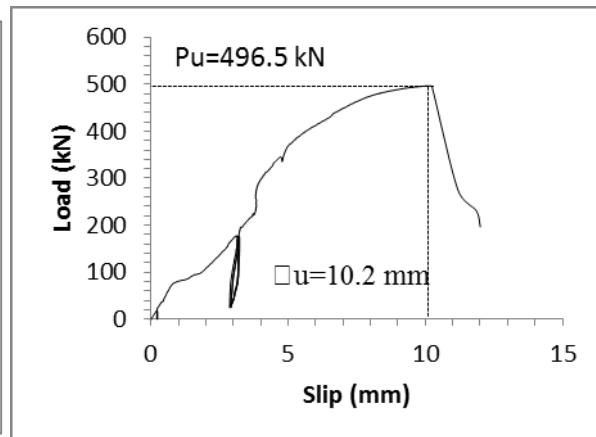
PS8-30-16: push-out specimen with number shear connector @ 300 mm spacing with M16 bolt; S4M14: specimen with 4 number of M14 bolt; $P_{u, exp.}$: ultimate load experimental; $P_{u, pre.}$: predicted load; δ_u : slip at ultimate load; δ_{uk} : characteristic slip capacity

Table 2: Influence of shear connector size on ultimate load capacity

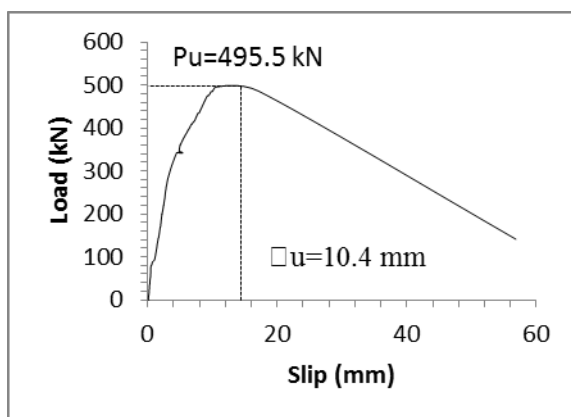
Specimen ID	Type of shear connector	$P_{u, exp.}$ Per connector (kN)	Increase of P_u (%)	
PS8-30-12	M12	44.06	-	-
PS8-30-14	M14	61.94	PS8-30-12vsPS8-30-14 41.0	-
PS8-30-16	M16	62.14	PS8-30-12vsPS8-30-16 41.0	PS8-30-14vsPS8-30-16 0.3
PS8-25-12	M12	43.38	-	-
PS8-25-14	M14	54.38	PS8-25-12vsPS8-25-14 25.0	-
PS8-25-16	M16	62.06	PS8-25-12vsPS8-25-16 43.0	PS8-25-14vsPS8-25-16 14.0
PS8-30-12	M12	44.06	-	-
PS8-30-14	M14	61.94	-	-
PS8-30-16	M16	62.14	-	-
S4M16	M16	91.27	PS8-30-12vsS4M16 107.0	-
-	-	-	PS8-30-14vsS4M16 47.0	PS8-30-16vsS4M16 47.0
PS8-25-12	M12	43.38	-	-
PS8-25-14	M14	54.38	-	-
PS8-25-16	M16	62.06	-	-
S4M16	M16	91.27	PS8-25-12vsS4M16 110.0	-
-	-	-	PS8-25-14vsS4M16 68.0	PS8-25-16vsS4M16 47.0
PS8-30-12	M12	44.06	-	-
PS8-30-14	M14	61.94	-	-
PS8-30-16	M16	62.14	-	-
S4M14	M14	71.52	PS8-30-12vsS4M14 62.0	-
-	-	-	PS8-30-14vsS4M14 15.0	PS8-30-16vsS4M14 15.0
PS8-25-12	M12	43.38	-	-
PS8-25-14	M14	54.38	-	-
PS8-25-16	M16	62.06	-	-
S4M14	M14	71.52	PS8-25-12vsS4M14 65.0	-
-	-	-	PS8-25-14vsS4M14 32.0	PS8-25-16vsS4M14 15.0
S4M14	M14	71.52	-	-
S4M16	M16	91.27	S4M14vsS4M16 28.0	-



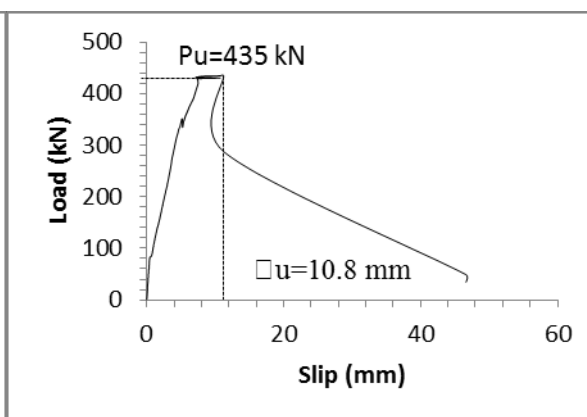
(a) PS8-30-16



(b) PS8-25-16



(c) PS8-30-14



(d) PS8-25-14

Fig. 3: Load-Slip responses of push-out test specimens



(a) Concrete Cracking and Crashing

(b) Steel flange buckling

(c) Connector sheared-off

Fig. 4: Failure modes of push-out test specimens

CONCLUSIONS

From the results of the experimental tests, the following conclusions can be drawn.

1. Failure modes of test specimens with 8 number shear connectors were attributed to concrete cracks on slabs, crushing of concrete slabs underneath and then tailed by CFS flange buckling at ultimate load level.
2. Failure modes of specimens with 4 number shear connectors were crushing of concrete slabs from underneath, and no CFS flange buckling failure was observed.

3. Mode of failure exhibited by specimens with M12 bolted shear connectors was sheared-off of connector at the ultimate load level, neither concrete cracks nor crushing were observed.
4. All bolted shear connectors used demonstrated good ultimate strength resistance capacity.
5. All bolted shear connectors used could be classified as ductile connectors as they attained a characteristics slip capacity of more than the recommended value of 6 mm by Eurocode 4, with the exception of that of specimen PS8-30-12 which attained 6 mm as the recommended value.
6. Good agreement is achieved between experimental and theoretical results of specimens with 8 number shear connectors with a ratio range of 0.97 to 1.42.
7. It is observed that shear connector size remarkably influenced the ultimate load carrying capacity of the specimens.

CONFLICT OF INTEREST

There is no conflict of interest.

FINANCIAL DISCLOSURE

None

ACKNOWLEDGEMENTS

The work was supported by Universiti Teknologi Malaysia Construction Research Centre (UTM-CRC), Institute for Smart Infrastructure and Innovative Construction (ISIIC) with grant vote number 06H41. The authors gratefully acknowledge the support provided.

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ARTICLE

THE INFLUENCE OF LOCAL GEOLOGY ON THE GROUNDWATER POTENTIAL OF KUNIKE SANDA AND BARINA CHIEFDOMS TONKOLILI DISTRICT NORTHERN SIERRA LEONE

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ABSTRACT

This research investigated the influence of the local geology on the groundwater potential of the two kunike chiefdoms (Sanda and Barina) in the Tonkolili District, Northern Sierra Leone. The local geology is made up of rocks typical of the West African Archean greenstone belt. The stratigraphic sequence is marked by the basic ultramafics followed by mafics (metavolcanics) and a metasedimentary unit i.e. quartzite and banded iron formations in a greenstone belt lying on or beside granitic basement rocks. The basement relationship of the granites to the supracrustals has been obliterated by intrusion of Late – Kinematic granites and by deformation and metamorphism during the Liberian tectonothermal event (= 2700 Ma) which produced the dominant N – S to NNE – SSW trend. Because of the geology, aquifers in the studied area are located in two different lithologies – granitic terrain and schist belt. Aquifer characteristics such as transmissivity and yield were measured and compared for the different lithologies. Comparison results show that the yield is greater (0.03%) in the granitic terrain than in the schist belt. And this is because of the presence of clays in the schist belt. The research also revealed that groundwater is readily available in the area.

INTRODUCTION

Sierra Leone forms parts of the West African Craton. About 70% of the outcrops are older than 2.1 G.a. These rocks have been affected by many tectonic events and the structures produced have been used to unravel the geological history of the country. The country consist mainly of an Archaean granite greenstone terrain bounded in the West by a West ward dipping zone of intense high grade rocks, this forms the Kasila group and it has been interpreted as suture. East wards the granite – greenstone terrain is bounded by low grade metamorphic rocks of the Marampa group where the project area is found. The water output of the boreholes in the area is largely dependent on the surrounding geology. Majority of the population in the district depend on groundwater for domestic use and other purposes. However, in spite of the high potential of groundwater in this region and the number of boreholes drilled by Aid Agencies, study reveals that there is still a serious problem with adequate availability and quality of groundwater. This is very evident from long queues at local and drilled wells of people scrambling for water and the high amount of water related diseases reported at health centers in the project area.

LOCATION OF THE PROJECT AREA

It lies between longitude 11° 42' and 11° 27' west of Greenwich and latitude 8° 42' and 8° 33' north. It lies within sheet 56 and 57 of the 1:50,000 contoured plain metric map of Sierra Leone. Figure 1 shows the topographic map of Sierra Leone. The studied area covered the following localities of Makali, Mathonkara, Makoni Line, Petifu Line, Masingbi, Masaba, Machain, Magbasia, Bumbe and a host of other villages.

GEOLOGY OF THE PROJECT AREA

The geology of Tonkolili forms the syntectonic to late tectonic plutonic intrusions (Marmo, 1955). The intrusions range in size from large masses having gradational contact with the basement to smaller cross-cutting stocks and plutons down to pegmatite and aplites. They are mainly of granites to granodiorite in composition and include smaller masses of diorite, gabbro, syenite and other related rocks. The granites intrude both the basement and supracrustals and are therefore younger than the two. They are proposed to have been emplaced during the last of the reactivation events of the basement. The granitic intrusions vary in size from large elongate batholiths to small circular stocks.

The larger bodies tend to be foliated and many of them are porphyritic with feldspars reaching several centimeters in size. The smaller intrusions are unfoliated and generally fine grained. The larger granites are syn-tectonic i.e. they were emplaced during the climax and metamorphism of the basement. The smaller granites are late – tectonic i.e. they were emplaced during the waning stage of deformation and metamorphism. Figure 2 shows the geological map of Sierra Leone and the nine (9) comprising geological units.

Groundwater,
Pumping Test,
Aquifer, Borehole, GIS

Received: 13 Oct 2016
Accepted: 16 Nov 2016
Published: 4 Dec 2016

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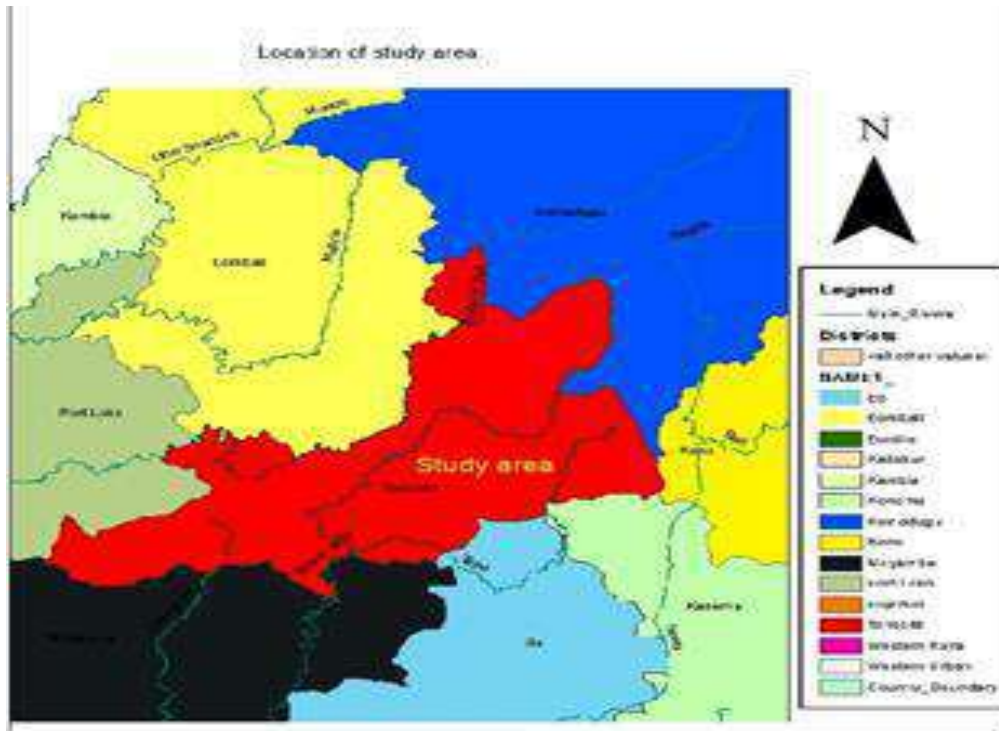


Fig 1: Topographic map of the Study Area

STATE OF EXISTING WATER RESOURCES

At present, the kunike Chiefdoms (Barina and Sanda) utilize both groundwater and surface water. Although surface water is in dominant use, about twenty (20) boreholes were visited in the entire project area including a spring located between Barrainin and Makali along the Kono highway. Table 1 shows the locality name and coordinates of the sampled boreholes.

Most of the groundwater point sources were constructed by the local people with the exception of six (6) boreholes constructed by Sierra Leone Water Company -SALWACO. Other boreholes were constructed by TAKOR, a local N. G. O group involved in the plantation of trees and some help to the communities like building culvert bridges and construction of boreholes. Most of the boreholes are in relatively good sanitary condition and are located away from surface contaminants like pit latrines

Table 1. Locality visited during the data collection

No.	Locality	Coordinates
1.	Masingbi	0227531E, 0955988N
2.	Bonke	0230964 E, 0955306N
3.	Makwalie	0225807 E, 0951774N
4.	Mabathof	0224523 E, 0956400N
5.	Mabgasia	0223048 E, 0953781N
6.	Madina	0219328 E, 0954495N
7.	Petifu Line	0220362 E, 0954576N
8.	Petifu Chain	0219092 E, 0952877N
9.	Makoni Line	0216574 E, 0955783N
10.	Mathonkara	0214194 E, 0954396N
11.	Barrainin	0209641 E, 0953807N
12.	Makali	0207039 E, 0954891N

STATE OF EXISTING WATER RESOURCES

By definition, any geological material that is sufficiently permeable to yield significant amount of water to pumping wells is called an aquifer. For a geological material to be an aquifer it should be porous and permeable. The aquifers in the studied area are largely unconfined, that is the water table forms the upper surface of the zone of saturation. The aquifers are poorly consolidated, porous media consisting of sands and gravel. The occurrence, distribution and movement of groundwater is determined and controlled by the porosity produced by joints, fractures and fissures within the basement rocks. Thus in Sierra Leone the

aquifer system and their characteristics are largely related to the various geological formations in the country. Figure 3 shows the aquifer system of Sierra Leone.

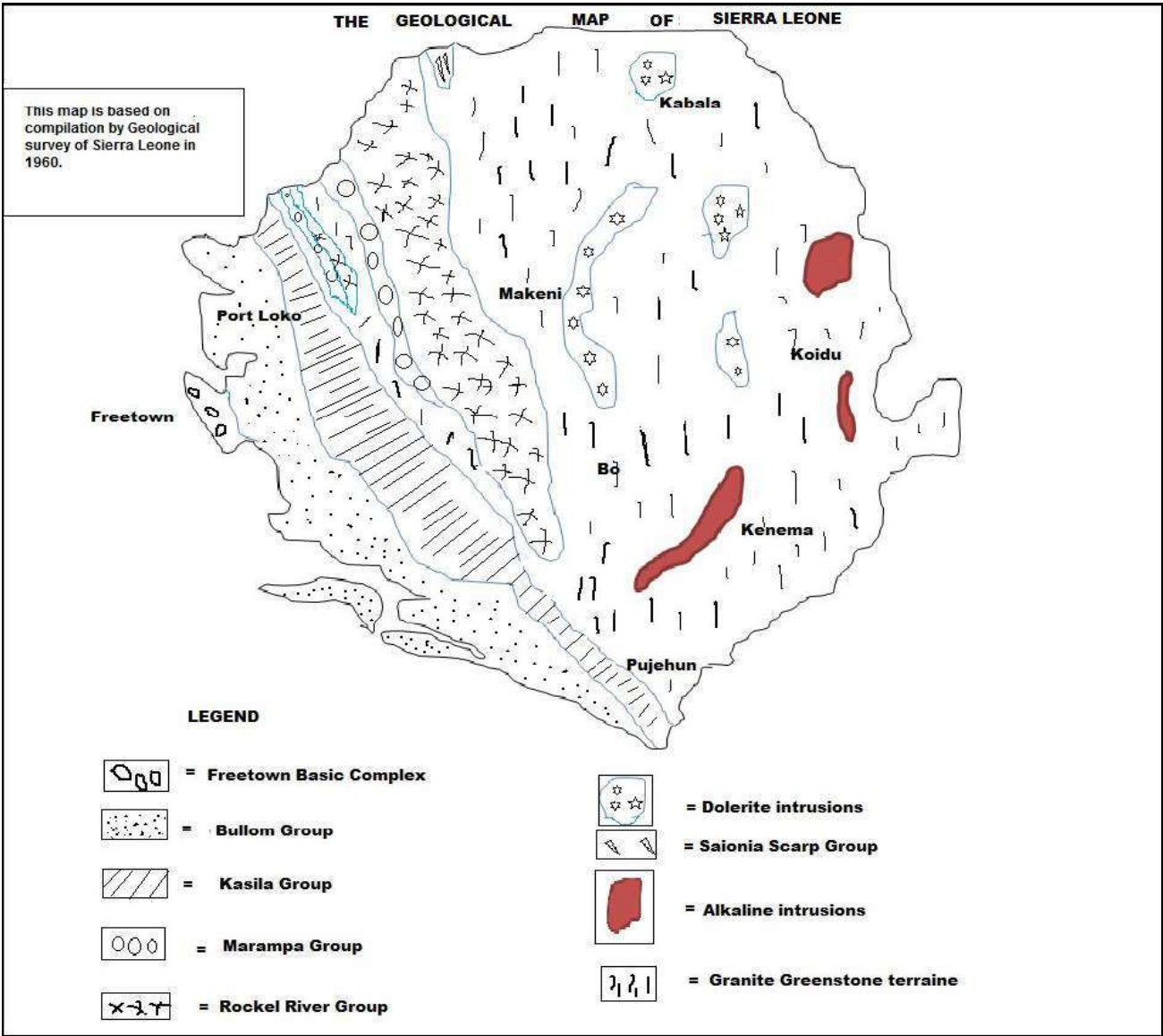


Fig.2. Geologic map of Sierra Leone

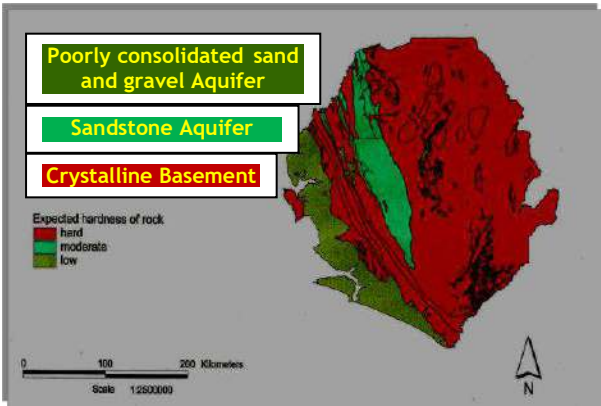


Fig.3. Aquifer map of Sierra Leone

Nonetheless, analysis of pumping test data for some boreholes in the area indicates that the aquifers receive some of their recharge from surface source.

Recharge may be estimated by using the water balance model to calculate actual evapotranspiration which is then fed into the hydrologic equation to determine groundwater recharge: The input parameters to the water balance model include; Temperature, Precipitation, Potential evapotranspiration and surface runoff. The surface runoff coefficient for Sierra Leone rivers is 0.12 (Kemokia, 1996). The hydrologic equation is thus:

$$Rg = P - (Sr - Ev) \quad (1)$$

where;

- Rg = Groundwater recharge (mm)
- P = Precipitation (mm)
- Sr = Surface runoff (mm)
- Ev = Evapotranspiration (mm)

The aquifers found in the two chiefdoms consist of sand, gravel, silt and weathered granite. Since the sediment have high porosity as a result of the pore spaces found in them it can be concluded that most of the aquifers in the project area are permeable to some extent. The major rock formations found here that have greater potential of groundwater storage include:

- i. The weathered layer – Nearly all handdug wells in the area penetrate this aquifer but recharge is generally low due to low transmissivity
- ii. The zone between overburden and hard rock – This aquifer is very difficult to penetrate, but with favorable climatic conditions, weathering of the hard rock gives high prospects of exploiting this aquifer. Wells that penetrate this aquifer give water of good quality since water is filtered as it passes through the rocks.
- iii. The Hard Rock – This aquifer is very reliable but drilling through this aquifer requires special drilling techniques and for this reason drilling through these aquifers is done by hammer drilling method.

ANALYSIS AND INTERPRETATION OF PUMPING TEST DATA

Pumping tests are carried out for the following reasons:

- a. To determine the behavior of the aquifer during pumping in the borehole and for different yields to fix the maximum yield for exploitation compatible with the conditions of the aquifer
- b. To determine particularly the hydraulic characteristics of the aquifer around the borehole (i.e. transmissivity)
- c. To determine that the water table of the reservoir do not over exploit the aquifer and to limit the yield according to the condition of the aquifer This method (pumping test) can be used for the determination of transmissivity and storativity. Two boreholes are needed in pumping test. The first one is the production well and the other is an observation well. Essentially water is pumped out of the production well, during this process the piezometric surface will fall and this is called a drawdown. However, in the project area only one borehole i.e. the production well was used during the pumping and as such certain assumptions needs to be made as it is only transmissivity is measurable in the boreholes in the project area. No radius of influence, hence storativity cannot be estimated. In an ideal aquifer, the following assumptions are made in carrying out the pumping test as in the project area:
 - 1) There is only a single pumping well in the aquifer.
 - 2) The pumping rate is constant.
 - 3) The well fully penetrate the aquifer
 - 4) The hydraulic head (h) prior to pumping is uniform.

RESULTS AND DISCUSSION

Pumping Test Analysis

The pumping test data during the SALWCO project implemented by KOREA GROUP are analyzed below. During the analysis, a semi-logarithmic graph of drawdown versus time was plotted for each data. With the drawdown and the time values obtained, the transmissivity can be calculated using the following equation (Cooper and Jacob's solution) presented by Cooper and Jacob (1946).

$$h_0 - h = \frac{2.3Q}{4\pi T} \log \frac{2.25\pi}{r^2 S} \quad (2)$$

where:

- h_0 = Static water level (m)
- h = Head at any level (m)
- $h_0 - h$ = Drawdown for a logarithmic cycle ($=\Delta h$) (m)
- Q = Discharge (m^3/s)
- T = Transmissivity (m^2/s)
- S = Storativity (m^2/s)
- r = Radius of influence (m)
- t = Time at zero drawdown (s).

Since there is only a single well in the aquifer with no observation well, so no radius of influence, hence storativity cannot be estimated. Transmissivity can be calculated as

$$T = \frac{2.3Q}{4\pi\Delta h} \quad (3)$$

The pumping test data of the selected boreholes in the project area are shown below with their analysis.

