



## RESEARCH ARTICLE

## Rotor Eccentricity Magnetic Analysis in IPM-Brushless DC Motors

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### ABSTRACT

Generally BLDC motors have found wide applications such as: electrical vehicles, industries, home appliances, etc. There are many factors which cause torque ripple and acoustic noise in BLDC motors. The unbalanced motor has the major role in the creation of torque ripple and acoustic noise. There are many reasons to the imbalanced air gap, which is the most common fault in asymmetric rotors such as: impacts on the axle or shaft due to the lack of proper design, lack of proper casting or inaccuracy arises in the factory. However, the asymmetry in the rotor which is caused by an imbalanced air gap, causes the differences in air gap flux, so, the vertical and tangential forces will be unbalanced which leads to the production of vibration and acoustic noses. In this paper, a new mapping is used to replace the IPM motor with it's SPM motor counterpart with the same treatments. For this purpose, the reluctance of the magnetic circuits of the motors in both cases should be equivalent and the dimension of the surface magnet is achieved. Then, Ansoft-Maxwell software is used to simulate the air gap flux density in asymmetric rotor and finally, the asymmetrical solutions in both of the motors are studied.

**Keywords:** air- gap flux density, torque ripple, BLDC motor, rotor eccentricity.

### INTRODUCTION

BLDC motors are generally used and have found wide applications such as: industry machineries, electrical cars, home appliances and etc. There are many factors that cause torque ripple and noise in BLDC motors. If there is an imbalanced air gap in the motor, we can see more and more vibration and noise from motor. Naturally, it is necessary to immediate action to repair or balance the motor [1, 2]. One of the major causes of imbalance in the air gap is the rotor asymmetry from of the main axis. Hence, following the lack of balance in the air gap, air gap flux density becomes unbalanced while, the areas with the lowest air gap has the maximum air gap flux and areas with





**Iman dolat shahi and Mehrdad jafarboland**

largest air gap has the minimum air gap flux. So, depending on the asymmetric rotor flux, some components of the motor heat up and even sometimes melt the insulation and cause motor burning. Therefore, identification of these defects prevents future complications and costs [1-3].

**The introduction of UMP factor**

The asymmetry in the axis of the rotor creates a unbalanced magnetic field which leads to asymmetric motor components (or heterogeneous) that briefly is called UMP (Unbalanced magnetic pull). With the creation of the UMP asymmetric rotor and reaction forces in the bearings, the mobility of bearings reduces the lifetime of bearings and increases the mobility of periodic and non- periodic harmonic of the motor. However, two major reasons exist as the root of the UMP, which are:

1. The errors in the windings
2. The occurrence of rotor eccentricity which produces more acoustic noise frequency components [6].

**Equations of the magnetic field**

In this section, we use magnetic field analysis to identify the main sources of UMP in BLDC motors and determine the main frequency components of the rotor eccentricity. Furthermore, brushless DC motors with fractional slots have complex air gap flux and wide frequency range [1, 2].

**Air gap flux and UMP factor**

As previously mentioned, the unbalanced air gap flux causes the unbalanced internal magnetic forces in the motor, So, if  $F_x$  is assumed to be a force in the X-axis , then [1]:

$$F_x = L \int_0^{2\pi r} \frac{b_n(y,t)^2}{2\mu_0} \cos\left[\frac{y}{r}\right] dy \tag{1}$$

Where,  $r$  , is the radius of the contour and  $y$  is the linear distance around the contour. It is commonly known that UMP will be generated when there are two air-gap flux waves with pole-pair numbers differing by one as it is discussed with details in [5]. The relative rotational velocities of the waves will dictate as to whether the force is a steady pull or a pulsating force. Multiplying to flux waves together with pole pair differing by one gives [5]:

$$b_n(y,t)^2 = \text{Re}\left[\overline{B_n} e^{j(\omega_n t - nky)}\right] \times \text{Re}\left[\overline{B_m} e^{j(\omega_m t - mky)}\right] \\ = \frac{1}{2} \text{Re}\left[\overline{B_n B_m} e^{j(\omega_n t - nky)} e^{j(\omega_m t - mky)} + \overline{B_n B_m}^* e^{j(\omega_n t - nky)} e^{-j(\omega_m t - mky)}\right] \tag{2}$$

$$= \frac{1}{2} \text{Re}\left[\overline{B_n B_m} e^{j((\omega_n + \omega_m)t - (n+m)ky)} + \overline{B_n B_m}^* e^{j((\omega_n - \omega_m)t - (n-m)ky)}\right]$$

$$F_x = L \int_0^{2\pi r} \frac{b'_n(y,t)^2}{4\mu_0} (e^{jky} + e^{-jky}) dy$$

$$= \frac{L}{8\mu_0} \int_0^{2\pi r} \text{Re}\left[\overline{B_n B_m} e^{j((\omega_n + \omega_m)t - (n+m)ky)} + \overline{B_n B_m}^* e^{j((\omega_n - \omega_m)t - (n-m)ky)}\right] (e^{jky} + e^{-jky}) dy$$

$$= \frac{\pi r L}{4\mu_0} \text{Re}\left[\overline{B_n B_m} e^{j(\omega_n + \omega_m)t} \Big|_{n+m=1} + \overline{B_n B_m} e^{j(\omega_n + \omega_m)t} \Big|_{n+m=-1} + \overline{B_n B_m}^* e^{j(\omega_n - \omega_m)t} \Big|_{n-m=1} + \overline{B_n B_m}^* e^{j(\omega_n - \omega_m)t} \Big|_{n-m=-1}\right]$$





**Iman dolat shahi and Mehrdad jafarboland**

For the vertical forces in y axis we have [5]:

$$\begin{aligned}
 F_Y &= L \int_0^{2\pi r} \frac{b'_n(y,t)^2}{4\mu_0} (e^{jky} - e^{-jky}) dy \\
 &= \frac{L}{8\mu_0} \int_0^{2\pi r} \text{Im} \left[ \overline{B_n B_m} e^{j((\omega_n + \omega_m)t - (n+m)ky)} \right. \\
 &\quad \left. + \overline{B_n B_m}^* e^{j((\omega_n - \omega_m)t - (n-m)ky)} \right] (e^{jky} - e^{-jky}) dy \\
 &= \frac{\pi r L}{4\mu_0} \text{Im} \left[ \overline{B_n B_m} e^{j(\omega_n + \omega_m)t} \Big|_{n+m=1} + \overline{B_n B_m} e^{j(\omega_n + \omega_m)t} \Big|_{n+m=-1} \right. \\
 &\quad \left. - \overline{B_n B_m}^* e^{j(\omega_n - \omega_m)t} \Big|_{n-m=1} - \overline{B_n B_m}^* e^{j(\omega_n - \omega_m)t} \Big|_{n-m=-1} \right] \tag{3}
 \end{aligned}$$

**Rotor air-gap flux waves**

The magnets will produce a trapezoidal shaped rotating flux and this can be put into a complex form [5] where:

$$\begin{aligned}
 b_r(\theta, t) &= \sum_m B_r^m \cos mp(\omega_r t - \theta + \varphi_m) = \text{Re} \sum_m \frac{\overline{B_r^m}}{2} e^{jmp(\omega_r t - \theta)} \\
 \Rightarrow b_r(\theta, t) &= \sum_m B_r^m [\cos mp(\omega_r t - \theta + \varphi_m)(1 + \lambda_{slot} \cos n_s \theta)] \\
 &= \text{Re} \sum_m \frac{\overline{B_r^m}}{2} \left[ (e^{jmp(\omega_r t - \theta)})(1 + \frac{\lambda_{slot}}{2}(e^{jns\theta} + e^{-jns\theta})) \right] \tag{4}
 \end{aligned}$$

Where,  $m = 1, 3, 5, \dots$  if we include the stator slotting  $n_s$  and restrict the harmonic number to the stator slot number.

**Stator air gap flux waves**

Assume that the winding is balanced 3-phase. However, in a fractional slot machine it should not be assumed that the winding MMF is made with a fundamental pole-pair harmonic with 5th, 7th, 11th, 13th, etc windings. We have to take the fundamental harmonic as two for the general case and eliminate harmonics if they are zero according to the method discussed in [6]. Hence:

$$\begin{aligned}
 b_s(\theta, t) &= \sum_{nw} B_s^{nw} \cos(\omega_s t - nw\theta + \varphi_m) \\
 \Rightarrow b_s(\theta, t) &= \text{Re} \sum_{nw} \frac{\overline{B_s^{nw}}}{2} (e^{j(\omega_s t - nw\theta)}) = \text{Re} \sum_{nw} \frac{\overline{B_s^{nw}}}{2} (e^{j(p\omega_r t - nw\theta)}) \tag{5}
 \end{aligned}$$

where  $n_w$  is the winding harmonic of the non symmetrical windings Equations (4) and (5) can be used and by putting into (2) and (3), the UMP components and frequencies will be obtained.





**Iman dolat shahi and Mehrdad jafarboland**

**Rotor Eccentricity situation**

Rotor eccentricity can be denoted using the method discussed in [7], using permeance modulation. So, the magnet flux wave can be represented as:

$$\begin{aligned}
 b_r(\theta, t) &= \text{Re} \sum_m \frac{\overline{B_r^m}}{2} \left[ (e^{jm(\omega t - p\theta)}) \left( 1 + \frac{\lambda_{slot}}{2} (e^{jns\theta} + e^{-jns\theta}) + \frac{\lambda_{ecc}}{2} (e^{j\theta} + e^{-j\theta}) \right) \right] \quad (6) \\
 \Rightarrow & \text{Re} \sum_m \left[ \left( \frac{\overline{B_r^m}}{2} e^{jm(\omega t - p\theta)} + \frac{\lambda_{slot}}{4} \overline{B_r^m} e^{j(m\omega t - (mp \pm n)\theta)} + \frac{\lambda_{ecc}}{4} \overline{B_r^m} e^{j(m\omega t - (mp \pm 1)\theta)} \right) \right]
 \end{aligned}$$

Where,  $n_s$  is the slots number. This equation is for static eccentricity and includes slotting [5]. It can be seen that, eccentricity modulates that MMF to produce air gap flux waves. However, as it is discussed in [5], the eccentricity is restricted to the first permeance harmonic (in a similar way to the slot permeance modulation approximation). Static eccentricity means that the rotor rotates on its own axis but is not centered on the stator bore axis. This could be caused by out of tolerance, misplaced or worn mountings or bearings [5]. On the other hand, the dynamic eccentricity means that the rotor does not rotate on its own axis but does rotate on the stator axis so that the point of minimum air-gap rotates with rotor speed. This could be caused by a bent shaft or out of tolerance manufacturing [5].

A similar equation exists for the stator air gap fluxes [5]:

$$\begin{aligned}
 b_s(\theta, t) &= \text{Re} \sum_m \frac{\overline{B_s^n}}{2} \left[ (e^{j(\omega t - np\theta)}) \left( 1 + \frac{\lambda_{slot}}{2} (e^{jns\theta} + e^{-jns\theta}) + \frac{\lambda_{ecc}}{2} (e^{j\theta} + e^{-j\theta}) \right) \right] \quad (7) \\
 \Rightarrow & \text{Re} \sum_m \left[ \left( \frac{\overline{B_s^n}}{2} e^{j(\omega t - np\theta)} + \frac{\lambda_{slot}}{4} \overline{B_s^n} e^{j(\omega t - (np \pm ns)\theta)} + \frac{\lambda_{ecc}}{4} \overline{B_s^n} e^{j(\omega t - (np \pm 1)\theta)} \right) \right]
 \end{aligned}$$

Where, for a balanced 3-phase machine  $n = 1, -5, 7, \text{etc}$ , in the usual sequence. Note that, the time component is now  $\omega t$  in (7) rather than  $m\omega t$  in (6). This leads to different vibration components when the machine is open-circuit (when there are only rotor flux wave components) and loaded (when there are both stator and rotor flux wave components) [9].

However, it is worth to say that all of the above equations are based on the SPM-BLDC motor which means the magnets are in the surface of the rotor, but, due to the fact that the interior magnet motors (IPM) have found increasing application [8], so, rotor eccentricity equations for the IPM-BLDC motors are required.

**Substituting IPM Rotor with SPM Rotor**

In this section, IPM rotor is substituted with the rotor of SPM machine. In this process as it is discussed in [9,10]:

- (i) Air gap flux should be remained unchanged.
- (ii) The inner and the outer radii of rotor and stator must be held fixed.

However, rotor of the IPM-BLDC is substituted with rotor of SPM machine. The substituted rotor of SPM is consisted of a magnet with a width  $l_{mspm} \gg g$  and pole-arc of  $\alpha_1$ , where  $l_{mspm}$  is the magnet's width for SPM





**Iman dolat shahi and Mehrdad jafarboland**

machine and  $\alpha_1$  is magnet's span[11]. Figure 1(a), shows a cross-section view of one-fourth of a four-pole IPM. Machine basic parameters are given in Table 1. Using flux line shown in Figure 1(a), lumped parameters model can be extracted as shown in Figure 1(b). Details of calculating air gap flux. Using Kirchhoff's law and equations presented in [10], the air gap flux,  $\varphi_g$ , can be calculated with high accuracy. For simplicity, the reluctances of the rotor yoke and stator yoke can be ignored in comparison with the reluctance of the air gap. Therefore,  $B_{rIPM}$  in IPM-BLDC is substituted with the new  $B_{rspm}$  which is much larger than  $B_{rIPM}$ , since,  $l_{mspm} \gg g$ .  $B_{rspm}$  is obtained from (1) which is obtained from the magnetic equivalent circuit of SPM machine shown in Figure 2(a). In this figure, the reluctance corresponding to the magnet's flux leakage is neglected because it is small [11].

$$B_{rspm} = \frac{\varphi_g}{A_{mspm}} \left( 1 + \frac{R_g}{R_{mspm}} \right) \tag{8}$$

$$R_{mspm} = \frac{l_{mspm}}{\mu_0 \mu_r A_{mspm}} \tag{9}$$

Where,  $B_{rspm}$  is the magnet flux of the SPM machine,  $A_{mspm} = \alpha_1 R_{ro} L$  is the area of SPM's magnet and  $R_{mspm}$  is the reluctance of SPM's magnet [11].

$$R_g = \frac{g}{\mu_0 A_g} \tag{10}$$

In the middle of air gap,  $A_g = \alpha_p \frac{\pi(R_{si} - \frac{g}{2})}{p} . L$  where  $\alpha_p = \frac{\pi \alpha_1}{p}$  is the pole-arc to pole-pitch ratio[11].

Figure 2(b), shows one pole of the SPM machine.

**Calculation of Radial and Tangential Flux Density for SPM Machine**

Zhu and Howe [5], solved the quasi-Poissonian equations for calculation of the air gap radial and tangential flux density in a slotless SPM machine [10]. Hence, in this paper, the air gap field solution will be given without detailed derivation of the equations. Note that, the square radial magnetization in [10] is substituted with trapezoidal radial magnetization, as shown in Figure3. However as it is discussed in [11], the fourier series expansion of the signal in Figure 3, is as follows:

$$\begin{aligned} \vec{M} &= M_r \vec{r} = \sum_{n=1,3,5,\dots}^{\infty} M_n \sin(np\theta) . \vec{r} \\ M_r &= \frac{-2B_{rspm}}{\mu_0 b \pi n^2} \left[ \sin(an) \{ 1 - (-1)^n \} + \sin(n[a+b]) \{ -1 + (-1)^n \} \right] \\ M_n &= \sum_{n=1,3,5}^{\infty} \frac{-2B_{rspm}}{\mu_0 b \pi n^2} \left[ \sin(an) + \sin(n[a+b]) \right] \sin(np\theta) \end{aligned} \tag{11}$$

Where,  $a = -\alpha_3 p$ ,  $b = 2\alpha_2 p$ , and  $p$  is number of pole pairs. Solving simultaneous Laplace's equation in air gap and Quasi-Poisson's equations in the permanent magnet, radial and tangential air gap flux density can be calculated. Details of field calculations in the middle of air gap for slotless SPM machine is described in [12]:





**Iman dolat shahi and Mehrdad jafarboland**

$$B_m(r) = \sum_{n=1,3,5,\dots}^{\infty} \frac{\mu_0 M_n}{\mu_r} \frac{np}{(np)^2 - 1} \left[ \left(\frac{r}{R_s}\right)^{np-1} \left(\frac{R_m}{R_s}\right)^{np+1} + \left(\frac{R_m}{r}\right)^{np+1} \right] \left\{ \frac{(np-1) + 2\left(\frac{R_r}{R_m}\right)^{np+1} - (np+1)\left(\frac{R_r}{R_m}\right)^{2np}}{\frac{\mu_r + 1}{\mu_r} \left[ 1 - \left(\frac{R_r}{R_s}\right)^{2np} \right] - \frac{\mu_r - 1}{\mu_r} \left[ \left(\frac{R_m}{R_s}\right)^{2np} - \left(\frac{R_r}{R_m}\right)^{2np} \right]} \right\} \tag{12}$$

$$B_{\theta n}(r) = \sum_{n=1,3,5,\dots}^{\infty} \frac{\mu_0 M_n}{\mu_r} \frac{np}{(np)^2 - 1} \left[ -\left(\frac{r}{R_s}\right)^{np-1} \left(\frac{R_m}{R_s}\right)^{np+1} + \left(\frac{R_m}{r}\right)^{np+1} \right] \left\{ \frac{(np-1) + 2\left(\frac{R_r}{R_m}\right)^{np+1} - (np+1)\left(\frac{R_r}{R_m}\right)^{2np}}{\frac{\mu_r + 1}{\mu_r} \left[ 1 - \left(\frac{R_r}{R_s}\right)^{2np} \right] - \frac{\mu_r - 1}{\mu_r} \left[ \left(\frac{R_m}{R_s}\right)^{2np} - \left(\frac{R_r}{R_m}\right)^{2np} \right]} \right\} \tag{13}$$

Where,  $R_s, R_m, R_r$  are radial of SPM machine as shown in Figure 2(b).

**Slots Effect for new SPM machine**

To consider the slots effect, conformal mapping is used in this paper. According to [13], the flux density in the slotted air gap of a surface mounted PM motor can be written as:

$$B_s(r, \theta, \alpha) = B_{sr}(r, \theta, \alpha) + jB_{s\theta}(r, \theta, \alpha) = [B_r(r, \theta, \alpha) + jB_\theta(r, \theta, \alpha)] \times [\lambda_a(r, \theta) + j\lambda_b(r, \theta)] \tag{14}$$

Where,  $B_{sr}$  and  $B_{s\theta}$  are radial and tangential flux density components in the slotless air gap, and  $\lambda_a$  and  $\lambda_b$  are the real and imaginary components of the complex relative air gap permeance. The  $B_{sr}(r, \theta, \alpha)$ ,  $B_{s\theta}(r, \theta, \alpha)$ ,  $\lambda_a(r, \theta)$ , and  $\lambda_b(r, \theta)$  along a circular arc inside the air gap can be written in the form of fourier series [15]:

$$\begin{aligned} B_r(r, \theta, \alpha) &= \sum_n B_m(r) \cos[np(\theta - \alpha)] \\ B_\theta(r, \theta, \alpha) &= \sum_n B_{\theta n}(r) \sin[np(\theta - \alpha)] \\ \lambda_a(r, \theta) &= \lambda_0(r) + \sum_m \lambda_{am}(r) \cos(mQ_s\theta) \\ \lambda_b(r, \theta) &= \sum_m \lambda_{bm}(r) \sin(mQ_s\theta) \end{aligned} \tag{15}$$





**Iman dolat shahi and Mehrdad jafarboland**

Where,  $r$  is the radius in the middle of air gap,  $\alpha = \omega r m.t$  is the angular position of the rotor and  $\omega r m$  is the mechanical rotor speed in  $rad/s$  and  $t$  is time. Also,  $B_{rn}(r)$  and  $B_{\theta n}(r)$  are described in Equations (12) and (13), respectively. The complex relative air-gap permeance is found by transforming the actual slotted air gap into a slotless air gap using four conformal transformations, as shown in Figure 4(a) [11]. The S-plane contains the original slot geometry (Figure 4(b)), and the K-plane contains the slotless air gap (Figure 4(c)), while Z, W and K planes are used for intermediate transformations. Based on the results discussed in [11], the following transformations are resulted:

$$\begin{aligned}
 T1: s &= e^z, s = r \cos(\theta) + jr \sin(\theta), r = R_s - g / 2 \\
 T2: z &= j \frac{g'}{\pi} \left[ \ln \left| \frac{1+p}{1-p} \right| - \ln \left| \frac{u+p}{u-p} \right| \right] - \frac{2(u-1)}{\sqrt{u}} \arctan\left(\frac{p}{\sqrt{u}}\right) + \ln(R_s) + j\theta_s + j\theta_2 \\
 T3: t &= j \frac{g'}{\pi} \ln(w) + \ln(R_s) + j \frac{\theta_s}{2} \\
 T4: k &= e^t
 \end{aligned} \tag{16}$$

Where,

$$\begin{aligned}
 p &= \sqrt{\frac{w-u}{w-v}} \\
 u &= \left[ \frac{b0'}{(2g')} + \sqrt{\left(\frac{b0'}{2g'}\right)^2 + 1} \right]^2 \\
 v &= \frac{1}{u} \\
 g' &= \ln \frac{R_s}{R_r} \\
 b0' &= \theta_2 - \theta_1
 \end{aligned} \tag{17}$$

So, the flux density is:

$$B_s = B_k \left( \frac{\partial K}{\partial S} \right)^* = B_k \left( \frac{\partial K}{\partial t} \cdot \frac{\partial t}{\partial w} \cdot \frac{\partial w}{\partial z} \cdot \frac{\partial z}{\partial s} \right)^* \tag{18}$$

With the calculations of eq.(18) , the  $B_s$  is as follows:

$$B_s = B_k \left[ \frac{k}{s} \cdot \frac{(w-1)}{(w-v)^{0.5} (w-u)^{0.5}} \right]^* \tag{19}$$

The flux density  $B_k$  with its real and imaginary parts  $B_r$  and  $B_{\theta}$  represents the field solution in the slotless air gap given by (12), (13), and (15) [15].





### Iman dolat shahi and Mehrdad jafarboland

#### MAXWELL simulation results of rotor eccentricity calculation

As an example, the field solution in the middle of the air gap ( $r = R_{st} - g/2$ ) for the four-pole interior permanent magnet BLDC machine is calculated using the method discussed in the previous sections and simulated in MAXWELL. The radial and tangential air gap flux density considering the stator's slot effect can be calculated using Eq. (19). Figure 5(a) and Figure 5(b), show the radial and tangential air gap flux density for the interior permanent magnet BLDC machine using the analytical method and finite element method which are in great agreement.

Furthermore, the simulation of the IPM-BLDC motor and SPM-BLDC replaced motor in MAXWELL are shown in figure (6). However, Figure 6(a) shows the lines of flux density in the IPM-BLDC motor and figure 6(b) shows the lines flux density in SPM-BLDC motor. Furthermore, Figure (7) shows an example of IPM-BLDC motor in the case of symmetric rotor (a) and with 10% rotor eccentricity (b). As shown in figure (7), with 10% rotor eccentricity, the flux density lines are compressed in some areas with narrower air gap, and sparses in some areas with wider air gap.

#### CONCLUSION

In this paper, a new method is proposed to combine the lumped-parameters model and quasi- poisson's equations by using conformal mapping which yields an accurate estimate of radial and tangential air gap flux density for interior permanent magnet brushless DC machine. Using radial and tangential air gap flux density, rotor eccentricity is predicted using Maxwell stress tensor. The validity of the proposed method is verified by comparing its results with that obtained from finite element method. The proposed method is proved to be accurate for calculations of the interior permanent magnet brushless DC machine's performance characteristics. Finally, it is resulted that using the proposed method for machine's optimization, which requires many machine analysis, is much faster than using Finite Element Method.

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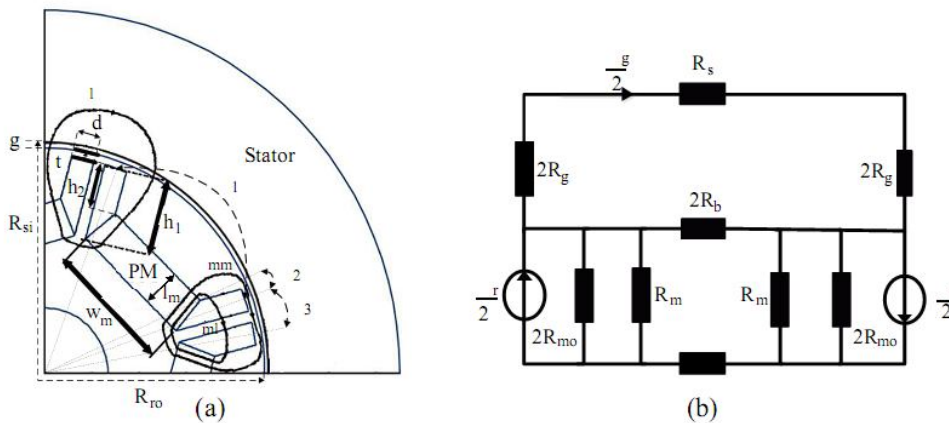




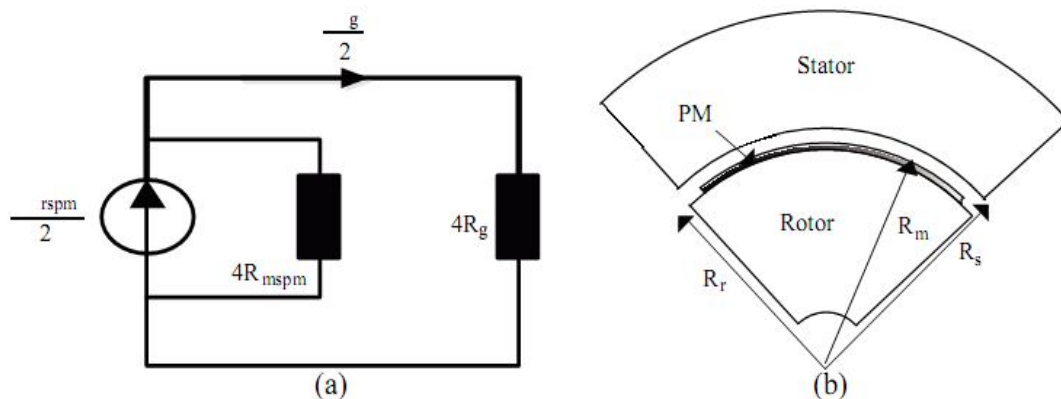


**Iman dolat shahi and Mehrdad jafarboland**

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**Fig1. Structure and magnetic equivalent circuit of IPM, (a) IPM structure (b) magnetic equivalent circuit for IPM [11]**



**Fig2. Structure and magnetic equivalent circuit of SPM machine, (a) Magnetic equivalent circuit for SPM machine (b) Substituted SPM machine [11]**





Iman dolat shahi and Mehrdad jafarboland

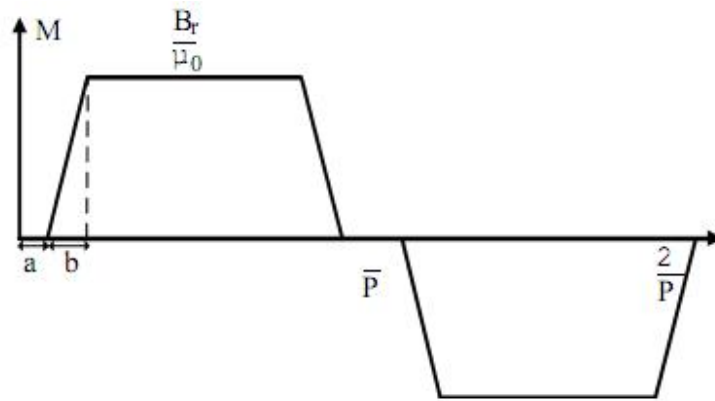


Fig3.Magnetization distribution of inserted PM of SPM machine [11]

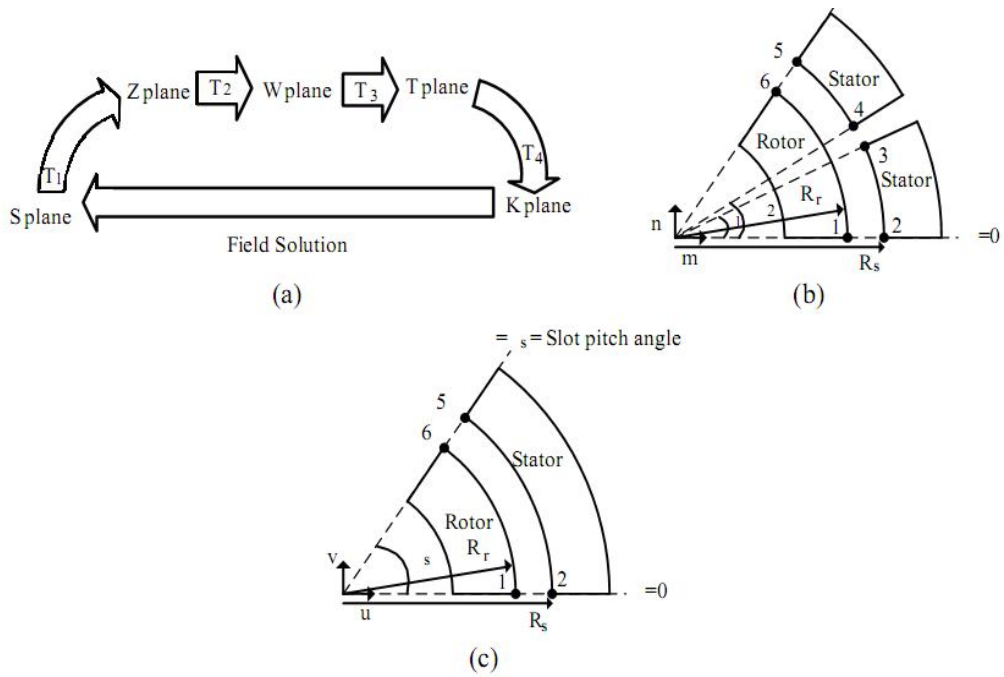
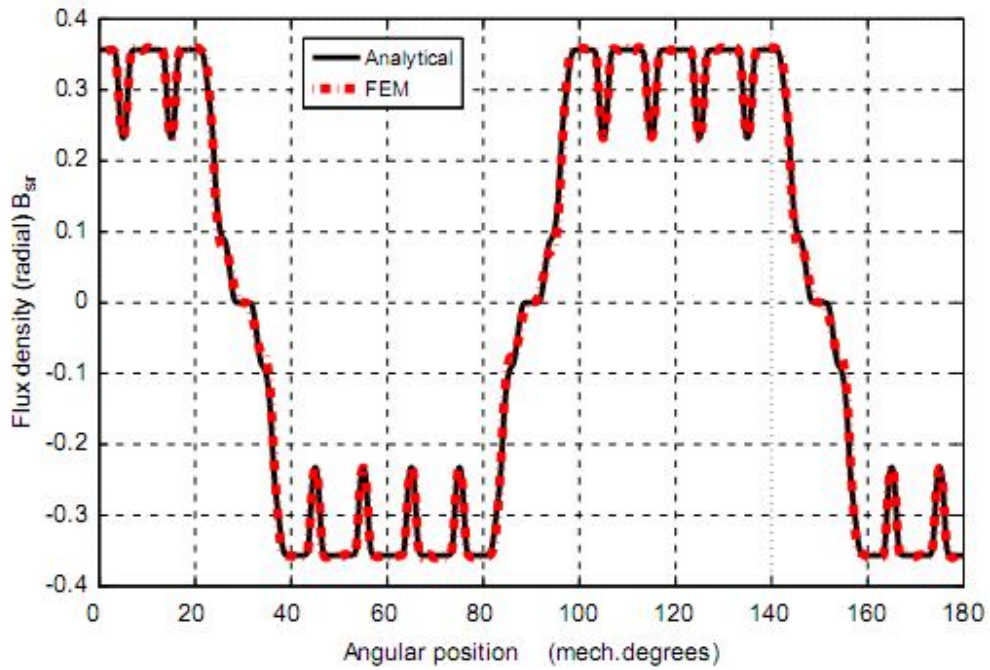


Figure 4. Basic transformation and shape of slot in the S and K plane [11]. (a) Basic transformation required for conformal mapping, (b) Single infinitely deep slot opening in the S-plane. (c) Slot opening in the K-plane (slotless air gap).