Makoni Line borehole

Yield during pumping = 2.5 m³/ hr
 Static water level (h₀) = 4.94m
 Temperature = 28 °C
 Total dissolved solids = 88.9 mg/L
 Electrical conductivity = 117.8 Ls/cm
 pH = 6.3

Table 2. Measurement data at Makoni Line Borehole

Time (s)	D. W. L h(m)	Drawdown h – h ₀ (m)
30	4.92	0.00
60	7.20	2.28
120	9.20	4.28
180	10.97	6.05
240	12.19	7.27
300	13.42	8.50
360	14.90	9.98
420	16.33	11.41
480	17.60	12.68
540	18.50	13.58

Drawdown: $\Delta h = 8.60\text{m}$
 Discharge: $Q = 2.5 \text{ m}^3/\text{hr}$
 Transmissivity: $T = \frac{2.3Q}{4\pi\Delta h} = \frac{2.3(2.5)}{4\pi(8.60)} = 0.053 \text{ m}^2/\text{s}$

Petifu Line Borehole

Yield during pumping: 1.8 m³/hr
 Static water level: 7.70m
 Temperature: 27.5 °C
 Total dissolved solids: 88.3mg/L
 Electrical conductivity: 117.2 us/cm
 pH: 6.1

Table 3. Measurement data at Petifu Line Borehole

Time (s)	D. W. L h(m)	Drawdown h – h ₀ (m)
10	7.70	0.00
60	10.49	2.79
120	12.37	4.67
180	13.53	5.83
240	15.65	7.95
300	16.26	8.56
360	16.58	8.88
420	16.66	8.96
480	16.73	9.03
540	16.78	9.08
600	16.80	9.10

Drawdown: $\Delta h = 6.40 \text{ m}$
 Discharge: $Q = 1.8 \text{ m}^3/\text{hr}$
 Transmissivity: $T = \frac{2.3Q}{4\pi\Delta h} = \frac{2.3(1.8)}{4\pi(6.40)} = 0.052 \text{ m}^2/\text{s}$

Masingbi (School) Borehole

Yield during pumping = 1.4 m³/hr
 Static water level = 8.60m

Temperature = 27.4 °C
 Total dissolved solids = 176mg/l
 Electrical conductivity = 35.1us/cm
 pH = 6.1

Table 4. Measurement data at Masingbi Borehole

Time (s)	D. W. L h(m)	Drawdown h – h ₀ (m)
0	8.60	0.00
60	10.63	2.03
120	13.49	4.89
180	14.78	6.18
240	16.22	7.62
300	18.30	9.70
360	19.58	10.98
420	20.34	11.74
480	20.87	12.27
540	20.99	12.39
600	21.35	12.75

Drawdown: $\Delta h = 9.20\text{m}$
 Discharge: $Q = 1.4 \text{ m}^3/\text{hr}$

$$T = \frac{2.3Q}{4\pi\Delta h} = \frac{2.3(1.9)}{4\pi(9.20)} = 0.028 \text{ m}^2/\text{s}$$

 Transmissivity:

BOREHOLE YIELD ANALYSIS

The yields of these boreholes were measured using a container of 5 liters and a stopwatch. The time to fill the container was recorded and the yield, γ (m^3/day) was calculated as follows: -

$$\gamma = \frac{\text{Container capacity}}{\text{Time taken to fill container}} \quad (4)$$

The yield of the boreholes in the villages visited were analyzed and compared. The types of lithologies considered are the granitic terrain and the schist belt.

The granitic terrain

i) Massingbi Borehole Yield

Capacity of container = 5 liters

Time to fill container = 19 s

$$= 5 / 19 = 0.263 \text{ liters/s}$$

$$= 15.78 \text{ liters/min}$$

$$= 15.78 \times 60 \times 24 \text{ liters/day}$$

$$= 22.72 \text{ m}^3/\text{day}$$

ii) Petifu Line Borehole Yield

Capacity of container = 5 liters

Time taken to fill container = 21 s

$$= 5 / 21 = 0.238 \text{ liters/s.}$$

$$= 14.28 \text{ liters/min}$$

$$= 14.28 \times 60 \times 24 \text{ liters/day}$$

$$= 20.56 \text{ m}^3/\text{day}$$

The schist belt

i) Makoni Line Borehole Yield

Capacity of container = 5 litres

Time taken to fill container = 24 s

$$\text{Yield} = 5 / 24 = 0.208 \text{ litres/s}$$

$$= 12.48 \text{ litres/min}$$

$$= 12.48 \times 60 \times 24 \text{ litres/day}$$

$$= 17.97 \text{ m}^3/\text{day}$$

CONCLUSION

The objective of the research was to map the various rock types and assess the geology and hydrogeology of the area, the potential of the groundwater for water supply in Kunike Sanda and Barina Chiefdoms, Tonkolili District, Northern Provinces, Sierra Leone. Field observations during the mapping helped to

unravel the geology of the area. Adequate information about the stratigraphic sequence of the project area during the exercise was difficult to unravel because of poor exposure. However, stream channels helped in unraveling of the geology of the area. From observations and findings we concluded that surface water is not reliable because of the excessive pollution tendencies due to dumping of garbage in the water and defecation by inhabitants nearby. Even though the surface water scheme can meet growing demand of the community, there are no funds available to pump the water to the community and to treat the water before use; because of this, many residents depend greatly on ground water for water supply. The boreholes drilled cannot meet the growing demand of the present community. From the analysis above we may conclude that the yield is greater in the granitic terrain than in the schist belt. And this is because of the presence of clays in the schist belt hence the significance of assessing the geology before drilling a borehole of digging a well.

RECOMMENDATION

After several findings, the following recommendations should be noted:

1. Instead of drilling a lot of boreholes only to be abandoned after a short period of time, it is noteworthy that the implementing agencies should be monitored so that all the problems if not all, some reported by the community be easily solved.
2. Regular maintenance of the boreholes should be done on a frequent basis at least once every three (3) months, whereby SALWACO Personnels visit the community to conduct water quality tests and advise them.
3. New boreholes should be drilled in every village to alleviate the problem of water shortage and these boreholes should be handled with care.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The author would like to acknowledge the support provided by Sierra Leone Water Company (SALWACO) for the borehole data and the Japan Society for the Promotion of Science (JSPS) for the RONPAKU funding

FINANCIAL DISCLOSURE

None

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ARTICLE

MORPHOLOGY, PHENOTYPIC RESPONSES AND VIABILITY OF HAPTOPHYCEAE MARINE MICROALGA *PAVLOVA LUTHERI* DURING Cu (II) EXPOSURE – A LABORATORY STUDY

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ABSTRACT

Background: Metal pollution has provoked the disorder in aquatic ecosystem; nevertheless some dissolved metals serve as nutrient in microalgal physiology. Microalgae form the base of a food chain. Hence, any impairment at the base of a food web will eventually affect the next trophic level. Copper (Cu) is an oligodynamic metal in microalgal physiology and is ubiquitously present in the aquatic environment. In this aspect the impact of Cu (II) was evaluated upon morphology and physiology of *Pavlova lutheri* (NIOT-3 & EMA Accession No: LT009495), as a model organism. **Methods:** An optimized monoculture of *P. lutheri* was utilized during the experiment based on the OECD protocol through growth inhibition, SEM and micrometric assay. During data analysis and illustrations Mean $\pm$ S. D. of triplicates were considered. **Results:** The data revealed the dose dependent decline in the phenotypic profile with increasing concentration of Cu (II) and subsequently morphological injury, alteration in cell size and viability were evidenced substantiating the cellular stress during Cu (II) exposure. **Conclusions:** The *P. lutheri* strain may be potential species in removing Cu (II) from the aquatic environment, if exploited efficiently during the application. However, the removal efficiency is subjected to the differential media and biotic or abiotic stress.

INTRODUCTION

KEY WORDS
Pavlova lutheri, BCF,
morphology, Cu (II),
phenotypic profile

Metal pollution has become a serious threat to the environment lately [1]. Metals reach to the environment from various industrial, anthropogenic and natural resources. Ultimately these metal ions from various allochthonous and autochthonous sources reach to the marine ecosystem via surface run-off, precipitation, etc. In marine ecosystem phytoplankton acts as a primary producer and use metal ions as nutrient. Few metal ions, for instance, zinc, molybdenum, copper, etc. at trace quantities serve as essential nutrient whereas other metals, viz. chromium, arsenic, etc. serve as nonessential metal ions in phytoplankton physiology. The presence of essential metal ion in excess or existence of nonessential metal ion in the aquatic matrix brings physiological stress in microalgal physiology. Since phytoplankton plays key role as a primary producer in the aquatic environment and forms the base of a food chain, any impairment at the base has potential to affect the next trophic level.

Copper is one such heavy metal which falls under essential nutrient category for the microalgal physiology at trace level. Though, it can be toxic and hazardous [2] at higher concentration to the aquatic biota with special reference to phytoplankton. It is reported that Cu²⁺ is the most toxic to the unicellular algae and inhibits the photosynthetic activity damaging the cell membrane. Copper is a biologically active metal and plays vital role in photosynthesis during phosphorylation and enzymatic reactions of algal cells [3]. The sensitivity or toxicity of Cu (II) is indirectly proportional to the initial cell density of the phytoplankton and also subjected to the differential efficiency of the exposed microalgal species.

Recently, marine microalgae which belong to the phytoplankton community and also the vital resource for nutraceuticals and biomedical aspects, are being explored for the removal of toxic metal xenobiotics with a new tempo. In comparison to other techniques, for instance, chemical, mechanical, etc., the biological techniques remain ahead in view of its cost effectiveness in terms of energy, economy and efficiency. Though, the ecophysiological aspects of the microalgae have been poorly explored.

In this study, we report the impact of Cu (II) exposure upon the haptophyceae marine microalga *Pavlova lutheri* (NIOT-3 & EMA Accession No: LT009495) as a model organism, during the exponential growth phase of the microalga, on its morphology, phenotypic profile and simultaneous metal uptake in controlled laboratory condition. The results may be useful during the formulation of effluent discharge criteria or strain optimization for the nutraceuticals.

MATERIALS AND METHODS

Microalgal culture and growth media

The unicellular marine microalga *Pavlova lutheri* (NIOT-3 & EMA Accession No: LT009495) was received from microalgae culture collection bank of NIOT and explored in Cu (II) exposure as a model organism. The culture was maintained in seawater enriched with f/2 media (Guillard and Ryther, 1962) and was acclimatized upto 5th generation under uniform abiotic conditions [photosynthetically active radiation: 54

Received: 10 Oct 2016
Accepted: 12 Nov 2016
Published: 4 Dec 2016

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$\mu\text{Mol m}^{-2} \text{ s}^{-1}$, photoperiod: 12 h : 12 h (light : dark), temperature: $24 \pm 2^\circ\text{C}$. Initial pH, salinity and cell count were 8.0, 35 psu and 10^6 nos. of cells/mL, respectively.

Toxicant

Cuprous chloride (Cu_2Cl_2) was procured from Merck and used as Cu (II) toxicant. A stock solution of 5000 $\mu\text{g/mL}$ of Cu (II) was prepared and used for the experiments. The required lower concentrations of Cu (II) xenobiotics were prepared through proper dilution of the stock solution using sterile Milli Q water.

Experimental method

The experiment was performed in triplicate based on the protocol of the Organization for the Economic Cooperation and Development (OECD, 201) [4]. The *P. lutheri* cells were treated with various concentrations of Cu (II) in 250 mL conical flask with a culture volume of 100 mL. The concentration of Cu (II), ranging from 0.9 – 6.47 $\mu\text{g/mL}$, was determined from the initially conducted range finding test.

Followed by, the study was conducted in five groups of Cu (II) concentrations along with control culture of *P. lutheri* for 96 h. Cu (II) dose was applied in each group at appropriate concentration at the 0th h and incubated upto 96 h in the experimental condition. The growth of the culture was monitored at 24 h interval upto 96 h and swirled gently thrice daily to avoid the settling of the culture.

Further, upon determining the median inhibitory concentration (IC_{50}) value of Cu (II) upon *P. lutheri*, the culture was exposed to this concentration in triplicate for 96 h along with control and samples were aliquoted for morphological, physiological, cytotoxicity and micrometric analysis.

Measurement of Growth Parameters

Algal cells were counted using haemocytometer by fixing with Lugol's iodine and visualizing under a microscope (400X, Karl Zeiss Axioscope2), whereas optical density (OD) was measured in a spectrophotometer (660 nm, Shimadzu). The counted cells were expressed as number of cells/mL. Dry weight was measured according to the protocol prescribed by Zhu and Lee [5]. Data were expressed as $\mu\text{g/mL}$ of algal suspension. Chlorophyll-a was measured following the protocol as prescribed by Jeffrey and Humphrey [6] and recorded through a spectrophotometer (Shimadzu). Trichromatic equation was applied to calculate the Chl-a content. The pigment content was calculated as $\mu\text{g Chla/ mL}$ of microalgal suspension, under consideration of the dilution factors. Nichol's equation (1973): $K \text{ (/day)} = [3.322 / (t_2 - t_1)] * (\text{Log } N_2 / N_1)$ was applied to calculate the growth rate; where, N_2 is the OD value at time t_2 and N_1 is the OD value at time t_1 ; while the percent of growth inhibition (GI) was calculated based on the equation: $\text{GI (\%)} = [(GR_{\text{control}} - GR_{\text{concentration}}) / (GR_{\text{control}})] * 100$ and successively doubling time (DT) was calculated as $\text{DT(h)} = (\ln 2 / K)$, where K is the growth rate.

Metal Analysis

To quantitate the Cu (II) uptake, microalgal biomass was harvested, lyophilized, weighed and then digested with concentrated ultra-pure HNO_3 and H_2O_2 (30%) (1:4) in 100 mL pre-cleaned teflon vessel with closure. Post digestion the samples were analyzed for metal content in ICP-OES (VARIAN 725-ES) under uniform analytical conditions (power: 1.2 KW, plasma flow 15.0 L/min, replicate: 3 and sample uptake delay 5 s). Also, the corresponding media and matrix were analyzed as prescribed by Grasshoff et al. [7] with necessary modification. Blanks and spikes were analyzed to validate the digestion process of the spectroscopic analysis, obtaining 95% recovery. In addition, 0.5 $\mu\text{g/mL}$ of multi-elemental standard was analyzed upon every 10 samples to monitor the matrix effects of the analytes and for quality assurance and quality control.

Further, bio concentration factor (BCF) was calculated as defined by Brooks and Rumsby [8] which is the concentration ratio of an element in dry biomass and in the water (culture growth media), whereas % uptake of Cu (II) by the microalgal biomass was calculated as: $\% \text{ Uptake} = [\mu\text{g of Cu (II) in biomass} / \mu\text{g of dry biomass}] * 100$.

Microscopic analysis and cell viability

An aliquot (1 mL) of cell suspension from control and treated samples were harvested to pellet through centrifugation at 6000 rpm for 15 min at 4°C . The respective pellets were resuspended in 100 μL of 0.1% of Trypan blue (SIGMA). The mixture was incubated at room temperature for 5 min. The cells were visualized and examined through haemocytometer under light microscope (1000X, Karl Zeiss Axioskope2). The % of cell viability was calculated as the ratio of the number of viable cells to the total number of cells and multiplied by 100. Followed by, about 10 μL of the resultant sample was smeared onto a glass slide and sealed with cover slip (Blue Star, No. 0) for observation and capturing image.

Field Emission Scanning Electron Microscopy (SEM Analysis)

Both pristine and treated samples were processed following the protocol of the Huck Institute of Lifesciences [9] and Elumalai et al. [10]. Optimization and modifications were carried out during sample preparation to suit the best for our sample of interest. An aliquot (1 mL) of the samples were fixed in buffered glutaraldehyde for overnight at 4°C . The samples were incubated in 4% of OsO_4 and subsequently kept at room temperature in dark. The fixed samples were then dehydrated with series of ascending grade (%) of alcohol and subjected to gold sputter-coating for approximately 30 min. Finally, the

mounted samples were visualized under HR-SEM (Fei Netherlands, voltage 20 KeV, spot size 3) at high vacuum mode. The corresponding images were captured using XP Microscope Server software.

Fourier Transform Infrared (FTIR) spectroscopy

FTIR analysis was carried out to look into the metal binding functional groups located on the microalgal cell surface. The freeze-dried microalgal cells were subjected to FTIR analysis by KBr method using PerkinElmer Spectrum 1 equipped with Deuterated triglycine sulfate detector (DTGS) within the wave number range $450 - 4000 \text{ cm}^{-1}$ (4 cm^{-1} resolution, 3 number of scans, and air as background) in transmission mode [11].

Statistics

Data were subjected to one-way Analysis of Variance (ANOVA) using Microsoft excel in Windows 7 Ultimate. ANOVA effects and treatments were considered significant at $p < 0.05$ and further post hoc analysis was carried out upon finding out the presence of significant difference between the groups. All the dataset presented over here are Mean $\pm$ S.D. of triplicates unless otherwise specified. Metal concentration values are reported based on the measured concentration values only.

RESULTS

Microalgal phenotypic characteristics get impaired due to heavy metal exposure [11,12,13,14,15]. The growth profile of *P. lutheri* in the conducted experiment revealed congruency with Fathi *et al.* [12], Namita *et al.* [13], Sucheta *et al.* [11,15] and many other research works carried out earlier. During our investigation it is observed that the duration and exposure concentration of Cu (II) leads to the retardation in growth profile of the exposed *P. lutheri*. The microalga was found to tolerate upto $5.24 \mu\text{g mL}^{-1}$ of Cu (II). The variations observed were found to be significant ($p < 0.05$) at all concentrations as compared to control. All experimental value reported over here are Mean $\pm$ S.D of triplicates. Cu (II) at lower concentrations is favored for the nutrition of microalgae, however, it is reported that in phytoplankton physiology Cu (II) is an oligodynamic metal as it is stimulatory at lower concentration whereas toxic at high levels. The growth retardation [Fig. 1] of *P. lutheri* can be attributed to the presence of the Cu (II) cations in the growth media. The Cu (II) ions create an uneven electrical charge between extracellular and intracellular matrix. Data analysis revealed that the % uptake of Cu (II) by *P. lutheri* is directly proportional to the exposure concentration of Cu (II) which is unlike to our previous investigation on Cr (VI) uptake of *Chlorella vulgaris* [15] while BCF profile was found to follow a declining trend with increasing Cu (II) concentration. Highest BCF (0.34) was found at $0.5 \mu\text{g/mL}$ of Cu (II) concentration [Fig. 2]. The biomass and chlorophyll-a were found to follow declining trend with increasing concentration of Cu (II) cation. This phenomenon substantiates the fact of potentiality of Cu (II) to affect the photosynthesis [14] of the microalga [Fig. 3].

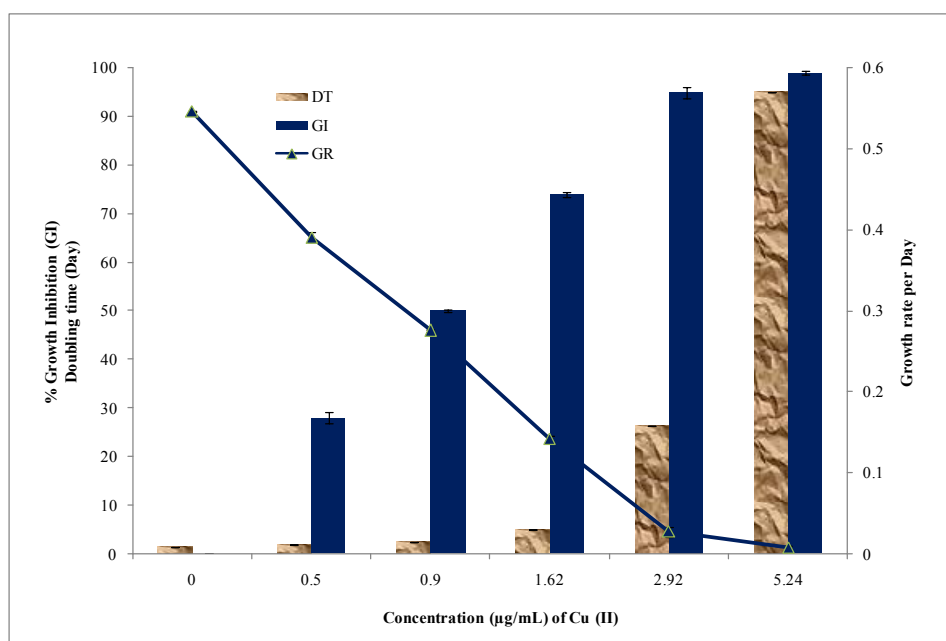


Fig. 1: Dose response curve of *P. lutheri* at various concentrations of Cu (II) after 96 h exposure.

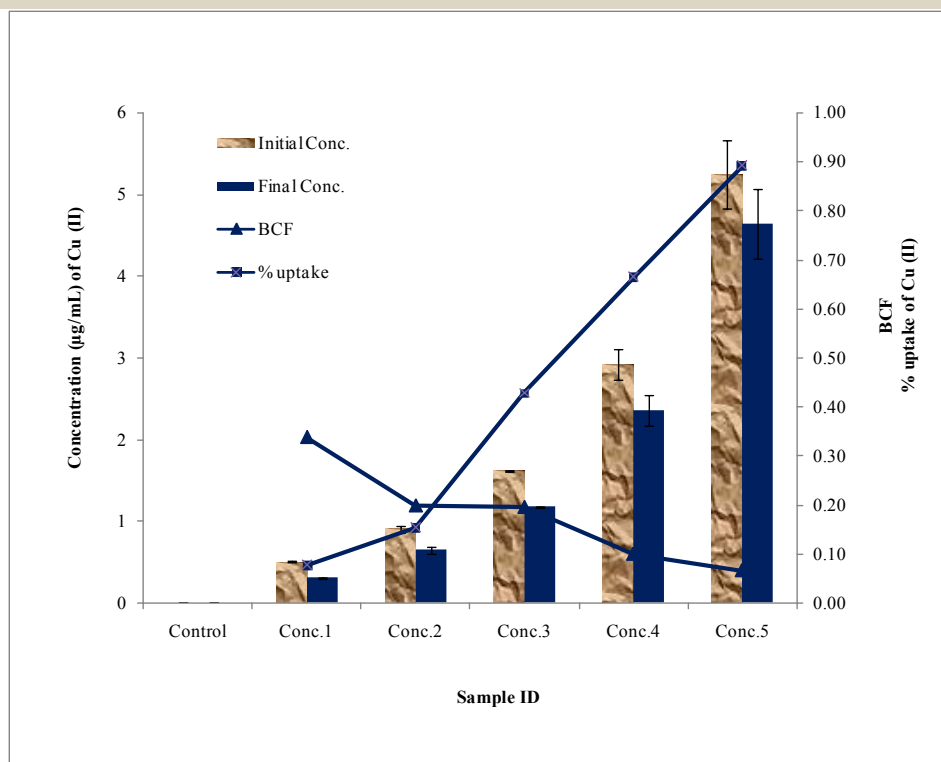


Fig. 2: Metal uptake, BCF and % removal of *P. lutheri* at various concentrations of Cu (II) after 96 h exposure.

Copper tolerant strains of microalga can tolerate exalted concentration through cellular exclusion or through formation of intracellular copper complexes during detoxification mechanism [3]. The Cu (II) removal efficiency of *P. lutheri* from the culture media was documented as 40.0%, 28.0%, 27.8%, 19.3% and 11.4% at the exposure concentration of 0.5 µg/mL, 0.9 µg/mL, 1.62 µg/mL, 2.92 µg/mL, 5.24 µg/mL, respectively [Fig. 2]. Hence, the *P. lutheri* strain may be potential species in removing Cu (II) from the aquatic environment [16].

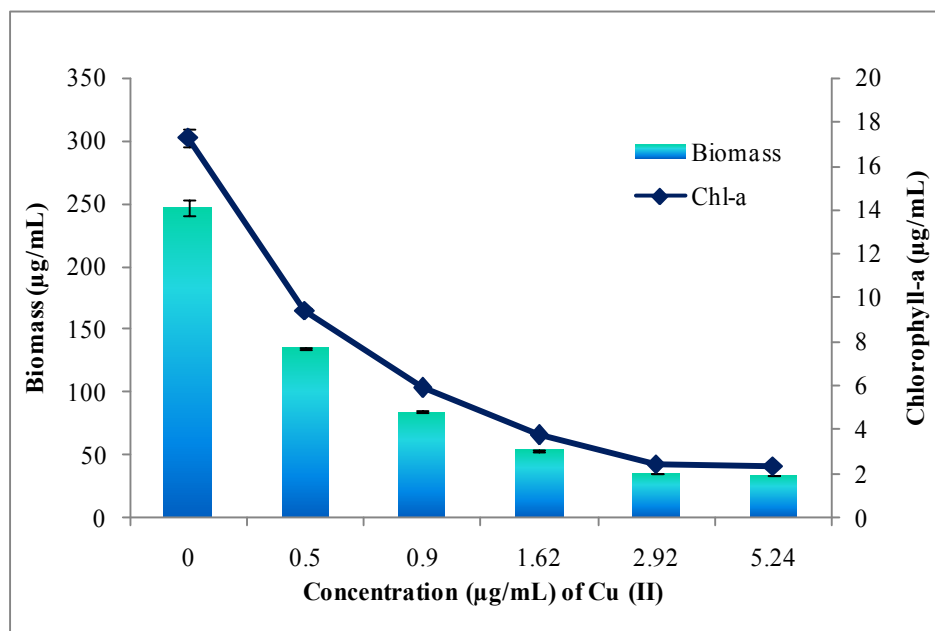


Fig. 3: Chl-a and biomass of *P. lutheri* at various concentrations of Cu (II) after 96 h exposure

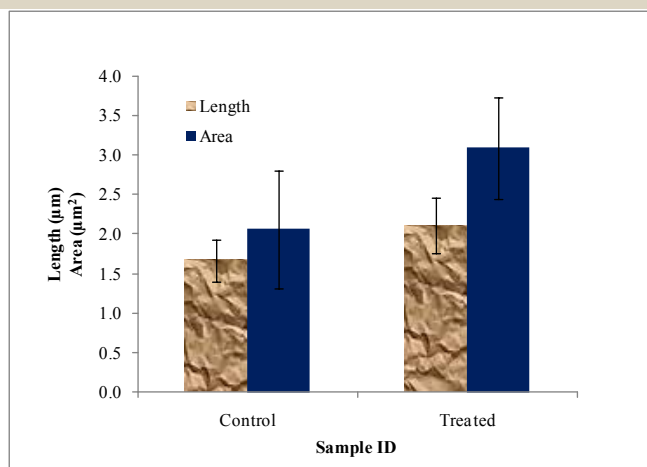


Fig. 4: Cell size of *P. lutheri* at IC₅₀ of Cu (II) after 96 h exposure

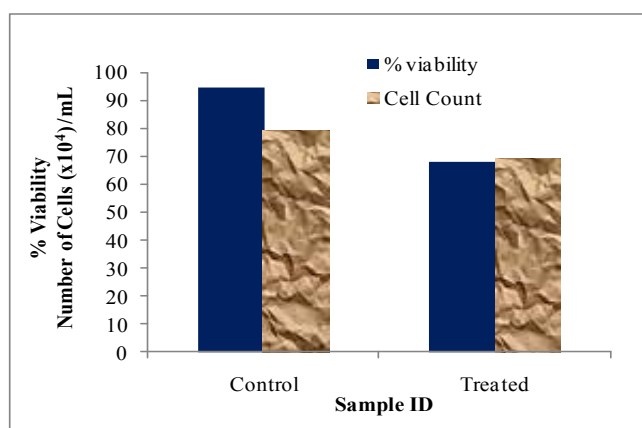


Fig. 5: Cell viability and cell count of *P. lutheri* at IC₅₀ of Cu (II) after 96 h exposure

Light microscopic (LM) observations revealed the spherical healthy cells in control culture whereas swollen cells are seen in the Cu (II) treated culture of *P. lutheri* [Fig. 6]. The viability assay disclosed the reduction of cell number due to Cu (II) exposure. At IC₅₀ of Cu (II), it is estimated that there was 12.7% reduction in cell count [Fig. 5].

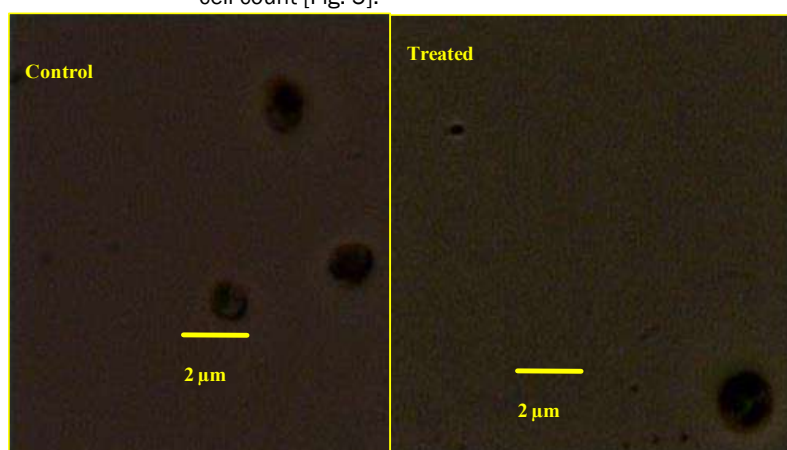


Fig. 6: LM (400X) photomicrograph of *P. lutheri* at IC₅₀ of Cu (II) after 96 h exposure

Upon calculation the cell viability was found to be 95% in case of control, whereas 68% for the Cu (II) treated (IC₅₀) microalgae at the end of 96 h [Fig. 4]. The amplification of cell size substantiates the fact that the cell expansion occurs during exposure of Cu (II) as compared to that of control. During micrometric analysis of *P. lutheri* at IC₅₀ of Cu (II) exposure, it is found that there is an increase in cell length (27%) and in cell area (50%) as compared to the respective control [Fig. 4].

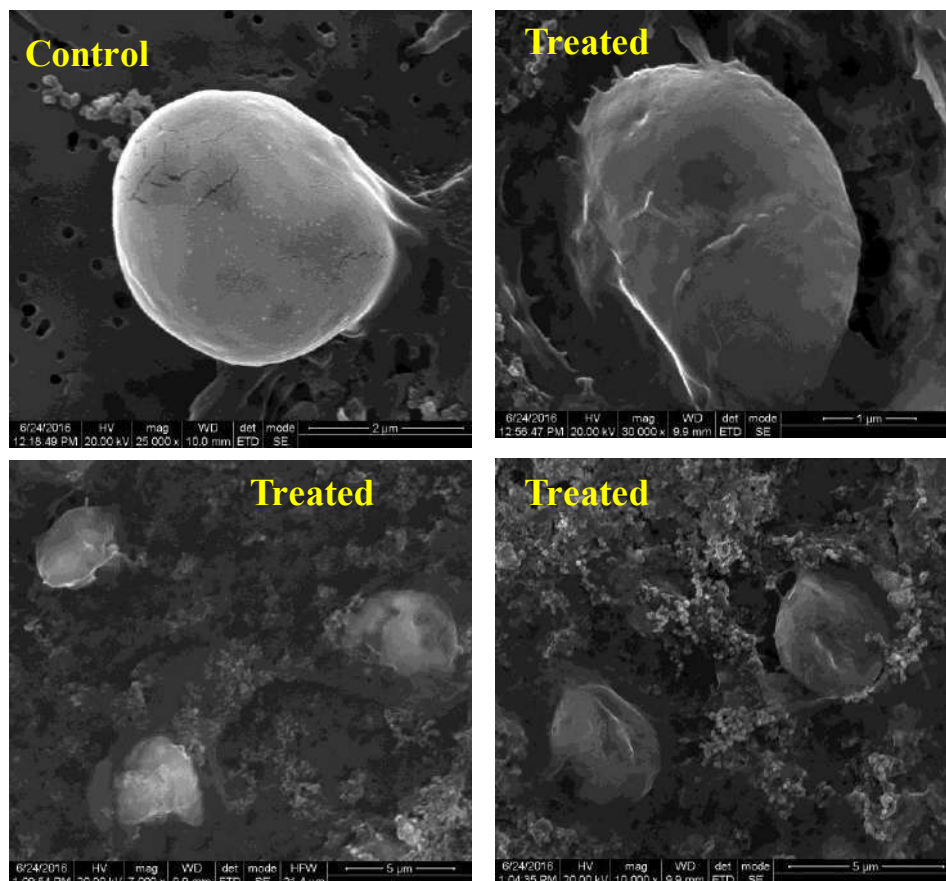


Fig. 7: SEM photomicrograph of *P. lutheri* after 96 h Cu (II) exposure at IC₅₀.

The integrity of the cell membrane of *P. lutheri* was studied through photomicrograph of the microalga using Scanning Electron Microscopy. The cell wall of *P. lutheri* is composed of largely hemicelluloses fibrils and saccharides for instance manose, ramnose, xylose, galactose, glucose, etc. During control condition an irregular smooth surface topology of *P. lutheri* cell was observed [Fig. 7]. The corresponding Cu (II) exposed cells [Fig. 7] were seen with ruptured membrane integrity. The heavy metals are adsorbed passively and assimilated actively from their surrounding niche as during the stress, release of organic ligands takes place into the media [17, 18]. The released ligands efficiently bind metal ions. Also, owing to heterogeneous cell surface, microalgae bind metal ions through various functional groups, for instance, carboxyl, amino, carbonyl, hydroxyl, etc. Though there are a variety of functional groups but the total number of functional groups present on the biosurface is constant leading to a maximum proton adsorption capacity. The efficiency of metal binding property with various functional groups was also revealed through SEM surface micrograph as compared to its respective control [Fig. 7]. During the exposure into the metal solution either heavy metal ions get attached on to the surface primarily or they enter into the cell through cell wall during passive transport of the metal ions. The adherence of metals on the surface of the microalgal cell is devoid of cellular metabolism whereas the ingress of metal into the cell and subsequently accumulation into the cell is dependent on cellular metabolism as reported by Sen and Ghosh Dastidar [22]. From the SEM photomicrograph formation of nanoparticles is also detected. Similar evidence was recorded by Radhika *et al.* [19] in *Chlorella vulgaris* upon treatment with ZnO nanoparticles and Sucheta *et al.* [11] in *P. lutheri* during Cr (VI) exposure.

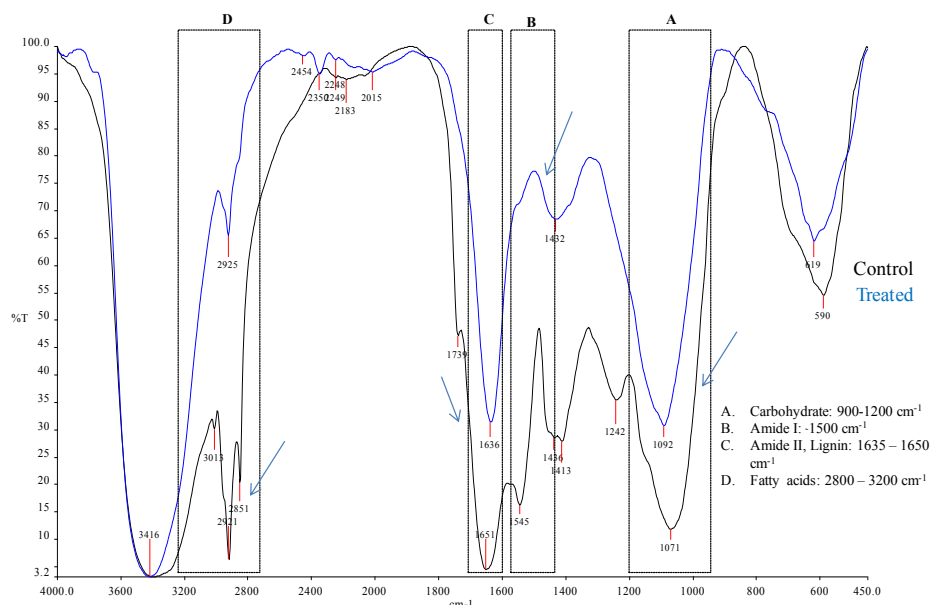


Fig. 8: FTIR spectrum of the control and Cu (II) treated *P. lutheri* at harvest (96 h)

To study the biotic and abiotic stress induced response in microalgae, FTIR spectroscopy was carried out. FTIR spectroscopy is an easy, non-destructive and entrenched technique [20]. The peak intensities in spectrum of the treated one were found to be different as compared to that of the control. These peak modulations substantiated the involvement of the bio molecules located on the cell wall to interact with the Cu (II) ions. These bio molecules exert a whole negative charge and bind the metal ions through their binding sites [21]. Distinct changes were observed in the wave number regions, for instance 900-1200 cm^{-1} , 1500 cm^{-1} , 1635-1650 cm^{-1} , 2800-3200 cm^{-1} in the spectrum of the treated one as compared to that of the control [Fig. 8], which can be attributed to the involvement of the carbohydrate, amide I, amide II and fatty acid moiety, respectively. The surface of the microalgae contains a number of electron dense functional group, for instance, carboxyl ($-\text{COOH}$), hydroxyl ($-\text{O-H}$), carbonyl ($-\text{C=O}$), etc. with high affinity towards positively charged metal ions and act as the binding sites of the metal ion/s to transport the metal ions across the cell wall. Ingestion of metal ions into the cells takes place through two distinct phases, viz. rapid assimilation when equilibrium is established between the intracellular and extracellular metal ion pool and a slower facilitated ion transport into the cytoplasm [22]. An extensive variation of peaks in the fingerprint region (1500 cm^{-1} to 500 cm^{-1}) of the spectra was also observed. The adsorption of metal ion on the microalgal cell surface provides an insight about the initial toxicant loading of the cells which is also a function of the microalgal cell surface area and the nature of the binding sites [23].

CONCLUSION

The present study revealed that the cellular density and growth rate is a function of the exposure concentration of copper and time of exposure as well. Doubling time and growth inhibition was found to be directly proportional with the increasing Cu (II) concentration. *P. lutheri* was found to tolerate up to 5.24 $\mu\text{g/mL}$ of Cu (II), however depending on initial cell density, exposure duration and concentration of copper, the results are likely to vary. The microalga was found to remove 40 % of Cu (II) from the growth media during 0.5 $\mu\text{g/mL}$ of Cu (II) exposure for 96 h, which is recorded as the highest removal efficiency during the experiment. The cell wall of the microalga *P. lutheri* gets damaged during the Cu (II) exposure and subsequently inhibits the photosynthesis process. The microalga can be beneficial for detoxification of Cu (II) while exposed to lower concentration (0.5-0.9 $\mu\text{g/mL}$).

CONFLICT OF INTEREST

Conflict of interest is declared none.

ACKNOWLEDGEMENTS

Authors are delighted to acknowledge the members of the Marine Biotechnology (MBT) Group of ESSO-National Institute of Ocean Technology (NIOT) for their kind support and co-operation during this work. The acknowledgement also goes to Dr. R. B. N. Prasad, Formerly Director, for extending the ICP-OES facility at Indian Institute of Chemical Technology (IICT), Hyderabad and to the Director of Indian Institute of Technology Madras (IITM), Chennai for extending the HR-SEM facility. SS is thankful to the Director, ESSO-NIOT, Chennai and to the Dean of Research, Sathyabama University, Chennai to carry out this work as a part of Doctoral studies. The authors thank the Ministry of Earth Sciences (MoES), Govt. of India, New Delhi, for financial assistance.

FINANCIAL DISCLOSURE

Financial disclosures are declared none.

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ARTICLE

WASTE TO WEALTH: ALTERNATIVE SOURCE OF GLYCOSAMINOGLYCANS (GAGS) FROM SEA FOOD WASTE

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ABSTRACT

Glycosaminoglycans (GAGs) are compounds that were used to treat various diseases. Generally GAGs widely used in biological and medical approaches. Osteoarthritis (OA) is the one example of disease that used GAGs by enhancing the production of cartilage matrix components in the joints. In Malaysia, management of organic waste such as fish bone is the focus point to achieve environmental sustainability. Sea food waste from *Lates calcarifer* was used as the model to extract GAGs where a few tests were carried out to verify the presence of GAGs. These fish is popularly sought-after and this will provide its unwanted parts (gills and viscera) into therapeutically and economically viable solution for society. Then, the invention convert this waste to wealth which help for the better utilization of seafood waste. Analytical testing were carried out to determine the similarity of the functional group that were presence in sample with standard provided. Instead of that, Blyscan assay kit was used to determine the presence of GAGs in crude sample. From the result obtained, GAGs are well distributed in sea food waste of *Lates Calcarifer*. Instead of that, waste management can be minimize by convert waste to wealth product

INTRODUCTION

Waste management is gradually becoming a serious concern globally. One of the approaches to reduce waste management is by using reduce, recycle, and reuse (3R) methodology their practices are at the low to moderate levels. There are lack of policy and participation from the public. In April 2009, the Ministry of Energy, Green Technology and Water was established to manage green technology development in Malaysia. Private sectors were encouraged to invest in green technology by promoting the usage of more environmentally sound waste management towards dealing the changes in the global environment in order to minimize the waste management [1]. According to the Department of Statistic, Malaysians among the world's top fish consumer and spend about RM100 a month for variety of fish. There are 54% of consumers that were reported eat fish once to three times a week [2]. Toward sustainable waste management, waste to wealth should be implemented among the consumer in order to minimize the global warming phenomenon from sea food waste. The commercial fish processing industry creates a problem when only a flesh are used to make a product and a huge number of unwanted parts will be dumped as waste. Waste from fish processing have active ingredients that can produce high value product. Currently, collagens are the example of the product that can be extracted from seafood waste and widely used in pharmaceutical field [3]. Environmental problems might occurs without proper utilization of waste. The fish waste was reported good source of protein content and polyunsaturated lipid [4]. Potential marketable shows active ingredients that present in food waste can create natural product such as proteins, polysaccharides, fibers, flavor compounds, and phytochemicals [5].

Glycosaminoglycans (GAGs) are large complex polysaccharide chain consists of repeating disaccharides unit. It composed of repeating disaccharide unit of hexosamine which are glucosamine or galactosamine and uronic acid which are glucuronic acid or iduronic acid. GAGs have the ability to maintain negative charge polymer towards cell membrane and also as hydration sites which maintain the properties of mucous membrane. GAGs commonly found in mammalian species and can be classified based on their interaction with the enzyme. There are six classifications of GAGs which are chondroitin sulfate, dermatan sulfate, keratan sulfate, heparan sulfate, heparin and hyaluronic acid [6-8]. GAGs can be extracted from cartilage which but too expensive for commercialization purposes. Even though cartilage has low value by product but it is rich in chondroitin sulfate which is one of GAGs members [9]. It has been reported that, cartilage contains approximately, 10% by dry weight a proteoglycan (PG) that was known as aggrecan where different types of GAG chains are covalently attached. In 1884, chondroitin sulfate (CS) which is one types of GAG that was first isolated and also been reported to treat osteoarthritis. On the other hand, from the previous study, CS is extracted from various natural sources such as, shark, chicken and also bovine cartilage [10].

MATERIALS AND METHODS

Extraction of GAGs

Sea bass waste of *Lates calcarifer* was used as raw material in this research to extract GAGs. The sample was obtained from seafood waste restaurant in Kuantan, Pahang. The sample was weighed and separated into their parts which are, gills, viscera and gall bladders. Then, the sample was washed with sodium chloride (NaCl) to remove blood and other impurities. Instead of that, NaCl was used to prevent any growth of microorganism on sample. The procedure then was continued with removal of protein where the sample was soaked with ethanol for 14 days. The purpose of this method is to remove fat in the sample. During this

KEY WORDS

Waste Management,
Glycosaminoglycans
(GAGs), Sea Food Waste

Received: 15 Oct 2016
Accepted: 14 Nov 2016
Published: 4 Dec 2016

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process, ethanol should be replaced three time for 14 days. Urea was used to denature protein and ribonucleic acid (RNA) in the sample and also making the intermolecular ones stronger. After that, the sample was kept at room temperature with soft agitation for overnight with the mix of digestion buffer. Precipitated protein was removed by centrifugation. Supernatant from the sample was collected and treated with 3 volume of ethanol while the residue was treated with of NaOH. To ensure the presence of precipitate in the sample, keep it in the chiller for overnight. On the next day, the second centrifuge was carried out to collect the residue which is the pellet that contain GAGs. When the method was commenced, the residue was collected and treated with 0.1 M NaOH. The crude then was kept in the freezer at temperature -80°C for further lyophilization process.

Characterization of GAGs

GAGs can be characterized using Blyscan Sulfated Glycosaminoglycans Assay that was, purchased from a British company Biocolors. This assay is a quantitative dye-binding method for the analysis of sulfated proteoglycans and glycosaminoglycan. Besides that, this assay can be used to determine the O- and N-sulfated glycosaminoglycan ratio within the sample. The standard plots were obtained using chondroitin sulfate standard solution and values of test samples were determined by using linear equation of standard graph [11-13]. Instead of using blyscan kit, Bradford Protein Assay was used to determine the protein solution that was presence in the sample solution. This assay relies on the binding of the dye Coomassie Blue G250 to protein. It widely used because of it simpler, faster and most important is most sensitive [14-16].

RESULTS AND DISCUSSIONS

Determination of protein content in crude sample

The Bradford Protein Assay was used to measure the concentration of protein in sample. The principal of this assay based on binding of protein molecule to Coomassie dye under acidic conditions. Bovine serum albumin (BSA) was used as the standard to measure the protein in sample [17, 18]. Different concentration of GAGs were prepared and dilute with 1mL of distilled water. This stock solution then was diluted with 1mL of Bradford reagent that was prepared before carried out this test. Different concentration of BSA was used to prepare the standard calibration curve starting from weight 0 µg to 10 µg at concentration 2 mg/mL. The sample and standard then were incubated for 20 minutes before proceeded with absorbance measurement at 595 nm using UV-visible spectrophotometer. The selected wavelength (595 nm) is the maximum peak where the relationship between protein and absorbance was occurred. The result showed that, concentration of protein sample that was measured from the standard calibration curve was 0.2056 mg/mL which is lowest protein in 100 µl of GAG sample. The protein concentration was considered low because during extraction process, 70 % of ethanol was used to remove protein. Instead of that, UV scanning also being carried out after extraction process to detect the presence of protein at wavelength 280 nm which is 0.0733 A. Animals tissue have the higher protein yield content. Thus, various protein solubilization are used to lower the protein content in the sample [19]. Interference of protein content in crude sample may affect the process of recovery the GAGs compound from sea food waste.

GAGs determination in sea food waste

Blyscan assay is the method that was used for the analysis of sulfated proteoglycans and glycosaminoglycans. The sensitivity of this quantitative dye-binding is 0.5 µg and it will take about one hour to run the assay. The absorbance peak for Blyscan dye in the dissociation reagent is 656nm. This absorbance is suitable to use with most colorimeters and microplate readers with a red filter. Total standard of sulfated GAGs using Blyscan assay kit was plotted. The statistical measure of data which is R2 is 0.9969 and it is the best coefficient of determination. Total GAGs that was presence in aliquot sample by using this assay is 1.9053 µg/ml. Equation 1 was used to determine the total GAGs that was presence in the crude sample.

$$y = 0.2122x \quad (1)$$

Table 1: Extraction yield of sample using 1151.59 g of raw material will produce 17.2 % of crude GAGs

Sample (g)	Before Freeze Dry (g)	After Freeze Dry (g)	% Yield
1151.59	198	7.67	17.2

Instead of using internal part of fish, shrimp head always used to extract GAG because it contains source of digestive enzyme. Recent study has demonstrated that, 79 mg of sulfated glycosaminoglycan can be obtained from 0.236 kg of shrimp head waste as well as some properties and technological applications [20]. In this research study, about 1151.59 g of raw material from the sea bass waste was used and produce 7.67 of GAGs. [Table 1] shows weight of the sample during the experimental process. According to the marine prospective, shark fins have commonly used source of CS which is the most common types of GAG. Since this source of GAG highly demanded, another source of GAG has been reported [21, 22].

Analytical analysis of GAGs

The most common method that usually used in the identification test is using Fourier Transform Infrared Spectroscopy (FT-IR). [Fig. 1] shows the result for of GAGs in the Lates calcarifer and it was compared with the chondroitin sulfate standard. The peaks were compared with the standard to find the similarity of the sample according to the provided standard. The absorbance of the maximum peak of the sample at 3456.54 cm^{-1} while compare to the standard is 3344.87 cm^{-1} . Throughout this research study, there are several functional groups that were determine that have similarity with standard provided. Identification test FTIR showed that the peak at 3456.54, 1667.23, and 1627.70 cm^{-1} in FTIR spectrum shown strongly suggesting the chemical entity as chondroitin 4 sulfate (CS). The absorption was read at 400 to 4000 cm^{-1} as shown in [Fig. 1, Table-2]. The band at 1667.23, and 1627.70 cm^{-1} were detected due to the stretching or deformation vibration of C=O-H bands and this bands were suggesting the presence of combined carboxylate with amine and sulphate [23, 24]. Further structural characterization of GAGs are required in order to obtain the confirmation between different samples and standard.

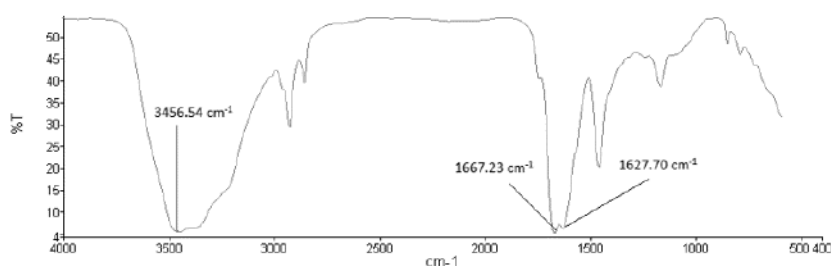


Fig. 1: Characterization of GAGs using FT-IR.

Table 2: Functional groups and frequencies (peak) that were presence in crude sample of GAGs. The absorbance were measured between wavelength 4000-400 cm^{-1} . Each sample used the Potassium Bromide (KBr) ratio method in sample preparation to form disc.

Functional Group	Peaks in Sample (cm^{-1})
N-H bends	3456.45 and 1627.70
C= O stretch	1667.23

Instead of using FT-IR for characterization, ^1H NMR also used to determine the structure of molecule presence in sample including large protein [24]. Nuclear magnetic resonance (NMR) is a spectroscopy technique that based on the absorption of electromagnetic radiation in the radio frequency 4 to 900 MHz by nuclei of the atoms. It has become an indispensable analytical technique in medicine, biology, chemistry, physics and food science. This instrument connect with the sample by electromagnetic wave in the radiofrequency range. According to the previous study, sulfation position at 4-sulfated of GAGs is between range 4.47-4.78ppm. Meanwhile, sulfation position for 6 sulfated at range 4.19-4.21ppm. Regarding the information from the graph, the structure and functions of GAGs can be identified from the graph. Classification of GAGs can be identified according to the identities of the hexoamines unit, hexorunic acid and the sulfation of both residue. Hence, it can be conclude that, sea bass waste has the presence of GAGs AS shown in [Fig. 2] [25, 26].