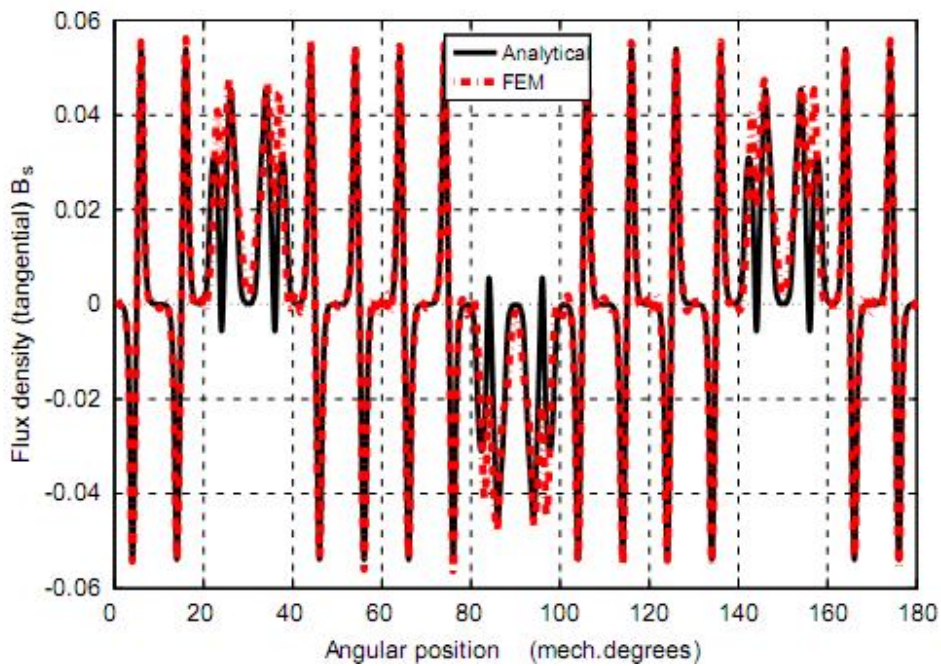




Iman dolat shahi and Mehrdad jafarboland



(a)



(b)

Figure5. MAXWELL simulation results of the radial and tangential flux density in the middle of the air gap of IPM. (a) Waveforms of the radial flux density in the middle of the air gap of a slotted IPM. (b) Waveforms of the tangential flux density in the middle of the air gap of a slotted IPM.





Iman dolat shahi and Mehrdad jafarboland

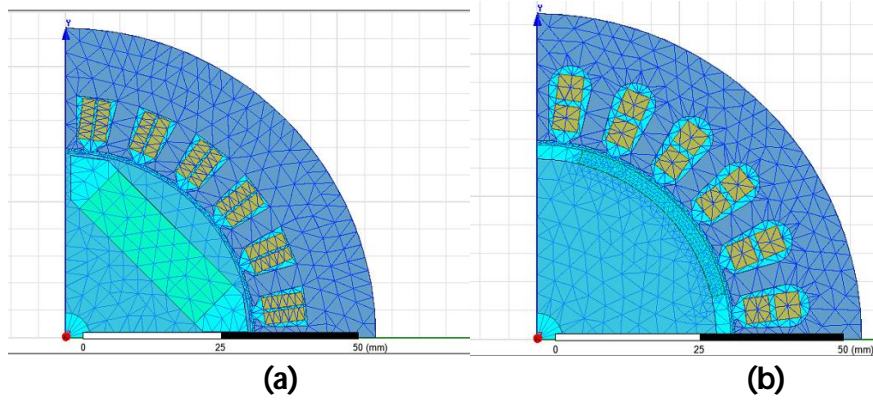


Figure (6): (a) Flux density lines for IPM-BLDC motor, (b) Flux density lines for SPM-BLDC replacement motor

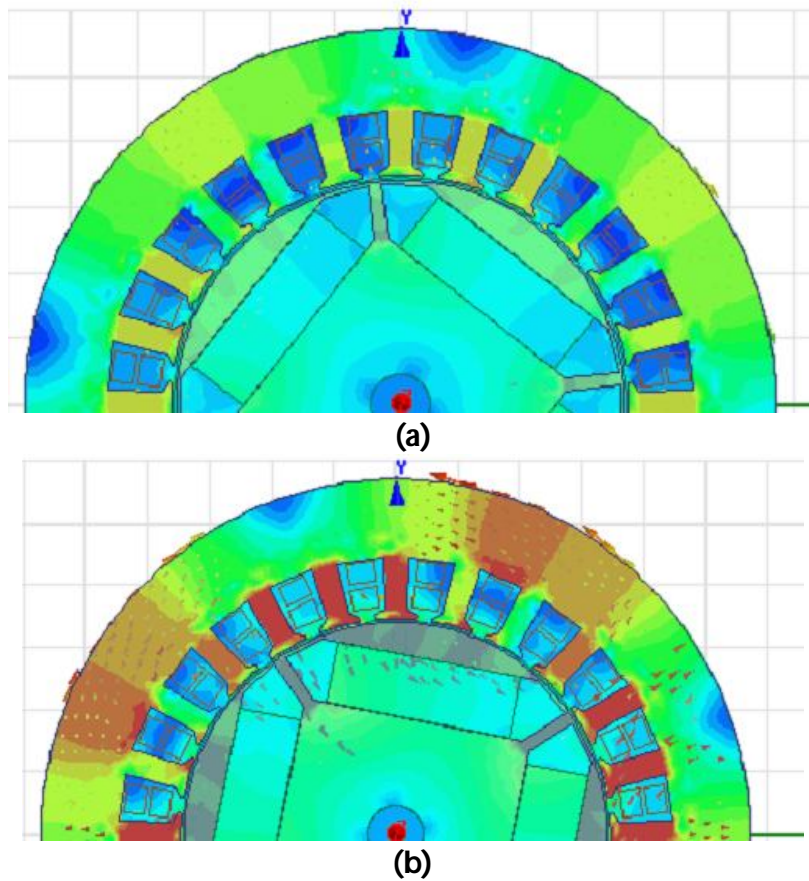


Figure (7): An example of IPM-BLDC motor in the case of symmetric rotor (a) and with 10% rotor eccentricity (b).



**BIOGRAPHY OF INDIAN SCIENTISTS****APJ Abdul Kalam**

Avul Pakir Jainulabdeen A. P. J. Abdul Kalam was a scientist and engineer, who served as the President of India from 2002 to 2007. Already a highly accomplished and much respected individual when elected to be the president, Kalam had spent four decades as a scientist and science administrator at several prestigious organizations like the Defence Research and Development Organisation (DRDO) and Indian Space Research Organisation (ISRO). Born into a family of humble means in Tamil Nadu, Kalam went on to study aerospace engineering in Madras Institute of Technology. His initial dream was to become a fighter pilot but he failed to qualify for the Indian Air Force. He then started working at the Defence Research and Development Organisation (DRDO) as a scientist and was later transferred to the Indian Space Research Organisation (ISRO). Eventually he was appointed as the Chief Scientific Adviser to the Prime Minister and in this position he played a key role in the Pokharan II nuclear tests. He became the President of India in 2002 and was known as the People's President. He left the office after serving one term and became professor of Aerospace Engineering at Anna University and a visiting professor at several other institutions



**Awards and Honors** A. P. J. Abdul Kalam has been honored with several prestigious awards from the Government of India including the Padma Bhushan in 1981, the Padma Vibhushan in 1990, and the Bharat Ratna in 1997. He was also the recipient of the Von Braun Award (2013) from the National Space Society "to recognize excellence in the management and leadership of a space-related project". Following his death, the Tamil Nadu state government announced that his birthday, 15 October, would be observed across the state as "Youth Renaissance Day".



**BIOGRAPHY OF INDIAN SCIENTISTS****Har Gobind Khorana**

**Born** - 9 January 1922 **Achievements** - Har Gobind Khorana is an American molecular biologist, who was born to an Indian Punjabi couple. For his work on the interpretation of the genetic code and its function in protein synthesis, he was awarded the Nobel Prize in the year 1968. Har Gobind Khorana is an American molecular biologist born on 9 January 1922 to an Indian Punjabi couple. For his work on the interpretation of the genetic code and its function in protein synthesis, he was awarded the Nobel Prize in the year 1968. This award was, however, also shared by Robert W. Holley and Marshall Warren Nirenberg. The very same year, he received another award 'Louisa Gross Horwitz Prize' along with Nirenberg that was presented to them by the Columbia University.



Read this biography to learn more about Har Gobind Khorana, who became a citizen of the United States of America in the year 1966. In present times, he's residing at Cambridge in Massachusetts, United States as a part of the MIT Chemistry faculty. Har Gobind Khorana was also the first to produce oligonucleotides, which is chains of nucleotides. He was also the first person to segregate DNA ligase, an enzyme that connects sections of DNA together.

These custom-designed portions of artificial genes are extensively used in biology labs for sequencing, cloning and engineering new plants and animals. This invention by Dr. Khorana has become automated and commercialized so that anyone now can order a synthetic gene from any of a number of companies. Thus, this is the history of the life of Dr Har Gobind Khorana as a biologist.





## Identification and Evaluation of Passage Damages Resulting from Geotechnical Problems in Behbahan

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### ABSTRACT

Current study was conducted aiming at identification and evaluation of passages injuries resulting from geotechnical problems in Behbahan. Research method is survey and data collection was done using library and field studies. Information related to weather conditions; geotechnical situation, geological issues, stratigraphy and regional geology, history of settlement in the city, as well as books and articles related to the research topic were obtained from respective offices. Asphalt damages were classified according to Journal No. 296 entitled as Guidance for Asphalt and Sand Pavement Improvement in 19 classes. Using local surveys, damages in respective passages were classified as high severity (H), Medium severity (M) and low severity (L) in the specific tables. Using bores in different points of Behbahan, sample extraction, analysis of experiments and investigation of different factors, it was concluded that the main reason for damages in Behbahan city is improper implementation and lack of compaction of sub-layer in specific thickness. If high quality materials of river or mountain in compact layer with minimum thickness of 15 cm with proper technical implementation and slopes are used, most problems can be solved.

**Key words:** Geotechnical problems, damage, crack, passages

### INTRODUCTION

Connective roads play effective and vital role in the past and present life and certainly damages in these roads considerably disturb material life. Natural disasters such as earthquakes, floods, war, tsunami, volcanic activity and



**Mahmoud Aghajari and Mohammad S. Pakbaz**

other cases very year seriously threaten lives and property of people and certainly safe and effective connective roads play a role in controlling damage. Unfortunately it is observed annually that lack of suitable access ways in such conditions especially in under-developed countries makes aiding seriously problematic and reduces its speed. In times other than emergency and risk, provision of material needs of regions especially in rugged and remote areas needs optimal access way and thus roads have become one of the main issues in construction. In addition, spending significant amounts of money on construction of new paths and roads confirms attention to standardization of road construction. Micro and detailed perspective has been prevalent up to now in road construction standards. Paying attention to moisture content, soil gradation and also considering geometry of layer, sub-layer and type of pavement all suggest detailed perspective which is of course needed. However, attention to large physical factors such as geotechnical or geology engineering factors in road failures has been less considered. Investigation, inhibition and prevention from these factors in road failures is complicated issue due to the number and complexity of factors and it is difficult and costly task due to magnitude and field nature. There are various factors in road failure. Considering road physics, foundation, sub-layer and pavement are constructed on the land selected for the road. If the land and different geotechnical factors, which influence ground level change, are not taken into account, it certainly will lead to failure of the road. Such factors as landslides, subsidence, and horizontal displacement of road surface are factors leading to road failure and damage. It is important to identify the factors that cause type of damage (slide, subsidence, etc.). Up to now research studies have been conducted on different factors of road damage in case study manner. Meanwhile, regular investigation of the failure factors in road which is the path or is to be designed has been overlooked. Also, repair and improvement and overall correction of problems and failures in the roads is the other issue which covers a wide range from geology engineering and soil mechanics to soil chemistry and composite materials engineering. Current research aims at understanding and assessing passage damages resulting from geotechnical problems in Behbahan city (finding causes and assessment of damages in geotechnical view). Field study and objective deep observations regarding damages in passages of Behbahan city is considered, and cracks in the passages were observed and collected following studying all failures and damages from Behbahan city map in Journal No. 269 entitled Guidance For Asphalt and Sand Pavement Improvement.

**THEORETICAL FOUNDATIONS AND REVIEW OF LITERATURE****Types of Failures****Types of asphalt pavement failure are described as follows**

**Lizard skin cracking:** lizard skin cracking or fatigue cracking includes connected cracks which develop from fatigue of asphalt concrete pavement under influence of traffic loading repetition.

**Tar bulging:** Tar bulging and exit of part of tart used in asphalt pavement develops in traffic flow. Tar bulging cause formation of thick layer in pavement layer and thus tar bulged part find shiny, reflective, smooth and sticky texture.

**Mosaic or block cracking:** Block cracking is type of connected cracks which divide pavement into relatively rectangular square shaped pieces. Dimensions of these pieces are almost  $0.3 \times 0.3$  to  $3 \times 3$ . Block cracking occurs mainly due to contraction of asphalt concrete and daily cycle of temperature (which causes daily cycle of stress and relative deformation).

**Bumps and troughs or ups and downs:** bumps include small and limited displacements of pavement surface upwardly. Difference between bump and folding is that reason for folding is instability of pavement. Troughs include small and sudden displacements in pavement surface downwardly, deformation and shifts that occur over large areas of pavement and large and long bumps in the pavement.





**Mahmoud Aghajari and Mohammad s. Pakbaz**

**Waving:** Waving includes ups and downs in regular distances less than 3 m along with the pavement. Ups and downs are along with the vertical traffic flow. This type of failure often occurs under influence of traffic load due to pavement or foundation instability. If bumps occur consecutively | 3 m distances, failure is considered as waving.

**Local subsidence:** Local subsidence is applied on limited areas of pavement surface which are lower locally in terms of height compared to pavement surface of adjacent parts. In most cases, mild local subsidence can be recognized easily, unless rainfall water is collected in it.

**Border cracking:** Border cracking occurs in parallel to external border of pavement in 30 – 60 cm distance to it. Trend of failure is facilitated due to traffic loading and it can be due to instability and lack of soil shear strength or road pavement border.

**Reflective cracking:** These types of failures often occur in pavements with asphalt pavement which are placed on cement concrete slabs. These cracks occur mainly because of displacement resulting from temperature change with cement concrete slab moisture of asphalt sub-pavement.

**Decline of road side:** Road side decline includes height difference between border and shoulder of pavement. This failure occurs due to shoulder erosion, shoulder subsidence, or implementation of roadway without of leveling with shoulder surface.

**Separation seam in road side:** Separation seam includes opening and crack between border and side of pavement. This type of damage facilities due to high loading and it is developed because of lack of stability and soil shear strength and materials of pavement sides and in cases in which road sides are not properly implemented and designed.

**Patch and carving:** Patch is part of pavement which is replaced with new materials in order to repair existing pavement. If patch is not properly implemented, it is considered as a failure in pavement assessment and overall this failure develops with some unevenness.

**Hole:** Hole is bowl-shaped and small depression in the pavement. It is usually less than 90 cm in diameter. Overall holes are with sharp edges and relatively vertical walls at the top of the hole.

**Slot or depression in the direction of wheels:** Slot or depression includes surface depression in the path of wheels. Although pavement may be swallowing a little along with walls of slot, slots can be identified in most cases only after rainfall when filled with rain water.

**Wick or displacement:** Wick is actually local and plastic deformation of asphalt which occurs due to traffic flow in line with direction of vehicles. When traffic flow imposes high shear force on the pavement (e.g. steep slopes in tropical areas, intersections and sharp bends), a short sudden wave is developed in pavement which is mainly due to lack of adequate cohesion between primer layer and practices and instability of asphalt in hot weather. This type of failure is mostly observed in steep slopes where trucks with stone loads move slowly or in sharp bends.

**Inflation:** Inflation is swelling pavement surface upwardly which includes a long gradual wave with over 3 m length. Inflation may appear with surface cracking. This failure often occurs due to icing in ground of inflatable soils.



**Mahmoud Aghajari and Mohammad s. Pakbaz**

**Weathering and cramps:** Weathering and cramp include erosion of pavement surface resulting from losing tar stickiness and displacement of granules. It suggests that tar adhesive has become stiff or its quality has been declined. In addition, granules may occur due to types of traffic, for example, linear vehicles.

**REVIEW OF LITERATURE**

Studies by Fakhri and Soltani (2004) showed cost reduction and measures reducing road repair time are points which are realized using protective asphalts. Thin asphalt surface, aggregate coating, slurry sealing without aggregate and sealing are among protective asphalts. In recent years, increased traffic of heavy vehicles, especially in the tropical areas has led to increased slots in asphalt pavements. Using asphalt mixed with coarse and hard aggregate increases shear strength and thus strength against slots on asphalt pavement. Asphalt mixed with coarse rock materials is a combination with maximum granular size as 25 – 37.5 mm [1].

Studies by Bakhshi and Poorreza (2004) showed that progress of unevenness in thin pavement (thickness below 3 inch) is more and humid area with icing causes more pavement collapse compared to other areas. Fine grain bed soil increases more unevenness progress trend compared to coarse grain bed soil. Also, increased traffic volume increases unevenness progress trend [2].

Kavoosi and Abdi (2004) indicated tar cohesion to rock materials is the main factor for asphalt stability and durability. If this phenomenon is disturbed for any reason, material stripping occurs which is not only a failure, but also it can pave path for occurrence of other asphalt failures. If hydrated lime is used as material filter in the mixture, it causes reduction of stripping and increasing cohesion, stability and strength of asphalt pavement [3].

Studies by Moghadasnejad and Toolabi (2004) indicated developing cracks on pavement and asphalt pavement results from mixture strength decline under influence of fatigue phenomenon or increased level of tensions imposed compared to final asphalt strength. Phenomenon of fatigue failure may occur by repeated load, change and dynamic time period somewhat less than the ultimate strength of asphalt [4].

Afshar et al. (2011) studied and analyzed pavement cracks in urban passages and found the water is the main reason for stripping cracks in urban passages, and anything which allows water stays around pavement for long term and damage the pavement, it is considered as a basic factor [5].

Mirae et al. (2013) conducted geotechnical investigation of land subsidence caused by groundwater harvesting and uncontrolled development in Marvdasht city and found that main factor for subsidence of Marvdasht plain is decline in groundwater levels due to excessive harvesting, faults and reduction in rainfall in the north last year [6].

Dauzatsand Rampal (1987) studied stress and thermal strain as one of the reasons for high to low cracks. They calculated stress and thermal strain and tensile strength of asphalt concrete layer using Shahinequation. Their findings indicated that stress and strain may be regarded as reasons for up to low cracks due to temperature following repetition of temperature cycle [7].

Khedaywi and White (1995) conducted indirect tensile strength and fatigue tests on the sample. They concluded that separation has bad impact on fatigue life and tensile strength. Result of separation is high porosity [8].

Marker and Richard (1999) stated that movement of aggregates and their approximation by compaction extend star membranes around aggregates leading to increased cohesion force between particles. Increase of cohesion force between particles increases tensile strength in asphalt concrete mix [9].



**Mahmoud Aghajari and Mohammad s. Pakbaz**

Wambura et al. (2010) tested pavement core and found tar oldness is a reason for up to low cracks. Malan found relationship between tar oldness and initiation of low to top cracking. They studied early failure of pavement surface and degree of crack in asphalt concrete mix in South Africa and found that oldness of tar is more effective in up to low cracking compared to specific weight of mix and tar viscosity has considerable impact on up to low cracking potential. They also explained that up to low cracking potential is reduced when tar viscosity is high and low traffic low and low viscosity is suitable [10].

**METHODOLOGY**

Location of this project is in the land area behind Behbahan Islamic Azad University (and a bore was developed in the area inside the university beside the mosque), and excavation was done at five points for studying allowable land subsidence and strength. Research method was survey method and data collection method was library and field studies. Data related to climatic conditions, geo-technical situation of the area, geological issues, stratigraphy and regional geology, history of settlement in the city, as well as books and articles related to the research topic were obtained from respective offices. Asphalt damages were classified according to Journal No. 296 entitled as Guidance for Asphalt and Sand Pavement Improvement in 19 classes. Using local surveys, damages in respective passages were classified as high severity (H), Medium severity (M) and low severity (L) in the specific tables. In geotechnical studies of Behbahan city, results and reports of Soil Mechanics Laboratory affiliated to Ministry of Transportation and cooperation respective offices were used. Results of geotechnical studies were prepared for 86 blocks of Mehr Housing Cooperative in Behbahan for studying allowable strength of soil in the project location. Then results of geotechnical studies of Behbahan Islamic Azad University project were provided for investigating status of soil layers, soil allowable strength, estimation of soil foundation subsidence and some necessary technical recommendations which cover somehow Behbahan city in terms of characteristics and soil type. Characteristics of physical tests are given in Table 1 which was conducted considering samples taken and field extractions in laboratory.

In this project, 5 bores with up to 12 m depth were excavated. Thus, overall, 60 m excavation was done. 24 disturbed samples and 4 undisturbed samples were extracted from these bores. In this project, groundwater was not confronted in none of bores in April (excavation time).

**Bore No. 1:** It is from ground surface up to depth of 12 m (end of bore) of ML type, and some sand is added to the composite after depth 3 m.

**Bore No. 2:** It is from ground surface up to depth of 2 m of silty sand with gravel (GM). This bore is from depth of 2 m up to 12 m (end of bore) of clay type with low plasticity properties (CL).

**Bore No. 3:** It is from ground surface up to depth of 1.5 m of sand type with good granularity with gravel (GW-GC). This bore is from depth of 1.5 m up to 12 m (end of bore) of clay type with low plasticity properties (CL).

**Bore No. 4:** It is from ground surface up to depth of 1.30 m of sardargul sand with gravel (GC). This bore is from depth of 1.30 m up to 12 m (end of bore) of clay type with low plasticity properties (CL).

**Bore No. 5:** It is from ground surface up to depth of 1.60 m of sardargul sand with gravel (GC-GM). This bore is from depth of 1.60 m up to 12 m (end of bore) of clay type with low plasticity properties (CL).

Also, considering shear strength tests and comparison of moisture in soil samples with its liquidity level it was found that clay in project location has been normally consolidated. In sticky soils, liquidity index suggest stress history in





### Mahmoud Aghajari and Mohammad s. Pakbaz

the soil. Normally consolidated soils often have liquidity index about 1, while pre-consolidated clay soils have liquidity index near to 0. Liquidity index can be negative about soils which are highly pre-consolidated.

$$LI = W - \frac{PL}{LL} - PL$$

For clay soil in project location, LI is smaller than 0 (negative values), thus clay soil of project location is highly pre-consolidated.

For determining mechanical characteristics and parameters of soil shear strength, CD direct shear test and single-axial test was conducted on the disturbed samples.

Considering results obtained from CD direct shear test and single-axial test and impact test and standard penetration test (SPT), parameters of shear strength and deformation in soil layers used in determining soil secure strength up to depth of 2 m are as follows.

In this study, and impact test and standard penetration test (SPT) was conducted at 2 m intervals of depth. This test determines number of impacts which occur due to fall of weight of 63.5 kg from a height of 76 cm, and causes 30 m penetration from a pile with external diameter of 5 cm and internal diameter of 3.8 cm (Raymond Xu for fine soil) and a pipe with diameter of 5 cm and conical end (Raymond Point for coarse-grained soils). It is used for assessing relative density of the coarse-grained soils and assessing consistency of the soil granules, and finally, as a sign of the soil strength.

In order to identify physical characteristics of soil layers, conventional tests of soil gradation, Hydrometry, Atterberg Limits (liquidity and pasty), specific weight, and soil moisture content were conducted on disturbed soil samples. Considering results of soil gradation and Atterberg Limits test, type of soil layers based on U.S.C.S unified classification is described as follows.

#### Bore BH1

It is from ground level up to depth of 2.30 m of sardargul sand with gravel type (GC-GW).

It is between depths of 2.30 – 5 m of sands with bad granularity with Silty clay (GP-GC).

It is between depths of 5 - 15 m (end of bore) all of clay type with low plasticity properties (CL).

#### Bore BH2

It is from ground level up to depth of 15 m (end of bore) all of clay type with low plasticity properties (CL) with sand.

#### Bore BH3

It is from ground level up to depth of 15 m (end of bore) all of clay type with low plasticity properties (CL).





**Mahmoud Aghajari and Mohammad s. Pakbaz**

**Bore BH4**

It is from ground level up to depth of 15 m (end of bore) all of clay type with low plasticity properties (CL).

**BoreBH5**

It is from ground level up to depth of 15 m (end of bore) all of clay type with low plasticity properties (CL).

Since it was not possible to take sample from Y4 taken from sabulous clay due to density for tri-axial and uniaxial tests, thus angle of internal friction and soil cohesion (for the short term) for clay layers (considering soil subsidence) are given in Table 3 using SPT tests and existing tables.

For estimation of soil subsidence due to load imposition and considering fine soil type of test site, consolidation test was done on undisturbed samples of soil flooding.

Volume compressibility factor (MV) can be calculated from these tests.

$$MV = (e_1 - e_2) / ((1 + e_1)(p_2 - p_1))$$

Subsidence level for square and strip foundations situated on clay fine soils is obtained from following Relation:

$$Sc = Mv \cdot \Delta\sigma' \cdot H$$

Lateral pressure coefficients based on Rankine's theory at inertia, driving and resistant states are proposed as follows:

$$\Phi' = 25^\circ$$

$$K_0 = 1 - \sin\Phi' \text{ lateral pressure coefficient of soil at inertia state}$$

$$K_a = \frac{(1 - \sin\Phi')}{(1 + \sin\Phi')} \text{ lateral pressure coefficient of soil at driving state}$$

$$K_p = \frac{(1 + \sin\Phi')}{(1 - \sin\Phi')} \text{ lateral pressure coefficient of soil at resistant state}$$

$$K_a = 0.41 \text{ lateral pressure coefficient of soil at driving state}$$

$$K_p = 2.45 \text{ lateral pressure coefficient of soil at resistant state}$$

It should be noted that in Rankine's theory, the levee behind retaining wall is horizontal and wall contact surface with ground is assumed as vertical and friction between ground and wall is ignored.





## Mahmoud Aghajari and Mohammad s. Pakbaz

### Research Area and Operation

List of study area can be observed in the appendix, which includes recording failures taken from streets and intersections in terms of intensity. Three main parts of these areas are described here.

#### Daneshgah Street

##### First layer of asphalt 1

Materials are sand type with suitable granularity, but it does not have characteristics of foundation layer. Granularity suggests fineness of the materials according to basic granularity in Journal 101. Material fineness is above 3.8 inches and passing percent is more than normal which leads to lack of bearing ability and due to high granularity, it causes lack of suitable drainage and waving in case of loading. Considering that asphalt is placed on this layer and this layer does not suggest suitable compaction and it is a reason for failure, while laboratory compaction of the materials suggests high suitability obtained from specific weight.

In case of proper compaction of this layer, most failures are prevented.

Considering laboratory results, CBR for this layer is 70. This layer could have good bearing in case of proper implementation and standard compaction. Although it is away from general characteristics of road, considering lack of heavy vehicle traffic, it is suitable for urban roads that many problems are prevented with low cost and energy at time of implementation and compaction using suitable rollers.

Given that compaction with heavy machineries for urban roads is not possible due to possibility for damaging the buildings, instead the numbers of compaction can be increased so that 100 percent optimal compaction of layer is obtained. It was done in the site using AASHTO T-191 method.

Asphalt implemented in this area is closer to characteristics of Topeka layer.

Asphalt enjoys good bearing (246 kg strength) and (softness of 4.3 mm).

However, following factors are effective in asphalt failure:

Percentage of tar (5.23%) is higher than allowable level which reaches to 5.5 at time of implementation considering the time. Given warmth of area, tar is excessive and it leads to waving in the layer.

Lack of suitable compaction in lower layers with non-standard thickness causes asphalt layer movement.

Considering asphalt strength is 1,246 kg, it is probable that tar is severely heated during and before implementation or it is warmed more than 165 C which leads to high strength of asphalt and it gives fragility state to the asphalt.

In this area, 2 layers beneath asphalt were investigated and none of them had characteristics of sub-layer and foundation layer.

Second layer is fine material. This layer is considered as foundation. But none have characteristics of foundation. Above layer is clay with liquidity limit as 28, while according to technical characteristics, foundation layer's liquidity and plasticity limits should not exceed 25 and 26. Lack of layer with sand granules and high liquidity and plasticity, which





**Mahmoud Aghajari and Mohammad s. Pakbaz**

denotes plasticity of the layer, cause lack of bearing that is clearly evident in CBR results and laboratory density. CBR of the material is 6 which suggest lack of adequate bearing and it can be one of factors for failure. Overall, this layer does not have characteristics of sub layer and its compaction is not suitable.

**First layer beneath asphalt**

Considering pavement definitions, asphalt is often implemented on the foundation or sub layer. Thus, by definition, the layer beneath asphalt is an aggregate later. This layer should serve as foundation layer which lacks characteristics of foundation layer as follows:

Its soil gradation does not match to foundation layer.

It is of natural materials which according to technical characteristics it should be of stone materials that are broken by crusher.

Passing materials from sieve is 30 out of 200.

Its bearing capacity CBR is 24, while according to technical characteristics; bearing capacity of foundation layer should not be below 80.

It lacks suitable compaction.

**Asphalt**

The asphalt was not in high quality due to sub layer factors and these factors cause failure in the area and at time of operation:

Considering warm weather in the place, high percent of tart may cause tar inflammation in the asphalt layer.

High porosity and lack of suitable compaction in asphalt layer

Lack of implementation of sand layer beneath asphalt and presence of plastic pavement ground and lack of suitable water drainage in rainfall season and water penetration in materials and tar which leads to stripping tar materials and its subsidence on soil ground..

**Ghasr 2 Street**

Second layer beneath asphalt should have characteristics of sub layer, but it lacked these characteristics.

Its soil gradation does not match to technical characteristics of layer.

This layer is a fine layer with clay material.

Percent of materials passing sieve (200) is over 30 percent which is against technical characteristics.

Its pasty index is 9 which exceed characteristics of sub later and it suggests plasticity of the layer.





### Mahmoud Aghajari and Mohammad s. Pakbaz

Bearing capacity of the layer is below technical characteristics.

Thickness of this layer is below characteristics limits.

Considering above cases, this layer is not a layer with suitable bearing capacity and optimal soil gradation and good ground for water drainage.

First layer was implemented as sand foundation, but it lacked perfect characteristics:

Its soil gradation is finer than characteristics and it has filler above allowable limit.

It lacks suitable compaction.

Asphalt in this area is good and suitable technically and experimentally and it enjoys all characteristics of good asphalt for pavement layer. However, asphalt failures may result from improper implementation and absence of suitable ground.

#### Amirkabir Boulevard

In this area the asphalt has cracks and subsidence. Asphalt of this area was studied. According to laboratory results, this asphalt is very good and suitable. It enjoys suitable tar 4.19 percent and strength 1329 and softness 2.8 mm, and the only failure factor is improper implementation and low thickness and the reason for subsidence can be improper implementation of lower layers and lack of good compaction.