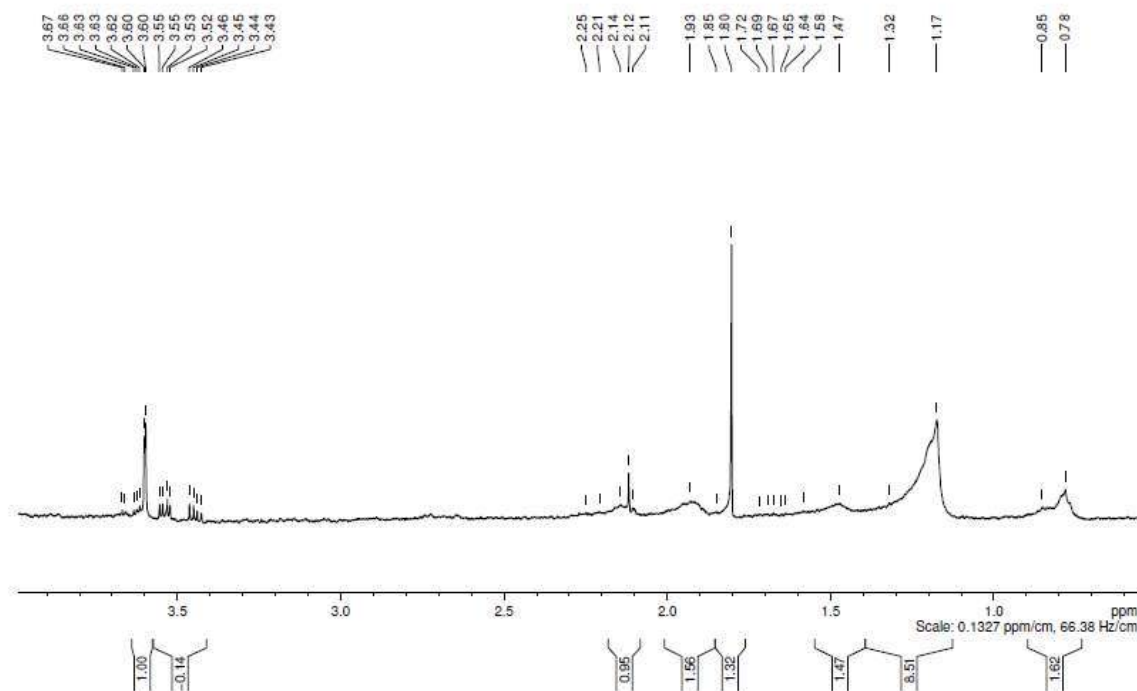


Fig. 2: Result of ^1H NMR of GAG at room temperature.

Glycosaminoglycans (GAGs) have been successfully extracted from Lates Calcarifer. The crude extract has been characterized using FTIR and NMR analysis to quantify the presence of GAGs. Besides that, the total amount of sulfated GAGs in the sample can be measured by Blyscan assay. It shows that $1.9053 \mu\text{g/ml}$ of GAGs concentration in an aliquot of $50 \mu\text{l}$ sample solution. Waste also useful to produce beneficial product and can solve the environmental problems.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The authors thank to the UMP GRS scheme for postgraduate research students, and we are grateful for the assistance of technical staff in Faculty of Industrial Sciences & Technology, University Malaysia Pahang. The authors thank others researcher that involve in this research.

FINANCIAL DISCLOSURE

This paper is based on research supported by University Malaysia Pahang under operation research grant (UMP RDU130308), Ministry of Higher Education for Research Acculturation Grant Scheme (RAGS RDU 131406) and Fundamental Research Grant (FRGS RDU 140131).

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ARTICLE

CAUSES AND EFFECTS OF COASTAL WETLANDS DEGRADATION IN YEMEN

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ABSTRACT

Wetlands have considerable importance as biodiversity holders (habitats, animals and plants), while they provide several resources and benefits to local communities in different parts of the world. In addition, wetlands can buffer pollutions, absorb floods and recharge aquifers. Yemen has been identified as hosting globally important biodiversity, thanks to its situation at the crossroads between the Afrotropical, Oriental and Palearctic regions. This biodiversity is particularly rich in coastal wetlands, given that the coastline of Yemen is over 2500 km long and overlapping three different seas with different characteristics that is: The Red Sea, Gulf of Aden and Arabian Sea. Coastal wetlands are continuously lost under pressure of several problems such as human activities, lack of data and climate change. This means that urgent description of these causes is needed to conserve wetland biodiversity. The main objective of this research is to give to the Yemeni government and other stakeholders baseline information to initiate a process of protection coastal wetlands. The work started by reviewing recent literature on the wetland degradation and interviewing various Yemen's experts in water, environmental issues. Finally, recommendations to guide decision-makers for protection coastal wetlands are given. Further research could focus on investigating how achieve the sustainable management for different wetlands.

INTRODUCTION

Situation review

KEY WORDS

Coastal Wetlands,
Degradation, Causes
and Effects, Yemen

WETLANDS have considerable importance as biodiversity holders (habitats, animals and plants) and they provide several resources and benefits for local communities in different parts of the world such as cultivation, recreation, education, timber production, etc. [10]. [18] Clarified that wetlands are important natural, economic and aesthetic resources and should be conserved. In addition, wetlands can buffer pollutants, absorb floods and recharge aquifers [26]. [16] Mentioned that wetlands of all sizes are very important, for example small wetlands in East Africa are important because they absorb carbon and provide clean water and fuel wood to the communities who live around them [10]. However, since 1980, more than 80% of the wetlands have been lost. It is important to protect wetlands by identifying the different causes and their interrelationships before taking any restoration actions and understanding problems in order to find solutions [17]. [8] mentioned that coastal wetlands in Yemen are diverse and include saltwater wetlands that occur along the coastal shorelines have important role because they play in buffering coastlines against storm and wave damage and in stabilizing shorelines in the face of climate change impacts. on the other hand. [2] Indicated that there is wetlands degradation on the red sea coast. For example, in the northern part of The Red Sea, there has been extensive coral mortality in the past 10 years with major reductions in living coral cover. This article describes the main causes of Yemen's coastal wetlands degradation. It also provides a brief overview of the literature, background of current situation of coastal wetlands, and a discussion of some of the proposed solutions. Finally recommendations to guide decision-makers for protecting and improving wetlands are given.

Background of wetlands in Yemen

The Republic of Yemen is located in the South-west part of Asia (the Arabian Peninsula); the total surface area is about 527,970 sq. km²; has been identified as a hosting globally important biodiversity, because it is situated at crossroads between the Afrotropical, Oriental and Palearctic regions [12] ; has undergone a number of rapid social and economic issues since 1970s.; has the highest rates of population growth in the world, about 27,477,600 million in 2016; the population is equivalent to 0.37% of the total world population [22]. The largest part of the population lives in the Mountain area in the western part, near the coastal of the country, where rainfall is still significant. Thus, Yemen is the largest development challenge in the Middle East.

Yemen has a predominantly semi-arid to arid climate, with rainy seasons during spring and summer and with high temperatures prevailing throughout the year in low-altitude zones [14]. Rainfall varies from less than 50 mm in the coastal plains region and desert plateau region, to more than 1,200 mm in the western mountainous highland region. The highest and most consistent rainfall occurs in the southern highlands near Ibb/Taiz area. The spatial pattern of annual rainfall varies from year to year [12]. Yemen has over 2500 km of coastline long and includes three different coastal regions, namely the Red Sea, Gulf of Aden and Arabian Sea. These coastal areas represent a complex and unique tropical marine ecosystem with extraordinary biological diversity and a remarkably high degree of endemism [13]. Moreover, it is considered one of the richest countries in biological diversity. It hosts about 2,500 species of plants, about 85 species of mammals 370 species of birds and more than 115 species of amphibians and reptiles. More than 250 species of plants and 25 bird species are considered endemic to Yemen. In Socotra Island

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Received: 10 Oct 2016
Accepted: 12 Nov 2016
Published: 6 Dec 2016

alone, more than 30% of the plants are endemic. Twenty percent of spidermite species and 10 % of insect species on the island bear the name of the island as a genus or species [23]. However, Yemen was faced with the big problem of biodiversity degradation and the environment continues to deteriorate. According to [3], there are 17 wetlands scattering inland and along the coastlines such as (Al Luhaya, Ras Isa/Kamaraan Island, Groups of Hannish and Zugar Islands, Aden Coastal Wetlands and Socotra Archipelago). See the [Table 1] below.

Table 1: Location of current wetlands in Yemen [5] & [34]

No	Name of Wetland	Name of Gov.	Area/Ha	Latitude	longitud e	Type
1	Midi to Al-Luhayyah	Al-Hudaidah	30,000	42.7833	16.35	Coast/ Marine
2	Islands off the Northwest Coast	Al-Hudaidah	5,000	42.2833	15.4666 7	Coast/ Marine
3	Bahr Ibn Abbas, Ra's Isa and Kamaraan Island	Al-Hudaidah	35,000	42.5333	15.1833 3	Coast/ Mangrove
4	Wadi Surdud	Al-Hudaidah	Un known	43.3333	15.2157	Coast/ Vally
5	Red Sea Coast: Al-'Urj to Al-Hudaydah	Al-Hudaidah	Un known	42.9167	14.9167	Coast/ Marine
6	Al-Hudaidah Sewage Lagoons	Al-Hudaidah	50	42.95	14.8167	Sewage/ Lagoons
7	Nukhaylah to Wadi Nakhilah	Al-Hudaidah	12,500	42.9666 7	14.6333	Coast/ Vally
8	Al-Khawkhah to Al-Mukha	Al-Hudaidah	7,000	43.2333	13.8	Coast/ Marine
9	Dhubab Flats	Taizz	100-200	43.4167	12.9167	Coast/ Marine
10	Taizz Sewage Lagoons and Marsh	Taizz	250	44	13.65	Sewage/ Lagoons
11	Wadi Warazan	Taizz	90	44.25	13.4167	Vally / Marsh
12	Aden Mudflats and Marsh	Aden	10,000	45.0333	12.75	Coast/ Sewage
13	Wadi Jahr	Abyan	500	46.3833	13.9667	Vally/ Marsh
14	Wadi Hajar	Shabwa	50-100	48.7	14.1	Vally/ Marsh
15	Qishn Beach	Al-Ghayda	100	51.75	15.4333	Coast/ Marine
16	Abdullah Gharib Lagoons	Al-Ghayda	50	52.3333	16.35	Coast/ Lagoon
17	Qalansiya Lagoon	Socotra Island	100	53.5	12.7	Coast/ Lagoon

In brief, many researches and studies in the world have investigated the causes of wetlands degradation and loss, such as [24] reported that the degradation and loss of coastal wetlands is more rapid than other ecosystems due to major changes in land use and water diversions; wetlands are degraded because of absence of the reliable information [9]; increased urbanization and industrialization[25] noticed that the diverse uses like crop cultivation, grazing, and harvest are resulting in the loss of ecosystem functions and land degradation. The degradation of coastal wetlands is high because local people depend on them for their livelihood. Moreover, wetlands conservation should be considered for improving biodiversity; the good way is to protect wetlands is to describe the different problems for finding good solutions [10]. On the other hand, there is a few literature research mentioned on wetlands in Yemen which we describe them deeply;

The most comprehensive general information on wetlands has been provided by The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA). PERSGA introduced the topic in many years such as 2005 by describing the use and development of natural resources and provide also detailed information on coastal areas in Yemen and discusses Yemen's environmental strategies, policies and legislations. They propose some solutions to the coastal areas, including good management and raise awareness.

Also, Al-Saghier, 2000 wrote information on wetlands in general and for Seabirds in specific. He provides detailed information on the background of currents wetlands and legislations. He gives a general overview of the situation on wetlands and particularly seventeen coastal wetlands (location, altitude, physical and ecological features, land use, etc.)

Few researchers studied specific areas of wadis and wetlands in long time ago, such as Barratt et al. in 1987, who have surveyed some wetlands in the coastal Red Sea and studies one of wadis in western Yemen.

Al-Najar (2008) provides in his Master research about Geological and Tourism Study for Coastal Areas in Taiz. He explains how could be achieved good management for coastal areas for tourism and raising the economic as a result of improved wetlands management.

The government agency, which is responsible on wetlands management, is The Environmental Protection Authority (EPA). EPA has many reports which indicated in general about wetlands situation especially in EPA' reports 2004b and 2009.

The National Biodiversity Strategy and Action Plan for Yemen (NBSAPP) in 2012 indicated about wetlands in Yemen in small part.

METHODS

Data collection

The Academic articles and books from Internet websites is the first source of the data collection such as Science Direct and Springer Link as well as from international documents which give an overview of wetlands in general and in different aspects which linked with wetlands management, classification, inventory, assessment,, etc. For example, "climate-vegetation: "Wetlands Market and Intervention Failures" [26], "The US fish and wildlife service's national wetlands inventory project" [29], "Geological and Tourism Study for Coastal Areas in Yemen" [2] , "Marine Biodiversity of Aden Wetlands Protected Areas" [7] , "Ecosystem Services and Human Well-being: Water and Wetlands Synthesis" [15] , "The Conservation and Management of Temperate Marshes, Bogs and Other Wetlands" [18], "Wetland Conservation: A Review of Current Issues and Required Action"[10], "Sedimentation Initiatives in Developing Countries" [19], "Tropical Freshwater Wetlands: A Guide to Current Knowledge and Sustainable Management" [25], "Stedman S. 2013. Status and trends of wetlands in the coastal watersheds of the Conterminous United States 2004 to 2009" [8] and "Sedimentation in mangroves and coral reefs in a wet tropical islands"[27]. The second source of the data collection comes from the international reports of RAMSAR, FAO, GNF, WB and PERSGA and national reports from EPA. These reports will be used to provide insight into how wetlands degradation is taken into account by the international and national sectors. The third source of the data collection is the opinion of Yemeni's Water and Environmental management experts, in order to investigate their point of view as a specialized group. For more information about the different types of experts, see the interview part below.

Interviews

First, interviews were conducted with government officials from the water sector, donors, and academic people involved in environmental and water issues, in order to investigate their opinions on the reasons why the wetlands degradation. Furthermore, collect their opinion of the consequences and analysis their ideas to have recommendations.

Six interviewees will be selected from different agencies which include sample of the major responsibilities parties in government, donors, researches, academic, and university. Thus, four types of interviews were taken. The first type of interview is intended for the Environment Protection Authority (EPA) under the Ministry of Water and Environment and General Directorate of Irrigation and Dams (GDI) under the Ministry of Agricultural and Irrigation. These interviews were focus on the makers-decision from government agencies. The second type of interview is intended for head of the Environment and Water in SFD which is worked with donors. Many questions focus on the information of coastal wetlands management issues. The last two types of interviews are intended for Academic parties; Research Authority (AREA) under the government agencies and Water and Environmental Department in Faculty of Agriculture. These questions are related to the characteristics of wetlands management, reasons, affects and what kind of solutions they suggest. Finally, their opinions and suggestions will be analyzed and then the recommendations are written.

RESULTS AND DISCUSSION

Causes of wetlands degradation

As the analysis from literature and interviews, there are 5 main causes of Yemen's wetlands degradation:

Climate change

Climate change is a critical issue and the impact on wetlands and water. Climate change will decrease the frequency and amount of rainfall [28]. [19] Reported that the climate in the Middle East and North African region will become even hotter and drier. Thus, Yemen will face many challenges such as flooding especially in coastal regions. Furthermore, Yemen faced years of drought, even when it does rain, because of heavy flooding and the ground inability to absorb the mass quantity of water. Many of the coastal wetlands, mangroves are being destroyed. This is affecting the livelihood of the people in these areas.

Limited water resources

Availability of water is the most often mentioned constraint to the development of the coastal wetlands management. Highland basins that rely on groundwater are experiencing rapid declines in the water table and competition for this dwindling resource is fierce. Coastal wetlands are dependent on rainfall levels that can vary from year to year. A few years ago, many regions were green and lush. Now they are dry and

barren, because of droughts and the decline in rainfall. Many researchers reported that about 80 percent of all rural conflicts in Yemen because of water [13].

Unsustainable human activities (Population growth, industrial, agricultural, urbanization)

Yemen's annual population growth is amongst the highest in the world, for example, the population was 12.3 million in 1990 and became 27,477,600 million in 2016. In addition, the coast of the mainland is suffering from pollution and prone to oil spills from ships and oil terminals. Thus, marine critical habitats such as mangrove, sea grass, and important coastal sites for bird feeding and breeding, are increasingly threatened by coastal development. Moreover, the pollution from oil waste in the coastal and Islands destroyed many coastal wetlands [11]. The agricultural technology is developed rapidly and chemical inputs and tube well technology were introduced. This is steered Yemen away from traditional farming practices which these technologies are lead no balance with the natural resources [2].

Many experts in Yemen indicated that the most challenges which destroys wetlands in unsustainable human pressures. [25] reported that increased urbanization and industrialization is degraded the wetlands. The degradation and loss of wetlands is more rapid than other ecosystems due to major changes in land use and water diversions [24]. [11] mentioned that the rapid development of the Agriculture and using a lot of pesticide since ten years ago have been affecting the environment and lost different biodiversity especially in coastal areas. Many wetlands have been drained and converted into agricultural use in the past. Now, some wetlands are protected as conservation sites, and others still are not conserved, but both are often close to farmland. [3] and [20] indicated that most local people in Yemen think that wetland is a wasteland and need to fill for building houses or hotel or resort. Thus, the coastal wetlands areas are urgent need for management to conserve their biological and natural resources. In addition, industries' areas raise the soil erosion and transports of higher amounts of pollutants and sediments into wetlands. Urbanization increases the amount of impervious surfaces in the watershed and causing floods. Moreover, the development of tourism, such as building hotels in the coastal areas, has a strong influence in the degradation and loss of many wetlands [4] and [5].

Insufficient availability of data and researches for wetlands

Wetlands are degraded because of absence of the reliable information [9]. Many experts in water, environment and ecology indicated that although wetlands in Yemen have great potentials for a multitude of uses, a lot of them are not even documented. Also, lack of official recognition has done little in preventing their over utilization. Few large Yemen's wetlands are typically having protection but there are still a large number of smaller wetlands which are not recorded [3], [1], [21], [20], [4] and [5]. Therefore, it is important to raise the awareness and knowledge. Local people need to be informed of wetlands and how to protect [3]. The source of recent information on the marine environment is old, such as the IUCN report by [6] which is the major source for much of the information on the coastal zone. Additional information is from the FAO Fisheries Development Project 1972-1977.

Lack of Policy, law enforcement and conflict

There is a lack of wetlands conservation laws. Also, the current law enforcement to protect areas' protection, which some of them are coastal wetlands, is absent. The lack of law enforcement and flawed policies has contributed to the wetlands degradation [22]. There is currently no legislation to protect any species which are already on the international list of threatened species. Furthermore, The funding absent to properly identify causes of wetland degradation and their interrelationships, for which further research is often needed. Moreover, the lack of involvement of all parties (local communities and stakeholders) in wetland management is decreased the wetlands degradation [1]. The conflicts are made the cooperation among all parties and stakeholders even more difficult to achieve. In addition, warfare has occurred in the region for several years, but the conflict has recently intensified. This conflict is restraining the government from focusing on the wetlands degradation.

In summary, wetlands of Yemen's coastal regions are being degraded rapidly due to; rapid development and population pressure; withdrawal of water for irrigation; Large scale habitat conversion; unsustainable harvesting policies; lack of environmental consideration; recreation and tourism and awareness and natural causes.

Effects

A lot of consequences and effects due to the wetlands degradation which the major effects are:

Hunger, loss of livelihood options, water scarcity, loss of plant and animal species and degradation of soil [20], [21], [5], [3] and [24].

Conflicts between communities over the use of resources may escalate as well and cause insecurity in the region [20], [21], [5], [3] and [24].

Degradation and loss of wetlands make climate change worse and leave people more vulnerable to climate change impacts such as floods, droughts and famine [17] and [24].

Some issues such as, steep topography, intense precipitation, and extensive land-use changes in watersheds could be led to high sediment loads that appear to have exceeded the sediment retention capacity of the coastal wetlands. This sediment deposition within estuarine and reef zones may be killed the habitat like adult and juvenile corals [27]. For example of rich wetlands' habitats in Red Sea coastal areas, is Bab Al Mandab area which includes coral reefs; sea grass beds; intertidal mud; and mangrove. All these habitats are highly benefited for local people [13].

Solution

Good base of data

The part of the Millennium Ecosystem Assessment is the achievements of global wetland inventory. Therefore, the need to improve information base of wetlands is important [15]. There is a need for information to support wetlands management from global, regional and national assessment to guide policy-making. Making good base of data about causes of wetlands degradation could be used to manage and protect wetlands [25]. Moreover, the wetland inventory is important to understand the various types of wetlands [9].

Raising awareness among various parties

[3], [20] reported that most local people in Yemen think that wetland is a wasteland and need to fill for building houses or hotel or resort. Thus, raising awareness is the key to understand the current situation to protect them. The Coastal Wetlands Areas are urgently needed for management to conserve their biological and natural resources. The priorities of conservation in Yemen are needs to raise conservation awareness among different stakeholders; and need for reassessment of a development and environment policy [3].

CONCLUSION AND RECOMMENDATIONS

The wetlands' degradation had negative implications on biodiversity and Yemen's economy. Thus, the causes need to be managed and organized. Moreover, new research and studies are urgently needed. The coastal wetlands degradation in Yemen has the potential to cause the destruction of the variety of environment. Thus, to establish any human activities such as Industries near to the coastal region should be stopped because many coastal wetlands are being illegally used as dump sites. Furthermore, different tourism agencies should be considered to make good studies before established any activities. Also, approach "Sustainable Wetlands Management" should be taken in account in the future. Finally, this research is tried to make some changes and we hope these attempts will be sufficient to improve coastal wetlands situation. Further research could focus on investigating how achieve the "Sustainable Wetlands Management".

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The author would like to thank all interviewers' experts who gave me their opinions and guidance of this research and all staff in wetlands Unit in Scientific Institute in Mohammed V. University.

FINANCIAL DISCLOSURE

None

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ARTICLE

MALAYSIA'S LOCAL AGENDA 21: IMPLEMENTATION AND APPROACH IN KUALA LUMPUR, SELANGOR AND JOHOR BAHRU

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ABSTRACT

Background: Local Agenda 21 (LA 21) has been adopted in a holistic approach to facilitate the economic development, with a manner of protecting and preserving the environment, and a goal to achieve the sustainable living in an equitable society. Kuala Lumpur, Selangor, and Johor Bahru are one of the urbanized State and city in Malaysia for which many initiatives have been taken to integrate the economic, social and environmental solutions into its urban development. This paper amasses the LA 21 implementation which performed by Kuala Lumpur City Hall, Iskandar Malaysia Johor and the pioneer in the state of Selangor which is Shah Alam and Petaling Jaya in order to comprehend their commitments given in the program. In addition, the implementation of LA 21 is summarized with the framework of initiatives taken by the local government to embrace the local community involvement. **Methods:** The methodology relies on the document analysis related to the LA 21 activities conducted by these cities in summary tabulation of practices. **Results:** Based on the results of the analysis, it indicates that each of the state and city has created their own sustainable approaches by carrying out impressive programs and plans such as clearing and cleaning up areas, recycling programs, cultural and heritage activities, develop the neighbourhood action plan, implementation green building project and others. Whilst, the initiatives taken by the local government to establish the commitment from communities vary from awareness campaign, seminar, general meeting with focus group and develop a strategy to deliver effective information such as focusing on the interest group, region, age and gender. **Conclusion:** Through this program, the committee, the Local Authority, and the private sector are actively contributing in building up the LA 21 through having an active participation and voluntarily involvement. In conclusion, LA 21 implementation in Selangor, Kuala Lumpur and Johor Bahru continues as a program that able to generate the present and future development exemplar to the other City Councils and States in Malaysia. It is a program to forge a partnership between various stakeholders to show the commitment to the sustainable development.

INTRODUCTION

KEY WORDS

Local Agenda 21,
Malaysia, Sustainable
Development,
Sustainable Cities

Sustainable development is defined in various ways and the most common definition is "The development that meets the needs of the present without compromising the ability of future generations" [1]. While, [2], defined sustainable development is "improving the quality of human life while living within the carrying capacity of supporting ecosystem". Sustainable development measures three major components which are economic, social and environmental systems in order to provide the generation with healthy and meaningful life [3].

The unsustainable urban development has impacted vastly in the urban neighbourhood which led to negative impact on the environment and urban quality of living. Sustainable development has become the foundation of planning and design of building structures and infrastructures. The land use development for neighbourhood should be protected and saved for the use of generation [4]. In the new millennium, the sustainability agenda has the potential of ensuring country in developing its economies with minimal or no irreversible damage to the environment and adverse impact on the health of its citizens [5]. As world had recognized that the present sustainable development is not dominant in fulfil the needs for the current and future generations, an integral approach is needed in order to achieve these three components. Thus, LA 21 was accepted as an indicator to be used by all the countries to determine and measure the sustainable development progress [6].

PROFILE OF MALAYSIA SUSTAINABLE DEVELOPMENT

The Malaysia intention towards sustainability was first established during the Third Malaysian Plan (1976-1980). It focuses on the natural heritage preservation by concern on the impact of the growth of industrialization and population. Then, during the Fifth Malaysian Plan (1986-1990), the effort towards environmental protection has been part of the main factor in national development plan. These include to minimize the deforestation, tourism and urbanization, make a preventive measure through conservation instead of curative and incorporation environmental planning in project development [7].

During Eight Malaysian Plan, it was further intensified to incorporate environmental solutions into planning and development. Thus, the planning tools were developed, the regulatory framework and capacity from

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institutional level was strengthened. It has resulted Malaysia was ranked 38 out of 146 countries worldwide and also ranked in 2nd place in Asia which concern on the environmental sustainability. Malaysia also has been ranked 9th from 133 countries in Environmental Performance Index Study due to the effort to protect the vitality of ecosystems. The environmental stewardship is continuing to Ninth Malaysian Plan (2006-2010) by ensuring for balancing between the needs of development and to maintain the environment. It greatly emphasizes on the efforts to intensify the conservation, natural resources management and mitigate the negative effects on the environment by developing the environmental planning tools [8]. The current 11th Malaysian Plan also encourage to pursue the green growth for sustainability and resilience to ensure the development is committed with sustainable manner since the beginning. It is to conserve and protect the precious environment and natural resource for the benefits of present and future generation [9]. Basically, the Malaysia sustainable development concern on three objectives, firstly is to promote the economic force to achieve a high standard of living, secondly is to promote cohesion and social justice and lastly is monitoring and protecting the environment for degradation prevention. Therefore, the incorporation of the objectives is included in the national planning strategies mainly in the five-year Malaysian Plans. Besides, the LA21 adoption and implementation is another effort for the connection and to strengthen between environment and development towards sustainability achievement [10].

LOCAL AGENDA 21

In June 1992, LA 21 has been introduced during the United Nations Conference on Environment and Development which was held in Rio de Janeiro. There are 178 countries including Malaysia who have attended for the conference and it is a global action plan for the sustainable development ([11]. During the conference, a mandate has been stated where Local Agenda 21 should be achieved in each country by the year 1996. The mandate also encourages the Local Authorities to have dialogues within the community towards achieving the development and consensus on the LA 21 Action Plan. Besides, the Local Authorities should also work together and play an important role with all the local community of the sector [12]. Since the LA 21 was introduced, a process of sustainability actions has been planned by the Local Authorities and the action pursued by implementing various programs [13]. Therefore, at the Council level, the requirement of unique approach is crucial in order to deliver the service that could facilitate mediation between the pressure of competing for economic development, environmental protection and more equitable society [14]. The LA 21 represents a major innovation in local planning for sustainable development. They have an international identity and an international network, but are locally driven and implemented [15].

THE CITY OF KUALA LUMPUR LA 21 IMPLEMENTATION

From a small town, Kuala Lumpur became the capital city and the largest city in Malaysia. Kuala Lumpur has become an important and play a role in various fields including business, finance, administration, education, religion, culture and sports. Kuala Lumpur municipal affairs are administered by a single corporation (corporation sole), since 1 April 1961 which is Commissioner of Capital. It was then converted into Mayor of Kuala Lumpur when awarded as a City status on February 1, 1972. Kuala Lumpur LA 21 (LA 21 KL) is a program that emphasizes the involvement of third parties, local authorities (City all), public and private sectors to work together in planning and managing their environment towards the achievement of sustainable development and higher quality of life. LA 21 KL is implemented in line with the Kuala Lumpur Structure Plan 2020 which is to create the role of Kuala Lumpur as an international commercial and financial center, create a city structure which is efficient and balanced, to enhance the living environment, forming a distinctive identity and image of the city and to have efficient and effective governance. Overall, the vision and goals for Kuala Lumpur have been formulated to create a sustainable city planning in ensuring that the City can achieve a balance between physical, economic, social and environment [16].

THE STATE OF SELANGOR AND LA21 IMPLEMENTATION

Selangor is located in the right and west Peninsular Malaysia with their total area of 7930km². The State of Selangor consists of nine (9) districts and their rate of population is the highest in Malaysia where in 1991 to 2000 their estimate population growth is 6.02%. In terms of development, Selangor is the most developed State in Malaysia because they had grown in almost every aspect of development. Selangor also has been considered as a State that contributes to the growth of country development and thus it is known as a house of economic power. In fact, Selangor is the state where their population enjoying their high standard living and having an excellent infrastructure. Furthermore, Selangor has their some distinctive developments which are not apparent in other 13 States in Malaysia. This means that, Selangor was having their development rapidly in terms of economy, socio-economic structure as well as environmental impacts [17]. Besides, in Malaysia, Selangor also is the first state who developed an approach of sustainability by incorporating comprehensive strategies of sustainability to all the level of governance. In order to bring their environmental consideration into social policy and economic mainstream, Selangor has incorporated a vision framed of their sustainable development into their process of political at both national and global levels. Undoubtedly, the state of Selangor is among the successful state with respect to their social-economic development. In order to embark the comprehensive

program of LA 21 in Malaysia, Selangor has been chosen as the first state in incorporating the strategies of sustainability to all the level of governance [18]. 'Agenda 21 Selangor' is also implemented as to develop the LA 21 plans by having a pilot project in Petaling Jaya Municipal Council and Shah Alam City Council. With the various consultations given by the stakeholders within the State such as public, private, Non-governmental Organisation and communities, the LA21 in Selangor was developed by having 103 initial set of indicators. The indicators consist of 14 economic sustainability, 16 environmental sustainability, 11 natural resource sustainability and 52 indicators of social sustainability [19]. Their commitment has started since June 1999 and they are producing the blueprints for sustainable development under the three years project development namely as "Environmentally Sensitive Areas of Selangor, Agenda 21 Selangor and Guidelines for Implementation of Agenda 21 Selangor. This shows that Selangor is an active state in implementing the LA 21 [20].

THE ISKANDAR MALAYSIA JOHOR AND BLUEPRINTS AGENDA

Iskandar Malaysia located in the South East Asia and southern Peninsular Malaysia. The total area of Iskandar Malaysia is 2216.3 km² which is three times from the Singapore size and two times from the Hong Kong Island size. The Planning Area consists of five local authorities namely as Johor Bahru City Council, Johor Bahru Tengah Municipal Council, Pasir Gudang Local Authority, Kulai Municipal Council and Pontian District Council [21].

Iskandar Malaysia has developed its Comprehensive Development Plan (CDP) which needs support, cooperation, commitment, active participation and sustained involvement of various stakeholders, players and agencies from all levels. These include the local governments, federal, states, communities, local leaders, global players of industry and business communities. Through the CDP, several blueprints agenda were developed such as Low Carbon Society, human capital and safety and security. The blueprints are concerned about the strategies or policies such as environment, land use, infrastructure and economic. From 32 planned blueprints agenda, 24 has been completed. The action plans and framework of the blueprint is based on the benchmark with other world or city best practice which act as a guide to implement the strategy, project or programs [22].

STAKEHOLDERS/PARTNERSHIP IN LOCAL AGENDA 21

In planning sustainable communities, the participatory approach becomes an important tool to ensure a meaningful participatory. It is because; a broad participation in sustainable development is to identify problems, formulating plans and to implement the decisions. Participatory approach consists of focus group discussion, meetings and site visit in order to come out with an action plan and actual implementation. Participatory means different people and organizations, different things and settings. The involvement of communities during the planning stage would be much more beneficial in bringing the transparency in the decision making process. It is because the input gain from the citizens creates a useful solution and broader range of perspective to overcome the problems facing in the communities [23].

As to determine and implement the vision for the sustainable city or town, the involvement of stakeholders is significantly important. Stakeholders are based on partnership group which they will jointly together in making their own decision [24]. The involvement of the local community and Local Authorities also crucially needed because Agenda 21 offers the involvement in a holistic approach. It encourages the Local Authorities and communities to build a relationship by having a partnership with other stakeholders, the government and non-government organization [25].

Basically, in Local Agenda 21, there are three (3) important parties involve which are private sector, Local Authority and Community [26]. According to [207], the participation by the stakeholders has a great implication towards the effectiveness of this program. In Malaysia, the involvements of stakeholders in local Agenda 21 are among the public sector such as Government, Local Authorities, Federal Government and statutory bodies such as Tenaga Nasional Berhad (Electricity Board), Telekom Malaysia, Alam Flora (the company who manage and reduce waste) and etc. Besides, the private sector, Non-governmental agencies and communities also had shown their interest in Local Agenda 21 by giving their own contribution to the program. The participation of these entire groups could influence and empower the decision making process.

In addition, the involvement of stakeholders and partnerships also important to plan and manage the environment towards sustainable development with the intention to improve the quality of life to be more comfortable [28].

METHODS

A comprehensive literature review was used with a thorough study of record review to gather the detailed information of the LA 21 implementation in Kuala Lumpur, Selangor and Johor Bahru. All sets of data information relies on the exploration of books, articles, published journals and website. The LA 21 initiatives was listed by doing a summary tabulation of practices.

INITIATIVES OF LOCAL AGENDA 21 IN KUALA LUMPUR

The Kuala Lumpur LA21 showed a good progress and positive development in the effort to achieve the vision to make Kuala Lumpur “a world-class city” by 2020. Kuala Lumpur LA 21 is a continuing program for Kuala Lumpur City Hall as a local authorities in engaging society, the private sector, non-governmental organizations (NGOs), community-based organizations (CBOs), citizens of the city and other interested parties in implementing programs and activities in accordance with local requirements. In fact, the local community is encouraged to cooperate to reach a consensus to reduce or deal with specific issues in their respective areas and to act managing and increasing the quality of their environment. The effort taken by Kuala Lumpur City Hall in the implementation of LA 21 as tabulated in [Table 1].

Table 1: Kuala lumpur city hall agenda 21 actions

Programs / Activities	Action by
Launching of 'Green Generation Campaign and Exhibition	Clean City Committee
Tree planting program in	
Eco Kids Day-Earth Day	
Launching a campaign of 'No Plastic Bag' with AEON JUSCO 'Let's Go Green	
Cleaning and clearing area at Bukit Bintang Central	
Eco-community project: Recovery of Penchala river in conjunction with the "World Rivers Day"	
'10,000 Green Expression' to raise awareness and preserve about environmental issues	
Eco Kids Day as an exposure and awareness of environmental issue	
Meeting 'Basic Use of Plastic Bags'	
Recycling Project	
'Keep Planting Trees' program	
Camping on "Waste Management Reduction Program"	
Briefing on recycling awareness program	
Camp introduction program on 'Greening for a Sustainable Future'	
Environment art camp	
Environmental Eco art camp for community	
Waste management project	
Seminar and workshop on recycling	
Herb Garden Project	Prosperous and Safe Committee
Food waste composting project	
An awards ceremony for continuing the implementation of the LA21 program	
EDC camp to educate people on environmental, health, social welfare and the arts	
Excellence identity camp for parents and students	
Examination workshop for primary school assessment test	
Parenting education seminar	
Lower secondary assessment seminar	
Neighbourhood cleaning program	
School Assessment Report	
Smart workshop for primary school assessment test	
Safe city programs	
Briefing and Dialogue with the society	
Briefing on the blueprints cleanliness	
Sports clinic and workshop (badminton)	
Clinical Arts: Theater	
Crime prevention seminar	

INITIATIVES OF LOCAL AGENDA 21 IN SELANGOR

The Selangor commitment towards the sustainable development was underpinned by having a realization of 'Agenda 21 Selangor'. There are various Councils exist in the state of Selangor which adopt the Local Agenda 21, however, in this paper, the discussion is only highlights on the implementation in two Councils which are Petaling Jaya Municipal Council and Shah Alam City Council. These two Councils were selected because they are among the earliest and active Council implementing the LA21 in Selangor.

Shah alam city council

Shah Alam City Council was chosen as the LA21 pilot project in 2000. The sustainable development was created in Shah Alam City Council as an agenda for the social, economic and physical development. In order to consolidate the Local Agenda 21 implementation, there are three committees has been established which are Environmental Committee, Social Committee and Economy Committee. An effort as per [Table 2], given by the Shah Alam City Council was received a good response from the residents in creating more green area in their town.

Table 2: Shah alam city council agenda 21 actions

Programs / Activities	Action by
Medical Checking by Johor Medical Group	Environmental Committee
Program of 'Loving our trees'	
Farming and gardening program in residents area	
Learning program on the technique of composting the food waste	
Children's day and World Environment Day celebration	
Cleaning and clearing program in residents area	
Recycling campaign program to the community and schools in Shah Alam	
A visit to Solid Waste Management Integrated	
Seminar on controlling aedes on construction site	
Campaign on minimize the paper and polystyrene usage	
Local Agenda 21 exhibition	
Clean zone briefing day to ensure the residents are clean	
Inspection and spot check in food premises	
Family day by having various of activities to the residents	Social Committee
Malaysia Local Enforcement seminar	
Vandalism prevention program	
Aerobic and extreme games program for youth and communities	
Colouring contest, cooking competition and collection of used cooking coil	
Environmental day celebration and tree planting event	Economy Committee
Medical checking by Johor Medical Group	
Le tour de Langkawi program	
Installation of white LED project on every street light	Social Committee
Green building project in section 14 Shah Alam	
Family day by having various of activities to the residents	
Malaysia Local Enforcement seminar	
Vandalism prevention program	
Aerobic and extreme games program for youth and communities	
Colouring contest, cooking competition and collection of used cooking coil	
Environmental day celebration and tree planting event	
Medical checking by Johor Medical Group	
Le tour de Langkawi program	Economy Committee
Installation of white LED project on every street light	
Green building project in section 14 Shah Alam	

Petaling jaya city council

In 1999, Ministry of Housing and Local Government has elected Petaling Jaya Municipal Council to become among the pioneer project of LA21. Petaling Jaya Municipal Council, communities and local authorities were committed to participate of LA21 program in order to develop a comfortable, safe, harmony and peaceful city. There are also three committees has been established which were Environmental Committee, Social Committee and Safety Committee to further develop the implementation approach of LA 21. The establishment these committees is based on the identification of issues faced by Petaling Jaya which is in the area of safety, social integration and environment. The following [Table 3] shows the program implemented.

Table 3: Petaling jaya city council agenda 21 actions

Programs / Activities	Action by
Briefing session regarding on Local Agenda 21 at Petaling Jaya school	Environmental Committee
Demonstration on composting the kitchen waste	
Printing and distribution of leaflets on awareness of recycling	
Establishment of recycling center	
Awareness program on the important of Local Agenda 21 program to teachers and students	
Implementation of pilot project "River basin Management"	
"Harmonizing National Environmental health Action Plans in the local government" program	
Natural and organic food product carnival	
An action plan for Domestic Solid Waste Management	
Best neighbourhood competition	Social Committee
Family day with Petaling Jaya communities	
Competition of "Neighbourhood of the year"	
Career fair festival	
Organizing competition designing the park	
Consultation with disabled people to develop a draft of action plan which could help to ease their burden	
Chinese new year celebration	

Develop an action plan for neighbourhood to strengthen the spirit among themselves	Safety committee
Safety and security handbook printing for distribution	
Neighbourhood cautionary scheme	
Exhibition on vandalism prevention and develop and action plan to prevent the vandalism	
Fire safety program	
Installation of street light in business premises	
Providing the security guard service at residents area	

INITIATIVES OF BLUEPRINTS AGENDA IN ISKANDAR MALAYSIA, JOHOR

From the approved of blueprints, it is identified that there are 649 initiatives developed. However, the initiatives are divided into 11 main categories to facilitate the implementation and monitoring. The 11 categories consists of transportation, economy, green, tourism, heritage culture, land use & physical development, information & communication technology, safety and security, utility, infrastructure & asset management, creative and social. The summary of the agenda as shown in [Table 4]. Most of the Iskandar Malaysia blueprints agenda has successfully implemented and part of the agenda is in progress stage.

Table 4: Iskandar Malaysia Johor Blueprints agenda

Programs / Activities	Action by
Pinewood Iskandar Malaysia Studios as a hub for creativity	Creative
Media@Medini for film production and media	
Iskandar Malaysia Digital Centre of Excellence	
Iskandar Malaysia Creative Talent Development Program	
Johor Bahru City Centre to develop economic activities in cultural, urban tourism and finance	Economic
Nusajaya development which focus on education, entertainment, recreation, state administration, biotechnology, finance, and tourism	
Western Gate Development: developed as a manufacturing hub	
Preparation of integrated climate change action plan through green economy, green community and green environment	Green
Promoting integrated river basin management	
Capacity building: public awareness, school programs, training and education program, inculcation through culture	
Low carbon action in Felda Taib Andakvillage	
School Eco-life challenge	
Inauguration on the environmental declaration.	
Masterplan on heritage conservation	Heritage and Culture
Street signage installation by having an information of its origins name	
Projects on model restoration for royal museum and Bukit Serene palace	
Workshop for contractors on how to make renovation and repairs with heritage building	

Table 4: Iskandar Malaysia Johor Blueprints agenda (cont'd)

Programs / Activities	Action by
Developed web-based application as a platform to promote Iskandar Malaysia	Information and Communication Technology
Training and educational programs on information technology in rural areas as an opportunity to enhance networking among the communities who involve in business	
Smart and connected city project in Nusajaya to improve the public and social service	
Improvement with current infrastructure especially in the	
Improvement with the public and social services	
River restoration programs in urban areas	Land Use and Physical Development
Local plan review by integrating the developed blueprints to the existing local plan	
In-fill development incentives for flagship zones	
Urban design framework formulation and city centre guideline	
Establishment of crime and disorder reduction partnership	Safety and Security
Developed strategies to increase and augment the security with the establishment of 942 auxiliary police.	
Implementation of integrated CCTV surveillance	

Implementation of management model for foreign worker enclaves	Social
Established the talent development initiatives for youth	
Income generating activities for fisherman	
Squatter relocation with construction of 2,720 units	
Constructed the Iskandar Malaysia house	
Established new affordable policy for housing	
Annual festivals and exhibition such as art festival and Eco-tourism	
Development of Johor Bahru Central district urban tourism	
Development of causeway link and 2 nd link to improve the tourist access via roads	
Create the heritage trail	Tourism
Improve the transportation service for tourist by constructing the ferry terminal	
Developed for more package of tourism that related to nature	
Promoting the river basin as to support the Eco-tourism potential to connect visitors with culture, nature and community	
Provide bus services (feeder bus) to cater the passenger especially for low and medium income citizen and in rural areas.	Transportation
Provide bus services with limited stops that cover on main trunk routes	
Provision to provide information for bus routes and timetable	
Engagement program between stakeholders and public through awareness campaign of road safety	
Study in detail regarding on the alignment and pre-engineering for bus rapid transit	
Develop an online platform known as Mobility Management System to allow visitors and citizens to access their travelling modes	
Improving connections between Malaysia and Singapore through Rapid Transit System	
Improve the taxi coverage through service coordination, training and development	
Provision to upgrade the bridge lanes for pedestrian walkway	Utility, Infrastructure and Asset Management
Upgrading the existing number of lanes	

SUMMARY FRAMEWORK OF INITIATIVES TAKEN BY THE LOCAL GOVERNMENT TO REACH THE LOCAL COMMUNITY

From the LA21 approaches adopted in each state and cities, it can be summarized that there are several initiatives taken by the local government to embrace the local community involvement. The initiatives are summarized in [Fig 1].

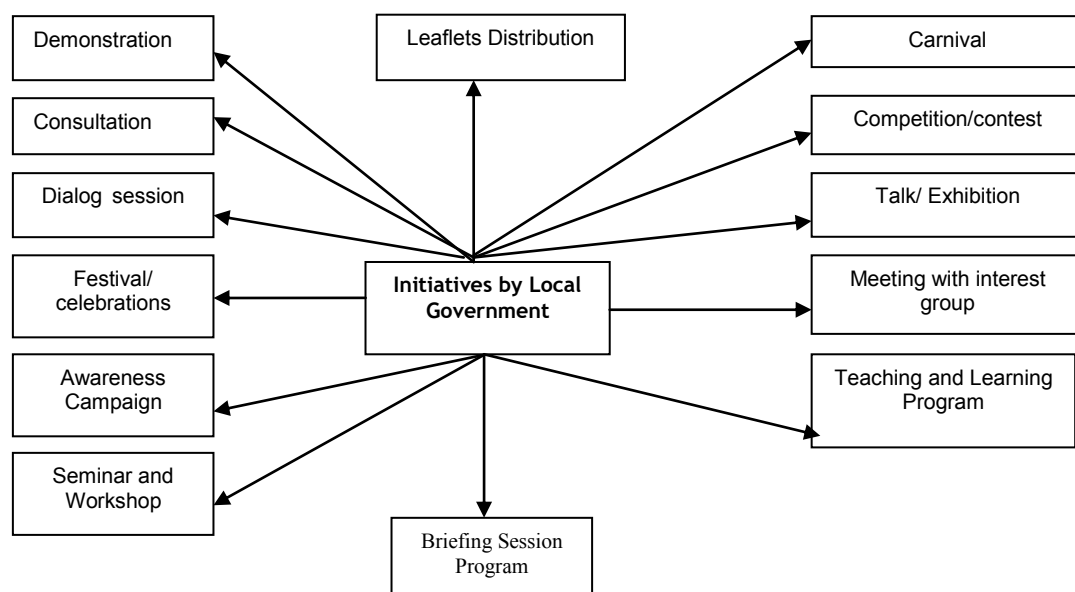


Fig. 1: Summary of initiatives taken by local government

The initiatives taken is the means for realizing the vision for the future of the community and also to gain their support which is the key successful of the LA 21 implementation. In addition, the local community involvement assists to measure the progress of the developed agendas vision. In fact, the encouragement of local community participation has been widely practiced in activities implemented in many organizations as a way to prevent public outcry. Besides, it is encouraged to have greater interaction with the local community in order to allow the public opinion to be included in the agendas provision based on the issue that has been encountered or may be crucial to do with an improvement. With this effort, the local community will have a broader perspective towards the importance of the agendas which have significant contribution to their quality of life. It gives the community to have a sense of ownership throughout the involvement and helps the government and other stakeholders to benefit the experience and knowledge of the local community in order to make for better decision in future.

CONCLUSION

The Local Agenda 21 implementation is a strategic implementation program in order to attain the aim for sustainability. The support and effort from various stakeholders such as Government, Non-Government Organization, committee, communities and the Council has made the Local Agenda 21 program in Selangor, Kuala Lumpur and Johor Bahru successfully implemented. The used of participatory techniques or engagement such as discussion with a focus group, having dialogues with communities had assisted in establishing collaborative relationships among the parties involved. Furthermore, it is also assisting in contributing realistic ideas for the development of their state and cities. Besides, the activities such as cleaning and clearing up the area, beautifying river, clean zone competition and many other activities had brought a significant impact to the people because it gives them knowledge on the importance of preservation of the environment and the effect of their current activities against the future generation. All of these approaches is hopefully would give guidance and inspiration to other states in developing and implementing the Local Agenda 21. As the country is expected to continually grow and the involvement of LA 21 is a continuous effort, undoubtedly the initiatives adopted in the state and city would contribute to the development and sustainability in the aspects of economy, social and environment. As for Malaysia, by implementing the LA 21 stage by stage throughout the nation, this can help to create the awareness among Malaysian and at the same time helps to develop an environmental responsive nation.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

This work was financially supported by Universiti Teknologi Malaysia, Research University Grant (Vot no:14H36).

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ARTICLE

CRITICAL SUCCESS FACTORS OF E-GOVERNMENT IMPLEMENTATION: A CASE STUDY ON FINANCIAL AUDIT AGENCY

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ABSTRACT

Background: At this time government is expected to further improve the quality of public services delivery and be effective in providing information to the public. One of the utilization of information technology that supports this governmental process is Electronic Government (e-Government). However, an organization sometimes has difficulties in the implementation of E-Government to the fullest. Therefore, it is important to acknowledge the Critical Success Factors (CSF) that relate to and affect to the success of the implementation of E-Government. This study conducted an analysis of 12 CSF implementation of e-Government of organization internal circle. **Methods:** To perform the analysis, this research conducted a case study in a government agency that has successfully implemented the E-Government, which is the Central Office of Finance Audit Agency (Badan Pemeriksa Keuangan RI- BPK-RI). Data collection is captured using a questionnaire of closed-questions with sampling conducted by purposive sample to internal employees in units that are directly related to the implementation of E-Government. **Results:** The research result shows that the 12 CSF is positively related to the successful implementation of E-Government except awareness factor. As a whole, the entire CSFs also affect the successful implementation of E-Government. Nevertheless, partially only one of the factors that affect largely, that is effective project management factor. **Conclusions:** Effective project management is dominated factor to the rising of successful implementation of E-Government in the BPK-RI. This factor should be enhanced and maintained so that BPK-RI can continue to be successful in implementing E-Government.