## CONCLUSION

Behbahan area is confined by Maroon and Kheirabad Rives which have good materials for road construction and foundation and asphalt materials and other materials around Behbahan are mountainous mixes. Considering stone level in them, they are useful for consumption in sub layer. Although they may lack some characteristics of sub layer such as SE, LL and PI, they have good bearing and consistent. This city enjoys high quality and rich sources of materials for road construction compared to other cities including Abadan, Khoramshahr, Mahshahr and Omidye. In case of proper management and usage, no problem should occur in road construction and streets in the city. However, improper implementation has led to various problems in this city.

According to studies and experiments, especially Tables 1 and 2 and Diagrams 3 and 4 it is concluded that failure factors for asphalt in this area include lack of using suitable materials despite of presence of high quality materials according to characteristics of sub layer and foundation layer. These characteristics can be described as follows:

1. Lack of suitable soil gradation
2. Lack of engineering properties (Atterberg Limits)
3. Lack of proper bearing capacity
4. Lack of adequate thickness
5. Lack of minimum equivalent sand
6. Lack of adequate compaction layer
7. Lack of necessary drainage
8. Implementation of asphalt on non-compacted soil layers
9. Failure to adhere to the proper soil gradation for asphalt





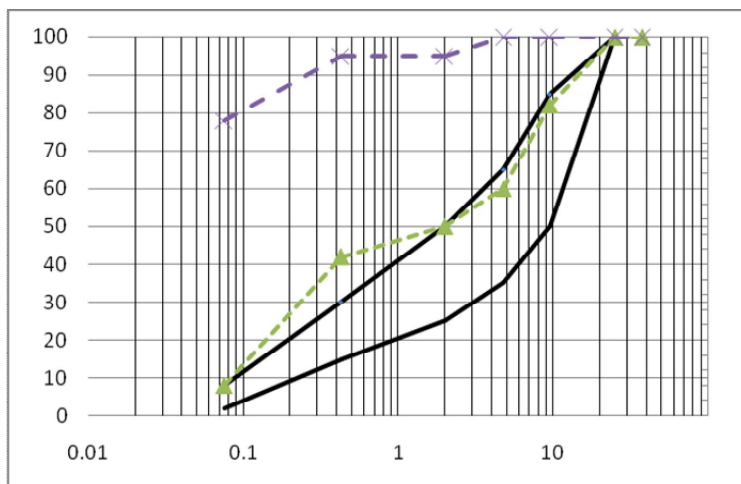


**Mahmoud Aghajari and Mohammad s. Pakbaz**

- 10. Non-compliance of tar percent and lack of implementation of preliminary studies and asphalt mix design
- 11. Implementing wrong connection of transverse and longitudinal sections that may lead to cracks and water penetration and it may be one of the causes of asphalt failure and create a bump.
- 12. Non-compliance with longitudinal and cross slopes that causes accumulation of water in passages which gradually damages the asphalt.

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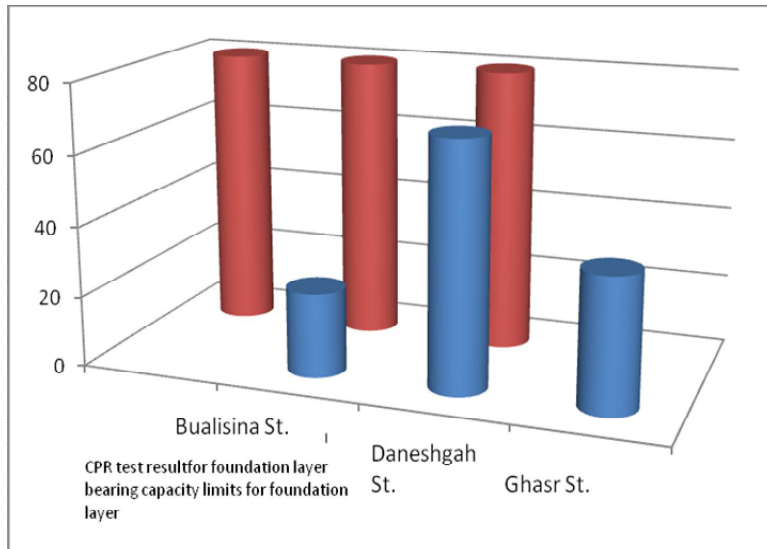
Characteristics of granulation  
 —————  
 Grading Test Results Curve - - - - -

**Fig 1. Results of granulation test**

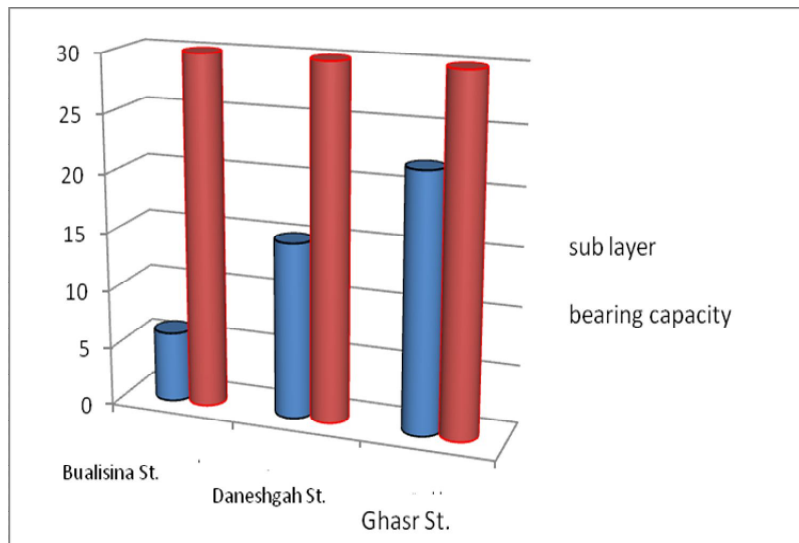




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**Fig 2. Bearing capacity status**

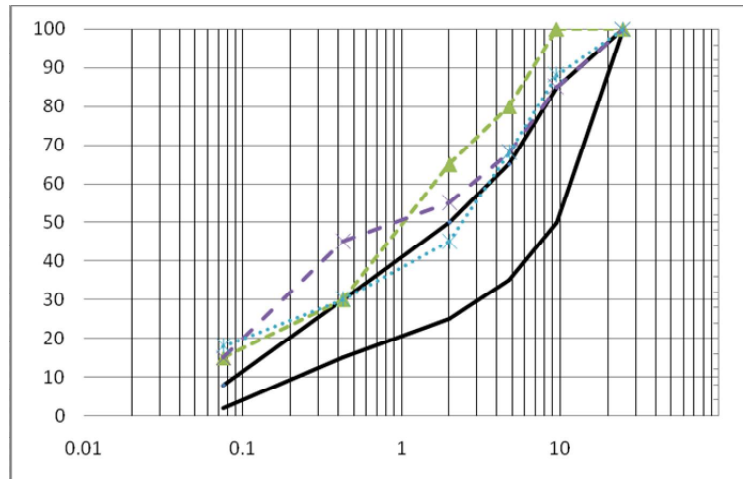


**Fig 3. Sub layer status in three areas**





**Mahmoud Aghajari and Mohammad s. Pakbaz**



**Fig 4. Non-compliance to soil gradation**

**Table 1: Characteristics of physical tests considering samples taken**

No.	Test	Method
1	Determining natural moisture of soil	ASTM, D2216
2	soil gradation and Hydrometric tests	ASTM, D421,422
3	Determination of soil liquidity and pasty	ASTM, D4318
4	Soil Classification using Unified USCS approach	ASTM, D2487

**Table 2: Determining mechanical characteristics and parameters of soil shear strength, direct shear test and single-axial test**

No.	Test	Method
1	CD direct shear test	ASTM, D3080
2	single-axial test	ASTM, D2166

**Table 3: Angle of internal friction and soil cohesion for clay layers**

	Short term	Long term
soil cohesion (C) (kg/cm <sup>3</sup> )	0.4	0.09
Angle of internal friction (Degree)	0	25
Natural soil specific gravity (g/cm <sup>3</sup> )	1.85	1.85
Modulus of elasticity of soil (kg/cm <sup>3</sup> )	170	170
Poisson's ratio of soil	0.4	0.4





**Mahmoud Aghajari and Mohammad s. Pakbaz**

**Table 4: Results of foundation layer tests**

No.	Sampling place	Test result		Characteristics limits	
		Pasty limit	Liquidity limit	Pasty limit	Liquidity limit
1	Daneshgah St.	Indeterminable	25	0-4	25
2	Ghasr St.	Indeterminable	25	0-4	25
3	Bualisina St.	Indeterminable	25	0-4	25

**Table 5: Results of sub-layer tests**

No.	Sampling place	Test result		Characteristics limits	
		Pasty limit	Liquidity limit	Pasty limit	Liquidity limit
1	Daneshgah St.	10	29	0-4	25
2	Ghasr St.	9	30	0-4	25
3	Bualisina St.	11	28	0-4	25

**Table 6: Registration of failures taken from streets and junctions in terms of their intensity**

We	Infl	Co	Slo	or	depress	Hol	pol	ished	Pat	ch	and	Lo	ngitudi	sep	De	Ref	Bor	Loc	Wa	Up	blo	Tar	Lizar	Ad	
							L					L						L		L				Ka'bi St.	
						L	L	L	L			L						L		L		L			Hash emi St.
									m											L					Rastg ooyan St.
	L					L	L	L	m			L							L		L	L	L		Masih poor St.
	L								L										L		L	m			Amoo zesh St.
						L	L	L	m			L			L			L				L	L		Asefi St.
							L	L	L			L						L	L			m	L		Astan eh St.
		L					m	L	L		L	m						m	L			L	L		Bagha ee St.





**Mahmoud Aghajari and Mohammad s. Pakbaz**

				L	L	L	L					L				L	H	BehbehaniA badi boulevard	
		L		L	L	H	L	L				L	L			L	L	Abuali St.	
				m		H	L	L				L				L	L	Bashir Naziboulevard	
					m							L						Fatemeh Zahra St.	
				L	L	m	H	L				L	L			L	L	Zolfaghari St.	
	L			L	L	L	H	L					L			N		Behroos St.	
	L			L	L	L	H	L					M			H	L	Azmon St.	
	L			L	L	L	H	L					M				L	ShaihkMasoomi St.	
				L	L							L					L	M	Behbehani Boulevard
						L											L		Shariati St.
				L	M							L							Montazeri St.
		L		H	L	M	L					L				L	L	MohamadJafari St.	
		L		M	L	M	L					L							Bagherzadeh St.
				L	M	L						L	L			L			Edalati St.





**Mahmoud Aghajari and Mohammad s. Pakbaz**

					L	L									L	M	L	Abdol ahi St.			
		L			M		H	L							H	M		L	M	Abros han St.	
						L	L								L			L	M	Alavi an St.	
						L	M	L							M	H		L	L	M	Bualis ina Boule vard
							L								L	L		L	L	M	Behbe hani Boule vard
																L			M	L	Raji St.
							L	L							M			L	L	H	Amir kabr Boule vard
							L									L		L	H	Cham ran Boule vard	
							L	L										L	M	Janba zan St.	
		L					M								L			M	L	Takht i St.	
							L								L			L		Imam Husse in St.	
							L									M		N	L	Naha ee St.	
							L								L			L		Edala t St.	
							L								L					Taleg hani St.	
							L	L							L					Choo bi St.	
							L	L	L						L			L		Moza fari	





**Mahmoud Aghajari and Mohammad s. Pakbaz**

					L	M						L	M			L		St.	
					L	L	M	L				L				L	L	Yagh ubBe hbaha ni St.	
							L	M	L				L			L	L	Enaya tolah Behba hani St.	
							L	M	L				L			L	L	Johari Behba hani St.	
						L	L	H	L				L			L	L	Shoja ee St.	
					L	L	M	L	L	L			L					Masih poor St.	
	L				M	L	M	L	L	L			L					Kheyr olahi Oyoo ghi St.	
													L					Andis he St.	
					L	L	H			L			L	L				Ham neshi n St.	
						L	M						L	L				Piray esh St.	
					L	L	L			L			L					Pazan d St.	
						L	M		M	M		L	L	L			L	L	Ghola mhus seinK aram nasab St.
	L				L	L	M	L	L	L			L	L			L	L	Zibae e St.
						L	L	L					L	L			L		Pirro z St.





**Mahmoud Aghajari and Mohammad s. Pakbaz**

	L			L	L	M	L		L			M	L			L		Mokhtarpo or St.
L		L		L	L	M	L	L	L		L	M	M			M	L	Bakhradian St.
				L	L	M	M	L	L		L	M	L			M		GholamhusseinKaramnasab St.
				L	L	M	H	L	L	L		L	M	L		L	L	Niakans St.
	L	L	M	H	M	H	H	M	M		M	H	H			M	H	Daneshgah St.
	L			L	L	M	L					M	L			L	L	MajidBaghaee St.
				L	L	M	L					L	L				L	Moghbeli St.
				L	L	H	L	L	L			L	L			L	L	Shabanipoor St.
				L	L	M						L	L			L		Jaghari St.
						L							L					SirusMohseni St.
				L	L	M	L					M	M			L		Baghaee St.
			L	L	M	L						L	L					BardiMosque St.
					L	L						L	L	L			L	JomehRajabi St.







## Geotechnical Factors Affecting Pavement System Failure in Roads (Case Study: Passages in Behbahan)

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### ABSTRACT

The roads as vital artery have always played a major role in the economic prosperity of the country. On the other hand, high costs are spent to repair damage in the roads. Current paper was conducted aiming at identifying geotechnical factors affecting pavement system failure in roads and conventional tests of soil gradation, Atterberg Limits, liquidity and plasticity limits, and asphalt tests such as Marshall and extraction tests were done on infrastructure and pavement of road through boring. Finally, the main failure factors in passages were identified and provided using results of soil mechanics, regional geological and field study tests.

**Key words:** Geotechnical characteristics, pavement system failures, laboratory studies

### INTRODUCTION

The road is one of the fundamental and major economic and social issues of the human in today world and many studies have been conducted in the past on the pavement failure factors and factors leading to early road failures. Early in 1910 and with entry of motor transportation to road transportation, serious studies were started. With increase of imposed loads, pavements already constructed for the roads did not meet the needs and they had to be renewed and repaired immediately, and hence repair and maintenance of these roads severely increased. To this end, extensive studies were conducted on design and discovery of failure factors. Various studies have been conducted on pavement failure factors both in the country and abroad:





### Mahmoud Aghajari and Mohammad S. Pakbaz

Dauzatsand Rampal (1987) studied stress and thermal strain as one of the reasons for high to low cracks. They calculated stress and thermal strain and tensile strength of asphalt concrete layer using Shahin equation. Their findings indicated that stress and strain may be regarded as reasons for up to low cracks due to temperature following repetition of temperature cycle (Dauzats, 1987). Khedaywi and White (1995) conducted indirect tensile strength and fatigue tests on the sample. They concluded that separation has bad impact on fatigue life and tensile strength. Result of separation is high porosity (Khedaywi, 1995). Marker and Richard (1999) stated that movement of aggregates and their approximation by compaction extend star membranes around aggregates leading to increased cohesion force between particles. Increase of cohesion force between particles increases tensile strength in asphalt concrete mix (Marker, 1999). Chang et al. (2010) investigated pavement management system for adding components of pavement failure prevention and found that sections with PCI as 55 or above have suitable section for maintenance operation implementation and different maintenance operation may have different lifespan. Lifespan of maintenance operation refers to the period when PCI declines to level which increase maintenance operation and a new renewal operation is needed. Higher PCI denotes better road service (Wambura, et al., 2010). Mirae et al. (2015) conducted geotechnical investigation of land subsidence caused by groundwater harvesting and uncontrolled development in Marvdasht city and found that main factor for subsidence of Marvdasht plain is decline in groundwater levels due to excessive harvesting, faults and reduction in rainfall in the last six years (Mirasi, et al., 2013). Tabataba'i et al. (2008) conducted studies and investigated factors affecting asphalt pavement lifespan reduction in tropical regions and provided ranking of factors affecting pavement lifespan reduction using AHP hierarchical method. Borrow resources with technical specifications in accordance with the standard, suitable road pavement design, testing and quality control of executive layers according to general road technical specifications (Planning and Budget Organization, 1994). monitoring and control by supervisor, toll operation and maintenance carried out in a timely manner and providing timely financial resources project are among factors affecting increasing road pavement's useful lifespan.

#### Introduction of Pavement System and Failure Types in Road Pavement

In road construction, pavement is often composed of several different layers that the number, thickness, material, dimensions and gradation of layers are function of resistance of soil and road pavement, passing traffic features (number, type, weight), climatic conditions, materials in the location (Borrow resources), and project economic conditions. Road pavement system with high traffic usually includes three distinctive layers which are placed on compact soli layer (Fig 1):

Asphalt surfacing (Binder and Topeka)  
 Foundation (base)  
 Sub - base  
 Bed of road pavement (sub-grade surface)

#### Conventional failure types of road asphalt pavements are classified as follows:

**Cracks:** mosaic cracks (snake – lizard skin), side cracks, contraction cracks, reflective cracks, crescent cracks (sliding)

**Pavement surface deformation:** subsidence in carved place, wave, slot or depression in the direction of wheels, local subsidence, inflation

**Carving:** holes, separating grains

**Slip road pavement surface:** Tar bulging on road pavement surface (Tar bulging), polished aggregates in road pavement surface





### Mahmoud Aghajari and Mohammad S. Pakbaz

#### Failure of shoulders

#### Area Under Study in Engineering Geology View

Engineering geology is application of geology science in engineering structures (construction projects). Since road construction is among linear projects, more changes in regional geological conditions are observed. Thus, road construction operation is divided into several pieces or variants considering regional geological conditions. Engineering geology investigated effect of environment on the engineering structures and provides suitable solutions for reduction or elimination of possible dangers and appropriate optimization methods. It should be noted that the environment surrounding an engineering structure is related to it (structure) in two ways in terms of geology (Memarian, 1993).

Development of geological materials (rocks, soil, water)

Processes and geological hazards (such as floods, earthquakes, movements, etc.)

One of the major tasks of engineering geology in construction projects is providing borrow resources of engineering structures. Borrow resources used in road pavement (in sub-grade, base and asphalt layers) should enjoy following technical characteristics:

Continuous and solid gradation (alluvial origin)

High density or specific gravity

High compressibility (density percentage 100%)

Low and standard fluidity limit and pastry limit

High SE in accordance with the technical specifications

High Young's modulus (E) and uniaxial compressive strength and low Poisson's ratio ( $\mu$ ) or strain ratio

Cubic grains shape, sharp corners, and a disk shape and high percentage of breakage on two fronts

High durability or hardness (low percentage of wear in the water, Los Angeles, sodium sulfate and magnesium)

Lack of frost risk (i.e. the percentage of passed materials from sifting is 200 or less)

#### Geographical Geological Position of Study Area

Area under study is located in a region with  $50^{\circ} 15'$  eastern longitude and  $30^{\circ} 35'$  northern latitude and it is in distance of about 205 km to Ahwaz, 90 km to Ramhormoz, 45 km to south east of Aghajari, 65 km to south east of Omidiyeh town and 70 km to north west of Dogonbadan town. According to Stocklin's zoning (1968), it is in the Zagros folded or external Zagros region, and according to Berberian's zoning (1995), it is an area on simply folded belt.

#### Failure Types in Pavement System of Study Area (Considering Field Surveys)

Lizard skin (mosaic) cracking: This type of cracks denote pavement fatigue and poor sub-grade due to its inappropriate technical characteristics of the material (the body of road or soil is fine grain)

Bumps and troughs

Ups and downs on passages

Stripping aggregates (asphalt aging and burnout)

Longitudinal and transverse cracks (contraction - reflection - two lines)





### Mahmoud Aghajari and Mohammad S. Pakbaz

Local and continuous subsidence  
Tar bulging  
Patch and carving

#### Technical Specifications of Materials Taken from Area of Study According Soil Mechanics Laboratory Results (Parent Company of Specialized Soil Mechanics Laboratory, 1998).

In order to investigate and determine factors affecting road failure, samples were taken from regions under research for testing, and results obtained from experiments were compared to technical specification of the alternative axis (which is close to standard). Conducted tests and technical specifications of layers (average total results of samples) for sub-grade, foundation and asphalt materials are provided.

### RESULTS ANALYSIS AND INTERPRETATION

Behbahan area is confined by Maroon and Kheirabad Rives which have good materials for road construction and foundation and asphalt materials and other materials around Behbahan are mountainous mixes. Considering stone level in them, they are useful for consumption in sub layer. Although they may lack some characteristics of sub layer such as SE, LL and PI, they have good bearing and consistent. This city enjoys high quality and rich sources of materials for road construction compared to other cities including Abadan, Khoramshahr, Mahshahr and Omidiyeh. In case of proper management and usage, no problem should occur in road construction and streets in the city. However, improper implementation has led to various problems in this city. According to studies and experiments, especially Tables 1 and 2 and Diagrams 2-5 it is concluded that failure factors for asphalt in this area include lack of using suitable materials despite of presence of high quality materials according to characteristics of sub layer and foundation layer. These characteristics can be described as follows:

1. Lack of suitable soil gradation
2. Lack of engineering properties (Atterberg Limits)
3. Lack of proper bearing capacity
4. Lack of adequate thickness
5. Lack of minimum equivalent sand
6. Lack of adequate compaction layer
7. Lack of necessary drainage
8. Implementation of asphalt on non-compacted soil layers
9. Failure to adhere to the proper soil gradation for asphalt
10. Non-compliance of tar percent and lack of implementation of preliminary studies and asphalt mix design
11. Implementing wrong connection of transverse and longitudinal sections that may lead to cracks and water penetration and it may be one of the causes of asphalt failure and create a bump.
12. Non-compliance with longitudinal and cross slopes that causes accumulation of water in passages which gradually damages the asphalt.

### CONCLUSION

Road pavement is national capital of every country and considerable parts of annual construction budget are spent on pavement repair and maintenance. In the current study, case study of Behbahan used aiming at investigating and determining failure factors in the area under study. Road pavement samples were taken for testing from regions under study and compared to technical specification of the alternative axis (which is close to standard). To this end, conventional tests of soil gradation, Atterberg Limits, liquidity and plasticity limits, and asphalt tests such



**Mahmoud Aghajari and Mohammad S. Pakbaz**

as Marshall and extraction tests were done on infrastructure and pavement of road through boring. Finally, the main failure factors in passages were identified and provided using results of soil mechanics, regional geological and field study tests. This city enjoys high quality and rich sources of materials for road construction and foundation, sub layer and asphalt materials. Materials around this city include mountainous mixes which are suitable for sub layer considering their rock level. However, improper implementation has led to various problems in this city. According to studies and experiments, it is concluded that failure factors for asphalt in this area include lack of using suitable materials, lack of appropriate gradation for materials and asphalt, inadequate layer thickness, non-compliance with tar percent and lack of preliminary studies and asphalt mix plan, lack of engineering properties (Atterberg Limits, minimal sand exchange, etc.) and the lack of necessary drainage. In addition, implementing wrong connection of transverse and longitudinal sections and non-compliance with longitudinal and transverse may lead to asphalt failure over the time.

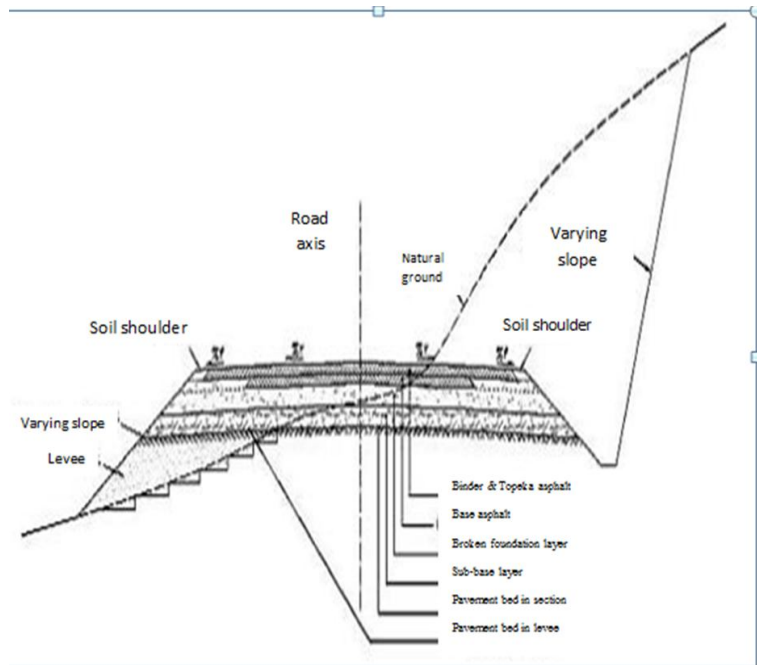
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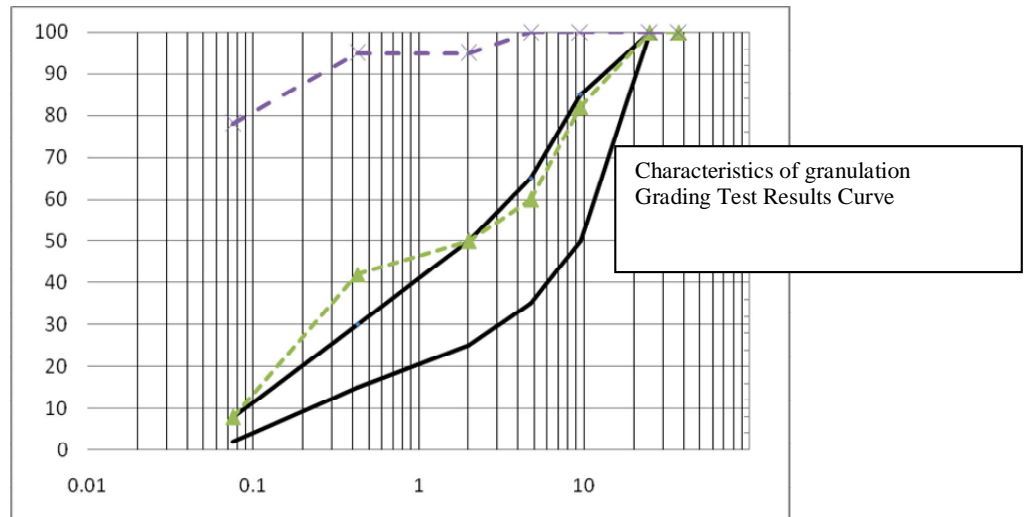




**Mahmoud Aghajari and Mohammad S. Pakbaz**



**Fig 1. Transverse profile of road pavement**

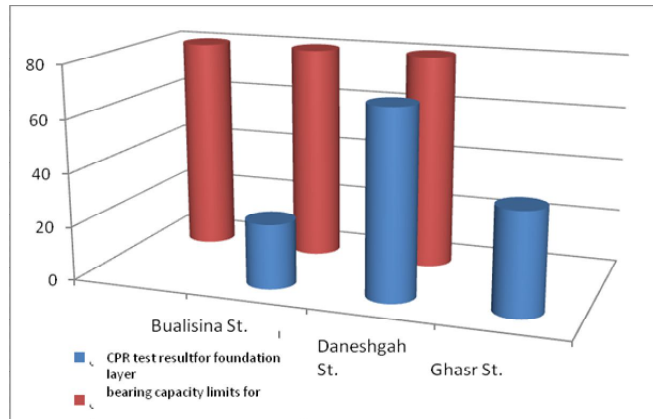


**Fig 2. Results of granulation test**

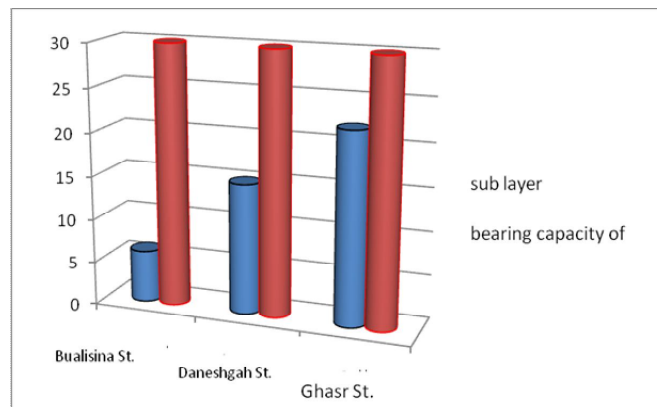




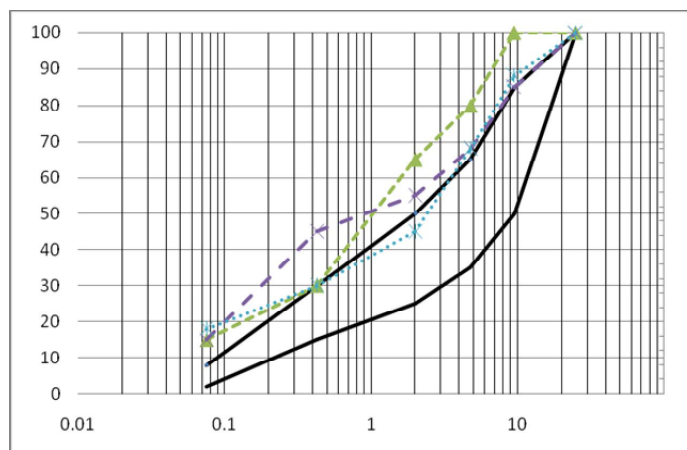
**Mahmoud Aghajari and Mohammad S. Pakbaz**



**Fig 3. CBR test results and Bearing capacity status in foundation layer**



**Fig 4. CBR test results and Bearing capacity status in sub layer**



**Fig 5. Gradation characteristics and limits**





**Mahmoud Aghajari and Mohammad S. Pakbaz**

**Table 1: Results of foundation layer tests**

No.	Sampling place	Test result		Characteristics limits	
		Pasty limit	Liquidity limit	Pasty limit	Liquidity limit
1	Daneshgah St.	Indeterminable	25	0-4	25
2	Ghasr St.	Indeterminable	25	0-4	25
3	Bualisina St.	Indeterminable	25	0-4	25

**Table 2: Results of sub-layer tests**

No.	Sampling place	Test result		Characteristics limits	
		Pasty limit	Liquidity limit	Pasty limit	Liquidity limit
1	Daneshgah St.	10	29	0-4	25
2	Ghasr St.	9	30	0-4	25
3	Bualisina St.	11	28	0-4	25







## Relationship between Conflict of Interests between Shareholders and Creditors and Income Smoothing and Return on Equity

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### ABSTRACT

Current paper aims at investigating relationship between conflict of interest between shareholders and creditors and income smoothing and return on equity. According to agency theory, the company is a place for gathering different stakeholders with their own information, efficiency and utility. In this gathering, agency problems occur when participatory behavior, which maximizes complex welfare, is not consistent with personal interests of each of involved parties, or it is consistent, but not optimal. Thus, it does not lead to maximum welfare for the complex. Conflict of interests increases inefficient resource allocation and extension of organizational problems and it often results in issuing non-transparent and misleading reports for hiding problems. In the current research, criterion of discretionary accruals (for quantification of income smoothing) and Modified Jones Model was used. Research hypotheses predict that conflict of interests lead to income smoothing and impact on return on equity. Thus, in this research, information of 715 companies during 2009 – 2013 and multiple linear regression method was used for testing hypotheses. Results indicate there is significant direct relationship between conflict of interest between shareholders and creditors to income smoothing. No significant relationship between firm size and return on asset and income smoothing was observed. No significant relationship between firm size and return on asset and return on equity was found.

**Key words:** Conflicts of interest between creditors and shareholders, income smoothing, modified Jones model, return on equity.