INTRODUCTION

Today, government's needs for an electronic-based information system is increasing. Government is expected to continuously improve services to citizens [1]. In addition the government is expected to further improve the quality of public services delivery and effectiveness in providing information to the public. One of the utilization of information technology to support the government's is called E-Government.

In general, E-Government is the ability to connect and create interaction between the dimensions of the government, citizen and businesses through the use of information technology (IT). E-government is used for the purpose of improving services, increasing transparency, convenience and accountability of a state's institution [2]. Hence, the impact can increase state's revenues and reduce its cost.

In the President Instruction No. 6 of 2001 on the Development and Utilization of Telematics in Indonesia, it explains that the Indonesian government needs to make a breakthrough in order to effectively accelerate the utilization of telematics technology that has great potential to improve the welfare of the citizen and strengthen the unity of the nation as a solid foundation for sustainable development. Generally, it states that government officials should use information technology to support Good Governance. The aim is to improve working relationships among government agencies and can provide public services delivery for the citizens and businesses effectively and transparently. Besides, as stated in Presidential Instruction No. 3 of 2003 regarding Policy and National Strategy of E- Government Development, it also explains regarding Guidelines for Preparation of Master Plan (Strategic Plan Development of E-Government) Institutionalization for Central and Local Government Agencies.

Government development that is undertaken by government agencies should consider related aspects such as network infrastructure, software and applications as well as organizational and human resources. Hence generally according to Laudon and Laudon for which quoted by Komara [3], dimensions that must be considered in the development and implementation of E-Government are IT, Human Resources and Organization. However, an organization sometimes have difficulties in the implementation of E-Government to the fullest. Therefore, it needs to know what are critical factors of organization to drive a success of E-Government in an organization [4]. The focus of this study is to find the Critical Success Factors (CSFs) of an E-Government implementation internally. As a case study, this research was conducted on one of the government agencies that have implemented, which called the E-Government Headquarters of Financial Audit Agency of the Republic of Indonesia Jakarta (Badan Pemeriksa Keuangan-Republik Indonesia).

E-GOVERNMENT

As explained earlier in the definition of E-Government, that the purpose of E-Government is to improve the performance and functions of government services by utilization of digital media. At the end, all

KEY WORDS

E-Government, Critical Success Factors, Indonesia

Received: 10 Oct 2016
Accepted: 12 Nov 2016
Published: 6 Dec 2016

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stakeholders can obtain government services and public information from the result. Stakeholder of E-Government consists of:

- Communities
- Businesses
- Government Employees
- Institutions, departments, and government ministries
- The leader of the union
- Community leaders, non-profit organizations
- Politicians
- Foreign investors
- and others

From the different types of stakeholders, Fang, quoted from Lee [5] identified eight models of the E-Government, as follows:

- Government to citizens (G2C): The delivery of public services in one direction by the government to the public.
- Communities to government (C2G): Enables the exchange of information and communication between the public and the government.
- Government to Business (G2B): Consists of electronic transactions where government provides needed information for business to transact with the government. For example, an e-procurement system.
- Business to Government (B2G): Leads to marketing of products and services to government to help government become more efficient for example, improvement of business processes and electronic data management. E-procurement system is an example of an application that facilitates both G2B and B2G interactions.
- Government to employees (G2E): Consists of initiatives that facilitate service management and internal communication with government officials. For example, an online human resources management system.
- Government to Government (G2G): Enables communication and online information exchange between departments or government agencies through integrated databases.
- The government to non-profit organizations (G2N): The Government provides information to non-profit organizations, political parties or social organizations.
- Non-profit organizations to government (N2G): Enables the exchange of information and communication between government and non-profit organizations, political parties and social organizations

RESEARCH MODEL

Implementation of E-Government is an activity undertaken by government agencies in helping to improve its services in the areas of government. E-Government is known to provide benefits to society, by addressing the bureaucratic complexity, increase efficiency, reduce service time and makes it easy for people and businesses to deal with the government, which in turn can be part for the community and the business world.

However, the implementation of e-government is not easy, because there are various factors that determine the success is known as Critical Success Factors [6]. Some models of the Critical Success Factors in Implementing E-Government a lot based on the gap analysis, named, "ITPOSMO", introduced by Heeks [7]. Such research on the factors of success and failure are conducted in Bangladesh by Hossan, Habib, and Kushchu [8] that produced some critical factors such as internal political desire, overall vision, dominance of politics or self-interest, change management, project management, competencies, technological infrastructure, and others factors. Similarly, research conducted by Prananto and McKemmish [9] which mentions the critical success factors of an E-Government implementation is the availability of adequate technology infrastructure, coordination between departments / units of the related policies, their political support, vision and government strategies and legislation, for good governance and the last is the appropriate change management strategy. Results summary of the literature review on the implementation of E-Government CSFs can be seen in Table 1.

Table 1: Summary of CSFs implementation of E-Government

Critical Success Factors	Reference
Overall Vision and Strategy	[8, 9, 10, 11, 12]
Technology Support	[8, 9, 11, 12, 13]
Top Management Support	[5, 10, 12]
Availability of Human Resource	[12]
Change Management	[2, 9, 11, 12, 14]
Effective Project Management	[15]
Strong Government Leadership	[8, 9, 10, 11, 12]

Critical Success Factors	Reference
Business Process Reengineering	[2, 11, 12]
Training	[10, 11, 12]
Awareness	[10, 11, 12]
Communication, Coordination and Collaboration	[5, 9, 11, 12]
Organization Culture	[11, 12, 13]

Based on Table 1, it can be composed to twelve hypotheses as can be seen in Fig. 1.

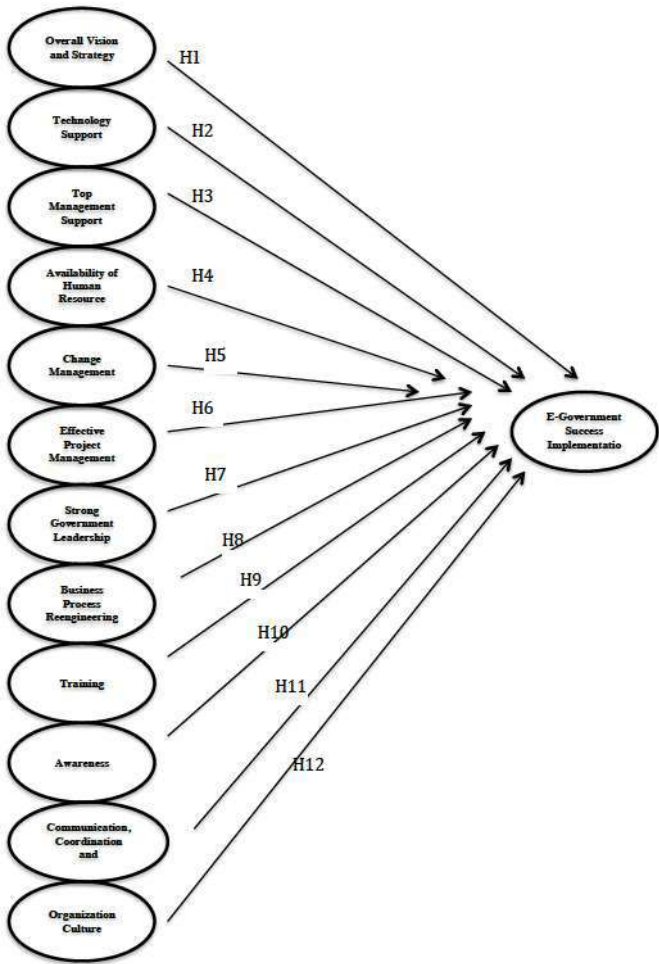


Fig. 1: Research Model.

METHODS

To test the hypothesis that had been developed, this research uses a questionnaire with closed questions (close-ended questionnaire) and using a Likert scale 1-5. Before filling out the questionnaire first asked about the respondents profile that consisting of respondent’s gender, age, education, past, class, years of work units and position. The variables are summarized in 44 statements that can be seen in Table 2.

Table 2: Summary of the research instrument

Variable	Description	Number of Indicator	Reference of Indicator
CSF 1	Overall Vision And Strategy	3	[15]
CSF 2	Technology Support	5	[15]
CSF 3	Top Management Support	2	[5]
CSF 4	Availability of Human Resource	3	[3, 5]
CSF 5	Change Management	7	[3, 5]
CSF 6	Effective Project Management	4	[16]
CSF 7	Strong Government Leadership	4	[17]
CSF 8	Business Process Reengineering	6	[3]
CSF 9	Training	3	[12]
CSF 10	Awareness	2	[12]
CSF 11	Communication, Coordination and Collaboration	5	[9, 11, 12]

Variable	Description	Number of Indicator	Reference of Indicator
CSF 12	Organization Culture	2	[12]
Success	E-Government Success Implementation	5	[18]

Samples taken from the inner circle population of the organization, i.e. employees and units leader that are directly related to the implementation of E-Government, namely IT Bureau, Bureau of Human Resources, Bureau of Finance, the General Bureau, PSMK and Auditama, with a visit to the office of BPK-RI. Results of the questionnaires are then processed with statistical data processing tools, named 'SPSS 16'. From these results, then enrich the data with triangulation by observation to see the implementation of E-Government in the BPK-RI. The data was compiled and statistically tested using the test validity and reliability, correlation analysis and multiple regression analysis.

RESULTS AND DISCUSSION

Respondent Demography

According to the result of data collection, there are 79 respondents that fill out the distributed questionnaire. The respondent profile can be seen on Table 3.

Table 3: Respondent demography

Category	Frequency	Percentage
Gender		
Male	33	42%
Female	46	58%
Age		
20-30 years old	43	54%
30-40 years old	32	41%
>40 years old	4	5%
Education		
Bachelor	49	62%
Master	30	38%
Working Duration		
0-10 year	61	77%
10-30 year	18	23%

Statistics Result

Based on result of validity and reliability test on the instrument study found that overall the entire item statement is valid and reliable so that it can be used in the process of further research. From the analysis of Spearman's rho correlation obtained significant value of each CSF, only CSF 10 (Awareness) that has no significant relationship, while the other CSF has a significant relationship to the successful implementation of E-Government. Based on the criteria for the interpretation of the correlation index (r) as follows:

$0,8 \leq r \leq 1$	very high
$0,6 - 0,799$	high
$0,4 - 0,599$	modest
$0,2 - 0,399$	low
$0,0 - 0,199$	very low

Hence, the correlation of each CSF to the successful of E-government implementation can be showed on Table 4.

Table 4: The correlation of each CSFs to the successful of E-government implementation

Variable	R	Correlation Type	Description
CSF 1	0.269	Significantly Positive	low
CSF 2	0.451	Significantly Positive	modest
CSF 3	0.296	Significantly Positive	low
CSF 4	0.222	Significantly Positive	low
CSF 5	0.462	Significantly Positive	modest
CSF 6	0.596	Significantly Positive	modest
CSF 7	0.370	Significantly Positive	low

CSF 8	0.410	Significantly Positive	modest
CSF 9	0.254	Significantly Positive	low
CSF 10	0.160	Not Significantly Positive	-
CSF 11	0.309	Significantly Positive	low
CSF 12	0.260	Significantly Positive	low

While the results of multiple regression test showed that only one critical factor that has the most significant effect on the successful implementation of E-Government, which is Effective Project Management factor, with significant value of 0. The summary of test results can be seen in Table 5.

Table 5: The output of T-Test (Coefficient)

Coefficients ^a							
	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1 (Constant)	-.136	.543		-.251	.803		
CSF1	.018	.098	.018	.186	.853	.637	1.570
CSF2	.042	.098	.043	.425	.672	.605	1.653
CSF3	-.018	.097	-.018	-.182	.856	.667	1.499
CSF4	-.002	.097	-.002	-.022	.983	.678	1.476
CSF5	.170	.088	.170	1.933	.058	.811	1.233
CSF6	.515	.090	.536	5.699	.000	.711	1.406
CSF7	.195	.112	.180	1.740	.087	.588	1.700
CSF8	.038	.128	.034	.296	.768	.477	2.098
CSF9	.112	.090	.120	1.241	.219	.672	1.468
CSF10	-.072	.108	-.065	-.668	.506	.671	1.491
CSF11	.088	.102	.085	.865	.390	.657	1.521
CSF12	-.006	.129	-.004	-.043	.966	.613	1.632

a. Dependent Variable: KESUKSESAN

Sumber : Analisis Regresi Ganda. diolah.

The regression equation is as follows.

$$Y = 0.515X_6$$

Based on the constant value and the regression coefficients of each independent variable as has been shown in the regression equation above, then the influence of the independent variables on the dependent variable can be explained that the value of the variable regression coefficient CSF6 (b6) is positive, that is 0.515, meaning that any increase CSF6 1% will increase the successful implementation of E-Government for the positive 0.515.

Discussion

As mentioned earlier, the misleading of implementation of E-Government that often occurs is when merely see the E-Government from the standpoint of information technology. At the end is often found that the implementation of E-Government regarded as something that has a high cost, resistance and change in work patterns [3].

To anticipate this, an implementation of E-Government should consider other aspects than only information technology aspect. Altameem, Zairi, and Alshawi [12] says there are three dimensions of the E-Government implementation factors proposed as Critical Success Factors which are Governing Factors, Organizational Factors and Technical Factors. All of these factors are then proposed in this study, and the other factors put forward by Vir and Bansal [15] concerning Effective Project Management is also regarded as a critical factor in the implementation of E-Government. Hidayanto et al. [19] found the importance of leadership, human resource, and culture as effective factors for e-government success.

At the end of the result showed that the implementation of E-Government in the BPK-RI has been able to reach success with an average value of success is 4 on a scale of 5. To maintain and enhance that success, then the BPK-RI must pay attention to the 12 Critical Success Factors that, especially on one factor that most affects the successful implementation of E-Government, namely: Effective Project Management. It is seen from the results of statistical tests showed that when these factors enhanced the successful implementation of e-Government will be increasing, thus giving benefits to its stakeholders [20] and increasing organizational performance [21].

Lesson Learned

Basically IT project management in BPK-RI has been running effectively. This can be seen with the completion of IT projects that are in accordance with the allocated budget, time schedule and determined results of the project. BPK-RI established a committee for each IT project which consists of steering committee and strategy committee. Steering committee called FKTI (IT Coordination Forum) was established to implement IT projects consisting of IT Bureau, the General Bureau, Bureau of Finance and

Planning Agency, Development Training and Projects that implement IT procurement. While the Strategy Committee on the so-called KPTI (IT Steering Committee) tasked to provide direction in every IT project is done, the BPK-RI leadership consisting of the Chairman, Vice Chairman and seven Members, as well as the officials of first level in the BPK-RI. With the establishment of the committee prior to the implementation of IT projects, IT projects are expected to be effective and in accordance with the needs of the organization that is also based on the existence of new policies imposed from the top leadership in BPK-RI. It is to produce an IT project that truly fit the needs of the organization BPK-RI

CONCLUSION

The results showed that all factors together have a relationship and influence on the successful implementation of E-Government. However, from the results of the partial test / bivariate obtained only one critical factor that partially have an influence on the successful implementation of E-Government is effective project management. This factor is dominated factor to the rising of successful implementation of E-Government in the BPK-RI. This factor should be enhanced and maintained so that BPK-RI can continue to be successful in implementing E-Government. Besides, several other factors must be supported by one of these factors that the successful implementation of E-Government can continue to be achieved.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

This research is fully supported by Universitas Indonesia through 'Hibah Publikasi Internasional Terindeks untuk Tugas Akhir Mahasiswa Universitas Indonesia 2017' with title 'Faktor Adopsi dari Smart Government di Indonesia'. It is a pleasure to convey our gratitude to our university for their continuous support, particularly for Research and Community Engagement Directorate for their excellent services.

FINANCIAL DISCLOSURE

None

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ARTICLE

EFFECTS OF SUGAR ESTER BLEND COATING OF KD-112 AND PLASTIC WRAPPING ON FRUIT SHELF-LIFE AND QUALITIES OF 'CALIFORNIA' PAPAYA

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ABSTRACT

Objectives: Sugar ester blend solution of KD-112 and plastic wrapping were applied to extend fruit shelf-life and to maintain high fruit qualities of 'California' papaya. **Methods:** Two parallel factorial-design experiments were conducted in a completely randomized design of KD-112 (0, 7, and 14%) and plastic wrapping (without and with one-layer of plastic wrapping). In the first experiment, observations were terminated once when the fruits reached stage IV of perfectly yellow/orange. In the second, fruit stage development was observed daily, while the others were observed at 2-4 days increment until the fruits reached stage IV. **Findings:** As sole applications, fruit coatings of KD-112 and one-layer plastic wrapping extended significantly 'California' papaya fruit shelf-life and maintained high fruit qualities. The combined application of 7% KD-112 and one-layer plastic wrapping was recommended to be applied as a postharvest handling for 'California' papaya because it was capable of delaying fruit ripening and maintaining high fruit qualities up to 21 days storage, 13-16 days longer than control. **Novelty:** A novel postharvest technology of 'California' papaya was promoted as a combined application of 7% KD-112 and one-layer plastic wrapping, which was capable of delaying fruit ripening and maintaining high fruit qualities.

INTRODUCTION

KEY WORDS

KD-112, papaya, postharvest, quality, shelf-life, wrapping.

'California' papaya (*Carica papaya* L.) is a newly released cultivar that is increasingly popular in Indonesia both as domestic and export markets. It has a very short shelf-life with a quickly decrease of fruit qualities due to high respiration and transpiration rates. Therefore, postharvest handlings to lengthen its fruit shelf-life and to maintain its high quality fruit up to its consumers are greatly needed.

KD-112 is mostly used in pineapple agro industries as a fruit coating to delay pineapple ripening during its postharvest handlings. It is a sugar ester blend solution that is used as bio-surfactant [1]. As with other sucrose polyester coatings, its main effects are to decrease respiration and transpiration rates, ethylene production, to delay fruit color development and softening [2]. Low fruit weight loss and softening rates are also expected by coating with sugar ester blend solution as it was also reported by another coating [3]. As far as our knowledge, KD-112 has never been studied and reported as a fruit coating to 'California' papaya in Indonesia.

Amongst fruit coating practices, plastic wrapping is known as a common practice in postharvest handling of horticultural products due to its simplicity, efficacy, and economical reasons. It works by developing a modified atmospheric condition of low O₂ and high CO₂ inside the coating and providing a physical barrier to water vapor which promotes low respiration and transpiration rates [4, 5] due to its lower permeability to atmospheric gases and water vapor [5]. Therefore, a longer shelf-life and maintaining high fruit qualities of 'California' papaya are expected by combining sugar ester blend solution of KD-112 with plastic wrapping.

The research objectives were to study the effects of sugar ester blend solution of KD-112 and plastic wrapping in extending fruit shelf-life and maintaining high fruit qualities of 'California' papaya.

MATERIALS AND METHODS

This research was conducted on July-September 2015. 'California' papaya at ripening stage I [green fruit with yellow line at peduncle side [6]] was received directly from Nusantara Tropical Farm, Co. Ltd., Way Jepara, East Lampung, Indonesia. Other materials were sugar ester blend of KD-112, and plastic wrapping of LDPE (Best Fresh®).

Two parallel postharvest experiments with treatments arranged in a 3 x 2 factorial design were conducted. They were both laid out in a completely randomized design of KD-112 [0% (K0, control), 7% (K1), and 14% (K2)] and plastic wrapping [without (W0) and with one-layer of plastic wrapping (W1)]. The first experiment

Received: 8 Oct 2016
Accepted: 10 Nov 2016
Published: 6 Dec 2016

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used three replications with one fruit each and its observations were terminated once when the fruits reached stage IV (perfectly yellow/orange). The second one used three replications with five fruits each to accommodate five consecutive samplings up to the end of observation. In the second one, the observation on fruit stage development was conducted daily, while the other observations were conducted predetermine at 2-4 days increment and terminated if the fruits reached stage IV. The second experiment was conducted mainly to study changes in fruit stages and qualities during storage according to the treatments.

KD-112 solutions were prepared by adding distilled water to KD-112 stock solution according to their concentrations. The fruits were quickly dipped in KD-112 solutions (or water in the control), air-dried, and then wrapped in one-layer of plastic wrapping. Treated fruits were then placed in a storage room of a room temperature of 28 ± 1 °C.

Observations were made on fruit shelf-life, weight loss, firmness (with a penetrometer typed FHM-5, with a cylindrical point of 5 mm in diameter of Takemura Electric Work, Co. Ltd., Japan), soluble solid as oBrix (with an AtagoN-1E hand refract meter), titratable acidity (titrated with 0.1 N NaOH and phenolphthalein as an indicator), and sweetness level (oBrix/acidity ratio). All data were analyzed with ANOVA, and then further tested with Least Significantly Difference (LSD) at 5%, and presented graphically.

RESULTS AND DISCUSSION

The results showed that as sole applications, both KD-112 and plastic wrapping applications extended significantly papaya fruit shelf-life [Table 1]. While 7% KD-112 did not significantly extend fruit shelf-life compared to the control, the higher concentration of 14% KD-112 extended significantly papaya fruit shelf-life by 3.66 days longer. These results were different than our other result of chitosan [7], in which chitosan applications did not affect papaya fruit shelf-life. This current result showed that, as a fruit coating, 14% KD-112 was better than 1.25-2.50% chitosan (7). KD-112 application seemed to develop a better modified atmospheric condition of lower O₂ and higher CO₂ so that respiration rate and ethylene production decreased [2, 8, 9]. Higher fruit weight loss [Table 1] might be a consequence of a longer shelf-life, as was also noted in our previous research [10].

Similar to KD-112, a sole application of one-layer of plastic wrapping extended significantly 'California' papaya fruit shelf-life by 8.44 days longer [Table 1], and it was generally capable of maintaining high fruit qualities. These agreed with the results reported by [7, 10]. Plastic wrapping developed a modified atmospheric condition of low O₂ and high CO₂ inside the coating and also provided a physical barrier to water vapor [5, 11-13] which promoted low respiration and transpiration rates [4, 5, 14]. As a result, not only fruit color development was delayed, as also shown by [15], but also fruit weight loss was decreased [Table 1].

Significant effects of 14% KD-112 and plastic wrapping as sole applications over other treatments (Table 1) were observed in their combined applications [Fig. 1]. While fruits coated with KD-112 but without plastic wrapping had very short shelf-lives of around 5-7 days [Fig. 1], those coated with KD-112 and plastic wrapping had longer shelf-lives up to 21 days storage with fruit stages had not reached full ripe [Table 1] and [Fig. 1].

Even though KD-112 did not affect fruit quality parameters [Tables 1, 2], and because plastic wrapping was capable of maintaining high fruit qualities by lower fruit weight loss and higher fruit firmness [Table 1], and lower acidity [Table 2], their combinations (K1W1 and K2W1) were capable of maintaining high fruit qualities [Fig. 1]. While other fruit parameter observations were terminated at around 5-8 days storage, combinations of KD-112 and plastic wrapping maintained high fruit qualities up to 21 days storage [Fig. 1]. Those might be due to decreased respiration and transpiration rates [8, 10, 16], that decreased carbohydrate degradation and water loss, and resulted in slower changes of fruit qualities up to 21 days storage.

Due to a more economical value of 7% KD-112 over 14% KD-112, the best postharvest handling for 'California' papaya, therefore, should be the combined application of 7% KD-112 and plastic wrapping. It delayed fruit ripening and maintained high fruit qualities up to 21 days storage.

Table 1: Effects of KD-112 and Plastic Wrapping on the Shelf-Life, Weight Loss, and Firmness of 'California' Papaya Fruits*

Treatments	Shelf-life (days)*	Weight loss (%)*	Fruit firmness (kg/cm ²)*
KD-112 (K):			
0% (K ₀)	10.50 b	5.85 b	5.91 a
7% (K ₁)	10.33 b	7.56 ab	9.27 a
14% (K ₂)	14.16 a	10.46 a	5.86 a
Plastic Wrapping (W):			
Without (W ₀)	7.44 b	9.32 a	4.63 b
One-layer (W ₁)	15.88 a	6.57 b	9.37 a

* Values in the same column of each treatment followed with the same letters were not significantly different at LSD 5%. Values of fruit firmness at 0 day-storage was 25.10 kg/cm².

Table 2: Effects of KD-112 and Plastic Wrapping on the Soluble Solid Content, Acidity, and Sweetness of 'California' Papaya Fruits*

Treatments	°Brix (%)*	Acidity (g/100 g)*	Sweetness**
KD-112(K):			
0% (K ₀)	11.46 a	0.19 a	64.5 a
7% (K ₁)	11.20 a	0.15 a	75.5 a
14% (K ₂)	11.18 a	0.16 a	70.7 a
Plastic Wrapping (W):			
Without (W ₀)	11.51 a	0.19 a	63.03 a
One-layer (W ₁)	11.08 a	0.14 b	77.47 a

* Values in the same column of each treatment followed with the same letters were not significantly different at LSD 5%. Values of soluble solid content (°Brix), acidity, and **sweetness (°Brix/acid ratio) at 0 day-storage were 9.20%, 0.15 g/100 g, and 63.12, consecutively.

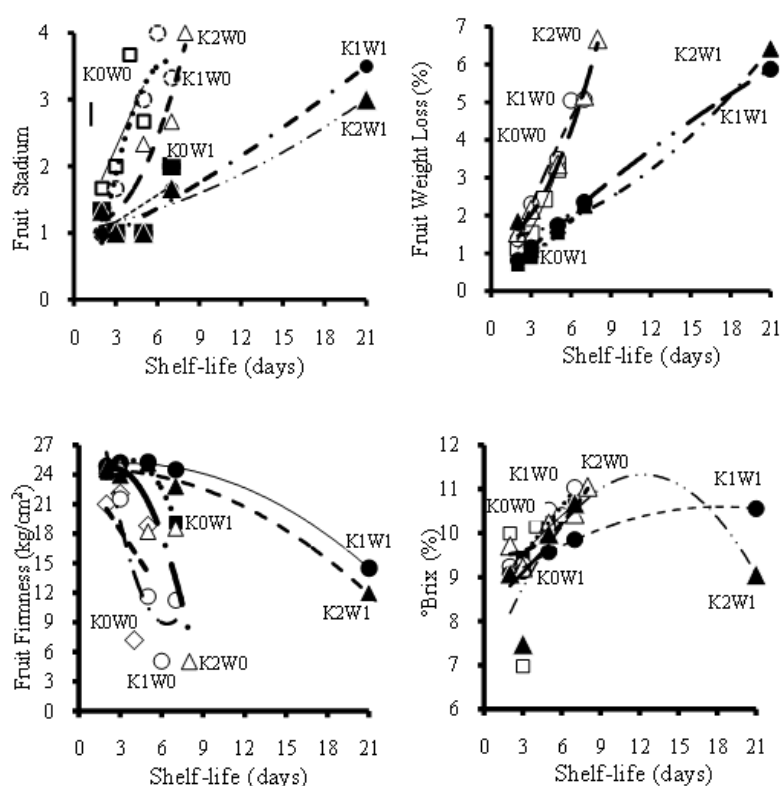


Fig. 1: Effects KD-112 and plastic wrapping on the fruit quality changes of 'California' papaya.

CONCLUSION

The results showed that as sole applications, fruit coatings of KD-112 and one-layer plastic wrapping extended significantly 'California' papaya fruit shelf-life and maintained high fruit qualities. The combined application of 7% KD-112 and one-layer plastic wrapping was recommended to be applied as a postharvest handling for 'California' papaya because it was capable of delaying fruit ripening and maintaining high fruit qualities up to 21 days storage, 13-16 days longer than control.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

A special thank was directed to the General Directorate of Research Empower and Development, the Ministry of Research, Technology, and Higher Education, the Republic of Indonesia for funding this research through the National Research Grand of The Research for Science and Technology Development 2015. Thanks to Nusantara Tropical Farm, Co. Ltd., Way Jepara, East

Lampung, Indonesia for providing fruit samples and Drs. Agus Karyanto and Kuswanta P. Hidayat for discussion during the preparations of research report and manuscript.

FINANCIAL DISCLOSURE

None

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ARTICLE

THE CHALLENGES OF PUBLIC ACADEME IN UNIVERSITY SOCIAL RESPONSIBILITY: THE INFLUENCES OF HUMAN RESOURCE DEVELOPMENT'S INTERVENTION

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ABSTRACT

Background: Human Resource Development has been identified to play significant role in Corporate Social Responsibility. Thus, this study aims to investigate the relationships between human resource development intervention and corporate social responsibility awareness among academic staff in a public university in Malaysia. **Methods:** A survey method using questionnaire was implemented to obtain data for this study. A total of 152 respondents participated in this study, giving a return rate of 67 percent from the entire population. Correlation and multiple regressions were performed using Statistical for Social Sciences to analyze the data. **Results:** The result indicated that training and development has significant and highest correlation with corporate social responsibility awareness. Performance and rewards management were the strongest predictors to corporate social responsibility awareness. **Conclusions:** It is crucial for HRD to take part in CSR as it helps in fostering organization and society belongingness with strong focus towards socially responsible activities.

INTRODUCTION

Universities started to focus on their civic responsibilities as well as public contributions in the areas of research and scholarship, teaching and learning, and outreach and partnership. Different terms are used to relate to the engagement of Higher Education Institutions (HEIs), including community participatory research, service-learning, volunteerism, science shops, civic engagement and corporate social responsibility have become more popular among HEIs in different countries as they are re-emphasizing their responsibilities to prepare students to be more active and while engaging the citizens to contribute to our everchanging global society. Alongside teaching and research, cultivating social responsibility within Asian universities is the third mission of contemporary HEIs. According to ISO 26000, the level of an institution's social responsibility is measured by whether it has considered the impact of social and environmental outcomes. A university is a stakeholder in a society and should bear its 'university social responsibility' (USR).

The term Corporate Social University (CSU) have shifted to University Social Responsibility (USR) through demonstration of framework which meet the expectation of the respective stakeholders [1]. Teesside University for instance, created space and opportunity for cultural activities, promoted and performed and provided a forum for dialogue on issues relating to culture in the Tees Valley. The 'community engagement' has become an important agenda nowadays and are documented in university policy, which was further converted into a community engagement framework. Apart from these responsible actions, the university holds an ethics committee to evaluate the ethical dimensions of the academic research conducted on human related subjects such as health, security, human rights, general law and ethical principles [2].

LITERATURE REVIEW

Corporate Social Responsibility (CSR) has received large amount of attention and is a form of value formation that has the power to reconnect business and society resulting to the next trend of global growth [3]. CSR may serve as an effective strategy for organization to gain competitive advantage by differentiating their products, processes or the firm itself from its competitors [4]. Besides that, CSR is in fact believed to be one of the challenging trends among organization nowadays and has become popular in companies globally as it may give a significant boost to corporate ethics [5]. Universities and colleges are recognized as the institutions surrounded by the communities and are also believed to play active roles in their contribution to community enhancement and problem-solving abilities [6]. Universities are more than intellectual centers with enormous knowledge and they have become known as engines that may enhance the core mission in teaching, research and service and serve as real world problem solver. The practice of USR represents a renovated commitment with their different publics, aligning USR with everyday management of institutional processes. USR is a concept whereby a university takes all the necessary steps to improve the quality of life for all its employees and their families, its students, its faculties, local and international communities as well as the society at large [7].

HRD intervention and CSR

Previous studies have looked at Human Resource (HR) contribution to CSR which has created a wide CSR culture-oriented organization. However, there is lot more that need to be understood and additional

KEY WORDS

Community engagement, outreach program, university social responsibility

Received: 15 Oct 2016
Accepted: 17 Nov 2016
Published: 6 Dec 2016

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understanding on specific involvement of HR in other CSR aspects covering the social, environmental and ethical aspects [8]. Due to the above, Human Resource Development (HRD) is proven to play a significant role in attaining social, environment and economic goals by assisting the organizations and has become important contributor to CSR [9]. Previous studies [10] [11] highlighted that the crucial variable in CSR is the size of the business, which serves as an indicator to why the company engages in CSR activities. In addition to the foregoing, CSR is believed to be different if the concepts and linkage to the company's principles and the progress of the activities are consistently monitored [10]. Therefore, organization's commitment to CSR can be identified from how they translate their CSR statements into action. Within this context, CSR could be linked to organizational management practices such as HRD [12]. This implies that HRD should demonstrate their leading role in promoting the CSR activities at all levels in organizations.

Despite the many strategies in developing organizational success, HRD is believed to have a significant role in assisting organization towards achieving social, environmental and economic goals [9]. Since employees' involvement is expected to be a crucial success factor in determining CSR performance, HRD may take a role in the implementation of the CSR plan and monitoring of the adoption proactively, reporting the CSR activities and documenting their success throughout the company [13]. Despite the number of previous discussions by many researchers on the importance of HRD and CSR [8] [9] [14] [15] [16] [17] [18] [19], there is lack of explanation on how these CSR principles can be implemented in the organization [20]. Furthermore, HRD's role in promoting CSR and contribution are still ignored by practitioners and are not empirically studied by previous researchers [21].

Proposed conceptual framework

In conjunction to the above, the purpose of this study has two folds: (1) to examine the relationship between HRD's intervention and CSR awareness, and (2) to identify the most used predictor of HRD's intervention. Figure 1 illustrates the proposed conceptual framework of this study. The predictor variables were the HRD's intervention components consisting training and development, management support, employees' engagement, employees' wellbeing and performance and reward management. Meanwhile, the criterion variable was CSR awareness.

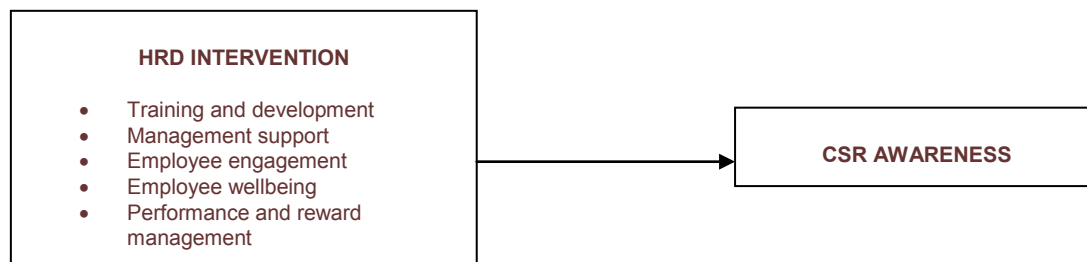


Fig. 1: Correlation between HRD intervention and CSR awareness

METHODS

This study was carried out in University Teknologi Malaysia (UTM), one of the established public universities in Malaysia. In order to sustain and to remain competitive, UTM needs to be involved in CSR to accelerate its shared mission and purpose by establishing strong collaboration with the community. This study was based on staff involvement in community outreach and community based participatory research (CBPR) program in 2014. We gathered the data from the UTM's Center for Community and Industry Network (CCIN). Out of 260 identified staff who were involved in the respective projects, a sample of 152 was involved in this study. Overall, only 102 questionnaires were returned, providing a response rate of 67%. 64% of the respondents were male and 36% were female. Majority of the respondents (68%) were those with more than 5 years of working experience in UTM.

The questionnaire was developed and adapted from previous relevant literatures and all the measures are reliable (Table 1).

Table 1: Summary of test reliability

Construct	Items	Reference	Cronbach Alpha (n=15)
Training and Development	12 items	Suksem and Takahashi [16]	0.910
Management Support	8 items	Garavan [22]	0.856

Employee Engagement	8 items	Mirvis [23]	0.909
Employee Wellbeing	10 items	Rodrigo & Arenas [24]	0.898
Performance and Reward Management	7 items	Lam and Khare [8]	0.838
CSR awareness	21 items	Ardichvili [21] Strandberg [25]	0.946

RESULTS

Based on the results in Table 2, respondents reported high mean scores for training and development, management support, employee engagement, employee wellbeing and performance and reward management. The highest correlation was found between training and development and CSR awareness ($r=.716$, $p<0.01$), while management support showed a moderate relationship with CSR awareness ($r=.585$, $p<0.01$). Other scales such as performance and reward management, and employee engagement had poor correlation ($r=.482$, $p<.001$, $r=.0397$, $p<.001$, respectively) while employees' wellbeing showed no significant correlation with CSR awareness.

Table 2: Correlation among variables (N=102)

Predictor	Mean	SD	CSR awareness
Training and development	4.49	0.531	0.716***
Management support	4.52	0.492	0.585***
Employee engagement	4.41	0.535	0.397***
Employee wellbeing	4.09	0.751	0.073
Performance and reward management	4.10	0.687	0.482***

***Significant at $p<0.001$

Table 3 showed the finding of multiple regressions to assess the impact of HRD's Intervention and CSR awareness. Overall, the model concluded that HRD's Intervention contributes 39% to CSR awareness. The strongest predictor of CSR awareness was performance and reward management ($\beta = .383$, $p<0.001$), followed by training and development ($\beta = .257$, $p<0.01$), employees' wellbeing ($\beta = -.242$, $p<0.01$) and employees' engagement ($\beta = .224$, $p<0.05$). There was no significant impact of management support on CSR awareness ($\beta = .054$, $p>0.01$).

Table 3: Regression analysis for HRD intervention and CSR awareness (N=102)

Predictor	R^2	CSR awareness β
Training and development		0.257*
Management support		0.054
Employees' engagement		0.224***
Employees' wellbeing		-0.242*
Performance and reward management		0.383**
	0.392**	

***Significant at $p<0.001$

DISCUSSION AND CONCLUSION

Social responsibility in a university as well as in a business organization is an important factor to strengthen employees' motivation and attracting highly qualified employees as well as maintaining them [26]. University demonstrated that they could educate young people to become more socially responsible individuals and encourage their participation in creating positive social change through personal projects related to the community development and educational program [27]. For that reason, providing training and development program to employees to get them embrace the organization's effort on CSR is crucial. Having trained employees on CSR is a challenge for organization to achieve its sustainability goal [28]. HRD's active involvement in CSR by providing training and development for the managers and employee may allow staff to gain competitive advantage that may develop a culture which focuses on societal issues [9]. The integration of HRD and CSR has been argued may lead to the development of potentials in organization through three facets such as individual development, performance improvement and organizational development [29]. This implied that academics and social and community development may benefit from training and development.

This study found that performance and reward management were the strongest predictors among HRD's intervention. These rewards and recognition program includes incentive pay, benefits such as award program, employee of the month, challenging and meaningful CSR task and others [25]. As for UTM, besides granting certain promotion to employees, they were also given paid time off when they were involved in CSR activities. This study postulates an understanding that employees' performance increased when they attributed their intrinsic and extrinsic motives for CSR. For instance, employees perceived organization is allowing them to grow as a person, improve self-confidence, mature and foster self-esteem. In summary, a resource-based view (RBV) claimed that the specific contribution by HRD and its resources would represent both assets and create values to the organization. Therefore, it is crucial for HRD to take

part in CSR as it helps in fostering organization and society belongingness with strong focus towards socially responsible activities.

ACKNOWLEDGEMENTS

This study was supported by the following grant sponsor; Universiti Teknologi Malaysia (UTM) Flagship Funding, Vote No. Q.J130000.2429.02G60.

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ARTICLE

AN INSIGHT INTO THE LEGAL FRAMEWORK ON HUMAN GENE THERAPY IN SELECTED COUNTRIES

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ABSTRACT

Background: Recently, the fields of biotechnology and genetic engineering have been given great emphasis by most of the countries from all over the world. It is proven that genetic living organism could be successfully manipulated and redesigned using various applications of biotechnological sciences. Similarly, this overwhelming advancement of science has also encouraged the government of Malaysia to put great emphasis to this biotechnology evolution. Given that this industry is believed to be the prominent key areas in generating economic growth, various incentives, investments, effective research and medical devices have been successfully conducted and developed. While the use of this novel technology is increasingly tremendous, so does the field of human gene therapy. Current trends signify that gene therapy technique has been widely used as it has been proven to be a successful treatment for cures of epidemic diseases in human at the molecular level. It has nevertheless been found that this technique has been associated with a wide range of ethical and legal issues. In view of this point, this study seeks to examine the legal issues surrounding human gene therapy. On this, special concentration would also be paid to the legal provision and regulation currently enforced in few selected countries governing human gene therapy. Considering that there has been absence of legislative regulation to regulate gene therapy treatment and activities in Malaysia, this study further recommends that it is essentially indispensable for Malaysia to also having a set of legal and regulatory framework in place. To achieve this, this study proposes that the relevant regulatory framework in selected countries could be considered in developing the legal framework for Malaysia. However, this study further submits that the extent of importation of the relevant legislation into Malaysia should be limited in order to safeguard Malaysians' ethical, spiritual and cultural concerns.

INTRODUCTION

The advancement of genetics and genomics have taken place world widely especially in the developed countries. Like in other countries, even though the development of biotechnology in Malaysia is rather slower, initiative has been taken by the Malaysian government specifically in making collaboration with other biotech partners such as Thailand, New Zealand, Hungary, Japan and Korea [1]. This collaboration has successfully assisted Malaysia in developing biotechnology field with special concentration given to the medical aspect.

The field of genetics and genomics have becoming a vast major field targeting to envisage potential benefits for chronic diseases such as breast cancer, colon cancer, cystic fibrosis and diabetes [2], [3]. The scientific discovery reveals that the genetic basis of the diseases might be caused by the changes (mutations) in the DNA, [4] on which it could be cured using genomics medicine. The similar view has also been pointed out as in [5] where the genomics and biotechnology were heralded as a successful tool to elucidate health problem in developing countries. Considering that this promising field has great potential [1] to resolve issues associating with human, this major contribution is therefore vital. Following these, various novel techniques associated with human genome have been used. These include; cloning (DNA cloning, reproductive cloning, and therapeutic cloning); somatic and germline therapy.

In view of the above, current trends signify that human gene therapy is efficacious to treat certain genetic diseases at the molecular level. Reviews of literatures demonstrate its benefits and successful treatment to cure epidemic diseases in human. [6], [7]. Therefore, the successful of this clinical trial has provoked an excitement amongst scientist and clinicians in this promising therapy for curing many genetic disorders. Nonetheless, despite the prospect of clinical trial obtained from gene therapy, it has been encountered with a wide range of ethical and legal controversies. [8], [9], [10]. This technology has been used irresponsibly with high level of uncertainty which consequently caused fears to the society at large. Besides, significant risks involved in this technique could possibly outweigh the

KEY WORDS

Biotechnology, Human Gene Therapy, Legal Provision on

Received: 18 Oct 2016
Accepted: 19 Nov 2016
Published: 12 Dec 2016

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potential benefits [11], [4], [12], [13]. On top of that, debates on gene therapy activities among scientists and Muslim scholars have also taken place. Although the ethical issues have been discussed extensively, less attention has been given to address the legal issues. Hence, this paper highlights the legal issues surrounding this technique. The existing legal and regulatory provision relating to human gene therapy in few selected countries shall then be appraised so as to establish whether it is able to adequately regulate the human gene therapy technique and activities

DEFINING HUMAN GENE THERAPY

There are vast array of literature representing the work that ultimately brought about the meaning of gene therapy, the procedure and techniques accomplished within, the application method and the vector system used in human gene therapy. Essentially, gene therapy is a medical technique that seeks to transfer genetic material to a cell to generate a therapeutic effect by correcting an abnormality that exists within the host cell [14]. The principle of human gene therapy as in [15], [16] is replacing the defective genes by a new functional gene that corrects the defects. New genetic instructions will be introduced into the patients' tissue for the treatment of disease or to compensate for an abnormal or missing gene by conveying a new function [17]. The procedure and techniques could be carried out either *ex vivo* or *in vivo* [18], [19]. Originally, certain diseases are caused by a defective gene or by the absence of a functioning gene. Therefore, this preventive approach involved the identification and cloning of the genes associated with many human diseases, including, B - thalassemia, Gaucher's disease, adenosine deaminase deficiency, cystic fibrosis, AIDS, and cancer [18], [19].

Types of Gene therapy

Practically, human gene therapy involves changes in either somatic cells or germ cells. As in [9], [26] human gene therapy comprises of i) Somatic gene therapy which involves an insertion of the gene directly into the host's tissue. This gene therapy enables to further correcting a genetic defect in the somatic (i.e., body) cells of a patient. Likewise, somatic gene therapy procedure is similar with other more conventional forms of pharmacological intervention as it involves the manipulation of gene expression in somatic cells that has been corrected, but not inherited by subsequent generations; [17], [22] ii) Whereas in Germ line gene therapy, it requires the insertion of the gene into the reproductive tissue of the patient (ovaries or sperm) which entails modification over the subjects' germline the disorder in his or her offspring and future progeny would also be corrected. Apart from that iii) Enhancement genetic engineering [9] is another type of gene therapy which involves the insertion of a gene to 'enhance' a known characteristic; for example, the placing of an additional growth hormone gene into a normal child ; and iv) Eugenic genetic engineering is a therapy which manage to alter or 'improve' complex human traits, each of which is coded by a large number of genes; for example, personality, intelligence, character, formation of body organs, and so on. Above all, performing of somatic gene therapy are the prevalent efforts and a novel approach to gene therapy for genetic disease taken in clinical trial rather than germline gene therapy. The primary concept of this therapy is that the application of gene therapy vectors to the targeted tissue may avoid or delay the development of early disease related organ damage and may allow targeting of inaccessible organs and tissues.

Potential applications of Gene therapy

Scientific discovery reveals that certain pediatric hereditary disorders are due to definite genes and defects in specific proteins. Thus, this scenario would eventually lead to the initial evolution of the gene therapy concept [4], [26]. Essentially, numerous potential applications of gene therapy could possibly extending from monogenic hereditary disorders such as Duchenne muscular dystrophy, lysosomal storage diseases or cystic fibrosis to acquired disorders like AIDS, cancer, thrombo-embolic cardiovascular diseases and neurological disorders, upper gastrointestinal tract infection, autoimmune disease, and systemic protein deficiency [26], [16]. These disease interact with genetic factors by which scientist have further found it could be treated using the genomic medicine. Additionally, the promising of this preventive approach in producing tremendous good and reducing the suffering and death caused by genetic diseases has been proven in many clinical trials. Studies with special attention discussing on the scientific aspects, elaborating its potential benefits and successful treatment to cure epidemic diseases using human gene therapy technique are enormous; [27], [16], [28], [29], [30], [31], [19], [23], [32], [33], [34]. Hence, it is further believed that gene therapy will certainly represent, a major therapeutic option applying in particular disorders with no available alternative treatment [27]. This new method for example has been successfully act as a preventive intervention against cancer targeted by utilizing genes to destroy cancer cell [29], [30], [18]. Also, gene therapy approach is currently being pursued in primary severe combined immunodeficiency (XSCID) and other immunodeficiency disorders, including chronic granulomatous disease and Wiskott-Aldrich syndrome [28], [35] and the active pursuit of gene therapy for inherited single-gene defects have also been sought in Cystic Fibrosis (CF) [36], [24] Despite the absence of curative treatment

available, other candidates severe genetic disease such as phenylketonuria (PKU), Duchene muscular dystrophies (DMD) which caused by mutations in the X-chromosomal dystrophy gene, hemophilia IX, and orthine transcarba- mylase deficiency (OTC) may also be amenable using gene therapy [26], [23]

LEGAL ISSUES SURROUNDING HUMAN GENE THERAPY

In view point of the above discussion, it brought to our attention that both types of gene therapy are surrounded by ethical and legal concerns [9]. Debates surrounding the human genome have focused primarily on the moral and ethical propriety of manipulating the human genome, as well as on the potential social harms. Amongst the studies which primarily examine the ethical issues of human gene therapy are as in [37], [38], [39], [40]. Reviews from these academic literatures reveal that ethical issues must remain a paramount consideration in conducting gene therapy. Unlike somatic gene therapy experiments, germline gene therapy appears to be more controversial and has been surrounded by a wide range of unresolved issues. Hence, this advent requires such a comprehensive policy and legal and provision to govern the scientific progress. However, in deriving legal solution, further scrutiny of the underlying ethical issues surrounded the human gene therapy is needed.

Since the goals and objectives of gene therapy in human are varied, the purposes of gene therapy in human would be a major issue that needs to be addressed upon. It is important to know as to what purposes would be considered as ethically acceptable, and in justifying the acceptability of each purpose, what mechanism should be applied. On the other hand, the question of human dignity is another pertinent issue that needs to be overcome as highlighted in [41]. Therapeutic interventions on human embryo might be affected while human cells could be amenable to treatment or alteration. Non-therapeutic interventions which alter the genetic of an individual are another concern which stems from the fear that human is considered as a mechanism to achieve certain aims.

Besides, issues regarding safety and regulatory aspects of gene therapy have been outlined as in [27]. Three significant areas have been identified and need to be overcome include i) experimental and pre-clinical research; ii) manufacturing of gene therapy products; iii) clinical trials and development. The author further concludes the essential issues in each of these areas remain unresolved particularly in terms of the efficiency and safety of gene therapy clinical trial. Concentration has been given on the ethical issues as in [7], [42], [43]; i) the process of establishing safety and efficacy of therapeutic gene manipulation. ii) Weighing potential harms and benefits, iii) establishment of procedural fairness in the selection of patients for research, iv) assurance that consent to experimental treatments is informed and voluntary, and v) protection of privacy and confidentiality of medical information. On this point, it is further submitted that the specific issue of informed consent is among crucial issue that should be given special attention in both type of gene therapy. In Germline gene therapy, since the therapy implies a patient who may give informed consent and subsequently being treated, the question would then arise; Who is the subject of therapy?; who did give the consent and if the clinical trial is successfully conducted, the resulting child and future generation never will have such disease, then, it is accurate to say that the child was treated? [44].