**MehranRazavi Panah and Mohammad Reza Shoorvarzy****INTRODUCTION**

Emergence of stock companies in the world started since Eighteen century. Undoubtedly it is one of the major economic changes. In these companies, small capitals are gathered for performing large works and its administration is allocated to managers which do not necessarily own great stocks. Result of this phenomenon is separation of ownership from management, making a difference in the utility function of shareholders and other stakeholders, thus creating a conflict of interest, followed by formation of an agency theory. According to agency theory, conflict between interests of owners and stakeholders may cause manipulation of profit and reduced return of shareholders. Also, information asymmetry causes that managers and major shareholders can use this information advantage in their own favor and against other investors in different ways. For example, they can abuse their position with distortion of management of information. It will affect ability of shareholders in correct decisions and thus their outcome. Literature related to conflict of interests between stakeholders in business units has considerably developed in recent years. Often studies on conflict of interests among stakeholders of business units focus on two separate areas: Conflicts of interest between owners and managers, as well as conflicts of interests between owners and other stakeholders (Douglas, 2004) Conducting research on conflict of interests, income smoothing and return on equity and their role in increasing general trust of shareholders and transparency and accountability is necessary because of people turning to stock exchange in recent years and its growth in these years. Over recent years in Iran, due to problems in the country's capital markets (regardless of political issues), possibility of abuse of information owners and some managers of the companies has been provided.

**Theoretical Foundations of Research****Conflict of Interests**

In this section, previous studies are reviewed in summary. (Chen et al. (2008)) showed empowerment of stakeholders which do not have financial resources in business unit causes reduction of funding through debt. They found with increasing conflict of interests between shareholders and creditors, this inverse relationship are stronger statistically. (Dongmei (2006)) showed there is direct relationship between return on equity in companies which have constraints in financial funding and their research and development expenditures. Also, he found there is direct relationship between constraints in financial funding and return on equity in companies spending more resources on research and development. According to theory of agency, a business unit is a collection of contracts signed between stakeholder groups. These contracts determine scope of the business unit. Stakeholder groups gather together and pursue a common economic activity because they have well found that performing economic activities in shared manner reduces transactional costs. By putting financial resources, management and their skills beside each other and with reliance on synergy of these factors, they follow an economic activity consistently. Relationships between stakeholders are shaped based on written or un-written contracts. These contracts are signed between stakeholders so that it is ensured that one group does not damage interests of other groups. In fact, every stakeholder knows that himself and other stakeholder groups in the business unit seek for their personal interest, thus he attempts to make his interests consistent with interests of others by signing contracts with other groups and make sure that his interest seeking does not influence interests of others (Deegan, 2006).

Watts (2002) state that contracts are tools for confronting ethical issues and risks resulting from presence and participation of different stakeholders in the business unit; stakeholders which have different information, outcome, utilities and commitments. Managers reward contracts, debt agreements and work contracts with employees are among contracts which use accounting data. Debt contracts are signed aiming at ensuring that distribution of resources among owners is done following keeping some resources for promoting rights of other stakeholders (Watts, 1993). According to Jensen and Meckling (1976). presence of these contracts is necessary, because there is conflict of interests between two groups of stakeholders over distribution of profit and net assets. One of these groups



**MehranRazavi Panah and Mohammad Reza Shoorvarzy**

(creditors) have constant claim on net assets and the other group (shareholders) is entitled toward residual of assets. (Roy and Mahajan (2003)) refer to information asymmetry between creditors and shareholders an emphasize necessity for these types of contracts. When a business unit face shortage of resources of liquidity problems and financial resources are limited, banks and financial and credit institutes are put in such situation that they can highly influence values and priorities of business unit through debt contracts (Shleifer and Vishny, 1997). In other words, with presence of creditors in business unit, gradually tendencies and demands of them is manifested in business unit and it is more probable that company seeks for preserving interests of creditors. Risk aversion, increasing emphasis on cash flows and preserving life of the company are priorities of the creditors (Thomsen, 2004). Reduced profit distribution especially id there is high conflict of interests between creditors and shareholders is one of the solutions adopted for protecting interests of creditors. In this case, profit distribution is limited to income earned from lending to companies (Begley, 1994). The main issue for creditors regarding lending is ability of lender to repay the principal and interest received credit. In western countries like USA creditors rely on financial statements of the companies to evaluate ability for repayment of principal and interest on loans (Poorheydari and Hemati, 2004). They evaluate risk of granting credit to a company using these statements. According to them, risks are probability for one-way wealth to other stakeholders of the company. With increase of probability of wealth transfer from creditor to shareholder (risk), conflict of interests between them is increased (Parrino and Weisbach, 1999). Thus, logically it is expected that companies with higher conflict of interests between shareholders and creditors face more constraints from creditors for funding. In practice, these groups of companies are forced to fund in higher rates (Ahmad et al., 2002).

**Income Smoothing Concept**

Copeland (1968) introducedrelatively ability in reducing or increasing reported income by managers as manipulation of accounts. Such titles as “maximizers”, “minimizers” or “smoothers” are implicitly applied on those who manipulate accounts. Of course, manipulation of accounts have broader scope than considered by Copeland, including the way of classifications of items in Profit and loss account (Ronen and Sadan, 1975, 1981; Black et al., 1998) which has been mentioned in accounting literature, or cases related to balance sheet (Black et al., 1998) which have been less considered. In fact, importance of manipulation of accounts is more than mentioned by Copeland. On the other hand, motivation for manipulation of accounts is one of the cases which require more attention. Some managers use accounts a tool for unrealistic representation of achievement of company's long-term goals or artificial reduction of expected risk (Mashayekhi et al., 2005)

Income something concept has been investigated also from other aspects. Some of its definitions are as follows:

Scott (1997) refers to income something as management authority in selection of accounting procedures to achieve specific goals. Beidleman (1973) considers income smoothing as an attempt by the company's management to reduce unmoral profit distortions. According to Ronen and Sadan (1981), income smoothing is management's intentional attempt for transferring specific information to users of financial statements. Schipper (1989) defines purposeful interference in financial reporting process in order to achieve personal interests as income smoothing.

Review of literature related to income smoothing suggests attempt of authors for explaining that why managers seek for manipulation of income, how they smooth the income and what are its consequences. Answer to these questions account for great part of experimental research works in accounting and financial reporting area (Mashayekhi et al., 2005). Overall, income smoothing is utilizing flexibility of standard methods and acceptedprinciples of accounting. Of course, various interpretations for administrative methods of an accounting standard are the other reason for presence of income smoothing. This flexibility is the main reason for variety in accounting methods. When interpretation of a standard is very flexible, naturally integration of data provided in the financial statements is reduced (Noorvasg et al., 2005).



**MehranRazavi Panah and Mohammad Reza Shoorvarzy****Relationship between Accruals and Income Smoothing**

Accounting profit is measured and reported based on accrual basis. Thus, there is difference between operational profit and operational reported cash flows in statement of cash flows and this difference is as accruals. Accounting profit can be divided into cash and accrual parts. Thus, management can use both cash and accrual parts for smoothing profit during periods. However, cash part of income cannot be easily manipulated by management since it is accompanied by reception and payment, otherwise cash flow related to incomes or costs are intentional deferred or put forward (Mashayekhi and Safari, 2006).

**Return on Equity**

Return on equity includes ratio between total gains (or losses) from investments and the amount of money that has been used in order to earn revenue in a given period. This period can be one day, one month, one year, etc. (Dastgirand Sharifi, 2011). Various criteria have been provided for evaluation of performance in business units. The most common and most important criterion for evaluating the performance and profitability of enterprises is currently returned on equity, which plays a key role in investment.

**REVIEW OF LITERATURE****Foreign Literature**

Ahmad et al. (2002) found there is reverse relationship between conservatism in financial statements of the company and conflict of interests among shareholders and creditors.

Viswanath and Eastman (2003) showed conflict of interests between shareholders and creditors is increased by increasing debt ratio and complexity of environment where the company acts.

Chen et al. (2006) studied relationship between accruals (difference between profit and cash flows) and future stock return and showed companies with high accruals at the day following financial information reporting have reduced return on equity. Findings by Eisdorfer (2007) suggested that conflict of interests between shareholders and creditors is higher in companies with financial constraints. Limitation in funding is salient feature of companies which have constraint and it has been studied by various works.

Naimah (2014) studied relationship between conflict of interests between shareholders and creditors and dividend policy and accounting conservatism. In this work, linear regression was used for testing hypotheses. Accruals model was used for measurement of conservatism. Variables of profitability, firm size and sale growth were considered as control variables. Time scope of research was considered as 2011 and 2012. Research findings showed there is direct significant relationship between conflict of interests between shareholders and creditors and discretionary accruals.

**Domestic Literature**

IbrahimiKordlar et al. (2008) studied relationship between conflict of interests between shareholders and creditors and dividend and funding constraints. For testing research hypotheses, data from years 2000 – 2006 of companies listed in Tehran Stock Exchange and correlation coefficients were used. Research findings indicate with increasing conflict of interests between shareholders and creditors, less profit is distributed among shareholders. On the other hand, research findings suggest that increasing conflict of interests between shareholders and creditors cannot lead to increasing funding constraints.



**MehranRazavi Panah and Mohammad Reza Shoorvarzy**

Mashayekhi et al. (2005) studied role of discretionary accruals in income smoothing of companies. Their findings suggest realization of income smoothing in the companies under study. In fact, management of companies under study did it through increasing discretionary accruals when facing reduced cash flows resulting from operation, which denote poor performance of the business unit. They did so for compensation.

**Hypotheses**

With separation of ownership from management in stock companies and conflict of interests between shareholders and different stakeholders, this potential possibility is developed that financial decisions are in favor of interests of one group and against interests of other groups. Previous studies in this field sought for finding solutions to reduce agency problem and reduce difference in utility function of owners and stakeholders and potential abuses, and this end, they achieved some results like suitable and proper disclosure of financial information. It is clear that suitable and proper disclosure of financial information causes reduction of agency problem and improvement of decision making by users of financial reports. Conflict of interests increase probability or inefficient resource allocation and extending organizational problems and it often leads to issuing non-transparent and misleading reports for hiding problems through income smoothing. If quality of reported accounting information is low, it is possible that information receivers do not take correct decisions and their investment return may be threatened. To this end, understanding mechanisms which can increase return on equity and reduce income smoothing is very importance, because if stakeholders are worry that their information has been prepared biasedly, they would be excessively conservatism and it would influence efficient of capital market (Yeganeh and Moayeri, 2006). Considering above facts, research hypotheses are formulated as follows:

There is significant relationship between conflict of interests between shareholders and creditors and income smoothing. There is significant relationship between conflict of interests between shareholders and creditors and return on equity.

**METHODOLOGY**

Current paper is an applied research with emphasis on correlation relations. Multiple linear regression method along with F and T tests are used in this research. Data of this research are extracted from stock exchange reports and audited financial statements and they are analyzed using SPSS 17 software. In the next stage and following obtaining results of variance analysis, all statistical tests are investigated at error level 5 percent and if test P-Value is smaller than 5 percent, statistical hypothesis would be rejected. Also, all assumption needed by statistical parametric tests are investigated and their establishment is studied.

**Research Population, Statistical Sample and Time Scope**

Statistical population includes all companies listed in Tehran Stock Exchange since 2008, and their transaction symbol has not exited stock exchange panel during research period (2009 - 2014). Statistical sample is specified with adjustment of statistical population using some constraints. In other words, selected sample in the current research are companies with following conditions:

Their fiscal year ends to March and they do not have fiscal year change during research period.  
The company should not have operational stop for more than 6 months during research period.  
They should not be part of banks, investment companies and financial intermediation companies.  
Their respective data should be available.





### MehranRazavi Panah and Mohammad Reza Shoorvarzy

#### Data and Variables and Their Calculation and Collection

For collection of needed data from information provided in stock exchange website, human resource and other databases are used. Respective data for the research are collected in two ways:

Information provided by the companies listed in Tehran Stock Exchange in stock exchange website

Information collected from other databases and related software (Rahavard)

Research variables are calculated as follows:

#### Independent Variable

#### Conflict of Interests

Conflict of interests between shareholders and creditors

Conflict of interests in the current research is measured using following model proposed by Ahmad et al. (2002):

$$CONFit = STDROAit + LEVit + (1/INTENSit)$$

Where,

STDROA: Standard deviation of return on assets for three fiscal periods

LEV: The ratio of debt to total assets

INTENS: Tangible fixed assets to total assets ratio (Ahmad et al., 2002)

For measurement of conflict of interests three indexes were used: ambiguity (occurrence of fluctuation in demand or major changes in sale prices or other sudden changes), that in this research standard deviation of net profit during three years was consisted as criterion for ambiguity in operations. Due to division of net income to total assets, standard deviation of return on assets is used. Debt ratio and the ratio of tangible fixed assets and total assets are other indexes suggesting conflict of interests between shareholders and creditors. Increasing ratio of debts to assets increases conflict of interests between shareholders and creditors. Third index is tangible fixed assets to total assets ratio. High Tangible fixed assets to total assets ratio means presence of adequate resources for repayment of debts leading to reduction of conflict of interests between shareholders and creditors.

#### Dependent Variables

#### Income Smoothing

Income smoothing in this research is calculated using discretionary accruals (income smoothing index) and modified Jones model (1991). In the first stage, total discretionary accruals should be measured. Total discretionary accruals in the current research are calculated using balance sheet method as follows:

$$TA_t = (\Delta CA_t - \Delta Cash_t) - (\Delta CL_t - \Delta CPL_t) - DEP_t$$

Where:

Total accruals in year t

Changes in current assets in year t

Change in cash flow in year t

Change in current liabilities in year t

Current portion of long-term debt in year t

Cost of depreciation of fixed assets in the year t

$TA_t$

$\Delta CA_t$

$\Delta Cash_t$

$\Delta CL_t$

$\Delta CPL_t$

$DEP_t$





**MehranRazavi Panah and Mohammad Reza Shoorvarzy**

The non-discretionary accruals for each industry are calculated using the following model:

$$NDA_t = \alpha \left( \frac{1}{A_{t-1}} \right) + \beta_1 \left( \frac{\Delta REV_t - \Delta REC_t}{A_{t-1}} \right) + \beta_2 \left( \frac{PPE_t}{A_{t-1}} \right)$$

Where

Non-discretionary accruals

Total assets at year t-1

Change in annual income (income at year t minus income at previous year)

Change in accounts receivable (amount of accounts receivable at year t minus the amount of accounts receivable at previous year)

Property and machinery at the same year

Firm-specific parameters which are obtained using the following models:

**NDA<sub>t</sub>**

**A<sub>t-1</sub>**

**ΔREV<sub>t</sub>**

**ΔREC<sub>t</sub>**

**PPE<sub>t</sub>**

*α1, β2, β*

$$\frac{TA_t}{A_{t-1}} = \alpha \left( \frac{1}{A_{t-1}} \right) + \beta_1 \left( \frac{\Delta REV_t}{A_{t-1}} \right) + \beta_2 \left( \frac{PPE_t}{A_{t-1}} \right) + \epsilon$$

And finally discretionary accruals are calculated using following method:

$$DA_t = \frac{TA_t}{A_{t-1}} - NDA_t$$

Where

discretionary accruals

**DA<sub>t</sub>**

Dechow et al. (1995) provided adjusted form of Jones model. According to them, Jones model implicitly assumes that income items are not manipulated by manager neither at the time of model parameters estimation (period and event) nor at the time of income smoothing estimation (period of estimation). They nulled this assumption and considered sale (income) changes in the estimation period resulting from income smoothing. Thus, with entering changes in accounts receivable in the original Jones model, they proposed adjusted Jones model which is adjusted form of primary model.

**Return on Equity**

Following method was used in this research for calculating normal return:

return on equity

$$= \frac{\text{Cash received from the capital increase and demands} - \text{approved dividend} + \text{company's market value at beginning of year} + \text{company's}}{\text{company's market value at beginning of year}}$$





### MehranRazavi Panah and Mohammad Reza Shoorvarzy

Market value of company at the beginning of the year = (Number of shares at the beginning of the year × stock price at the beginning of the year)

Market value of company at the end of the year = (Number of shares at the end of the year × stock price at the end of the year)

**Approved dividend:** (Dividend per share × number of shares on assembly date)

Cash received from the capital increase and demands is calculated as follows:

Percent capital increase brought by cash and receivables × (capital at the end of period – capital at the beginning of period)

#### Control Variables

Firm size includes natural logarithm of total book value of assets at the end of fiscal year (Johari et al., 2008).

Return on asset includes net profit to the company's assets at the end of fiscal year (Johari et al., 2008).

#### Testing Hypotheses and Findings

Testing hypotheses is as follows:

##### Hypothesis 1

Model for testing H1: There is significant relationship between conflict of interests between shareholders and creditors and income smoothing.

Following model is used for testing H1:

$$EM = \alpha_0 + \beta_1 CON + \beta_2 SIZE + \beta_3 ROA + e$$

In this model, EM is earning management, CON is conflict of interests between shareholders and creditors, SIZE is firm size and ROA is return on assets.

##### Hypothesis 2

Model for testing H2: There is significant relationship between conflict of interests between shareholders and creditors and return on equity.

Following model is used for testing H2:

$$RET = \alpha_0 + \beta_1 CON + \beta_2 SIZE + \beta_3 ROA + e$$

In this model, Ret is return on equity, CON is conflict of interests between shareholders and creditors, SIZE is firm size and ROA is return on assets.







**MehranRazavi Panah and Mohammad Reza Shoorvarzy**

Descriptive statistics are used for better understanding of the population. Tables provided in this section give descriptive statistics of independent variable and dependent variable.

For testing total significance of regression, following hypothesis is stated:

H<sub>0</sub>: All coefficients of regression model are zero.

H<sub>1</sub>: At least one of coefficients of regression model is non-zero.

For testing above hypothesis, F test is used. F value for sample regression model is obtained from following relation.

$$F = \frac{\frac{SSR}{K - 1}}{\frac{SSE}{N - K}}$$

Where SSR denotes sum of squares of the difference between the predicted value of the average total data, SSE denotes sum of squared errors, K suggests number of calculated model parameters, and N is number of observations. If regression is significant, coefficients should be investigated. For testing significance of coefficients, it is assumed that regression coefficient is zero. In other words, independent variable has no effect on changes in dependent variable. That is, the hypothesis is stated as follows:

$$\begin{cases} H_0: \beta_i = 0 \\ H_1: \beta_i \neq 0 \end{cases}$$

T student test is used in this research for testing above hypotheses and t value is obtained from following relation:

$$t = \frac{\alpha}{Se_{\alpha}}$$

$\alpha$  is coefficient value and  $Se_{\alpha}$  is standard deviation.

Results of regression model's variance analysis shows F statistics is significant at error level 5 percent (sig = 0.000). Thus, H<sub>0</sub> is rejected with confidence above 95 percent and H<sub>1</sub> is supported. Hence, assumption of linearity of regression model is H<sub>1</sub> is supported.

Results of regression model's variance analysis shows F statistics is significant at error level 5 percent (sig = 0.008). Thus, H<sub>0</sub> is rejected with confidence above 95 percent and H<sub>1</sub> is supported. Hence, assumption of linearity of regression model is H<sub>2</sub> is supported.

In order to use regression, firstly some assumptions should be considered. There are several assumptions at every linear regression model which if they are establishment it denotes regression is reliable, otherwise, other model should be replaced. In this regards, diagram of residuals versus predictions, which suggests homogeneity of variance, is investigated and homogeneity of variance is supported. Many of parametric statistical tests assume that



**MehranRazavi Panah and Mohammad Reza Shoorvarzy**

dispersion of population is similar to the extracted sample. In many cases, difference of variances is so low that it can be assumed samples are actually taken from one population. If dispersion is between -4 and +4, assumption of variance homogeneity is supported. Following diagram supports homogeneity of variance.

For investigating assumption of normal distribution of variables, normal distribution of residuals is investigated, because if distribution of residuals is normal, response variable distribution is also normal. In the diagram of normality probability, regression residuals and standardized residuals are as follows. Sample's experimental distribution function values are on the bisector of the first quarter, which is indicative of data normality.

In addition to above diagram, values above 5 percent, probability Kolmogorov-Smirnov test also shows normality of the data as the following table:

In relation with Hypothesis 2, similar to Hypothesis 1, underlying assumptions of regression should be controlled. In this regards, diagram of residuals vs. predictions, which suggests variance homogeneity, is investigated and variance homogeneity is proved.

For investigating assumption of normal distribution of variables, normal distribution of residuals is investigated, because if distribution of residuals is normal, response variable distribution is also normal. In the diagram of normality probability, regression residuals and standardized residuals are as follows. Sample's experimental distribution function values are on the bisector of the first quarter, which is indicative of data normality.

In addition to above diagram, values above 5 percent, probability Kolmogorov-Smirnov test also shows normality of the data as the following table:

The other assumption of regression analysis is that predictor variables are independent of each other. Of course, in most cases it is not established and these variables have relationship. If it is a linear relationship, regression is highly influenced. In this case, it is said there is co-linearity between predictor variables. If there is co-linearity between predictor variables, then regression coefficient may not be significant, and if co-linearity is perfect, i.e. at least of one of the predictor variables is a linear combination of other variables, then calculation of coefficients is not possible by least squares method. Thus, there should not be co-linearity between predictor variables.

According to above Table, Variance inflation factor of independent variables for both hypotheses is smaller than  $VIF < 10$ . Thus, considering fluctuation of variance inflation factor, multiple of co-linearity is not a threat to the model.

As observed in above table, Durbin – Watson Statistics was obtained as 1.610 for H1 and it was obtained as 2.126 for H2. If fact, if this statistics is between 1 and 3, it can be concluded error elements in this model do not have significant correlation and their behavior is independent, thus independence of error elements in the regression fitted model is approved in this research. Also, investigation of statistical summary table indicates that multiple correlation of research first model is  $R = 0.187$  and coefficient of determination is  $R^2 = 0.035$ . Investigation of coefficient of determination (variability in dependent variable which can be explained by regression) in this model indicates that main research variables can describe 3.5 percent of total changes in dependent variable. These results suggest that about 3.5 percent of changes in dependent variable is the sample under study is described by independent variables in this research and remaining changes are contribution of other factors and random events which are beyond the model. Overall coefficient of determination is low in financial research works due to presence of many influential variables on dependent variable. These results show a ratio of variance of dependent variable can be described by regression which is 3.5 percent. In the second research model multiple correlation is  $R = 0.09$  and coefficient of determination is  $R^2 = 0.008$ .





**MehranRazavi Panah and Mohammad Reza Shoorvarzy**

Regression coefficients are estimated in the following and results of estimation are given in the table below.

For testing significance of regression coefficients, it is assumed that regression coefficient is zero. In other words, independent variable has no impact on dependent variable. That is, hypothesis is stated as follows:

H0: There is no significant relationship between conflict of interests between shareholders and creditors and income smoothing.

H1: There is significant relationship between conflict of interests between shareholders and creditors and income smoothing.

For investigating rejection or supporting the hypothesis in this state, hypothesis probability should be studied. In fact, t test probability suggests rejection or support of hypothesis.

**Results for H1**

Hypothesis: There is significant relationship between conflict of interests between shareholders and creditors and income smoothing.

According to results obtained from above table, conflict of interests between shareholders and creditors in this test has beta coefficient as 0.135 with three figure of decimals probability. Thus, first research hypothesis is supported at error level 5 percent. In fact, according to the results, since relationship between conflict of interests between shareholders and creditors and income smoothing is direct and significant relationship, it can be stated presence of conflict of interests between shareholders and creditors causes increasing level of income smoothing. Also, results indicate lack of significant relationship between firm size and income smoothing. But direct significant relationship is observed between return on asset and income smoothing.

Second model's regression coefficients are estimated in the following and results are given in the table below.

For testing significance of regression coefficients, it is assumed that regression coefficient is zero. In other words, independent variable has no impact on dependent variable. That is, hypothesis is stated as follows:

H0: There is no significant relationship between conflict of interests between shareholders and creditors and return on equity.

H1: There is significant relationship between conflict of interests between shareholders and creditors and return on equity.

For investigating rejection or supporting the hypothesis in this state, hypothesis probability should be studied. In fact, t test probability suggests rejection or support of hypothesis.

**Results for H2**

Hypothesis: There is significant relationship between conflict of interests between shareholders and creditors and return on equity. According to results obtained from above table, conflict of interests between shareholders and creditors in this test has beta coefficient as -0.004 with three figure of decimals probability as 0.923. Thus, second





### MehranRazavi Panah and Mohammad Reza Shoorvarzy

research hypothesis is not at error level 5 percent. Results suggest there is direct relationship between firm size and return on asset and return on equity, but this relationship is not significant.

#### Recommendation for Financial Statement Users

Investors are recommended to consider different aspects of accounting information quality including profit quality in decision making process regarding their investment and they should use multiple indexes for evaluating the company performance.

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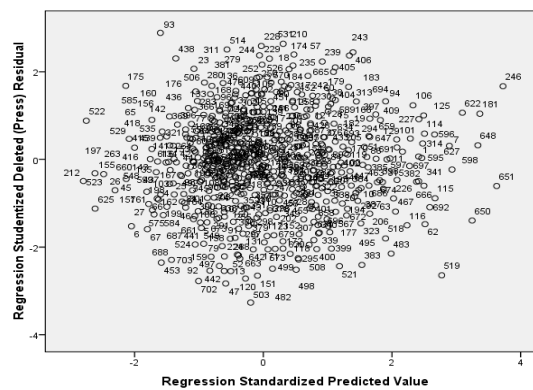
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**MehranRazavi Panah and Mohammad Reza Shoorvarzy**

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**Fig1: Residuals vs. predictions – Model 1**





MehranRazavi Panah and Mohammad Reza Shoorvarzy

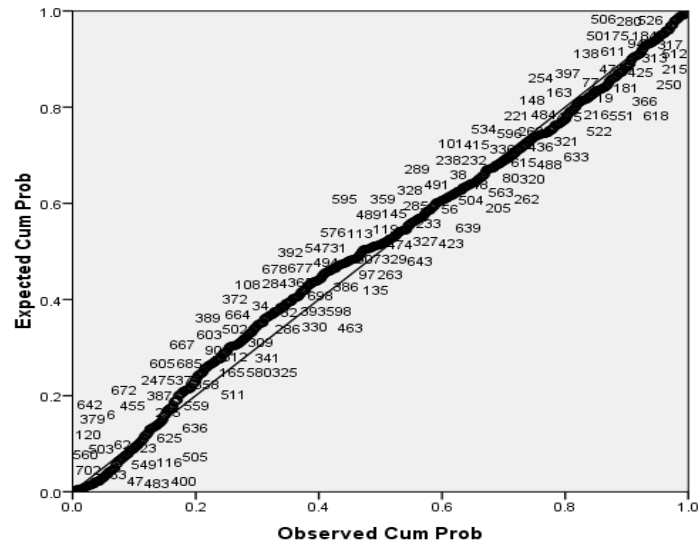


Fig 2: Probability for normality of regression residuals (Model 1)

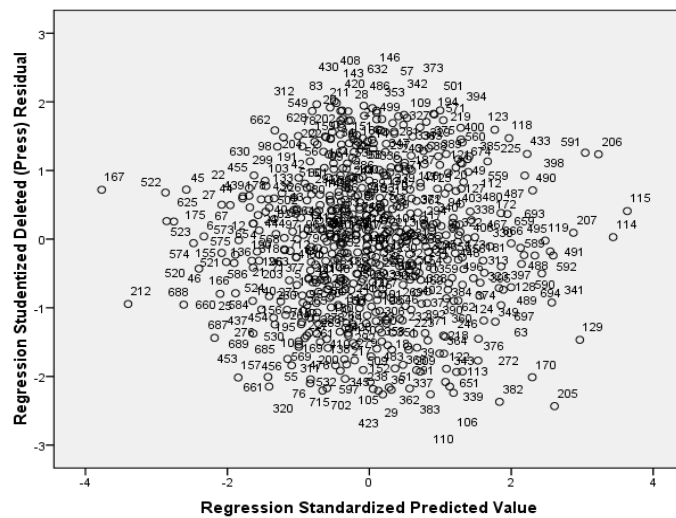
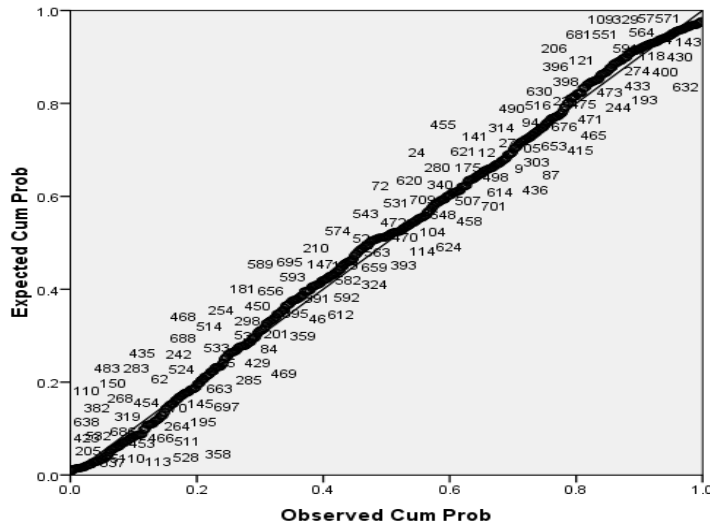


Diagram 3: Residuals vs. predictions – Model 2





**MehranRazavi Panah and Mohammad Reza Shoorvarzy**



**Diagram 4: Probability for normality of regression residuals (Model 2)**

**Table 1: Data collection and extraction way in income smoothing measurement**

Variable name	Source
Change in current assets	Balance sheet
Change in cash	Balance sheet
Change in current liabilities	Balance sheet
Change in current portion of long-term debt	Balance sheet
The cost of depreciation of fixed assets	Notes with financial statements
Total assets at year t-1	Balance sheet
Change in annual income	Income Statement
Change in accounts receivable	Balance sheet
Property and machinery	Balance sheet

**Table 2: Descriptive statistics**

Variable	Min	Max	SD	Median	Mean
Income smoothing	-0.52	0.56	0.18	0.09	0.08
Return on equity	-0.70	2.70	0.70	0.13	0.35
Conflict of interest	1.63	29.81	5.21	4.99	6.73
Firm size	10.03	18.82	1.44	13.24	13.37
Return on assets	-0.44	0.63	0.15	0.09	0.10





**MehranRazavi Panah and Mohammad Reza Shoorvarzy**

**Table 3: Variance analysis (Model 1)**

Model	Description	Sig probability	F statistics	sum of squares
1	Regression	0.000	8.458	0.760
	Residual			20.946
	Total			21.706

**Table 4: Variance analysis (Model 2)**

Model	Description	Sig probability	F statistics	sum of squares
2	Regression	0.008	3.968	6.317
	Residual			341.174
	Total			347.490

**Table 5: Kolmogrov-Smirnov test - Model 1**

Probability	Kolmogrov-Smirnov test
0.073	1.287

**Table 6: Kolmogrov-Smirnov test - Model 2**

Probability	Kolmogrov-Smirnov test
0.662	0.730

**Table 7: Test of lack of co-linearity – VIF test**

Variable	VIF (H2)	VIF (H1)
Conflict of interest	1.038	1.032
Firm size	1.047	1.058
Return on assets	1.074	1.086

**Table 8: Durbin – Watson Statistics, Pearson correlation coefficient and coefficient of determination**

Hypothesis	coefficient of determination	Pearson correlation coefficient	Durbin – Watson Statistics
1	0.035	0.187	1.610
2	0.008	0.09	2.126







**MehranRazavi Panah and Mohammad Reza Shoorvarzy**

**Table 9: Significance tests of regression coefficients (H1)**

Description	Beta coefficient	T statistics	Sig probability level	Type of relationship	Test Result
Conflict of interest	0.135	3.595	0.000	Direct	Support
Firm size	0.016	0.407	0.684	Direct	Reject
Return on assets	0.151	3.899	0.000	Direct	Support

**Table 10: Significance tests of regression coefficients (H2)**

Description	Beta coefficient	T statistics	Sig probability level	Type of relationship	Test Result
Conflict of interest	-0.004	-0.096	0.923	Reverse	Reject
Firm size	0.049	1.226	0.221	Direct	Reject
Return on assets	0.065	1.586	0.113	Direct	Reject





## William Morgan Schuster's Advice and the his Hiring Results in Iran

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### ABSTRACT

"I believe that no one had been more liable than American Morgan Schuster in the twentieth century. With the help of myopic ministers, one of unscrupulous politicians in England [Sir Edward Grey] fired this man and frustrated him in his deeds. Sir Edward Grey had fired Morgan Schuster by the help of Russian forces." - Georges Brandes, famous and great Danish writer.