Conversely, despite the extremely potential applications of gene therapy, this may however causes risk which involves insufficient therapeutic efficacy. As a result, like any other new treatment, proper assessment of safety and effectiveness and informed consent are crucially needed in conducting somatic gene therapy [11]. Few studies indicate that many fear that the risks inherent in using these procedures in humans far outweigh the potential benefits [12], [13]. Similarly, failure to communicate on the potential risks along with the benefits has then establishing fears to this technique so attained [45], [27]. As in all cases of research, it is imperative to balance the value of knowledge to be gained, with the risk of harm that has incurred. Therefore, gene therapy in human brings into tension two fundamental moral principles: the duty to prevent or alleviate suffering, and the duty to respect the value of human life. The question then is which principle should be given precedence in the event of a conflict? Should be given the first priority over the second by permitting human gene therapy and allow its destruction? Or should we totally ban such therapy without considering the potential benefits it could offer? Also, taking into account on the potential benefits and the risks of a gene therapy, the potential benefits may be outweighed by the risks involved. As a consequence, it is pertinent to further consider an appropriate mechanism to protect the rights and welfare of gene therapy patients participating in clinical research.

LEGAL PROVISION ON HUMAN GENE THERAPY IN SELECTED COUNTRIES

Given the above, having a statutory legal provision to govern gene therapy is therefore vital. This is to ensure that research and applications are done for the benefit of human welfare and the rights of others are not infringed. In addition, to avoid misuses of these new technologies, effective responses

from legal perspective coupled with international cooperation are indispensably crucial. The harmonization of appropriate regulation [27] is essential to facilitate the scientific evolvement. This is evident by significant efforts which are being made towards harmonization and the establishment of international guidelines to govern gene therapy activities.

Among the notable international declarations and guidelines issued by non- governmental organizations such as the World Medical Association (WMA), the Council for International Organizations of Medical Sciences and other academic or professional institutions. Other documents which merely cover on specific bioethical issues is the UN Declaration on Human Cloning of 2005 and the UNESCO Universal Declaration on the Human Genome and Human Rights of 1997. Another regional instrument is the European Convention on Human Rights and Biomedicine of 1997. Despite the great number of existing international guidelines, statements and declarations relating to bioethics, the new Universal Declaration on Bioethics and Human Rights adopted by the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) which put in place on 19 October 2005 is another international declaration, though non-binding that comprehensively deals with the linkage between human rights and bioethics in particular which involve biomedical research and clinical practice [46].

Considering that the moral conviction and domestic regulation for each countries differ because of socio cultural, historical, philosophical and religious background associated with human gene therapy, as in [47], he proposes that international cooperation is needed to not only harmonize the existing legal standards but also to ensure that such standards are effectively implemented by establishing appropriate mechanism.

European countries

In discussing on medical genetics technique, juridical questions are among the issue that avail apart of ethical issues. Few authors have discussed on ethical issues with special reference to the international regulation [48], [49]. According to [50], recent advances in stem-cell research have also been accompanied by social, political, economic, legal, religious, and ethical questions. Current European legislation has been enforced among various European countries ie; Sweden, Norway, Germany, Belgium and United Kingdom upon the acceptance of therapeutic and reproductive cloning. While it appears the acceptance is on the ground that medical benefits outweigh the risk, it has nevertheless opposed by Europe Convention on Human Rights and Biomedicine (adopted by the Council's Committee of Ministers on November 19, 1996) which involved 29 European countries except Germany, Belgium and the United Kingdom. It seems that numerous laws and regulations have been implemented or are being considered in order to control the use and spread of this new technology.

On the other hand, as in [51] comparison studies on "Gene Therapy in Germany and in Europe: Regulatory Issues with special concentration on Germany Regulation" reveals that there is a considerable body of regulations including the German Drug Law protecting the patients during clinical trials. Amongst the regulation is that the requirement of marketing authorization prior treatment towards patients. German gen Law is another regulation governing the requirements of experiments, storage and inactivation in gene therapy involving the use of genetically modified organisms (GMOs). As for Germany, gene therapy drugs can be constructed and analyzed in laboratories approved according to the German Gene Technology Law ('GenTG') by the competent authorities in each federal German state. Aside from that, there appears to exist a considerable body of regulations including the German Drug Law ('Arzneimit- telgesetz') protecting the patients during clinical trials. Likewise, in experiments of gene therapy using genetically modified organisms (GMOs), they have to be adhered to German Gene Law (which is a transformation of Council Directives 90/219/EEC and 90/220/EEC) where such trial have to be performed in gene laboratories of safety levels 1-3 used for research, which have been approved of by the competent authority of the federal German state where the laboratory is located. This has been made clear that Gene Law regulations will ensure that necessary precautions are taken into account during the use of viral vectors and genetically modified cells. Safety of human beings other than the patient and the environment will be put at the utmost consideration.

The implementation of a gene therapy clinical trial in France however is under the responsibility of the French Medicines Agency. Documents for guidance in conducting clinical trials shall be released by the expert working group in French Medicines Agency. This documents contain such a comprehensive safety and efficacy issues relating to gene therapy clinical trials in humans: information on the GMOs and risk for deliberate release; pharmaceutical and biological information, a comprehensive approach to strategy, gene construct and gene delivery system, manufacture and control, intended product use ex viva or in vivo, storage and destruction; the delivery system and the full therapeutic product and clinical trial data. Final decisions must be given by coordination of several departments inside the Medicines Agency [27]. Further to that, as in [51] under this agency, it involves the independent advisory body known as The National Advisory Committee on Ethics (CCNE). As an independent body,

the CCNE may decide to release comments or questions on any subject of its choice. On the other hand, the 'Commission de Genie Genetique' (CGG) and the 'Commission de Genie Biomoleculaire' (CGBM) are two bodies which connected directly with French Ministry of University-Education and Research and French Ministry of Environment. Their function is to review of the clinical trials protocols before giving an approval for gene therapy for human is being permissible to be conducted. Ultimately, the protections of human beings which participate in biomedical research are controlled by the Research Ethics Committees. This include, certain protocol have to be followed to before an approval being vested by the Local Research Ethics Committee.

These denote the rules in particular; have been extended to be applied to the use of products derived from biotechnology form the basis for gene therapy. In terms of the clinical trials, approval of the competent national authorities is required by most of the EU countries before they can be conducted. Meanwhile, Ethics Committee approval is a requirement prior to the trial being conducted at the hospitals and centers. [52], [7], [35] however further claims that besides its complex treatment strategy, gene therapy is considered as more expensive compared to conventional drug treatments.

United States of America

[53], [54] highlight on the regulation of gene therapy in USA. Currently gene therapeutic products and gene therapy research in human subjects' therapy in the United States administered primarily under the auspices of National Institute of Health (NIH) and Food and Drug Administration (FDA). The FDA regulates the clinical application of gene therapy and acts as deliberative body that oversees and reviews the safety and control measures associated with gene therapy. FDA's approval is required for all gene therapy protocols. On the other hand, in terms of regulation to govern the gene therapy activities, NIH carries primary oversight role [55]. Within NIH, the subcommittee composed of professionals in the science, medical, and law fields together with The Special consultative group known as Recombinant DNA Advisory Committee (RAC) will be formed and will then review gene therapy protocols. These three bodies should actively control and monitor the gene therapy activities. However, besides the formation of regulation as a necessary component of gene therapy research and applications, extra caution and modification should further be imposed by the government regulation to also govern the germ line gene therapy which possesses much more controversies which may affect future generation [56].

Similarly, as in [13], current regulation governing these technologies with special reference to Food and Drug Administration (FDA) has been discussed. Seemingly, the FDA's authority and jurisdictions has also been extended to both public and privately funded agencies. FDA seems to be the appropriate regulatory agency to oversee federal regulations since the federal government has very little legislation or guidelines regulating this activity. As a consequence, those attempting to use the techniques as reproductive technologies or medical therapies would firstly answerable to the FDA for applications of germline gene therapy used clinically in humans. The same approach as in European countries, the FDA regulation requires the institution to submit a research proposal and obtain authorization before the trials in human subjects is being implemented. On this, the FDA has a full discretion to obviate certain procedures or assays when it is felt there is no impact on safety. The element of informed consent of human subjects is also another vital element required by virtue of FDA and hence subject to enforcement and sanctions.

However, flexible approach [35] has been brought by the Food and Drug Administration (FDA) with regard to an early clinical trial of cell and gene therapy which does not require full cGMP manufacturing. All in all, the FDA framework is flexible and subject to modifications in the light of scientific advances as with the RAC 'Points to Consider documents' which present pertinent issue in a given area of product development [27]. Center for Biologics Evaluation and Research (CBER) has been appointed for being responsible to reviewing gene therapy protocols as well as the new biological by adopting the principles already established.

United Kingdom

Review of the literatures demonstrates that a vast array of works being done on human gene therapy with special focus on the UK legislation. Among the scholars are [52], [4], [51], [57]. As far as UK legislation is concerned, germline gene therapy is totally illegal in the UK and many other jurisdictions because the risks of unintended harm would be harder to predict and control [4] compared to somatic cell therapies. The relevant provision could be referred to in Part 3, Regulation 19 (3) of The Medicine for Human Use (Clinical Trials) Regulations 2004.

Reg 19- Authorisation procedure for ethical trials involving medicinal products for gene therapy
 Reg 19 (3)- The licensing authority shall not authorize a clinical trial involving products for gene therapy if the use of those in the trial would result in modification to any subject's germ line genetic identity (The Medicines for Human Use (Clinical Trials) Regulations 2004, 2004 No.1031)

Thus, the above regulation has made clear that germline gene therapy is illegal and would not be permitted to be conducted. Other than that, Article 24 of the Universal Declaration on the Human Genome and Human Rights states that the International Bioethics Committee of UNESCO should disseminate the principles set out in the Declaration and should further proposes that germ line gene therapy activities could be contradictory to human dignity [58].

However, this is likely to be affected by virtue of Human Fertilisation and Embryology Act, (2008) for the possibility and permissibility of making changes to mitochondrial genomes that could be inherited by future generations in order to treat or prevent mitochondrial disease. Also, Article 13 of the European Convention on Human Rights and Biomedicine further states that; An intervention seeking to modify the human genome may only be undertaken for preventive, diagnostic or therapeutic purposes and only if its aim is not to introduce any modification in the genome of any descendants.

As in [4], he again claims even mitochondrial disease could be inherited in the maternal line but it is not part of germline genetic modification. Having reviewed the protocol in UK, few literatures [51], [57], [59] elaborate on the regulatory body involves in human gene therapy activities. Gene Therapy Advisory Committee (GTAC) which was created in November 1993 is the authoritative body to govern, to oversee, review and monitor gene therapy activities in UK. This GTAC has replaced the former Committee on the Ethics of Gene Therapy (CEGT). The following tasks of the GTAC include: review of the clinical protocols for gene therapy research with respect to the scientific merit and the potential benefits and risks; cooperate with other agencies which have responsibilities in this field including local ethics committees and agencies with statutory responsibilities, i.e. the Medicines Control Agency, the Health and Safety Executive and the Department of the Environment; and advice of the UK Health Ministers on trends and development in gene therapy research. A case-by-case review is performed by the GTAC and approval of the protocol must be obtained before starting the clinical trial. In addition, the final statement of GTAC is always transmitted to the local research ethics committees and to the applicant. Any clinical study must be referred to and gain the approval of a Local Research Ethics Committee (LREC) as it is also required for other clinical trials. With regard to the licensing authority in the UK, the Medicines Control Agency (MCA), operates the national scheme for clinical trial certificates under the provision of the Medicines Act 1969 [7]

In addition, [60] further notes that gene therapy which involves a research and recruitment of patients into research trials should be governed under strict rules set out by the GTAC. Even so, GTAC approval can only be obtained in the case of somatic cell gene therapy (i.e. on any cell other than the sperm or egg cells) proposal. As such, consideration would not be given for any proposals for germ line cell (egg or sperm) gene therapy. Among the primary consideration that would be assessed by this Committee include; i) whether the research proposal meets accepted ethical criteria for research on human subjects. ii) GTAC reviews would strictly examine the scientific merits of the research and evaluating its potential benefits and risks. On top of that, the safety and welfare of patients is of paramount importance. Annual report as well as guidelines on submitting protocols [54] to carry out gene therapy and on writing information for patients has also been established by the GTAC. The special reports contain an examination of the use of adenovirus in human clinical trials, and the potential use of in utero gene therapy.

CONCLUSION

The above review demonstrates that there have been different approaches taken by countries in regulating gene therapy research. In certain countries gene therapy is regulated as an experimental therapeutic and therefore subject to general medical legislation. On the contrary, given the ethical issues surrounding Gene Therapy, in some other countries the regulatory mechanism developed was only non-statutory advice by the creation of specific monitoring body; national ethics committees and advisory boards such as the US Recombinant DNA Advisory Committee (RAC) and the UK Gene Therapy Advisory Committee (GTAC).

Meanwhile, in the Malaysian context, there has been absence of legislative regulation to regulate gene therapy treatment and activities [61]. The only guideline is the "Medical Genetic and Genetics Services 2006" by Malaysia Medical Council. The Guideline however should be read in conjunction with, the Medical Act Regulations, Code of Professional Conduct of the Malaysian Medical Council and other Guidelines issued by the Council or any related organization, as well as any statute or statutory provisions in force and all related statutory instruments or orders made pursuant thereto. This guideline merely provides a very general guideline on medical genetics and services. On top of that, by virtue of Clause 19 of the said guideline which addresses on the gene therapy and cloning, appears to merely reaffirm that gene therapy is likely to present with ethical dilemmas (Malaysian Medical Council, 2006).

With the many ethical issues surrounding Gene Therapy and the dynamic progress that it shows, the existence of a comprehensive legal and regulatory framework emphasizing on the ethics is vital. In the

absence of a legal mechanism, such activities may take place irresponsibly, merely for enhancement rather than medical purposes. Most importantly, without a statutory regulation, the safety and life of patients and research subjects may also be at risk too. On top of that, by having a statutory regulation over self-regulation public confidence and trust could possibly be retained if greatest attention is given in protecting the rights of patients participating in the therapies.

However, considering the different approach among law of nation, this study further propose that those principles outlined by the international instrument and declaration could be integrated and be adopted as a basic standard to help countries to develop proper legal and regulatory framework on gene therapy clinical trial without repugnant with the principles of international human rights law.

CONFLICT OF INTEREST

There is no conflict of interest

ACKNOWLEDGEMENTS

The authors would like to take the opportunity to thank the Dean of the Academy Of Contemporary Islamic Studies (ACIS), Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia Prof. Dr. Hj. Muhamad Rahimi Osman, and specifically the Universiti Teknologi MARA (UiTM) for their financial support extended to the author in attending and presenting this paper at this International Conference on Humanities, Social Sciences and Education (HSSE'17) in London, UK, 20th-21st March 2017 Their encouragement and support are very much appreciated.

FINANCIAL DISCLOSURE

None

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ARTICLE

SECURITY IN REQUIREMENTS AND DESIGN PHASES

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ABSTRACT

Objective: The objective of the research is to integration security in the development process to develop secure software. **Method/Analysis:** The proposed methodology involves all stakeholders to rank their relevant entities over security parameters. Based on this ranking, diagrams are drawn that indicate the level of security desired. The diagrams are near to UML and easy to understand. **Findings:** Developing secure software is important in the light of increasing flow of sensitive information and different kinds of users interacting with the system. A good solution is to integrate security in the development process but there are several issues and constraints. There are a few existing techniques proposed to address this problem but these have one or the other limitations. There is lack of empirical analysis in this area of research and existing design languages are not efficient in presenting the security concerns. However, most researchers believe that early phases of requirement and design are the most appropriate for such integration. **Novelty/Improvement:** The suggested methodology involves all stakeholders in the process but with concept with empirical analysis, tightly coupled requirements and design phases, easier and effective diagrams, and concept of relevance.

INTRODUCTION

Researchers [1,2] believe that development process is a major source of security problems in software and the solution lies in integrating security in the development process. The discussion presented in [3] reveals that such an integration in the first two phases of Software Development Life Cycle (SDLC) i.e. requirements and design, will be most appropriate. Requirement elicitation is considered critical and ambiguous [4] and necessity of security in this phase has been stressed. An ideal approach is to freeze requirements initially but it is not practical. Similarly, designing is essential for better communication between developer and client. In this regard Unified Modeling Language (UML) is quite prevalent but researchers do not find it suitable for modeling security requirements due to varied reasons [5, 6]. These issues have served as a motivation for the development of Security Requirements Elicitation, Assessment and Design (Sec READ) methodology. Several other software process models have been proposed earlier but all of them have certain limitations. These have been elaborated in Goel et al. [7, 8].

METHOD

Sec READ is a methodology that integrates of security in the software development life cycle. It is based on Assets (data items), functionalities and stakeholders. Sec READ is a well-structured process that first gathers requirements, then rates them on security parameters and finally, shows these ratings graphically in a meaningful way. It is kept in mind that only the relevant stakeholders rank the relevant assets and functionalities. The steps of this methodology are Identification, Refinement, Mapping, Ranking, Analysis and Design. [Fig. 1] depicts the process flow.

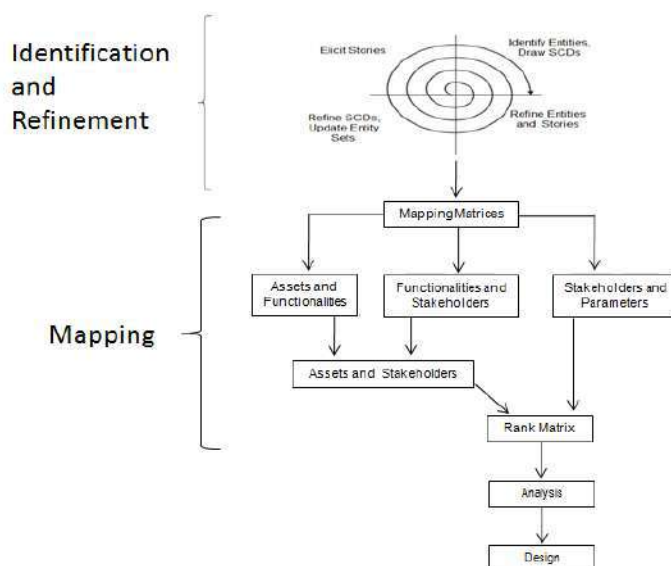


Fig. 1: Sec READ Methodology.

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KEY WORDS
requirements
engineering, modeling,
functionality

Received: 1 Nov 2016
Accepted: 8 Dec 2016
Published: 16 Dec 2016

IDENTIFICATION & REFINEMENT

These two phases move spirally as seen in [Fig. 1]. The spiral activity is initiated by the representative(s) from the client and developer side and the expert group. After each spiral newer stakeholders, assets and functionalities are incremented, if any. The expert group includes the business experts and experienced technical people.

Stories and story conversion diagrams

The client and the users narrate the requirements to the expert group. These requirements are called 'Story' and can be in natural language. Once a story is elicited the assets, stakeholders and functionalities are identified and put into three sets i.e. S, A and F respectively.

$S = \{S_1, S_2, \dots, S_n\}$, $A = \{A_1, A_2, \dots, A_m\}$ and $F = \{F_1, F_2, \dots, F_p\}$ $n \in W$, $m \in W$, $p \in W$

where, W is the set of whole numbers

A Story Conversion Diagram (SCD) is drawn for every story as and when it is elicited for graphical representation. There are different kinds of stories and each of them requires a different type of SCD. Stories may contain only one entity from stakeholder, asset or functionality. Other stories may contain two, three or multiple instances of entities. The SCD for a three-entity story is shown in [Fig. 2]. Here, $S_i \in S$, $A_j \in A$ and $F_k \in F$.

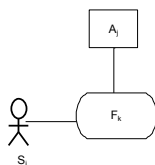


Fig. 2: Three entities.

Refinement of stories and SCDs

Up till now, the stories are elicited and converted as it is into SCDs. This information is refined by experts through the techniques of redundancy removal, and decomposition and aggregation. There may be more than one name (or similar names) for a single asset, functionality or stakeholder, which are removed. In the next cycle, the newly identified stakeholders sit together with the previous stakeholders to identify more entities. If new entities are not found, the process stops. When the spiral culminates sets for asset, stakeholder and functionality are formed. In this paper, for explanation, following sets are used.

$F = \{F_1, F_2, F_3, F_4\}$
 $S = \{S_1, S_2, S_3\}$
 $A = \{A_1, A_2, A_3, A_4, A_5\}$

MAPPING

Matrices

In this phase, the related entities are mapped through. The experts and the developers perform the mapping. These matrices are developed on the basis of the information collected. This process is performed by. The shaded cells in the matrices show relevance. Functionalities and assets mapped by matrix X shown in [Table 1]. Matrix Y [Table 2] maps stakeholders to functionalities. Matrix Z, shown in [Table 3], relates stakeholders to assets and is obtained by the multiplication of matrices X and Y.

$X = (x_{ij})$

where, $i = 1, 2, 3, \dots, a$
 $j = 1, 2, 3, \dots, f$
 $a = n(A)$, $f = n(F)$

$Y = (y_{ij})$

where, $i = 1, 2, 3, \dots, f$
 $j = 1, 2, 3, \dots, s$
 $f = n(F)$, $s = n(S)$

Table 1: Matrix X

F	F ₁	F ₂	F ₃	F ₄
A				
A ₁				
A ₂				
A ₃				
A ₄				
A ₅				

Table 2: Matrix Y

S	S ₁	S ₂	S ₃
F			
F ₁			
F ₂			
F ₃			
F ₄			

$$Z = (z_{ij})$$

where, $i = 1, 2, 3, \dots, a$
 $j = 1, 2, 3, \dots, s$
 $a = n(A), s = n(S)$

Table 3: Matrix Z

S	S ₁	S ₂	S ₃
A			
A ₁			
A ₂			
A ₃			
A ₄			
A ₅			

Parameters

The assets are to be ranked by the stakeholders on the confidentiality, authentication, integrity, non-repudiation and authorization parameters. P is set of parameters. Stakeholders are mapped to parameters based on their expertise or technical awareness. A stakeholder, thus, can rank assets on his/her relevant parameters only. Matrix W [Table 4] maps the two.

Table 4: Matrix W

P					
S	Authenticatio n	Integrit y	Confidentialit y	Non- repudiation	Authorizatio n
S ₁					
S ₂					
S ₃					

Rank matrix

R is a three dimensional matrix, developed using X, Y and Z. It has assets as rows, parameters as columns and stakeholders as depth or sheets. Every stakeholder has one version of the sheet on which he/she has to perform ranking.

$$R = (r_{ijk})$$

Where, $i = 1, 2, 3, \dots, a$
 $j = 1, 2, 3, \dots, p$
 $k = 1, 2, 3, \dots, s$

$$a = n(A), p = n(P), s = n(S)$$

RANKING

The applicable cells in the rank matrix are ranked as 1 (Low), 2 (Medium) and 3 (High) for the level of security desired. Always, the assets are ranked over authorization parameter by the core group only to avoid partiality. Goel et al. [9] describes elaborately how this parameter is dealt with and corresponding diagrams.

ANALYSIS

The final rank of the entities is calculated and diagrams are drawn. Taking matrix R, the mode of all values stored in the same cell in all the sheets is calculated and this consolidated value is stored in a matrix C. In this way a 2-dimensional matrix is obtained with assets as rows and parameters as columns. Now, using matrix C, for every row, mode of all values is calculated. These values serve as the consolidated asset rank. Similarly, consolidated parameter rank is obtained by calculating the modes of all columns. To find the rank of any functionality, the assets relevant to it only are considered as in matrix X [Table 1].

DESIGN

A rank diagram is drawn for every functionality of the system. [Fig. 3] is an example rank diagram for functionality F_4 as per matrices X, Y and Z. It shows that F_4 is a medium security functionality with two stakeholders S_1 and S_3 . Three assets are associated with it. Security requirement for asset A_2 is low, for A_3 is medium and for A_5 is high. Ranks are denoted by concentric rectangles for assets and concentric ovals for functionality. [Fig. 4] summarizes the complete system.

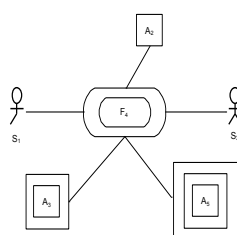


Fig. 3: Rank diagram for functionality F_4 .

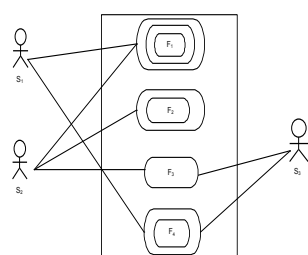


Fig. 4: System Rank Diagram.

CONCLUSION

The methodology is unique as it involves all stakeholders. Functionalities and assets are ranked by the stakeholders that are related to them only. The diagrams grow with the increasing information obtained. A single diagram illustrates a large amount of information in a manner which is simple to comprehend.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

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