Hiring American Morgan Shuster and his advisors Committee for reform of customs and tax situation and then their expulsion from Iran - after receiving an ultimatum from Russia – was an important season in relations between the two countries. The thought that Iran should be tended toward USA and Americans and liberating Iran from competition cycle and pressure of Russian and British colonialists with their entrance in Iran with reliance on a third force emboldened Iranian Mellium to direct attention of Iranian governing body to USA, that ever reflected voice of Russia and Britain. Its initial outcome was manifested as recruitment of this American advisor. This issue and its challenges are discussed in this paper.

**Key words:** advisors, America, Iran, relations, Schuster.

### INTRODUCTION

When Iranian economic situation was critical, poverty and emptiness of the treasury had led Iran to a chaos, the second National Assembly was opened. Because the parliament has concerned representatives, with the coordination and cooperation of Mustawfi Mamalik's government and by the advice of Sani'odowleh, it decided to hire some financial advisors for financial reform in Iran. First, they decided to borrow from private Syndicate, but the Russia's



**Seyed Ghani Eftekhari and Keyvan Loloie**

influence stopped them. The Russians insisted that the government must borrow from the Russian government and the UK, but Iranian government decided to borrow from a neutral country. While modern Iranians were close to France, the government decided to enter into negotiations with the American delegation because France was an active member of Allied Powers and Germany had many problems with Iran (Katouzian, 2000). The Americans were still not tainted the game of politics in the Orient at this time, they did not transgressed the principles of freedom, independence, honor and dignity of the people of the Middle East by a colonial views, and they did not begin to interfere in the internal affairs of the Orient and plunder their wealth resources.

The Americans were isolated in the political world and were less involved in Europe based on the Monroe Doctrine, America for Americans. Since the Americans had been released from the yoke of Great Britain's colonialism and they accompany other colonized countries to fight against colonialism, they showed empathy and compassion with the Iranians. In this regard, Baskerville joined Iranian liberals (Navaei, 1985). He taught history in a school in Tabriz and joined Sattar Khan to defend Tabriz; finally, he died in this path (Kamalvand, 1957; Abraham, 1989). Mohit Tabatabaei states that Baskerville's attendance in Tabriz Protest and his death was humanistic and accidental; it has nothing to do with the policy of Americans in relation to the fate of the Iranian nation (Tabatabaei, 1988). Due to the Americans' charities of religious circles in Iran, they were admired in Iran. The policy of choosing a third country was carried out to reduce the influence of big powers. The Iranians did not decide to just a director, but they aimed to involve America in Iran to release the country from the dominance of Russia and the UK (Ghani, 1998). Nevertheless, America's Foreign Ministry was preparing to rebuff any Iranian proposal to send a consultant (Abraham, 1989).

In such a situation, they ordered the Iranian Minister, Ali Gholi Khan Nabil al-Dawla, to hire some financial advisor from America to reform, modify, and renew Finance Organization of Iran. At that time, because of the neutral policy of the Americans in Iran, two powers of the Russia and England did not oppose to send financial advisers. In addition, Americans also wanted to have influence in Iran. Finally, the Americans agreed after various consultations.

Act for Employment of 5 Americans was approved on the Shawwal, 2 of 1328; Morgan Schuster, an American lawyer who had been sent to Cuba and Philippines as official customs duties, entered to Iran at the head of a delegation of sixteen people (and their families). The approved salary of Schuster was two thousand liras, payment of traveling to Iran, and the salary of his accompanies (Hedayat, 1984). The approved salary of Schuster was two thousand liras plus the expenses of his travel to Iran and the payment of his companions that were less than his payment (Hedayat, 1984). It is said that Schuster had entered Iran for absolute service and dedication to save the people and economy of Iran; he was so decisive to fulfill his mission. His companions were Charles Leskaski, financial audit, Ralph Hiller, accountant, Bruce Dickie, inspector, and Corner, tax administrator from Paris, Vienna, Istanbul, Batumi and Baku. When he entered in Bandar Anzali, he met Momtazoldowleh, Minister of Finance. Schuster asked him "Where are we going?" Hormoz Khan answered, "From now, you go to hell." Schuster was surprised. He said again, "You have entered the land which is worse than hell." Schuster ignored his words, but fired hm when they they arrived Tehran (Safaei, 1974).

At the arrival of Schuster and his accompanying delegation in Tehran, Charles Russell, America Chief Minister, accompanied by a few priests welcomed him. With the advice of Nabil al-Dawla, some Iranian Baha'is welcomed him. Seeing this scene, people began to doubt about Schuster and his ideas. Schuster writes, "It was rumored among the people who advisors have come to propagation of the Baha'i faith in Iran" (ibid). When the American delegation entered Iran, state treasury had 600 thousand Tomans supply, 2300000 Tomans commitment for received loans, 240000 England's lira and 38000000 Manat debts to the Russian bank. In addition, it owed to local businesses. The government could not borrow from other governments because the government owed these two governments and they had determined the financial situation of Iran in Anglo-Russian Convention of 1907 (Hedayat, 1984). Economic, political, and social conditions of Iran at this time was so complex that Schuster described full of corruption Iran's financial system as Eugene's stall, which could not be cleaned except by extraordinary devices. He was opposed to the old colonialism and sympathy with the Iranians because he was a liberal man; he disagreed to traditional





### Seyed Ghani Eftekhari and Keyvan Loloie

methods of bargaining and trading that governed works in Iran. He was determined to create an island of efficiency and financial integrity in the midst of an ocean of old traditions that were challenged by a hard storm of revolution while Russian and British intervention was still effective (Katouzian, 2000). Schuster was a serious, passionate, and honest man. (Iqbal, 1947). He was powerful and sought to help. He entered like a summer lightning in Tehran (Kazem Zadeh, 1992). He was a miracle and settled Iran's economy in a short time (Ghani, 1998); but he was not successful at the end. Contrary to the Belgian and French advisors, he regards himself as one of the agents of the Iranian government, he was accountable only to the government of Iran and refuse to show his dependency on one of the international groups in Tehran (Abraham, 1989; Hedayat, 1984). Schuster interpreted 1907 Anglo-Russian agreement article by article. In the agreement, they promised to respect Iran's sovereignty. Therefore, he tried to preserve the interests of Iran and take steps to improve the financial situation and economic development in Iran (Hedayat, 1984).

To ensure his supporters, Morgan Schuster did some works that raised the opposition of the Russians (Bahar, Mir Ansari, 2000) and the English (Mahmood, 1965); but Democrats and Liberals welcomed him and they had been optimistic. Mahdi sharif Kashi declares, "When the delegation arrived in Iran, I believed that they absolutely do nothing with the development of Iran because if they obeyed the order of the two governments, they have nothing for Iran; if they acted contrary to them, they would not maintain them. Hence, politicians should be aware not to be deceived" (Sharif Kashi, 1983). With his familiarity with the political structure of Iran, Sir Percy Sykes believed that Schuster lacks the ability to carry out reforms in Iran. He says, "Certainly, his selection for the post was regrettable and demonstrated the misery. He had not great attributes and benefits required to meet the difficult tasks; if he was capable and competent, Russia did not let him to be successful in his works; therefore, He showed his excuse in the book called *The Strangling of Persia*. (Sykes, 1987, vol. 2, p. 569).

#### Schuster's most Important Actions

1. Schuster's first encounter was with Belgians. According to law, he asked Mornard, Belgian head of Iran's customs, to transfer the customs' revenues to the treasury account. He refused. Even, the Russians supported Mornard against Schuster. English took a neutral policy on the appearance, but finally, Schuster forced Mornard to transfer the revenue of North and South Customs to the treasury account.
2. Schuster wrote Mr. Wood, Imperial Bank President, that not payment is allowed except by the signature of General Treasury. Here, Schuster used his official power (Navaei, 1985).
3. Budgeting and create a 'gendarme of the Treasury,' which was its armed forces. This action was very annoying for the Russians because they did not allow the Constitution to grow in Iran. Schuster appointed the British military member, Major Stokes, as the head of gendarme of the Treasury since he knew Persian (Hedayat, 1984). He decided to establish an army to work under his authority, but he withdrew and created 'gendarme of the Treasury.' He invited some officers in collaboration with Stokes and Colonel Merrill, an American. Most of the officers were nationalist; and had key roles in future. Persons like Fazlollah Agh Avali, Farajollah Agh Avali, Ali Gholi, Heidar Gholi Pesyan, Ahmad Khan Akhgar, Masoud Khan Pooladin, etc who joined state army after the the dismissal of Schuster (Stephanie, 1377, p. 42; O'Connor, 1376).

Schuster took this action with the permission of the National Assembly, but the Russians opposed appointing Charles Stocks as the head. Russian knew him as an anti-Russian element. This appointment was good for the British because it was contrary to the approval of the National Assembly. The Russians believed that the head should be an officer from a smaller country. Even, Barkley, British Foreign Secretary, suggested that they appoint a Swedish officer for this position for the sake of political expediency. Schuster did not accept and said British Chief Minister that he





### Seyed Ghani Eftekhari and Keyvan Loloie

need Stocks for the position because he is a capable man who can help him in the troubles (Kazem Zadeh, p. 563). Finally, Schuster appointed him at the position.

4. Abrogating old method of taxation and firing some of the opportunists. Schuster acted according to the law. Mokhberol Saltaneh wrote, "Schuster was wrong to think that Iran is New York in which one can do any legal action" (Hedayat, p. 281). He wanted to take tax from the Princes and Lords, but this brought the animosity of powerful Iranian officials, including Sepahdar and Ala al-Dawla (Foran, 1999, p. 267). Abdollah Mostofi states, "This partial reforms was not bad for routines, but they seems like to paint a house without foundations (Mostofi, vol. 2, p. 334). The first problem of Schuster was Ibrahim Khan Motaze Al-saltaneh (the father of Ghavam Al-saltaneh and Vosogh al-Dawleh. The old man did not want to fully execute Schuster's commands and refrain to pay taxes. He also notified several times. Abdollah Mostofi notes, "Once, when Schuster wanted to sign his summons, I stopped him and said that he is the father of Vosogh al-Dawleh, former Minister of Finance, and Ghavam Al-Saltaneh. He put his pen on the paper and said: I sign it earlier because he is their father. I declared: we make these two our enemies by signing the paper. I asked: I know you a fair man, how can you violate the rules you have set to regulate bank funds? I told: sometimes, you need to sacrifice the principle for conditions. He said that this is weakness of confidence, which I escape from it. I should do it to organize and regulate financial status of the country. He was right, but I wasn't also wrong" (Mostofi, p. 349).

Once again, when Samsam Al-Saltaneh went to Schuster to reduce taxes of Abdol Hossein Farmanfarma, Samsam said: he tries much for the Constitution; Schuster answered: he should show his interest in the Constitution by paying tax (Navaei, vol. 3, p. 254). At that time, many aristocratic figures had arrears and unpaid tax. While they some of them had wealthy and several million in assets, they begged the National Assembly to exempt them from paying tax (Mahmood, vol. 8, p. 230). When they could success by appealing to the government and parliament, they assisted Russian and British colonial embassies and began to protest Schuster. Using people's bias, they accused the Americans of Babi beliefs (Kazem Zadeh, p. 561). The Russian newspapers accused Schuster of Jewishness.

5. Schuster announced all urban and rural landowners that taxes would be received at the harvest time and printed receipt would deliver to them (Sharif Kashi, vol. 3, p. 649).

6. Reducing the number of customs offices to three subsidiaries: The collection office, control office, and payments office. It was decided that all all received amounts should transfer to borrowing and imperial banks.

7. Reducing budget of some organizations. Schuster who knew that a significant portion of funding did not included in the main consumptions was forced to bargain for hours with influential individuals on the budget of their organizations. After the Russian ultimatum and the dismissal of Schuster, the Iranians who saw him incorruptible and saw their interests at risk, were released (Katouzian, 1993, p. 113). When Schuster saw that he couldn't go forward without financial and tax rules, he asked parliament and government for legal authorities. The government sent a bill to the parliament and he was assigned as the head of Treasury with extensive powers to organize and finance the collection of taxes. He declared that he would return to US if they did not accept his demands. According to the law, Schuster acquired full powers in financial affairs. He had the right to control all financial affairs of state, the state treasury, taxes and other governmental revenues. He controlled all expenses. One of his duties was to adjust the state budget and to monitor its implementation. He could change financial rules; in general, many economic affairs had been carried out under his supervision (Raean, p. 17). The parliament gave him the authorities because it thought that the Americans are away from Iran.

Sirus Ghani states, "When Morgan Schuster engaged in the routine correction of officials, Mohammad Ali Shah's army along with his brother Salar al-Dawleh from Mesopotamia had attacked to Iran with the help of the Russians, but Schuster's financial innovations caused their defeat. After defeat, Mohammad Ali Shah returned to Russia and





### Seyed Ghani Eftekhari and Keyvan Loloie

his brother fled to Mesopotamia. Then, Schuster seized the assets of Shoa' Al-Saltaneh in return for unpaid taxes" (Ghani, p. 28). In the tenth Mehr 1290 (Persian date), the government decided to confiscate the property of Shoa' Al-Saltaneh and Salar Al-Dawleh. They ordered Schuster to seize their assets and announce British and Russian embassies; he noted the embassies that the Iranian government would maintain their rights in this regard. Mahdi Sharifi Kashi who was not optimistic at their arrival wrote, "Iranian agents of who serve Schuster guide him and stop him to interfere in the Russian embassy" (Sharif Kashi, p. 647). It is said that Soleiman Mirza and other Democrat leaders had advised Schuster to seize the assets of Shoa' Al-Saltaneh. Mokhber Al-Saltaneh believed that it was a wrong action, "He thought that Iran is New York to act any legal action while he should inform Foreign Ministry, then he could take the permission of Russia" (Hedayat, p. 281).

After the parliamentary mandate, Schuster sent some groups to seize the assets of Shoa' Al-Saltaneh and Salar Al-Dawleh in 15 Mehr. Shoa' Al-Saltaneh's park and garden in Dolat Abad was a village outside Tehran in the road to Abdolazim. Shoa' Al-Saltaneh's assets were a city park in the King garden gate, Dolat Abad village, Chizar village in Shemiran.

Schuster's agents went to the park of Shoa' Al-Saltaneh at ten o'clock, some Cossacks were guards; but they did not prevent agents seeing the state rule. The agents made inventory of assets in the park. This action was a great attack to the Russian government. The Russians pretended that Shoa' Al-Saltaneh owed to Russia. The result of such complex actions was tension. Democrats were happy because they saw it a great victory; but happiness was ephemeral. The Russians pretended that Shoa' Al-Saltaneh is a Russian citizen and his estate is a collateral for a loan that he had received from State Bank. The claim was wrong because Shoa' Al-Saltaneh has citizenship of Ottoman government (ibid, p. 280). Iranian government proved that the collateral is false (Safaei, p. 110).

In this situation, two Russian officer and twelve Cossacks entered the park and evicted the Treasury officials. Schuster informed the Russian Chief Minister and asked him to move Cossacks from the park. The next day, Merrill sent his Deputy with fifty gendarmes and three officers to the Park. Due to refusal of Russian general consul, Pakhtianov, Schuster's agents entered the park from a secondary door and evicted the Cossacks. This caused a conflict between Cossacks and the gendarmes of the treasury.

Mokhber Al-Saltaneh wrote, "Pakhtianov, the Russian general consul, was sending false reports to Russia. He was a corrupt and caused the chaos in Tabriz. Since the Russians couldn't return Mohammad Ali Shah (due to English opposition to prove Anglo-Russian Convention of 1907), they stand against Schuster;" Schuster was wrong in this case. Iranian government was dissatisfied of Pakhtianov; even, it demanded his deposition, but Russia had claimed that the qualification of its agents is relevant to the Russian government (Hedayt, p. 251). Schuster's mistake was his unawareness of the influence of Britain and Russia on Iranian government because Iranian government could not even stop their apparent intervention in Iran (Zoqi, 1989, p. 89). O'Conner wrote, his basic assumption was refusing to accept particular rights of other powers while some countries regarded some rights for themselves in Iran. Russia and England had defined a sphere of influence for themselves by Anglo-Russian Convention of 1907. Schuster believed that Iran should not be committed to this convention because it had been approved without his advice (O'Conner, pp. 53-4).

#### The Russian Government's Ultimatum to Iranian Government in 1950

Morgan Schuster hoped to attract the spiritual support of Britain government by recruitment and appointment of English officers in financial affairs of Iran. He was aware of the compromise diplomacy of Sir Edward Grey in the Foreign Ministry of Great Britain against Russia, but he was unaware of international military and political developments as well as the strained international atmosphere, which had lead the world to the tremendous Great War (Zoqi, pp. 88-9).



**Seyed Ghani Eftekhari and Keyvan Loloie**

Russia was a powerful country with a population of one hundred and fifty million; it had destructive armed forces as one of the great powers of the day. According to Anglo-Russian Convention of 1907, they regarded Iran as their sphere of influence and realized the weakness and inability Iranian government. In addition, English was also not behind in the race with Russia.

Possession of Shoa' Al-Saltaneh as well as disarmament and the expulsion of Cossacks from his park by Iran state were difficult for the Russians. In a meeting with Auburn, Russian Foreign Minister expressed that some tools and facilities belonged to Russian farmers had been lost at seize of Shoa' Al-Saltaneh's property (Rezazadeh Malek, 1998, p. 510). In such circumstances, Russia issued an ultimatum to Iranian government expressing (1) the Iranian government should immediately exclude the gendarme of the Treasury and Shoa' Al-Saltaneh's park; (2) the Iranian government should formally apologize to the officers of Cassack Khaneh. (Hedayat, p. 281; kazemzadeh, p. 596).

Meeting Palkosky, Vosogh Al-Dawleh stated that the Cabinet did not like the Schauster's approach and tended to harness it. Russia should not rush in this situation because it adds Schauster's popularity in the view of extremist Iranian politicians. Palkosky answered that Russia would react immediately (Kazemzadeh, p. 597).

Iranian government rejected the demands of Russia to apology and evacuate Shoa' Al-Saltaneh's property and reminded that it had declared that the rights of Russian citizens would be maintained. It asked the Russian Consul to avoid interfering in this affair. Given that it was not the fault of the Iranian officials, Palkosky's demands are obscene and harmful. Russian politicians run two ploces in this time. Pakhtianov believed that the Russian government should abandon the policy of non-interference and help the former king and his supporters. Even, he argues that the Russians should endure the difficulty of England's dissatisfaction to monitor their interests in Iran. The Russians were determined to set a government that would deposit Schuster, close the parliament, and establish public order. Both Iranians and English feared that the Russians to set Mohammad Ali Shah on the throne.

Russian policy was to deport Schuster from Iran and they had acquired the approval of Great Britain. Nicholson believed that Schuster should not be forcibly expelled from the country; it was better he resigned because it avoids future disputes and controversy in the press and Parliament of America (ibid, 598). Schuster was a horrible giant for the Russians. They wanted to deport it from Iran without any common action because he was a citizen of US; they tried to stop the interference of America in Iran (ibid, p. 640). Iranian parliament and some Iranian politicians were supporting Schuster. Vosogh Al-Dawleh and his brother who were friends of Schuster at first had become his enemy in the story of their father, who was governor of Azerbaijan. Many politicians had gradually realized that Schuster was radical and did not understand the deterioration. Schuster did not know that the Russians had talked Britain to deport him from Iran. Katouzian argues, "Although the English had a good relationship with Democrats at that time, some of them had resorted to British Embassy in the coup era of Muhammad Ali Shah, and opposed to the Russians, their policy was to involve Schuster in a fight against the Russians (Katouzian, p. 91).

The Russians issued a 48-hour ultimatum to Iran that if their demands did not fulfill, they stop their diplomatic relations with Iran. Samsam Al-Saltaneh's cabinet knew that it means the Kazakh's attack on Iran. They could not accept the ultimatum and tried much to convince Schuster to send out the gendarme forces of the Treasury from the property of Shoa' Al-Saltaneh; but Schuster did not accept. Schuster wrote in this regard, "When the command was submitted to me while it was contrary to the former command about confiscation of the property of Shoa' Al-Saltaneh and only the Prime Minister had signed it instead of the Council of Ministers, I had no choice other than saying that the command had not the signature of the Council of Ministers. The action did not terminate my first command that left the assets under the supervision of my agents or assigned the responsibility of all affairs to another person (Schuster, 1972, p. 208-9). Samsam Al-Saltane was forced to resign, but his deputy refused to resign.



**Seyed Ghani Eftekhari and Keyvan Loloie**

When the force of Russians entered Iran, Iranian government accepted the ultimatum. They had planned to send two thousand men to Tehran, but the English reacted against Russian troops. It seemed that the situation would affect bilateral relations. Apparently, the main reason for fear of the English was Muslims sensationalism in the region. Against this sensitivity, the Russians announced that they would avoid doing actions that jeopardize the interests of the English and when both of the demands had fulfilled, they would return their forces (Kazemzadeh, p. 603). Great Britain was very frightened of the Russian government policy and suggested for Iran to accept the Russian ultimatum to prevent their advancing. In this time, new cabinet was formed, all its members agreed on apology to the Russians. Vosogh Al-Dawleh, Iran's Foreign Minister went to Russian embassy all dressed in official and he took the hand of Chief Minister of Russia and said, "Your Excellency! [Me] I am commanded by my government to apologize due to misbehavior to your agents in the lands of Shoa' Al-Saltaneh" (Afshar, 1990, p. 459). Then, the gendarme of the Treasury was taken from Shoa' Al-Saltaneh's park. Situation was so dire that even people who were outside the country had informed. Taghizadeh telegraph to a number of political figures and begged them to cope with the Russians to prevent a catastrophic failure. He wrote a telegraph to Soleiman Mirza, "I am very wondered about the decision of the parliament in the case of ultimatum; enmity and obstinacy in this position bring eternal damnation... the governmental and the parliament authorities should form a crisis committee like a whole body and beg the Russians' pardon." Conflict for power began between the parliament and the government. The parliament that knew itself as the representative of people protested that its power is not enough. Nevertheless, the government accepted the ultimatum; but when Iran's Foreign Minister apologized, Russian Ambassador replied that another ultimatum would be issued, and maybe it is on the way. Such an approach was unprecedented in the world. If the Russians were not sure about the English, they would never be so reckless (Navaei, vol. 3, p. 246).

Iranian authorities were trying hard in this crisis. Meeting Mirza Mahdi Khan, Iran's ambassador in London, said that the reason for delay in Iran's response was the crisis in the cabinet, which would be removed by formation of a new cabinet (Rezazadeh Malek, p. 511).

The main goal of the Russians was Schuster's dismissal; therefore, they did not attend to the positive reaction of Iran to the ultimatum. It was decided during a meeting that the Russians claim Schuster's dismissal and bear any pressure for this goal. The Russian government asked 150000 Manat as compensation for moving the troops.

The reports had strange reflections in Iran. Unstable government had dispute with the Parliament; other powers did not support Iran. Edward Grey reported to the Embassy of Great Britain in St. Petersburg, "We agree Russian and British embassies about Schuster and determination of future employees and the commitment of the government of Iran to recruit forces; but we disagree about asking compensation for moving the troops because we have damaged more in terms of trading affairs. As Russia decides to return Mohammad Ali Shah, the British government can not recognize him as former authority; even, the foreign Minister of Russia has been informed that England disagree to return Mohammad Ali Shah because he has not admirable and desirable traits. It is impossible for us to know him even if the Bakhtiari agree to return him (ibid, p. 530; Hedayat, p. 285).

By accepting the ultimatum, the government of Iran prevented the Russian government to achieve its goals; but Russia used a letter printed in the Times; the letter expressed how Schuster had violated the policy of Russia and uncovered Russian and British intrigues in Iran (Kazemzadeh, p. 606; Zoqi, p. 91).

The publication of this letter forced the Russian government to take action. Morgan Schuster wrote about it, "Ignorant ministers of Iran have not comprehended the truth of Russians political administration. Accepting the demands of the Russians was not their final desire. If the Russians were seeking only the glory and honor of their rebellious officers, the apology by Vosogh Al-Dawleh would put an end to it; but the Russians wanted to move their troops in the North of Iran; they began even before sending an agent" (Schuster, p. 210).







### Seyed Ghani Eftekhari and Keyvan Loloie

In November 28, 1911, the second Russian ultimatum was submitted to the Iranian government. The ultimatum let Iran 48 hours to meet the demands of Russia. The demands were:

- (1) The dismissal of Morgan Schuster and Lekofer from their service. The status of other American agents who were employed by Schuster would be determined latter.
- (2) The Iranian government pledged not to hire foreign advisors, except with the consent and prior consent of Russia and the United Kingdom.
- (3) Compensation to Russia, for costs related to the deployment of military force against Iran. Determining the compensation and its related costs would be determined after the response for Iran (Zoqi, p. 92; Kazemzadeh, 606; Schuster, pp. 212-3).

Russians added, "If the Iranian government does not accept the requests or says that they are not effective due to inconsistency with the Constitution, we have to move a group of our troops to Iran; we suggested for the regent to form a new government, dissolve the illegal parliament, and issue the order of selection. Then they should resign Schuster (Kazemzadeh, pp. 606).

Taghizadeh states, "Against the Russian ultimatum, some said that the British government would not let Russia to occupy Iran, it is a gaff. Hoping to accompany the the British government in preserving the independence of Iran and trust in this hope are neglecting of the political situation of the day, especially in foreign affairs, and unawareness of British policy since ten years ago. The story of British policy and Edward Grey, as shown in the Blue Book, is like the story of Mula Nasr Al-Din and the thief of his saddlebags; Mula shouted, "Oh! Thief bring the saddlebags back otherwise I know what to do! The thief afraid and sought to find what is Mulla's threat. He returned the saddlebags and asked mulla what he would done if he has not returned it, Mulla answered, "If you had not returned the saddlebags, I would make one from a haversack in my house. Now, every policy based on friendship and demand, which has not 'if not'pair is like this story. The British government says the Russian government that it is better not to return the deposed king, but British Foreign Ministry has no suggestion for the opposite case, or if Russia return the deposed king. Maybe, it would send a letter to Iran that now we are neutral; or it would say, now that Russians have done it, please, avoid struggles and accept it. Previously, the British government has ignored his official declaration on the case of employing Major Stocks fearing of the protests of "Vermia voice", a Russian newspaper (Afshar, vol. 9, p. 238). Fearing of the suspicion of Russia to support America, England had also telegraph to Petersburg and demanded the dismissal of Schuster (Rezazadeh, Malek, p. 506). It shows that the British policy was crisis in Iran; in addition, Russia moved to Iran by the knowledge of Britain. The best document in this regard is a telegraph to Foreign Minister of Great Britain, Mr. Auburn, from ambassador of Great Britain in St. Petersburg in November 14, 1911. The telegraph says, "You inform the Secretary of State that Russia will not transgress the interests of Britain in its goals (As Kent Benkderf has assured me). It means that the troops will be stopped in Tabriz and no soldier will be sent to Tehran unless for protection of Russian embassy" (ibid, 505). It is stated in another report from Edward Grey to Mr. Auburn, "I met Mr. Benkderf, he represented his concern about the possibility of Schuster's dominance over all affairs in Iran. It is not possible for the Russian government to allow a small government to dominate over Iran" (ibid, p. 491). Britain had already that the promise of Russian Embassy to act only in Russian Embassy in Tehran and did not transgress its political interests.

This represents how England acts to protect its interests. The play with Russians based on the provisions of 1907 Convention. All efforts of the English were to protect its relations to maintain its international interests. Then, they cooperated Americans to divide religious regions; they also adjusted their policies with the interests of governors and heads os states based on provincial interests to keep their share in Iran.



**Seyed Ghani Eftekhari and Keyvan Loloie**

Russia and Britain did not satisfy with America's influence and financial reforms in Iran. The British opposed to the presence of Schuster in Iran; vandalism and sabotage of the British ambassador, George Berkeley, in Tehran was one reason for Schuster 's failure (Sanjari, 1989, p. 20). However, Schuster was still optimistic to English. The English also aimed to challenge Russia in Iran and lessen their power in Iran.

In any case, England follows its own interest in Iran and it was successful. Sometimes, they defended the Russians and complained in private. In a time, they force Iran to accept an ultimatum. In another time, allow Russia to begin military actions. They may oppose to Tehran occupation by Russian and regarded it violation of 1907 convention, or they oppose to the employment of Stocks and considered it as imbalancing the relations with Russia. In fact, these games threatened the independency of Iran.

When Russia sent a severe ultimatum to Iran, they forced Iran to accept it. It shows that Britain had been coordinated with the Russia in this action; they had similar interests. England tried to follow its own interests and suggested for Russia to act moderately. When the Foreign Minister of Britain heard about the Russia attack on Tehran, advised them to act moderately because it may have a negative effect on Islamic world and stimulated Muslims. Therefore, Russia should occupy North customs of Iran and obtain the taxes in Tabriz rather than putting pressure on Schuster (Rezazadeh, p. 507). Beratov answered Russia that he did not intend to question the independency of Iran and the troops actions are trivial; he also did not aime to violate the agreement between Russia and Britain (ibid, 529).

After frustration and disappointment of English, the Iranian government resorted to America. Vosogh Al-Dawleh wrote a telegraph to Nabil al-Dawla and described critical situations in Iran. He said that they should accept either dismissal of Mr. Schuster or real and immediate destruction of the country. Vosogh Al-Dawleh wanted to know the idea of the Americans in this regard. Their answer was short and indifference. They answered, "Due to the inconvenience for the Iranians, America's Foreign Ministry prefers not to propose any offer for them" (Kazemzade Malek, p. 608-9).

The British allow the Americans to engage in religious activities and the Americans were committed to the principles of this agreement so that the American school did not show any reaction against the dismissal of Schuster while this school had published "Al-Adab" newspaper in the rise of Bolshevism to prevent tendency to Bolshevism (Tabatabaei, p. 246).

The silence and the cold reaction of Americans to the dismissal of Morgan Schuster showed people who there is an agreement between America and Britain to promote religion; they hade divided Persian Gulf area between their religious delegations. The Iranians and many liberals found that America and England are the same and England is the America inhabited this side of the Atlantic (ibid, p. 199).

**Reaction of Iran Government to the Russian Ultimatum**

The Russians needed a reason to occupy northern of Iran; then, they sent about twelve thousand troops into Iran. Abrahamian writes, "The Russians imposed their powers to satisfy their markets, implement the provisions of 1907 convention, and the abolition of Schuster's mission who had been appointed as President of the Treasury" (Abrahamian, 2000, p. 98). The Russians intended to occupy Tehran. They agreed on how to deal with Schuster and Yeprem Khan who was the head of police forces (Kazemzadeh, p. 618). The Iranian government consulted with the British Embassy and wanted their help, but the efforts failed. Edward Grey suggested for Iran to accept the ultimatum immediately. Iran accepted it and apologized; but it failed. Then, Iran called America for help, but America responded coldly. Iran did all its efforts, but they were disregarded. News of the ultimatum landed on Tehran as a bomb. A challenge rised between the parliament and the government because political groups like



**Seyed Ghani Eftekhari and Keyvan Loloie**

Democrats, moderates, developing moderation, and Dashnaction (the Armenians) believed in the resistance against ultimatum (ibid, 69).

Iran's government was weak and the Chief Minister of Russia tried to oust the gendarme forces from Shoa' Al-Saltaneh's park or force Iranian government to apologize officially from Russian officers. Iranian government took refuge in the Russian career partner, namely Britain. The situation in Iran was very chaotic; Mohammad Ali Shah and Salar Al-Dowleh had waited to return. Lorestan and Kermanshah protests, Mohammad Ali Shah in Damghan, Ala Al-Dawleh and his friends in Tehran waited for Mohammad Ali Shah to enter Iran. If he had entered Tehran, the situation would reach to a greater crisis. Crisis was growing and despair overcame people. The government was astonished. The intense pressure from the government to the parliament, the Russians advancing from Qazvin, and neutral behavior of Britain had complicated the situation. Some tried to prevent a war that would lead Iran to destruction and failure. The Cabinet was unstable and some ministers, including Interior Minister was going to quit. The regent was going to leave and go to Europe. Some went to Sardar As'ad, but they did not succeed (Hedayat, p. 287).

People threw away the goods of Russian and English in a negative campaign and angry; they refused to eat tea and brew mint instead. People used candles because oil had come from Russia. They consume berries instead sugar and did not accept notes in their trades (Abrahamian, p. 99; Raein, 2535, p. 375). Famous southern clerics of Iran ordered to uncleanliness of notes in Imperial bank because it belonged to Britain; they transferred the money to governmental coins (Schuster, p. 230).

Tehran school students gathered in Baharestan. About three hundred women went to the Parliament uncovering their veils while some had guns. They had impassioned speeches and threatened the representatives to death; they were ready for any type of sacrifice and influenced on the representatives (Abrahamian, p. 98; Safaei, p. 113). In the aftermath of the resistance against the Russian ultimatum, they shouted "death or independence" and called any political compromise "the logic of betrayal" (Katouzian, p. 99).

Morgan Schuster wrote, "After the announcement of the Russian ultimatum, Hossein Gholi Khan Navab and Monsieur Yefrem Khan met me and wanted my advice. I suggested for them to inform the parliament and the cabinet to make a proper decision for the country regardless of my situation and my American deputies" (Schuster, p. 222).

The National Assembly stood up against the ultimatum again and did not surrender to the pressure of the government. Despite the persistence of the parliament, individuals like Taghizadeh asked the government and the parliament not to resist. Taghizadeh telegraphed to Vosogh Al-Dawleh, the parliament, Mo'tamen Al-Molk, and Sardar Asa'd from Germany. In a letter to the parliament,

"I wonder how you dare to insist on your words in this narrow point and lead the country to overthrow. What is an apology and do not you know the history of other countries? Are not the parliament and the government aware of their responsibilities that lead the country to failure? Why are they sacrificing the country for their own interests and intentions?" (Afshar, p. 463). Because of the critical social, political and military situations and despite rejection of the ultimatum, the parliament could not make a good decision for the country to save the country. The representatives' speeches were mostly for relieving mental and emotional pain of the people to integrate the available forces and make a decisive decision. For example, haj Sheikh Mohammad Hossein Astar Abadi's speech in parliament represents the depth of the tragedy that was inflicted on Iran; he declared, "Perhaps God wants to eliminate our freedom by force, but we should not eliminate it with our hands". He uttered the sentence with a trembling voice; then, he stretched out his trembling hands to ask for help to the audiences who tears involuntary and returned to his place. (Navaei, vol. 3, p. 250). Russia's ultimatum caused some courtiers to think that they will return to court with





### Seyed Ghani Eftekhari and Keyvan Loloie

the return of Mohammad Ali Shah. Ala Al-Dawleh who was a supporter of Shah and loyal to the Russians tried much so as a confidential letter was delivered to Yefrem Khan by police forces; it could be a document for arresting Ala Al-Dawleh; but his opponents choose a more decisive way and shoot him when he was going out from his house. His murder is related to the fighters of Yefrem (Raeyn, p. 373). Moshir Al-Saltaneh, the accessory of Ala Al-Dawleh, and Khabaz Bashi- who has a role in the scarcity of bread- had also been assassinated. When Samsam Al-Saltaneh heard about the death of Ala Al-Dawleh, he cried and swore to kill his killers. He said, "I will kill twenty Democrats" (Schuster, p. 222). Assassination of Ala Al-Dawleh influenced the hesitant and compromising representatives and they rejected the request of Russia and allowed the government to make a conclusion by political talks. When the representatives voted, some people tears of joy (Kasravi, 1967, p. 240).

The Iranian government should investigate the proper case for the country, but there was still mistrust and lack of cooperation between nation and government (Katouzian, p. 98).

As mentioned, the government was in strange predicament. Cabinet was dissolved and Samsam Al-Saltaneh form a new cabinet; but fear and pessimism had overcome the authorities. Ministers were scared and the parliament rejected the government's proposal. Indeed, there was no hope. The regent, Naser Al-Molk, was informed of the parliament's response. He should resign or or reject the ultimatum based on the rule of the parliament. The Russians and the English pushed the government to accept the ultimatum; especially the English insisted much on this issue.

At that time, the state board called for a meeting. In this meeting, Vosogh Al-Dawleh declared, "We need two things in this situation that should be prepared by authorities: (1) the formation of a strong government in the center; (2) defining a program for foreign relations. These two are hand in hand" (Sharif kashi, vol. 3, o. 700). After the meeting, a delegation along with Vosogh Al-Dawleh went to the parliament. He spoke there and began his words by this poem:

"Dark night and fear of eddy wave so illusory,

How litters know our condition?"

After presentation of a report, he requested carte blanche from the parliament (Navaei, 1985). Then, it was decided that a committee of five Members of Parliament run the case. The cabinet believed in the acceptance of ultimatum, but the parliament was an obstacle. Hence, they asked the regent to dissolve the parliament. The regent agreed. A committee of 12 persons was formed to dissolve the parliament. Yeprem- the head of police forces- went to the parliament and accepted the ultimatum. Yeprem's mission was to arrest and exile the opponents of the ultimatum. In this regard, the life of second parliament was ended; parliamentary rule – that may people had injured and sacrificed their lives - was forgotten (ibid). Parliament was closed. Newspapers were also closed. The head of police forces in Rasht was executed. Opponents were massacred in Tabriz and Mashhad, Schuster was fired, and the Russians closed the National Assembly by fighters.

## CONCLUSION

There are many ideas about Schuster's failure including the selfishness and pride of Schuster and his colleagues, rogue against foreign and domestic authorities, lack of familiarity to diplomacy, radical actions, etc. Mokhber Al-Saltaneh believes that he failed because it was difficult for him to enter a three-dimensional policy of Iran as an American (Hedayat, p. 290). O'Conner, Britain Consul General in Shiraz and Sistan, wrote about the failure of Schuster, "Schuster's problems were not mainly due to the sabotage of Iranian ... but his basic assumption was refusing to accept particular rights of other powers while some countries regarded some rights for themselves in Iran. Russia and England had defined a sphere of influence for themselves by Anglo-Russian Convention of 1907. Schuster





### Seyed Ghani Eftekhari and Keyvan Loloie

believed that Iran should not be committed to this convention because it had been approved without his advice". Sir George Barkley who had implemented the sabotage policy of Sir Edward Grey confesses, "It so annoying to see that Schuster's administration is run by unqualified people ... I really loved this man".

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## Color in the Second School of Tabriz (Focusing on Shahnameh Tahmasebi)

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### ABSTRACT

Color and light are the main elements of Persian painting. These two are manifested as inner and outer entity of a single reality, which represents the grace of God in the universe. Considering the verses from the Quran that "Allah is the Light of the heavens and the earth", allegorical and mysterious aspects of light and color have always been considered by Islamic philosophers, sages and mystics. Effects of Islamic philosophy and mysticism on the views of Muslim artist to the art and artistic practice display specific effects of color and light in the Iranian painting for inner observation of color and light through the paintings. Considering the origins of color in ancient Iran and Islamic Iran, this work addresses the mysterious allegorical aspects and application of color in the masterpieces of the second school of Safavid Tabriz.

**Key words:** Color, the second school of Tabriz, Iranian painting, Shahnameh Tahmasebi.

### INTRODUCTION

In the early Safavid era, the favorable political, cultural and artistic conditions of Iran ruled by a single reign and support of artists by Shah Ismail as well as the incorporation of two artistic traditions of Herat and Tabriz provided an opportunity to form a new field of painting which was the pinnacle of evolution in Iranian painting called as Tabriz school. According to visual documents, Persian manuscript paintings, by the presence of bright colors and dramatically bright representations of night scenes, have always caused most researchers speak of a massive and pervasive light in most Iranian paintings. These paintings make the audience to ask about the origin and source of this light. Allah knows Himself as is the light of heaven and earth. Light and its compositions are noted 17 times in

9869





### Nasrollah Taslimi et al.

the Qur'an. In addition, the twenty-fourth chapter of the Qur'an is called 'Noor' (light). On a general approach to Islamic art, color is always addressed metaphysically; thus, human observes the duality of darkness and light as possibilities hidden in the eternal pattern. The world of colors is not free from conflict. The point is that the color itself originates from pure light, or in other words colorlessness. Light is the realm of absolute unit entity, "light of the heavens and the earth" where there is no individuality as it is difficult to recognize God due to its excessive brilliance. Imam Mohammad Ghazali said: "The difficulty [in recognition] of God is brightness; it is so bright that hearts cannot understand it; nothing is brighter than the sun, which appears everything. However, if you do not set in the night like the sun, or you become popular because of shadows, you do not understand that there is a light on the ground. They only saw the white and green and other colors, and they said there is no more; so, they knew the light is something but color and the light appears colors" (Ardalan & Bakhtiar, 2001).

#### The Concept of Color in the Perspective of Islamic Scholars

In ritual ideology, human being highlights the nature of objects and do not perceive the reality of the object through its external effects; instead, human tries to perceive the inner self. This is an inward-looking approach. Perhaps, one of the most important components of this approach is represented by the Prophet (pbuh) that 'reveal the nature of the objects and the reality of objects, not what is said in their face'. According to Najm al-Din Razi, colors are categorized in seven levels, each connected to a spiritual state. The first six levels including white, yellow, purple, green, blue and red lights represent the beauty, while the seven level which is represented by black light is the glory. This light, also called as the bright night, is the Allah's essence which, can be identified to the night because of its undifferentiated visual indeterminacy; as nothing can be recognized at night, there is no perception at this level of essence which is the exhaustion of phenomena.

#### Sacredness of Color in Ancient Iran

Vohu Manah is the god of wisdom in ancient Iranian thought. Intellect is a factor which discovers phenomena by its nature in the realm of human understanding. By wisdom or true knowledge, we put the dark curtain of existence aside and we come to light. By the similarity between the light and whiteness, we find that the white can be the color of Vohu Manah, the god of wisdom. Through ritual ideology, colors become sacred due to their relationship with the sacred realm. White becomes sacred due to its relation with wits and wits with Vohu Manah. Gold is sacred due to its relation to yellowness and yellowness to the sun. Phenomena like sun and Vohu Manah, whether gods of the heavens or immaterial gods, are worshiped by ancient humans. Any color related to these gods is sacred. Therefore, the realm of art which manifests this sacredness represents the presence of these sacred colors. Sometimes, the source of this sacredness is completely abstract (Bolkhari-Ghahi, 2009).

#### Colors in Iran after Islam: Painting

In Iranian painting, color embraces light and light is reflected from the color. In Iranian art, colors are used by knowledge of both symbolic concepts of color and effects of words which pass the spirit by combining or coordinating colors. Colors are the essential part of Persian art and one of the components which require full attention to their symbolic meaning to understand the inner meaning of Iranian art (Ardalan & Bakhtiar, 2001).

The pure resplendent colors of Persian paintings amaze man. The most notable distinction of Persian paintings and Chinese and Western masterpieces is the brightness of colors. Powders of gold and silver, lapis lazuli, emeralds and precious stones purify the body of Persian paintings, as they are a reflection of metaphysics. Because, color is the same light in the Persian painting and the artist tries to represent the luminous world of heavens by colors.





### Nasrollah Taslimi et al.

The dominant colors of Persian painting are green and blue along with red, yellow and alike which express the elegance, beauty, excitement and fascination of another world (Khoshnazar & Rajabi, 2009). In addition, the extraordinary purity and elegance and harmony of colors which reflect light distinguish Iranian painting and Hindi and Chinese painting. In Persian paintings inspired by the imagination, light colors come first, since the artist tend to manifest the aesthetic principle which is an evidence of God; this is not possible except by light colors. On the other hand, this is the human spirit which satisfies the inner need for light source by relying color (Tajvidi, 1996). In symbolic use of seven colors, white, black and brown are synonymous with fall and rise and expansion, respectively. White is the ultimate integration of all colors, pure light color and a symbol of unity. Black is self-secrecy, total covering of the Kaaba. Brown is the color of soil and the earth and a symbol of man. Red, yellow, green and blue are associated with fire, air, water and land, respectively, which are the four main elements of creation. The first two (red and yellow or fire and air) are active and two others (green and blue or water and land) are passive. Thus, blue symbolizes the infinite sky and gold is the symbol of the soul. This blue along with gold refers to mercy which tends to manifest itself. Color in the painting is beyond the noncompliance of the narrator reality of the world (Bolkhari-Ghahi, 2009).

In Seljukian paintings, the dominant color was madder lake. In this way, more than two-thirds of the background was painted by madder lake and images such as trees and birds were spread over the background in mauve, gold, olive green and purple colors. According to Lowry, colors used in Iranian painting at early seventh century AH have been limited to five colors: light blue, purple, vermilion, pale yellow, and a grayish heavy golden. The Ilkhanate art, under the influence of Chinese painting, mostly used gray and dark and light brown. In this period, cold colors are replaced by warm colors; intense colors are so balanced that the eye does not stay in one place and circulates to all colorful parts. In the period, artists became more skilled in preparation of purer colors by more luster colors. At late eighth century AH, a higher quality blue was prepared and Venetian Ceruse was more applied (Goudarzi, 2005). However, painting with bright colors revived since the Timurid period in Herat and Shiraz. The Persian tradition of coloring was still common in Fars, because it was not completely under influence of Ilkhans. Heratian color was under influence of Ilkhanid Shiraz. In this school, the painter tended to use warm colors. Moreover, colors shifted from naturalistic to imaginary style. Theyellow gold represented the radiation of pure world, and backgrounds were covered by azure sky as a symbol of heavens. In this period (Timurid), colors were used conceptually under influence of concepts like Sufism, mysticism. During this period, artists could develop a detailed plan and yet eye-catching subtle colors. In this school, accuracy and balance of colors reached to the degree of perfection. During ninth and tenth centuries AH, painters could reduce the contradiction and contrast of colors by reducing the painted area. During this period, various colors were used beautifully and proportionally in small geometric shapes, or parts divided on colorful backgrounds (Ibid: 212). Although the Timurid coloring and newly adopted methods apparently followed the same luxurious proportion, it described the real details of daily life. Works of this period contain the most decorated, royally colorful pictures representing the daily life of Iranian people (Johnson, 1989).

#### Color in the Second School of Tabriz

During the reign of Shah Tahmasp, the Turkmen and Herat painting styles were integrated, which led to the creation of paintings with amazing colors. Unique bright colors of paintings make a harmonious, diverse and brilliant festival of colors by their rational landscapes and harmonious compositions which represent the influence of Sufism during the reign of Shah Tahmasp. In the paintings, harmonious light colors provide a vibrant atmosphere. Tabriz painting builds a special system of beauty, in which the joyful glory of arrangement and abundance of extremely bright colors is common (Pakbaz, 2000). In Tabriz paintings, the bright diverse colors are applied on the whole picture, particularly for cloths of rulers. Colors are bright, replete, compelling, sensitive and peaceful. This school embodies the elements by elegance and beauty of colors. Harmoniously bright colors are another feature of this school. In the second school of Tabriz, all decorative elements are equally important. People, architectural decoration and natural landscapes are represented by intense brilliant colors to be joyful. In this school, colors are mysteriously free, intense, diverse, and







### Nasrollah Taslimi et al.

magnificent. Artists are more satisfied with cliffs and mountain landscape than with other motifs. Colors are used brilliantly and purely. These bright colors are associated with the powerful rhythm and complex composition of Turkmen painting. Works of Sultan Muhammad in Shahnameh of Shah Tahmasp are a combination of bright, joyful and vibrant colors of Turkmen school and complex structure of Herat school (Canby, 2003). Finally, the colors of Tabriz painting are different in Shah Ismail and Shah Tahmasp era. During the reign of Shah Ismail, colors are bright, joyful and vibrant, the sky is golden, background is rich and bright green and bushes are bright green and yellow, where the effect of Turkmen style is evident. During the reign of Shah Tahmasp, on the other hand, a variety of colors is used; the sky is often golden or azure and sometimes blue. Often, golden and blue colors are often reflected on the edge of the hills and the clouds are often blue with white edges.

#### Shahnameh of Shah Tahmasp

Shahnameh of Shah Tahmasp is one of the most precious Iranian manuscripts containing very beautiful paintings. This valuable manuscript was presented to the Ottoman court for enthronement of Sultan Selim II in mid tenth century AH (976 AH); but it was moved mysteriously from Istanbul to the collection of Baron Edmond Rothschild in 1903. Paintings of this manuscript are gloriously decorated. This manuscript contains sponge reefs in the form of human head, a carpet of flowers and plants throughout the land, meander streams, twisted clouds, singing birds. A number of artists use colors to express a particular concept. These paintings usually present heroes, kings or specific individuals by a certain garment in a special color. For example, Rostam's horse has a pink-orange spots, which is common in all paintings.

#### Keyumars's Court: People Are Wearing Leopard Skin



This painting was made by Sultan Muhammad. In this painting, Keyumars has a throne on top of the mountain. The king sits in the line of composition and Siamak sits at a lower level and higher than others do. In front of Siamak, Houshang, his son and the avenger of Black Daeva stands with respect. The sky is golden and decorated by clouds in the Chinese style. As the golden color leads to the divine world in Islamic-Iranian paintings, the golden sky here represents the divine and heavenly environment. The colors used for garments reduce uniformity. Particularly, the position of people induces a sense of flames. Moreover, this color along with purple and blue ties a special sanctity to the work. This painting contains many bright and joyful colors. The dominant colors are dark green, light purple, azure, orange, golden, and pinkish yellow. Different spectra of colors are applied. Trees blossom; blossoms are white, pink and orange which are glorious in the golden heaven. There is a small silver waterfall in the center, passing through the garden. Keyumars is wearing a brown leopard coat and a golden azure hat. Siamak is wearing a brown dress and a leopard garment. They are surrounded by courtiers with the pelisse-like clothes made of tiger skin or other animals. The overall atmosphere, as previously noted, is fantastic and supernatural.

#### Sadeh Festival



Riding in the mountains, Houshang sees a tall black animal and throws a stone to kill him; the stone hits another stone and a spark is made; in this way, fire is discovered. Houshang celebrates his discovery by setting up a party. Sadeh Festival is represented by Sultan Muhammad. This painting contains abundant and very bright and joyful colors. Dominant colors are golden, dark and light green, pinkish yellow and orange, red, light and dark violet and azure. Different spectra of colors are applied. Blossoms are white, blue, yellow, pink and red which are manifested beautifully in the azure sky night. Houshang is wearing





**Nasrollah Taslimi et al.**

an orange dress and a blue and gold garment. His diadem is also blue and golden on which there is a black and white fairy. He is sitting on a cream and brown carpet. Safavid Sufi leaders are often called Sheikh Alsajadeh. In the top, there is a black monster hidden in purple, orange, and yellow cliffs.

**Nightmare of Zahhak**



This work is painted by Mir Mosavar, one of the students of Behzad. The painting illustrates the moment Zahhak wakes up and the reaction of courtiers. Gold and silver are used for the painting. The dominant color is warm colors including yellow, azure blue, red, pink, dark and light green, brown and white. Courtiers are wearing fine clothing. Men have white turbans with a red mark on their heads. Two women can be seen on both sides of Zahhak. One of the women, possibly Arnavaz who is his wife, has a diadem on her head. He is wearing five layers of cloths: 1) light gray underwear, 2) dark blue shirt with a button collar, 3) green shirt with sleeves, 4) red cloak with golden ornaments and accessories, 5) white lace over his shoulders. In this work, Zahhak is old and anxious. There are two white snakes symmetrically on both sides of him. In this painting, the scene of the dark blue sky with a crescent moon between the two parts of the palace indicates an incident happened at night. All colors are so bright and clear, as if the story happened in the day, not in mid-night. Not

even locally, the light on the face of the guards holding the torch and bright colors of his dress from head to toe can be discarded.

**To enslave Zahhak on Mount Qaf**



Fereydoun enslaved Zahhak in a dark cave on Mount Damavand. This painting is a work of Mir Sayyid Ali. Much of this painting contains colored cliffs. In this painting, the dominant colors are yellow and gray. The ground, mountains and cliffs are in purple in contrast with the blue sky and green trees. The figures are dressed in beautiful colors in contrast to the rocks and the ground. Enslaved Zahhak is wearing a blue garment with red shawl and orange pants. His clothes are harmonious to the yellowish brown. The dress of people seen in all corners of the painting is colored by warm colors and the dominant colors are red, orange, yellow, azure blue and green. The colors of horses are in dark and light contrast. The clouds are elaborately curling with bright gray and purple lines. Colors used in this painting are red, blue, dark and light green, golden and silver, yellow, cream and light blue. The composition of the painting has an important role. White color is used on the head and forehead of horses, flowers, hats, clothing, clouds, as well as hair and beard of

Zahhak. Fereydoun is on top of the mountain on the right. He has a bull-headed mace in his hand. His shirt is green, light blue and orange. There are golden figures on his shirt. Green has its own meaning in both realms of mysticism and psychology. Green is the color of innocence, catharsis and purity. His shoes are yellow. Clothing, shields and harnesses are golden. There is a red mark on turbans.

**Rakhsh Defeats the Lion**



This painting is portrayed by Sultan Muhammad. Mixed plants and rocks, bright colors, powerful rhythms and complex compositions are all features of Turkmen painting. In this painting, naturalistic element is so dominant that the audience will not perceive the story at first glance if Sultan Mohammed did not present Rakhsh by red with pink-orange spots and green supplements around a golden-yellow lion. Live rocks in blue and light orange, red, yellow, orange and blue flowers and blossoms in different sizes, turbulent clouds in blue





**Nasrollah Taslimi et al.**

with white streaks are visible in the sky. Bushes and thick grasses cover the landscape by different greens. Rustam is lying on a colorful carpet with warm colors including red, orange, pink, yellow and blue.

**Ferdowsi Discusses Courtier Poets Sultan Mahmoud**



This painting is attributed to Aqa Mirek. It shows the scene where Ferdowsi meets Ghazni poets. To complain the cruel ruler of Tus, Ferdowsi travels to Ghazni and meets three courtier poets outside the city. This meeting leads to the composition of Shahnameh in the order of Sultan Mahmoud. The painting presents a green garden full of trees, bushes and flowers and blossoms in red, white, blue, pink, orange and yellow. Even trees are covered by white blossoms. Ferdowsi stands alone in front of Ghazni poet on the left. He is wearing a blue robe. A cedar tree separates him from other poets. Blue represents peace, happiness and inner journey. The mountains and the sky are light blue. Cloths are yellow, dark and light blue, white, orange, brown and azure. Both warm and cold colors are used equally.

**Ferdowsi Tests His Literary Taste against Sultan Muhammad of Ghazni**



This unique masterpiece is the work of Mir Mosavar. In this painting, Ferdowsi is reading Shahnameh and Sultan Mahmoud is watching him on the throne. In this painting, the colors are diverse, harmonious and balanced. In total, colors tend to be warm and bright. Red and cooked green are dominant in the painting. There is an interesting contrast between light and dark blue and green, and red and cooked green. The blue sky decorated with flowers, shrubs and plants is in conflict with its adjacent yellow sky. The building is manifested by orange and yellowish brown bricks and blue-green tiles. The blue-green pave is repeated in the exterior roof, which is a sign of balance and movement. The carpet covering the hall is greenish with dark blue decorations. The carpet has a purple border with golden, blue and orange ornaments. Sultan Mahmoud is dressed in red with a bright green vest. Bending his neck, Ferdowsi is dressed in turquoise blue with orange scarf tied to his waist. The color of clothing for women, children and guards and the other bodies are admirably consistent and balanced. White turbans and scarves contribute to the strength of the composition.

**As a Dragon, Fereydoun Tests His Children**



This painting is attributed to Aqa Mirak. In general, the dominant colors are orange yellow, light violet red and golden. The sky is golden in contrast with the ground colored in gray and violet. The white and pink blossoms glow at the golden sky. A silver river passes the right side of the painting. The dragon is dark gray, possibly covered by silver. Its wings and golden flames as well as its red tongue fill the left hand of the painting. Princes are depicted on horseback by contrasting colors including brown, white and gray in orange yellow, light orange, green, yellow, white, dark blue and red cloths. The two princes, probably Salm and Tur, are wearing Ghezelbash hats with a black mark on them. There is a black and white feather on their turbans. Iraj, wearing a golden and azure blue diadem, attacks the dragon. Horses are blue, green and orange decorated with golden streaks. Trees are dark and light green; flowers are red, white, pink and blue.





### Nasrollah Taslimi et al.

#### Barbad the Musician



This masterpiece is attributed to Mirza Ali. This painting shows Barbad playing among cypress. The scene is quite colorful and vibrant and colors are intensely glowing. Chinese-style gray clouds disturb the blue sky. Trees and cypresses are painted by dark emerald green. Almost all the background is green. In this painting, colors are neither warm nor cold; all the colors are bright and joyful in surprising harmony with each other. The dominance of green enhances the brightness of other colors. Bright purple surrounds the green cliffs. Barbad is wearing an orange robe and white turban. Accompanies of Khosrow Parviz are dressed with transparent colors.

#### Tahmores Defeats Daeva



The painting is attributed to Sultan Mohammed. This painting contains a unique variety of purple and pink for rocks, clothes and daeva. The dominant colors of bodies are red, purple and pink. The background is divided into two areas. The area in which Tahmores is fighting daeva is light blue with wavy margins of green, purple and light pink. The other area in which daeva is located is green. The flowers are white, red, blue and yellow. The figures are dressed in blue, red, purple and orange. There are black and red marks on white turban.

## CONCLUSION

Safavid Tabriz School witnessed the diversity, integrity and richness of color in the history of painting. In this school, color is highly pure and bright; in other words, colors embrace light and the light is reflected from the colors. By perusing the paintings of Tabriz school, it is evident that the colored lights are consistent with the feeling of seeing colored lights which were observed by mystics in their spiritual journey. The art of coloring was reborn in the works of artists such as Kamal al-Din Behzad, Sultan Muhammad and Mirek heravi. Red, brown and orange highlight the joy and beauty and gold and silver emphasize the artistic nature of paintings. The primary and secondary colors were not different for painters; they were not preferred over each other. The colors were used as pure as the colors driven from nature. Whenever the painter did not find his desired colors in the nature, he made them by combining other colors. The colors were put together in such a way that not only they added to brightness of each other, but also gave balance and harmony to the painting as a whole. The made colors were very light. The colors were not mixed together, but were put side by side. The colors had no certain extent, but their coordination, balance and diversity were interesting.

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## The Effect of Abusive Family Environment on Warm Communication and Family Satisfaction

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### ABSTRACT

This study aimed to investigate the family environment effect on warm communication and family satisfaction using structural equation modeling. The study populations weremarried female students of Azad University of Abharthat include the number of 353 people. 184 of them were selected randomly. They responded to the questionnaires of abusive family environment, warm relationships and family satisfaction. The study method was correlational stratified random sampling. To analyze the data, structural equation modeling was used. Structural equation modeling results indicated that the impact of warm communication trait is significant and negative on the abusive family. The impact of warm communication stateon family satisfaction is significant and positive. The impact of abusive family environment trait on family satisfaction is significant and negative. The effect of warm communication trait is significant and negative on the family satisfaction through abusive family environment. In total, warm communication has effect onabusive family environment, which in turn has effect on the family satisfaction.

**Key words:** abusive family environment, family satisfaction, warm communication state, warm communications trait.



**Sogand Heshmatipour and Alireza Jafari****INTRODUCTION**

The family as the oldest organization in human society is the most appropriate organization for physical and psychological needs of the members and the best breeding ground for efficient generation with religious and social values that underlying economic, legal and psychological security and human peace. Family has great impact on society and safe and effective society in the light of healthy and efficient families is possible (Minochin, 2000). The family is the cornerstone of every great human society and has a fundamental role in the strengthening of social relationships and the growth of each family member. The effort to establish the grounds for family relationship brings the moral health of family relationships and provides general well-being for the community (Sanaei, 2005). Family functioning should respond to the needs of various biological, psychological and social needs (Nazoktabar, 2004). Family is the first place in the social life and should be such that a person's spirit can bring balance and harmony. The warm atmosphere, spirit and developing family is a reliable bulwark for its members and spouses and children will try with more confidence. Insecurity and lack of satisfaction of the emotional needs may cause depression, severe anxiety, infidelity, increased crime and suicide in the society. The nature of family functioning, including parental relationship, children relationships and parents' relationship to each other can be facilitating or inhibiting in building confidence and independence in children and adolescents (Navabinejad, 2003). Therefore, because of the important functions of family, examination of factors affecting family satisfaction has the utmost importance in the study of relationships between family environment and warm communication trait and state have been investigated. An abusive family environment may have effect on the individual relationships with family members and friends and partner (Noller & Fitzpatrick, 1990). These relationships also affect the ability to express emotions (Planalp, 1998). Harassment generally refers to the result of damage to the thrill of a person by another person (Folkes, 1982 and Hesse et al., 2014). Interpersonal nature of the abuse, how to hurt, hurt severity, hurt frequencies, its effects on relationships, communication response to abuse are important areas for research about abuse as an emotional state (McLaren and Solomon, 2008). Feelings of persecution may be result of feelings such as blame, attack, defend, apology, crying and disturbance of the relationship (Vangelisti, 2001). Each of these reactions potentially causes significant changes in relation to the behavior of abused person and also abused and abusive relationships (Hesse et al., 2014). For a family environment classified as abusive, disturbing events should occur on a regular basis, and also should be a part of the family image by family members (Vangelisti et al., 2007). In the abusive family environment the hostile behaviors, such as aggression, lack of affection, aggression, hostility, neglect, teasing, criticism, indifference, rejection by parents, hatred, humiliation and loss of love for each other regularly occur (Mills & Piotrowski, 2009). Studies show that the abusive family environment affects family satisfaction and reduced family satisfaction (Vangelisti et al., 2007; Bachman & Guerrero, 2006; Hesse et al., 2014). On the other hand, the expression of love to others is considered as a fundamental need for humans (Maslow, 1968). Previous studies about the benefits of warm communication (kind) showed a positive relationship between loving and close family and also emotional stability in children (Davies, Cummings & Winter, 2004). In addition, warm relations has the countless biological, psychological and social benefits such as higher levels of self-esteem and relationship satisfaction (Floyd et al., 2005), emotional competence (Hesse and Floyd, 2008), mental health (Hesse and Floyd, 2008) and health (Floyd et al., 2008). Humans have an innate need to give and receive love (Floyd and Hesse, 2008). Therefore love is an adaptive behavior. Previous studies have shown the consequences of receiving and giving love. For example, the health benefits associated with cortisol, blood pressure, cholesterol and blood sugar has been thought to have relationships with loving communications (Floyd, Hesse and Pauley, 2009). In addition, they concluded that warm communication state and trait have relationship with personal and relationship issues (Hesse et al., 2014). Floyd et al (2005) reported that people who have experienced higher levels of warm communication trait (total amount of love by those who are around them) are happier, have higher self-esteem and satisfying relationships and also reduced fear of intimacy and preparation for depression. Expressed love in the form of state (warm communication state) (the love expressed in a specific time period, usually within 2-4 weeks) is associated with more satisfaction from relationships (Floyd et al., 2009). In general, studies show a positive relationship between both levels of state and trait of warm communication and healthy relationships (Hesse et al., 2014). Moreover Hesse et al (2014) in their research found that warm communication trait has effect on the family environment and thereby affects family satisfaction.





### Sogand Heshmatipour and Alireza Jafari

#### Conceptual model and research hypotheses

Figure 1 shows the research conceptual model. In this figure, the variable of warm relationship trait and state are considered as independent variables, abusive family environment is considered as mediator and family satisfaction is considered as dependent variables. So the research hypotheses are as follows:

- Warm family communication trait has effect on the abusive family environment.
- Warm family communication trait has effect on the family satisfaction.
- Warm family communication state has effect on the abusive family environment.
- Warm family communication state has effect on the family satisfaction.
- The abusive family environment has effect on the family satisfaction.
- The abusive family environment has mediator role between warm family communication trait and state.

#### METHODOLOGY

This study is descriptive research method (non-experimental) and correlational research design is structural equation modeling.

#### Population, sample and sampling method

The study population includes all married women in Azad university of Abhar that their number is 353 people. 184 students were selected as examples. In the present study, the sampling method is stratified random sampling. The population of married women includes 44 technical colleges, 60 persons nursing, agriculture and 249 persons are human sciences, which according to the population 23 married female students are from technical colleges, 31 are for nurses and agriculture and 130 female married students belonged to Faculty of Human Sciences were selected as the sample.

#### Measuring Tools

Warm Communications trait: the questionnaire developed by Floyd (2002) was used to measure warm communications trait. The questionnaire consists of 16 questions. Questions are based on seven-point Likert scale that are measured from strongly disagree (1) to strongly agree (7). Cronbach's alpha coefficient is calculated 0.92 for warm Communication trait. Communications warm state: the questionnaire developed by Floyd and Moorman (1998) was used to measure warm Communications state. The questionnaire consists of 19 questions. Questions are based on seven-point Likert scale that is measured from never (1) to always (7). Cronbach's alpha coefficient is calculated 0.85 for warm communications trait. Abusive family environment: the questionnaire developed by Vangelisti et al (2007) was used to measure abusive family environment. The questionnaire consists of 37 questions that measures the four aspects of aggression (20 items), lack of affection (10 items), neglect (4 items) and violence (3 items). Questions are based on seven-point Likert scale that are measured from strongly disagree (1) strongly agree (7). Cronbach's alpha coefficient for abusive family environment is calculated 0.91.

Family satisfaction the questionnaire of couple ideas of Houston, McGraw-Hill and Kreuter (1986) is used to measure family satisfaction. This measure is designed primarily for the satisfaction of couples in the study that changed so that instead of marriage, family relations participants express their feelings. The questionnaire consists of 8 questions. 7 questions from the questionnaire were designed so that participants graded on a scale bipolar their family relationships. Question 8 also provides a global assessment of family satisfaction. The rating of the question is scaled from completely dissatisfied to completely satisfied. Cronbach's alpha coefficient for family satisfaction was obtained





**Sogand Heshmatipour and Alireza Jafari**

0.87. Confirmatory factor analysis has been reported in Table 1 to assess the validity of the variables. As you can see, all the indices for the variables are desirable.

**Data analysis methods**

After calculation of descriptive statistics variables, structural equation modeling was used to examine the relationships between variables. To analyze the data, SPSS and LISREL softwares were used.

**RESULTS**

Pearson's correlation coefficient was used to identify the relationship between the variables. The findings of the correlation coefficient between the variables are listed in Table 3. Results of Table 2 show the correlation between warm communication trait and state with aggression, lack of affection, neglect and violence are negative and significant. Warm communications state-trait correlations were significant and positive with family satisfaction. The correlation coefficient of aggression, lack of affection, neglect and family violence satisfaction is significantly negative.

In Figure 2, the tested models for examination of the hypotheses with standard values listed on each of the paths are shown. The results of structural equation modelling showed that the rate of warm communication trait-state path coefficient on the abusive family environment is negative. Warm communication trait impact factor on family satisfaction is not significant but impact factor of warm communication state is positive and significant. Impact factor of abusive family environment on family satisfaction is negative and significant at 0.01.

In the study in addition to the direct effects of abusive family environment, its mediated role on warm communication state-trait and family satisfaction is examined. In Table 3, the values of direct, indirect and total variance explained by the variables have been reported in table

As can be seen in Table 4 warm Communications trait and state has indirect positive significant effect on family satisfaction. In addition, 44% of family satisfaction variance and 19% of the variance of abusive family environment are explained by the study model.

Fitting parameters obtained for the test model in Table 5 show that RMSEA index in estimated model has an acceptable level of 0.034 and other fitness indicators such as CFI, GFI, NFI, NNFI and AGFI are 0.99, 0.96, 0.99, 0.98 and 0.93, respectively, all are at an appropriate level, and the characteristics of fit data from this study showed that the factor structure of the model has a good fit.

**RESULTS AND DISCUSSION**

This study examined the abusive family environment on warm communication and satisfaction in family. Structural equation modeling results indicated that the model fit is good and 44% of family satisfaction and 19% of the variance of abusive family environment is described by the study model.

The results of structural equation modeling showed that the impact factor of warm communication trait on abusive family environment is significant and negative. This result is consistent with the results of Hesse et al. (2014) and Floyd et al. (2010). The results showed that the how much person considers himself kind and warm, to tell their loved ones to be careful, express their love to another, comfortable expressing emotions, to embrace their loved ones, have warm and emotional relationships with others, and feel that he/she is important for others has direct impact on



**Sogand Heshmatipour and Alireza Jafari**

abusive environment reduction. Floyd et al (2005) in line with the findings of the study suggest that people with higher levels of warm communication trait (total amount of love receives by those who are around them) are happier, have higher self-esteem and satisfying relationships. These characteristics, in turn, eliminate family environment abusiveness. In other words, when the family has a warm communication trait will cause the decrease in violence and aggression in the family and atmosphere full of affection and attention to each other within the family will be created in.

The results of structural equation modeling showed that the impact factor of warm communication trait on family satisfaction (0.11) is not significant. These findings are consistent with the results of Hesse et al. (2014). In explaining this finding, it may be said that warm communications trait may not directly affect family satisfaction. But as the results of this study showed it has impact via variables of reduced violence and aggression and increased attention to other emotions on satisfaction of family members.

The other results of structural equation also show that the impact factor of warm communication trait on abusive family environment is significant and negative. In explaining this finding it can be said that the family environment is a function of the communications between individuals in the family. When warm communication exists between family members, there is a feeling of intimacy and love more, as a result of abusiveness in family environment will reduce. Therefore, if the family members shake hands to one another, hug each other, give each other messages, sit side by side by each other, show interest, have affection and love to each other, help each other when problems arise, congratulate each other in appropriate ceremonies, share private information, praise from each other and congratulate and praise each other's success, the abusiveness significantly reduce in a family environment.

The results of structural equation modeling showed that the impact factor of warm communication state on family satisfaction is positive and significant. These findings are consistent with the results of Hesse et al. (2014). These findings indicate that the warm communication positively associated with commitment and satisfaction with family life. In explaining this finding, it may be said that warm communication is a useful aspect of communication in the family because of many advantages such as lowering the levels of stress mechanisms, low cholesterol, and improvement of family satisfaction (Butterfield et al. 2010). In line with these findings, Floyd (2002) showed that people with a high level of warm communications show high levels of happiness, social participation, mental health and social self-esteem that in turn lead to high levels of satisfaction with the relationship. Then warm communication is necessary for the satisfactory relations. In line with these findings, Moorman and Floyd (1999) suggest that family with warm communication have more satisfaction from their relationship compared to those who low warm communication. As a result, it increases the family satisfaction.

The results of structural equation modeling showed that the impact factor of abusive family environmental on family satisfaction is negative and significant. This finding is consistent with studies (Vangelisti et al., 2007; Bachman & Guerrero, 2006; Hesse et al., 2014). These findings indicate that aggression, violence, lack of emotion and ignoring each other will lead to a decrease in family satisfaction. In other words, if a family member humiliate each other, try to dominate each other, insult, criticize each other constantly, blame each other for negative events, compromise each other's emotions, be angry at each other, try to control each other, be inconsiderate to each other, be opposite to each other, lie to each other, blame each other, not like to gather around the same, do not pay attention to each other, cannot express their emotions, have less time for each other, ignore each other, be violence, and damage to each other, finally, the family satisfaction will decrease. Therefore, the sense of persecution may have responses such as blame, attack, defend, apology, crying and disturbance the relationship (Vangelisti, 2001), each of these reactions potentially cause significant changes in relationships and behavior for the abused person and also the relationship between abusive and abused person (Hesse et al., 2014) and this in turn leads to reduced family satisfaction. The results of structural equation modeling showed that warm communication trait and state have significant negative impact on family satisfaction through the abusive family environment. These findings indicate that the warm communications trait and state reduce violence and aggression and increased attention and affection within the





### Sogand Heshmatipour and Alireza Jafari

family and in this way increase family satisfaction. Therefore, abusive family environment has mediator role between warm communication trait - state and family satisfaction.

#### Practical suggestions

1. The results showed that warm communication trait and state has significant and negative impact on abusive family environment and therefore reduces violence, and aggression and increase affection and respect to each other. This finding attracted the attention of family counselors to teach warm family communication to their customers.
2. The results showed that abusive family environment has the mediator role on warm communication trait and state and family satisfaction. Therefore, it is necessary to design family therapy techniques to understand and reduce abusive relationships samples within so that warm communication increases in family.
3. The results of this study showed that abusive family environment will cause decrease in family satisfaction. Given these findings, family counselors should pay attention to aggressive behavior, neglecting and lack of affection that leads to abusive family environment. Therefore, it is recommended that the abusive family environment factors to be considered and used in order to strengthen their family satisfaction because the decline of abusiveness in a family environment provides a safe environment. If the conditions will be provided for the creation of a favorable environment for families, we could expect the improvement of the mental health level and satisfaction in person's life.

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**Sogand Heshmatipour and Alireza Jafari**

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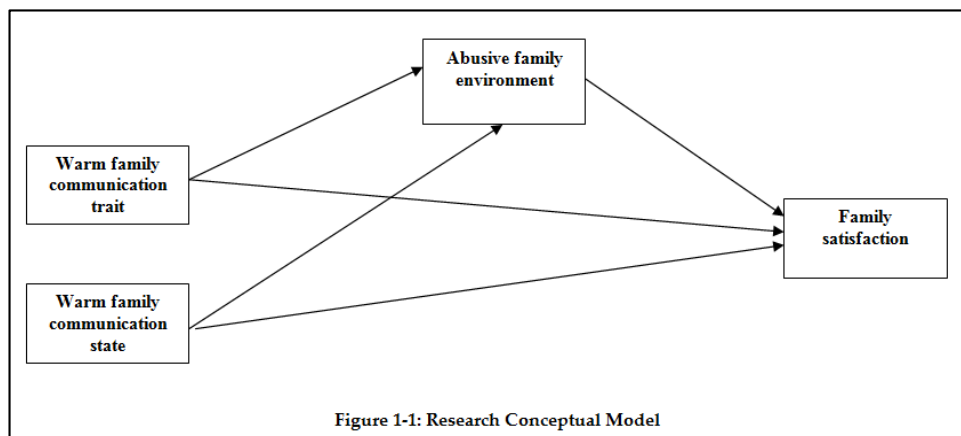


Figure 1-1: Research Conceptual Model





Sogand Heshmatipour and Alireza Jafari

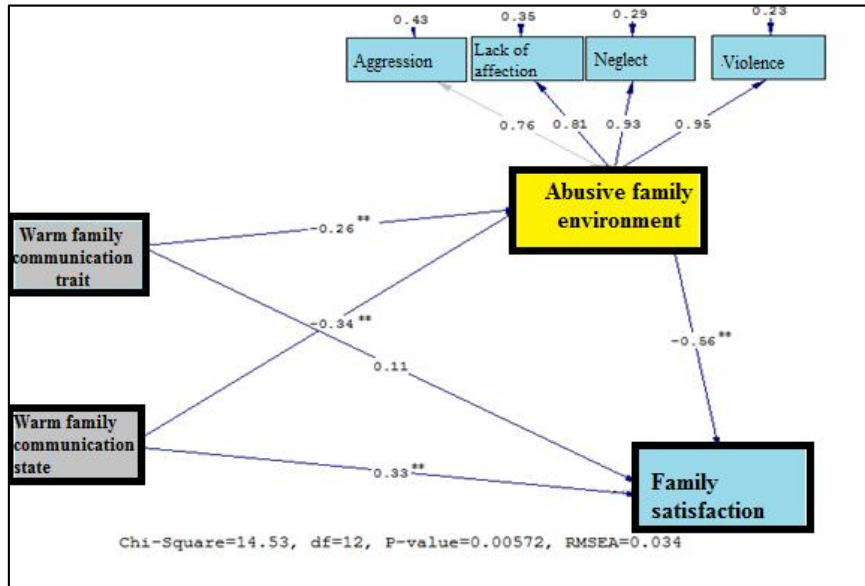


Figure 2: Research tested model

Table 1: Indicators of confirmatory factor analysis

Index	Warm communication trait	Warm communication state	Abusive family environment	Family satisfaction
$\chi^2/df$	1.74	1.56	2.22	1.47
RMSEA	0.063	0.055	0.081	0.05
GFI	0.96	0.94	0.93	0.98
AGFI	0.91	0.90	0.89	0.94
CFI	0.99	0.98	0.96	1
NFI	0.98	0.96	0.93	0.99

Table 2: Correlation matrix of research index

Variables	1	2	3	4	5	6	7
1. Warm communication trait	1						
2. Warm communication state	**0.45	1					
3. Aggression	** -0.28	** -0.34	1				
4. Lack of affection	* -0.17	* -0.14	** 0.34	1			
5. Neglect	** -0.27	** -0.28	** 0.32	** 0.24	1		
6. Violence	** -0.32	** -0.48	** 0.42	** 0.22	** 0.44	1	
7. Family satisfaction	** 0.22	** 0.40	** -0.32	** -0.64	** -0.48	** -0.40	1

\* p < 0.05 \*\* p < 0.01





**Sogand Heshmatipour and Alireza Jafari**

**Table 3: The tested model results**

Paths	Direct effect	Indirect effect	Total effect	Explained Variance
Family satisfaction From:				44%
Abusive family environment	** -0.56	-	** -0.56	
Warm communication trait	0.11	* 0.15	** 0.26	
Warm communication state	** 0.33	** 0.19	** 0.52	
Abusive family environment From				19%
Warm communication trait	** -0.26	-	** -0.26	
Warm communication state	** -0.34	-	** -0.34	

\*\* p < 0.01, \* p < 0.05

**Table 4: Features of fitness model**

x/df	RMSEA	CFI	GFI	NNFI	NFI	AGFI
1.21	0.034	0.99	0.96	0.98	0.99	0.93





## Evaluation of New Technologies in Electronic Banking using Technology Acceptance Model: Case Study on the Branches of Saderat Bank in Lorestan Province

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### ABSTRACT

Like many other organizations in Iran, banks seek to take advantage of new technologies to gain competitive advantage, reduce costs, and achieve their organizational goals. Therefore, it is critical to identify of the most important factors influencing the acceptance of new electronic banking technologies from the perspective of employees. This article investigates effective factors on the acceptance of new technologies in electronic banking at the Saderat Bank. The authorities can use the results of this study for better planning to pave the way for better adoption of new technologies of electronic banking by employees; this enhances the quality of service and bank's power in competition with other banks. This is a descriptive correlation and path analysis. Statistical population contains 550 staffs of Saderat Bank in Lorestan province; 266 samples have been selected using relative random sampling method. The research tools are questionnaires of attitude towards technology, perceived usefulness, and perceived ease-of-use. Data analysis has been conducted in both descriptive and inferential terms. In descriptive terms, data has been analyzed by indexes of frequency, mean and standard deviation; in inferential terms, path analysis by LISREL software has been used. Results of path analysis indicate that staffs' perceived usefulness, staffs' perceived ease-of-use, and staffs' attitude towards new electronic banking technologies have positive impacts on the rate of new technology acceptance. Fitness indexes of test show that fit indexes are at good level. Therefore, research results confirm research hypotheses.

**Key words:** attitude, mental conception, use of technology, technology acceptance



**Fatemeh Akbari and Mohammadtaghi Taghavifard****INTRODUCTION**

In recent years, application of new technologies in various fields of life has become a routine matter around the world. Notions like digital technologies, e-learning, e-government, e-commerce, and so on are known to most people. Although many of these cases have not been defined and localized in Iran, the Iranians have to eventually be familiar with the terms and use them; the role of domestic specialists, administrators and the authorities of centers and organizations can be very effective in connection between society and the evolution of technologies (Safari Mehr & Albadawi, 2008). Spacy et al (2004) show that customer acceptance is a key factor in the development of new technologies. Various models and methods have been used worldwide to evaluate the factors influencing the acceptance of new technologies; Technology Acceptance Model (TAM) is one of the most prestigious models. This model is based on perceived usefulness and perceived ease-of-use. These two factors influence on the attitude toward the use of technology, cause decision to use the technology, and finally, the operation is done. Increasing growth and development of communication technology has revolutionized all aspects of life and the performance of organizations. The technology has changed the function methods and attitudes of individuals, organizations and governments; it has created new industries, new jobs and creativity in tasks. The emergence of phenomena such as business and electronic banking is the main outcomes of development and influence of information technology in economy. Development and application of information technology in various fields, especially in the field of banking, are results of information technology capabilities, which has been welcomed in the world of business (Bagherzadeh, 2009). Although Iran has tried to increase banking services in recent years, it has a long path to walk in this area to reach advanced countries; there are many barriers in this regard including lack of appropriate infrastructure such as communication networks, cultural barriers related to the acceptance and use of electronic services, and problems related to management systems. The authorities can use the results of this study for better planning to pave the way for better adoption of new technologies of electronic banking by employees. This article aims to investigate application of new technologies in electronic banking.

**Theoretical Foundations**

Banks act as intermediaries between depositors and Borrowers; the distinctive feature of banks from other financial institutions is that banks offer services in relation to deposits and loans. The production resulting from deposit is the ability of bank to pay money on demands; therefore, banks' task is the management of liabilities. With the entry of private banks and various financial and credit institutions in Iranian banking, the industry was removed from the absolute monopoly of state-owned banks; of course, customers have more choices in the competitive environment of activities among banks and financial institutions. Proper marketing is one of the tools that can increase the income of banks. According to the well-known managers of large banks in the world, only 5% of customers constitute more than 85% of the Bank's profitability. The term 'electronic banking' is defined in two ways: first, providing banking services using the electronic system; second, banking electronic services. Electronic banking includes all electronic channels used by customers to access their accounts, transfer their money or pay bills. These channels are telephone, Internet, mobile and digital television (Karjaluo & Koivumaki, 2003). The advantages of electronic banking can be considered from the following aspects: (A) the advantages of electronic banking from the perspective of customers: (1) quick transactions, (2) ease of use, (3) precision and accuracy, (4) removal of restrictions. (B) Advantages of electronic banking from the perspective of banks: (1) competitive advantages, (2) customer retention and attraction, (3) increased revenue, (4) reduced cost. Management of mobilization and allocation of resources in the money market is called banking. Electronic banking is defined as tools, techniques and solutions for automating the processes of direct delivery of various traditional and new banking products and services to customers through two-way communication channels, (Sha'ban Pour et al., 2011). Technology Acceptance Model (TAM) was introduced by Davis et al in 1989. The model was investigated widely in North America; it is based in two main factors in technology acceptance, namely usefulness and ease of use (Safari Mehr & Albadawi, 2008). New technology refers to all information and communication technologies that make quick and secure sending and transmission of





**Fatemeh Akbari and Mohammadtaghi Taghavifard**

information and data in virtual communication network possible; it eliminates the geographical limitations of communication coverage to allow presentation of new electronic banking services and facilities and to compete with the leading banks in this type of banking. An attitude toward using technology is a person's fitness for favorable or unfavorable answer to technology, applications, IT service managers, or process to use the system or application (Melone, 1990). Perceived usefulness is a person's belief in the idea that using technology enhances his occupational performance (Davis, 1989).

**LITERATURE REVIEW**

Akbari and Ali pour (2013) investigated the use of information technology in small and medium enterprises in Tehran. Shoaie and Alavi (2007) studied factors affecting the acceptance of information technology by librarians in engineering schools of state universities in Tehran within the Technology Acceptance Model. Bagheri et al (2009) examined the acceptance of internet banking in Iran with the development of Technology Acceptance Model. They added two elements of perceived personal abilities and confidence in the Technology Acceptance Model by studying the most important suggested models in personal technology acceptance. Moradi et al (2011) checked factors affecting the acceptance of information technology by police forces. Their results showed that perceived usefulness, subjective norms, perceived ease-of-use, previous experience and self-efficacy are effective factors in the acceptance of information technology by police forces. Nasri, Lanouar and Allagui (2013) examined Technology Acceptance Model in Internet banking. Eaeen and Ozbag (2014) investigated the impact of organizational preparation on IT acceptance. The results indicated that organizational preparation has a positive and significant impact on perceived usefulness, perceived ease-of-use and intention to use. Santouridis and Kyritsi (2014) conducted a research about Internet banking determinants in Greece. Schipper and Vetzels (2007) studied Technology Acceptance Model. Through quantitative results, they used previous studies on the Technology Acceptance Model to find appropriate results about the role of individual norms and moderating effects. Johnson (2009) examined factors influencing acceptance of new managerial technologies in financial organizations.

**Conceptual Model and Research Hypotheses**

Figure 1 shows the research conceptual model. Perceived usefulness, perceived ease of use and attitude towards technology are regarded as independent variables and the acceptance of new electronic banking technologies is regarded as dependent variable.

**According to the model, the research hypotheses are:**

1. Staffs' perceived usefulness of new electronic banking technologies influences on the acceptance of these technologies.
2. Staffs' attitude towards new electronic banking technologies influences on the acceptance of these technologies.
3. Staffs' perceived ease of use of new electronic banking technologies influences on the acceptance of these technologies.

**METHODOLOGY**

This is a descriptive (non-experimental) correlation and path analysis research. It examines the relationships among variables in a causal model. Since the research attempts to investigate and develop practical knowledge in the field of assessing new technologies in electronic banking, it is a practical study. It also may be called a descriptive correlation of the structural equation modeling.





### Fatemeh Akbari and Mohammadtaghi Taghavifard

#### Statistical Population, Sample and Sampling

Statistical population contains all 550 staffs of Saderat Bank in Lorestan province. Considering the population size, Cochran formula has been used to determine the number of samples:

$$n = \frac{Nt^2s^2}{Nd^2 + t^2s^2}$$

Where:

t: the percentage of acceptable reliability standard error

d: degree of confidence or potential efficiency

s: the proportion of the population lacks certain traits

N: Number of samples

$$n = \frac{550 (1.96)^2 (0.5)^2}{550 (0.5)^2 + (1.96)^2 (0.5)^2} = 226$$

Therefore, 226 personnel of Saderat Bank in Lorestan have been selected as samples

#### Variables and Research Scope

Independent research variables are perceived usefulness, perceived ease of use and attitude towards technology and dependent variable is the acceptance of new electronic banking technologies. The research is conducted in the realm of banking management and information technology. The place of research is branches of Saderat Bank in Lorestan Province. This is a single sectional research about present status of the banks.

#### Data Collection Methods

The main data collection methods are library studies (articles and books have been used to gather information about theoretical foundations and research literature) and field studies (questionnaire has been used to gather information for analysis). Questions (items) of the questionnaire are categorized in two parts: (A) general questions to find general and demographic information about the respondents including gender, education and work experience. (B) Technical questions: it has 12 questions. The scoring of these instruments is performed based on the Likert scale.

#### Data Analysis Methods

Descriptive and inferential statistics have been used to analyze data. Percentage, mean and standard deviation are used in descriptive parts; Pearson correlation and path analysis tests are used in inferential statistics. Path analysis was first developed by Sewall Wright (1934). It is indeed a development of regression methods and the application of Multivariate regression in relation to the formulation of clear causal models. It aims to obtain quantitative estimations of the causal relationships between a set of variables (Hooman, 2008). SPSS and LISREL softwares have been used to analyze the research data. Confirmatory factor analysis is used to test data analysis and LISREL software is used for path analysis.



**Fatemeh Akbari and Mohammadtaghi Taghavifard****Demographic Characteristics of Statistical Sample**

Research findings indicate that 75% of the respondents are men and 25% are women. In terms of age, about 48% of the respondents from 30 to 35 years old, 21% from 36 to 40, 24% from 41 to 45, and 18% have more than 45 years old. In terms of education level, 2 percent of the samples are below Diploma, 43 percent have Diploma, 17 percent have Associate Degree, 3 percent have B.A. Degree, and 7 percent have M.A. Degree. In terms of job experience, 2 percent of the samples have 1 to 5 years experience, 49 percent of the samples have 6 to 10 years of experience, 6.6 percent of the samples have 11 to 15 years of experience, 14.2 percent of the samples have 16 to 20 years of experience, and 29 percent of the samples have more than 21 years of experience.

**Confirmatory Factor Analysis**

Confirmatory factor analysis method has been used to determine the reliability of attitude toward technology, perceived usefulness of technology, and its perceived ease of use. Table 1 shows load factors and explained variances for the research variables. As seen, questions 1 to 4 have significant load factor on variables of attitude toward technology, perceived usefulness of technology, and its perceived ease of use.

Table 2 represents the calculation of LISREL output for variables of attitude toward technology; in this table, Chi-square ratio to degrees of freedom is 0.975. Smaller amounts than 3 shows that the model is a good fit. In addition, the square root of estimated approximate error of variance should be less than 0.8; it is 0.000 in the estimated model. The amounts of GFI, IGFI, CFI, and NFI must be more than 0.09; all this indexes are higher than the defined amount. Therefore, research data is a good fit with the factor structure of this scale. This indicates the alignment of questions with the variable of attitude toward technology. As seen in terms of variable perceived usefulness of technology, both Chi-square ratio to degrees of freedom and the square root of estimated approximate error of variance s are at proper levels. Indexes of of GFI, IGFI, CFI, and NFI are also at good levels. Thus, research data for perceived usefulness of technology and its perceived ease of use are good fit with the factor structure of the scales.

**Descriptive Indicators of Research Variables**

Table 3 shows descriptive indicators of research variables including mean and standard deviation.

**Correlation Coefficients among Variables**

After determining the validity of measurement tools, the relationships among variables should be identified to begin path analysis. Pearson correlation coefficient has been used to identify the relationships among the variables in the model. The results of Pearson correlation coefficients are stated in Table 4. Findings show that perceived usefulness ( $r=0.59$ ), perceived ease of use ( $r=0.53$ ) and the attitude to technology ( $r=0.21$ ) have the highest correlation coefficients with technology acceptance.

**Testing Research Hypotheses**

**First hypothesis:** the impact factor of staffs' perceived usefulness of new electronic banking technologies on the acceptance of these technologies ( $\beta=0.36$ ) is significant and positive at the level of  $p<0.01$ . Thus, the first research hypothesis is confirmed and staffs' perceived usefulness of new electronic banking technologies has a positive impact on the acceptance of these technologies.



**Fatemeh Akbari and Mohammadtaghi Taghavifard**

**Second hypothesis:** the impact factor of staffs' perceived ease of use of new electronic banking technologies on the acceptance of these technologies ( $\beta=0.31$ ) is significant and positive at the level of  $p<0.01$ . Thus, the second research hypothesis is confirmed and staffs' perceived ease of use of new electronic banking technologies has a positive impact on the acceptance of these technologies.

**Third hypothesis:** the impact factor of staffs' attitude towards new electronic banking technologies on the acceptance of these technologies ( $\beta=0.15$ ) is significant and positive at the level of  $p<0.01$ . Thus, the third research hypothesis is confirmed and staffs' attitude towards new electronic banking technologies has a positive impact on the acceptance of these technologies.

**CONCLUSION**

Path analysis in relation to the first hypothesis showed that the impact factor of staffs' perceived usefulness of new electronic banking technologies on the acceptance of these technologies is significant and positive. This finding is in line with the results of Shoaiei and Alavi (2007), Darani and Rashidi (2007), Moradi et al (2011), Roze and Strab (1998), Johnson (2009), Taylor and Todd (1995), Theo (2009) and Sun and Zhang (2006). It can be said in explaining the results that staffs believe that using new electronic banking technologies increases their effectiveness, has a positive role in their job, increases their occupational efficiency, and enhances their occupational performance; thus, they will have a more positive attitude towards the use of new technologies, and accept them better. It explaining the impact of staffs' perceived usefulness of new electronic banking technologies on the acceptance of these technologies, one should argue that using technologies enhances staffs' work performance; then, they will have more efficiency by consuming less energy and they accept new technologies better. According to Technology Acceptance Model, staffs' perceived usefulness of technology is one of the most important variables that influence on the acceptance of technology. Davis (1989) believes that if technology enhances individuals' efficiency and performance, they will foster a positive attitude in this regard; consequently, its acceptance will increase.

Path analysis in relation to the second hypothesis showed that the impact factor of staffs' perceived ease of use of new electronic banking technologies on the acceptance of these technologies is significant and positive. This finding is consistent with the results of Shoaiei and Alavi (2007), Darani and Rashidi (2007), Moradi et al (2011), Roze and Strab (1998), Johnson (2009), Taylor and Todd (1995), Theo (2009) and Sun and Zhang (2006). This finding indicates that if staffs think that acquiring skills to use new electronic banking technologies is easy in their activities, to use new electronic banking technologies is easy for performing job duties, to learn using new electronic banking technologies is easy, and to feel that new electronic banking technologies has a useful role in their job, they will have a more positive attitude towards the use of new technologies, and accept them better. In addition, staffs' perceived ease of use of new electronic banking technologies enhances individuals' self-esteem and self-efficacy; this causes formation of positive attitude towards using new electronic banking technologies; consequently, it increase the acceptance of these technologies.

Path analysis in relation to the third hypothesis showed that the impact factor of staffs' attitude towards the use of new electronic banking technologies on the acceptance of these technologies is significant and positive. This finding is consistent with the results of Shoaiei and Alavi (2007), Darani and Rashidi (2007), Taylor and Todd (1995), Theo (2009) and Sun and Zhang (2006). In explaining this finding, it can be said that the staffs who like using new electronic banking technologies, consider using new electronic banking technologies entertaining, have tendency to use new electronic banking technologies, and know learning and working environment attractive due to the use of new electronic banking technologies, have more capability to accept new technologies. Taghavi (2001) asserts many studies have proved that creation and retention of positive attitudes towards new technologies are essential for progress and success in using these tools. Moreover, studies have shown that negative attitudes lead to one's distance from the new electronic banking technologies and failure to use them. Attitude towards new electronic banking



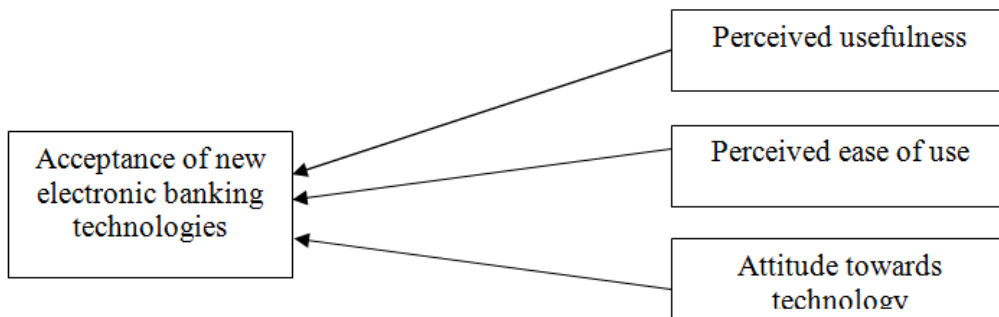


**Fatemeh Akbari and Mohammadtaghi Taghavifard**

technologies prepares one to respond to appurtenances of new electronic banking technologies favorably or unfavorably.

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**Figure 1: Conceptual model**

**Table 1: Load factor and explained variance of variables**

Variable	Load factor	Explained variance
Attitude toward technology	0.93	86%
	0.93	86%
	0.64	41%
	0.92	85%





**Fatemeh Akbari and Mohammadtaghi Taghavifard**

Perceived usefulness of technology	0.93	86%
	0.94	89%
	0.96	92%
	0.92	84%
Perceived ease of use	0.97	94%
	0.98	96%
	0.97	94%
	0.96	92%

**Table 2: Shows LISREL output for the variables. Fit index of variables**

Characteristics	Attitude toward technology	Perceived usefulness of technology	Perceived ease of use
( $\chi^2/df$ )	0.975	1.54	1.46
(RMSEA)	0.000	0.049	0.045
(GFI)	1	0.99	0.99
(AGFI)	0.98	0.97	0.97
(CFI)	1	1	1
(NFI)	1	1	0.99

**Table 3: Descriptive indicators of research variables**

Variables	Mean	Standard deviation
Attitude toward technology	12.07	1.67
Perceived usefulness of technology	15.35	4.01
Perceived ease of use	13.89	5.60

**Table 4: Correlation matrix of research variables**

No.	Variables	1	2	3
1	Attitude toward technology	1		
2	Perceived usefulness of technology	0.28**	1	
3	Perceived ease of use	0.22**	0.57**	1
4	Acceptance of technology	0.21**	0.59**	0.53**

\* p < 0.05 \*\* p < 0.01





## Comparison of Newtonian and Quantum Management Style in Samen Pharmaceutical Co.

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### ABSTRACT

This applied research aimed to compare the Newtonian and Quantum management style in Samen Pharmaceutical Co. in Iran. In this paper, the effect of independent variables, including Newtonian management style and Quantum management style, on the dependent variables of the job motivation, job satisfaction, organizational commitment and energy consumption- by machineries-, were studied. The first three variables are associated with effectiveness and the last one is associated with efficiency. Statistical community in present research is personnel of biotechnology department in Samen Pharmaceutical Co. including 28 people. The results of this study showed that applying of Quantum management style, has increased the productivity of the company, so that in Quantum management style, job satisfaction, job motivation and energy consumption, have increased. According to the analysis, hypothesis of increasing of organizational commitment in Quantum management style was not accepted.

**Key words:** Job satisfaction, job Motivation, Newtonian management, Organizational commitment, Quantum management

### INTRODUCTION

In 21<sup>st</sup> century interaction among the various disciplines is the focus of the attempts and discussions regarding the redefinition of the approaches that will be adopted in the scientific studies. As a result of those attempts and



**Hamid Faramarzi and Tooraj Sadeghi**

discussion, it is expected that the science of management develops defining itself continuously and using the finding of other disciplines (Ercetin et al., 2008). The leadership, within the context of Newtonian assumptions, has been evolving where this evolution is managed by certain and limited formulas and equations. But, leadership can exist without formula, it is independent. Shortly, the Quantum leadership is about processes, it is unknown and endless, not about to do and determine or results and techniques. It is all about to understand and discover leadership universe and potential, energy and eternity. Leadership is not a deterministic and controllable phenomenon. Any attempt to control and to correct indeterminacy will always be unsuccessful (Papatya, 2013). Current ideas about the environment dynamicity and biological organizations, led to the emergence of Quantum organizations. The leadership role in these changed organizations is holding the balance between tension and discipline (Aghababayi et al., 2013). Lexical meaning of Quantum is the amount of something and its meaning in mechanics is study of the movement, since Quantum mechanics means study of movement in particle of small atom. Certainly, the particle of small atom wouldn't be material ones but probably trend means that energy has potential or dynamic power, these particles are interchangeable in time and place/space in unknown and unpredictable method. Their unpredictable and apparently accidently behaviors are also the second law which is about action is adherent to contrast and similar reaction this doesn't mean that the movement of the small atom is completely accident, rather it means that it couldn't identify for then a definite reason, Traditional skills of management aren't enough in complex rapid changeable 21<sup>st</sup> century organization in today world (Razavi et al., 2013).

**Theoretical framework research**

Theoretical framework in this paper is based on quantum paradigm in management science.

The quantum paradigm holds that nothing is fixed, events are not predictable, control is an illusion, and change is continuous. Older management traditions focus on parts of a whole. Their central thesis is that systems tend toward order and stability (homeo-stasis), with disorder kept at bay by clearly defining boundaries and roles; change occurs through redefinition of boundaries and roles. Traditional leadership paradigms emphasize delimiting roles and controlling boundaries. Causality is linear; an organization's internal dynamic affects members, but only leaders are seen as affecting the internal dynamic. The quantum perspective, on the other hand, emphasizes free-flowing interaction and co-determination; members influence the internal dynamic as much as the internal dynamic influences members (Curtin, 2013).

**LITERATURE REVIEW**

Ercetin and Kamact (2008) have discussed four assumptions of the quantum physics in terms of their reflections on leadership. Similarly by following the main property of the quantum leadership, which considers leadership as unstructured and unpredictable, it is being discussed that the administrators should have the ability of handling organization chaos and dynamic feature of its environment. Finally it is being discussed that by delegating and sharing power, the leaders will give the others the opportunity to evaluate their performance (Ercetin et al., 2008).

Dargahi (2013), have determined the quantum skills, quantum leadership characteristics and functions of Tehran University of Medical Sciences hospitals' nursing administrators. A cross-sectional, descriptive and analytical study was conducted among 25 nursing administrators of Tehran University of Medical Sciences (TUMS) hospitals, Tehran, Iran. The research tool for data collection was a self-constructed questionnaire that measured the quantum skills, quantum leadership characteristics and functions of TUMS hospitals' nursing administrators. The validity of questionnaire was confirmed by 5 management science experts and its reliability was performed by using test-retest method yielded a Cronbach's alpha coefficient of 0.90. Data were collected and analyzed by SPSS software and t-test statistical methods. The results of this research showed that all respondents had desired quantum skills ( $75.71 \pm 5.98$ ), quantum leadership characteristics ( $82.01 \pm 6.77$ ), and quantum leadership functions ( $78.57 \pm 6.28$ ) and total quantum





**Hamid Faramarzi and Tooraj Sadeghi**

leadership ( $78.76 \pm 4.50$ ). Also, passing management training courses of the respondents was significantly correlated with their quantum leadership. Iranian healthcare organizations require quantum leadership that provides an important resource to advance Iranian nursing leadership to the organizational excellence (Dargahi, 2013).

Razavi, Hosseini and AzimiSanavi (2013), have reviewed and compared the usage of quantum-management skills, in the athletic director. Research method is descriptive. Statistical community is the staff of the Ministry of Sport and Youth Leaders and Managers Association of Sport. Accordingly, the numbers of 32 people, as the samples, were evaluated. Research tool in this paper is questionnaire. For data analysis, independent T-test was used. Also, the Friedman test was used to rank the variables. Research findings showed that between level of knowledge and applying quantum skills there is a significant positive correlation ( $p > 0.05$ ). Also, it was found that the highest rate of knowledge and applying is related to quantum acting, and the lowest rates is related to quantum trusting and quantum seeing (Razavi et al., 2013).

**RESEARCH OBJECTIVES****The main objective is as follows**

Comparison of productivity in Quantum management style and Newtonian management style.

Sub-objectives are:

- Comparison of the effect of Newtonian and Quantum management styles on job satisfaction.
- Comparison of the effect of Newtonian and Quantum management styles on job motivation.
- Comparison of the effect of Newtonian and Quantum management styles on organizational commitment.
- Comparison of the effect of Newtonian and Quantum management styles on energy consumption.

**MATERIALS AND METHODS****Statistical Community and the Sample of Research**

Statistical community in present research is personnel of biotechnology department in Samen Pharmaceutical Co. in Iran. Since the number of this community is small ( $n=28$ ), statistical sample is obtained by counting wholly, which in fact is equal to community ( $n=N$ ).

**Research Tools**

In this paper, for the first three objectives, three questionnaires were used including the Minnesota Satisfaction Questionnaire to measure job satisfaction, the Allen & Meyer Organizational Commitment Questionnaire to measure organizational commitment and the Hackman and Oldham Questionnaire for measuring job motivation variable. For the last objective, documents in organization were checked (observation).

**Reliability of the Questionnaires**

In this study, to assess the reliability of the questionnaires, Cronbach's alpha was used. Cronbach's alpha coefficient calculated by applying SPSS software was 0.71, 0.72, and 0.95 for job satisfaction questionnaire, organizational commitment questionnaire and job motivation questionnaire, respectively. Note that reliability of 0.7 or higher is considered "acceptable" in most social science research.





**Hamid Faramarzi and Tooraj Sadeghi**

### **Validity of the Questionnaires**

Since all three questionnaires are standard, then it can be concluded that the questionnaires have good reliability.

### **Analyzing Method in Statistical Data**

In this paper, SPSS version 18 was used for data analysis. To analyze the first three hypotheses, a paired sample was used. Paired samples are used to compare two population means in the case of two samples that are correlated. Paired sample t-test is used in "before-after" studies.

At first, in this statistical community, one personnel was responsible for one machine (Newtonian management style). The manager decided to make multi skilled personnel (Quantum management style) for reduction the length of production process. at the beginning, the questionnaires were distributed in Newtonian management style situation, and then after changing structure to Quantum management style and matching personnel to this situation, the questionnaires was distributed after about 8 months again.

## **RESULTS AND DISCUSION**

### **Research Hypotheses**

#### **The main hypothesis is as follow**

Applying of Quantum management style instead of Newtonian management style makes to increase the productivity of the organization.

#### **Sub-hypotheses are**

Job satisfaction in Quantum management style is more than Newtonian management style.  
Job motivation in Quantum management style is more than Newtonian management style.  
Organizational commitment in Quantum management style is more than Newtonian management style.  
Energy consumption in Quantum management is less than Newtonian management style.

#### **The First Sub-Hypothesis Analysis**

According to Statistical hypothesis test, we considered the null-hypothesis as the following:

$$H_0: \mu_1 = \mu_2 (1)$$

#### **Hence alternative hypothesis is defined as follows**

$$H_1: \mu_1 \neq \mu_2 (2)$$

Where  $\mu_1$  is the mean job satisfaction in Quantum management style and  $\mu_2$  is the mean job satisfaction in Newtonian management style.

The results of the analysis in SPSS are provided in tables (1) and (2).





### Hamid Faramarzi and Tooraj Sadeghi

According to table (1), the mean job satisfaction in Quantum management style (3.92) is more than the mean job satisfaction in Newtonian management style (2.83). As it can be seen in table (2), P. Value in this test is too small (0.000) and is zero for at least three decimal places. Hence, null hypothesis was rejected at 1% significant level (and consequently at 5% significant level) and the alternative hypothesis is accepted.

However, given that the upper and lower bounds of a 95% confidence interval for the difference between the two averages are both positive, it can be concluded that:

$$\mu_1 - \mu_2 > 0 \text{ thus } \mu_1 > \mu_2 \quad (3)$$

Hence, the mean job satisfaction in Quantum management style is significantly more than the mean job satisfaction in Newtonian management style.

#### The Second Sub-Hypothesis Analysis

The same method used in the first hypothesis, we have:

$$H_0: \mu_1 = \mu_2 \quad (4)$$

$$H_1: \mu_1 \neq \mu_2 \quad (5)$$

Where  $\mu_1$  is the mean job motivation in Quantum management style and  $\mu_2$  is the mean job motivation in Newtonian management style.

The results of the analysis in SPSS are provided in tables (3) and (4).

#### Similar to previous argument the result of this analyze is

The mean job motivation in Quantum management style is significantly more than the mean job motivation in Newtonian management style.

#### The Third Sub-Hypothesis Analysis

$$H_0: \mu_1 = \mu_2 \quad (6)$$

$$H_1: \mu_1 \neq \mu_2 \quad (7)$$

Where  $\mu_1$  is the mean organizational commitment in Quantum management style and  $\mu_2$  is the mean organizational commitment in Newtonian management style.

The results of the analysis in SPSS are provided in tables (5) and (6).

As it can be seen in table (6), P. Value in this test is 0.026. This value is more than 0.01. Therefore, null hypothesis was accepted at 1% significant level. **But 0.026 is less than 0.05 hence**, null hypothesis was rejected at 5% significant level and the alternative hypothesis is accepted.





### Hamid Faramarzi and Tooraj Sadeghi

However, given that the upper and lower bounds of a 95% confidence interval for the difference between the two averages are both negative, it can be concluded that:

$$\mu_1 - \mu_2 < 0 \text{ thus } \mu_1 < \mu_2 \quad (8)$$

Then, at the both level of 1% and 5% the hypothesis of  $\mu_1 > \mu_2$  was rejected. Therefore:

No significant relationship was observed between management style and organizational commitment variable.

#### The Fourth Sub-Hypothesis Analysis

As noted above, at first, each employee was responsible for one section of the production process. The duration of the production process in this situation lasted 12 hours in average. By using the process of education, Individual skills at least in two sections, increased so that to be able by replacing people, dead times in the production process to be reduced. With this method, duration of the production process lasted 9 hours in average, it means 3 hours reduction in production process. Therefore, energy consumption was reduced about 30%.

## CONCLUSION

With all that has been said, it is important to understand that leaders should not fall into the trap of thinking that the Quantum paradigm will replace the venerable and well proven Newtonian paradigm. Instead they need to appreciate that each philosophy explains different aspects of life in organizations, and not only would they be wise to become adept at accommodating both points of view, but their success absolutely depends on it! The Newtonian metaphor lends itself to situations that are predictable and subject to control by managers. The Quantum paradigm, on the other hand, is useful for understanding unfamiliar events in complex living systems that are in turbulent environments (Curtin, 2011).

In this paper, there were 4 dependent variable which job satisfaction, job motivation and organization commitment were indicator of effectiveness and energy consumption was an indicator of efficiency. The results of the research showed that job satisfaction, job motivation and energy consumption have better conditions in Quantum management style. As you know:

Effectiveness + Efficiency = Productivity

Hence, it can be concluded that applying of Quantum management style makes to increase productivity of organization compared with Newtonian management style.

#### Suggestion for next researches

Since most of researches on Quantum management has done theoretically and have been described the characteristics of this management style, the following suggestions for next researches are offered:

Comparing other variables such as creativity, innovation, organizational communication and organizational culture on the Newtonian and Quantum management styles.

Identifying competitor organizations in different fields, and studying their management styles in order to determine better management style in that particular field.



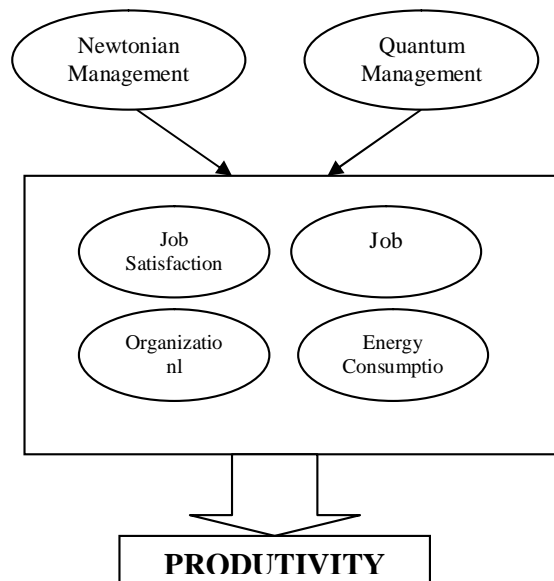


**Hamid Faramarzi and Tooraj Sadeghi**

Since this paper compared the two management styles of the employees 'viewpoint, therefore, the two management styles can be compared of the managers 'viewpoint as well.

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**Figure 1: Conceptual Research Model**

**Table1. Paired Samples Statistics table for job satisfaction**

Std. Error Mean	Std. Deviation	N	Mean	Management Style
0.135292	0.589724	19	3.924812	Quantum
0.238412	1.039212	19	2.834586	Newtonian

N = Number of questions in questionnaire





**Hamid Faramarzi and Tooraj Sadeghi**

**Table2. Paired sample T-Test for job satisfaction**

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Newtonian & Quantum	1.0902	.92363	.21189	.6451	1.5354	5.145	18	.000

**Table3. Paired Samples Statistics table for job motivation**

Std. Error Mean	Std. Deviation	N	Mean	Management Style
0.360721302	1.397067594	15	5.561904762	Quantum
0.261068548	1.011114137	15	4.047619048	Newtonian

N = Number of questions in questionnaire

**Table4. Paired sample T-Test for job motivation**

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Newtonian & Quantum	1.5143	.89018	.22984	1.0213	2.0073	6.588	14	.000

**Table5. Paired Samples Statistics table for organization management**

Std. Error Mean	Std. Deviation	N	Mean	Management Style
0.258101	1.264432	24	4.130952	Quantum
0.291476	1.427937	24	4.363095	Newtonian

N = Number of questions in questionnaire





**Hamid Faramarzi and Tooraj Sadeghi**

**Table6. Paired sample T-Test for organizational commitment**

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Newtonian & Quantum	-.2321	.47811	.09759	-.4340	-.0303	-2.379	23	.026





## Comparison of Physical Parameters of Fatty Acids Ethyl Ester and Diesel Fuels

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### ABSTRACT

Vegetable oil derived fuels for diesel engines are becoming important as alternative to petroleum diesel fuels due to their environmental friendliness and availability. In this research, the Fatty Acids Ethyl Ester fuel is produced with the trans-esterification method by using ethanol and sodium hydroxide as catalyst from seven types of vegetable oils (sunflower, soybeans, canola, olive, corn, grape seed and rice bran). In order to examine the possibility of replacing Fatty Acids Ethyl Ester with diesel fuel, physical parameters of fuels were investigated. In this research, Cetane number, heating value, cloud point, density, viscosity and flash point properties of Fatty Acid Ethyl Esters measured and compared with current diesel fuel of Iran. These parameters were measured based on ASTM D445, ASTM D4052, ASTM D93, ASTM D240, ASTM D97 and DIN 51773 standards. The results showed that cetane number of Fatty Acid Ethyl Esters are suitable in the range of (41- 49) and Cetane number of diesel fuel was measured 57. The flash point parameter of Fatty Acid Ethyl Esters is very high, so that the flash point of diesel fuel is 92 and flash point of Fatty Acid Ethyl Esters fuels is in the range of (154 to 167.8) but the parameters of density, viscosity, cloud point, and heating value have less difference.

**Key words:** Fatty Acids Ethyl Ester, physical parameters, diesel fuels





**Saleh Mohammadi et al.**

## INTRODUCTION

The prospect of a decline in crude oil as the main source of energy, especially in transportation, and environmental threats has led to extensive research done in the field of renewable energy sources. These Researches were undertaken on improving the engine and its systems for the betterment of the parameters of energy, economy and environment. So now the main factor in determining the success of modern internal combustion engines is its lowest impact on the environment, the lowest emissions of exhaust gases, and less consumption of fuel (Zajac, Węgrzyn, 2008).

The usage of plant oils as fuels to replace fossil fuels in diesel engines is one of the important research areas in order to achieve these objectives (Ajav et al., 2000). Renewable fuels produced from vegetable oils are cheap and environmentally safe and have a good performance in diesel engines (Badr, 1998).

Biodiesel fuel is type of plant fuels that have properties similar to diesel fuel with the difference that biodiesel does not have unpleasant substances such as sulfur, nitrogen and polycyclic aromatics. Generally biodiesel is methyl ester or ethyl ester that fatty acids are formed and have several alkyl groups with 15 hydrocarbon-chains. This fuel can be used with no change in boilers, machinery and thermal combustion engines instead of diesel fuel (Ghobadian, Rahimi, 2004). Esters of fatty acids are generally obtained during the process of trans-esterification. Trans-esterification is a process of exchanging glycerol group with the alcohol group that commonly used alcohols are methanol and ethanol (Hanna, 1999; Srivastava, 2000). Biodiesel manufactured by means of the Trans esterification method exhibits improved fuel properties as compared to its corresponding oil. Biodiesel shows improved volatility characteristics approaching those of petroleum diesel fuel (Souza et al., 2007). Methanol in industrial quantities is a byproduct of organic synthesis while the ethanol is derived from renewable resources and is more environmentally friendly (Graboski, 1998). Physical properties of biodiesel fuels have an important role in the process of combustion. It is necessary to inject the fuel into cylinder for preparing the combustion. Fuel should be sprayed as a fine mist then fuel vaporizes and vapor mixes with air of cylinder. All these processes depend on the physical properties of the fuel such; cetane number, density, viscosity, flash point, cloud point and heating value (Abbasi fakhr et al., 2010; Ambrozik et al., 2005; Bamgboye and Bamgboye, 2008).

## MATERIALS AND METHODS

In this research, the biodiesel fuel is produced with the trans-esterification method by using ethanol and sodium hydroxide as catalyst from seven types of vegetable oils (sunflower, soybeans, canola, olive, corn, grape seed and rice bran). Specific molar ratio of alcohol to oil (6 to 1) under certain temperature (70 ° C) and a certain specific weight of sodium hydroxide catalyst ratio (1% weight of oil) was considered in accordance with optimum conditions for producing biodiesel fuel intensity mixer (600 rpm). In this case, the fatty acids chain will be converted to impure fatty acid ethyl esters. But due to use of sodium hydroxide catalyst, PH of fuel got in the bases range that Chloride acid was used to neutralize it. Considering the fact that alcohol is evaporated and glycerin is solved in the water, in order to remove the existing glycerin and alcohol in fuel, water leaching process is performed by using distilled water in three stages. In this position the fuel is made pure (Garnica et al., 2009; Meher et al., 2006; Vyas et al., 2010). Thermo properties were measured according to DIN and ASTM standards. Parameters such as viscosity, density, flash point, cetane number, heating value, and the cloud point were determined for biodiesel fuel samples. Viscosity of biodiesel fuel compared to diesel fuel, 15-18 cc of fuel tested in triplicates at temperatures of 30 to 70 centigrade. The Brookfield viscometer model of DV-II Prime, with adapter of UAL, was used as ASTM D445 standard. It is shown in Figure (2-6). The density of fuels was tested by digital system DA-130N model according to ASTM D4052 standard, at 25 centigrade. The method of open cup according to ASTM D93 standard was used to measure flash point of fuels. In this study, the CFR cetane number meter engine was used with the DIN 51773 standard to determine the cetane number. Tests for seven different types of biodiesel fuel were performed in the three replicates at ambient conditions.





**Saleh Mohammadi *et al.***

The colorimeter bomb Model Parr, according to ASTM D240, was used for measuring the heating value of the fuel. Cloud point was determined for the samples according to D2500 and ASTM D97 standard.

## RESULTS AND ANALYSES

Results of experiments from CFR engine are shown in Table 1. These results are the average of three replicates data obtained from the engine. Table (1) shows that cetane number of diesel fuel is more than the whole samples of biodiesel fuels. In the samples of biodiesel fuel, biodiesel produced from olive oil has the highest cetane number and soybean oil has minimum value.

The density of biodiesel and diesel fuels was measured at temperatures of 15/5, 20, 25, 30, 40, 50 and 55°C in kilograms per cubic meter. The data in Table (2) shows the density at different temperatures. The results showed that in the same temperature and volume, the mass of biodiesel fuels is more than diesel fuels.

The results of the viscosity of seven types of biodiesel fuels consist of soybean, rapeseed, sunflower, rice bran, grape seed, olive, corn and diesel fuel are shown (Table 3). In all samples viscosity decreased with increasing temperature, and also viscosity of biodiesel fuels is higher than diesel fuels. Viscosity of corn Biodiesel is lower than other Biodiesel fuels.

Heating value, flash point and cloud point were measured three times in the same experimental conditions. Average data of heating value, cloud point and flash point are shown at Table 4.

The results indicate that biodiesel fuels have higher cloud point and flash point value than diesel fuel but heating value of diesel fuel is more than biodiesel fuels. Heating value of Biodiesel fuel is in the range of (38 to 40.08) is while the diesel fuel heating value is 44.77. The flash point of diesel fuel is 92 degrees centigrade.

## CONCLUSION

In this research, experiments were conducted for the ethyl esters of fatty acids and diesel fuel. Tests revealed the following:

Cetane number of biodiesel fuels was appropriate at intervals of 41.2 to 49.35 and Cetane number of diesel fuel was measured 57.125. the comparison of viscosity and density of biodiesel fuels with diesel fuel at constant temperature showed that these parameters of biodiesel fuels is higher than diesel fuel But if we can keep the temperature of biodiesel fuel in high range, the difference between these parameters will decrease.

The difference in heating value and point cloud of fuel samples are small, but the flash point of biodiesel is very high, so that the flash point of diesel fuel is 92 and flash point of biodiesel fuels is in the range of (154 to 167.8).

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**Saleh Mohammadi et al.**

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**Table 1 - CN measured**

fuels	CN measured
Gas oil	57/125
Soybean biodiesel	41/2
Canola biodiesel	41/25
Sunflower biodiesel	45/75
Race bran biodiesel	44/25
Grape seed biodiesel	48/1
Olive biodiesel	49/35
Corn biodiesel	46/38





**Saleh Mohammadi et al.**

**Table 2 - Density of biodiesel fuels at different temperatures.**

Fuels	Temperature (°C)						
	15.5	20	25	30	40	50	55
Gas oil	0.836	0.835	0.832	0.825	0.818	0.813	0.813
Soybean biodiesel	0.895	0.894	0.891	0.888	0.876	0.863	0.859
Canola biodiesel	0.889	0.888	0.886	0.879	0.872	0.861	0.859
Sunflower biodiesel	0.893	0.892	0.887	0.878	0.872	0.864	0.860
Race bran biodiesel	0.885	0.884	0.881	0.872	0.863	0.858	0.856
Olive biodiesel	0.880	0.879	0.877	0.872	0.864	0.852	0.850
Grape seed biodiesel	0.893	0.892	0.891	0.875	0.866	0.854	0.852
Corn biodiesel	0.883	0.882	0.881	0.873	0.865	0.854	0.852

**Table 3 - Results of the viscosity of Biodiesel fuels according to (cst) at different temperatures**

Fuels	Temperature (°C)							
	30	35	40	45	50	55	60	65
Sunflower biodiesel	13.1	11.6	9.6	8.89	7.85	7.05	4.82	3.3
Soybean biodiesel	10.9	9.69	7.8	7.35	6.49	7.75	3.47	2.93
Corn biodiesel	6.56	5.82	4.98	4.76	4.34	2.86	2.37	1.82
Canola biodiesel	9.81	8.52	7.33	6.83	6.12	5.51	3.23	2.46
Olive biodiesel	15.5	13.3	11.2	10	8.87	7.29	4.84	3.25
Grape seed biodiesel	19.3	16.6	13.7	12.3	10.5	8.41	6.02	5.63
Race bran biodiesel	9.1	7.35	5.86	4.9	4.13	3.53	3.08	2.36
Gas oil	3.48	2.80	2.53	2.09	1.59	1.13	0.72	0.56

**Table 4 - Data of heating value, cloud point and flash point of the tested fuel samples**

Fuels	Flash point	Cloud point	Heating value
Gas oil	92	-2	44.77
Soybean biodiesel	164	-5.5	38.09
Canola biodiesel	162.5	-11	35.49
Sunflower biodiesel	167.8	-8	39.64
Race bran biodiesel	154	-7.5	39.5
Grape seed biodiesel	154.5	-5	40.01
Olive biodiesel	160.5	-4	40.08
Corn biodiesel	157	-6	38





## Investigating the Relationship of Financial Leverage and Debt Maturity Structure

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### ABSTRACT

Many studies have dealt with the issue of factors affecting firm's financing, but studies about debt maturity structure are rare and insufficient. A number of studies have dealt with this issue indirectly and have processed their relationship with firms' characteristics to identify factors affecting firms' borrowings. Therefore, this study investigates the potential relationship between capital structure and debt maturity structure in listed firms in Tehran's Stock Exchange. Thus, the data of 97 firms listed in Tehran's Stock Exchange over the 1386 to 1392 period, linear regression, and generalized torque method have been used. The results indicate that there is a direct significant mutual relationship between capital structure and debt maturity structure. Hence, the hypotheses are confirmed.

**Key words:** capital structure, debt maturity structure, financial leverage, Tehran's Stock Exchange

### INTRODUCTION

Financial resources are the most important required resources for firms to survive and continue their activities. Part of these resources are provided by founders' investments, public shareholders, operational activities, and firms' services, together with borrowing. The main causes of debt are insufficient resources of investors, firms' internal resources, as well as low cost of debt compared to equity (Sinaee and Rezaeeian, 1384). Debt is commitment to transfer economic benefits by the business unit, arising from transactions or other past events. The concept of commitment ensures that the business unit cannot avoid the exit of economic benefits. A business unit may persuade its creditors to receive their debt in a way other than settled by the contract; however, the business unit cannot insist on accepting such offers. A debt should be classified as current debt when longer debts are expected to be paid off



**Mohammad Vahdani and Zahra Rahimian**

through the normal operating cycle of the business unit or within one year of the date of the balance sheet. Other debts should be classified as non-current (long-term) debts (Accounting Standards Committee, 1385). The amount of firms' debt and its maturity are important and popular topics in financial literature field and this study attempts to clarify the potential relationship between them in firms listed in Tehran's stock Exchange.

**Statement of the problem**

Financing through debt is one of the important factors in investment decisions at micro and macro levels (Reinhart, 2002; Erol, 2004; Sinaee and Rezaeeian, 1384; Sinaee et.al, 1390). Financing through debt often has priority for firms' managers due to tax savings and its lower rate compared to returns expected by the shareholders (Sinaee et.al, 1390).

Many studies have dealt with factors affecting firms' financing, but studies on debt maturity structure are rare and insufficient. A number of studies have dealt with this issue indirectly, for example Titman and Wessels (1998), Barceley and Smith (1995), Beevan and Danbolt (2002) have used different criteria for borrowing (short-term and long-term), and have processed their relationships with firms' characteristics to identify factors affecting firms' borrowing. Existing literature which have dealt with maturity directly are focused on developed markets of the United States and Britain (for example Mitchel, 1993; Barceley and Smith, 1995; Stohs and Mauer, 1996; Ooi, 1999; Ozkan, 2000; Ozkan, 2002; Scherr and Hulburt, 2001). Few studies on this topic have been conducted in other countries (for example, Majumdar, 2010; Terra, 2011; Terra and Kirch, 2012). Although many studies have been conducted about factors affecting capital structure and financial leverage in Iran, but its relationship with debt maturity structure has not been seriously considered yet.

**REVIEW OF LITERATURE****Capital structure and debt maturity structure**

Leland and Toft (1996) stated that firms with higher leverages tend to choose longer debt maturities and vice versa. Optimal leverage depends on debt maturity, and when a firm with short-term debts is financed, firm's value is greatly reduced. Morris (1992) also believed that firms with higher debt ratio tend to release long-term debt in order to be at risk of bankruptcy with more delay. On the other hand, ownership and agency theories forecast negative impact on debt maturity structure; thus, the impact of leverage on debt maturity is still unknown (Korner, 2007). Therefore, leverage can be considered as an independent theory for determinants of debt maturity structure. Studies on the relationship between leverage and debt maturity have shown different results (Leland and Toft, 1996). Diamond (1991) believed that firms with higher leverage prefer long-term debt to avoid liquidity with low optimality; because it gives more time to firms to repay their debts. Flannery (1986) showed that firms with more debt can minimize the risk of their re-financing by borrowing long-term debt. Dennis et.al (2000) argued that the leverage should have negative impact on debt maturity, since it can reduce agency costs of inefficient investment problems with two strategies: reducing the leverage or shortening debt maturity. These two financing strategies can be replaced with each other. The summary of the relationship between debt maturity and capital structure can be demonstrated in the following figure:

**Background of the study**

Muradoglu et.al (2011) investigated debt maturity of European Union firms. They concluded that European Union firms are moving towards financing through equity. These firms also use short-term debts significantly.



**Mohammad Vahdani and Zahra Rahimian**

Terra and Kirch (2012) investigated factors affecting debt maturity of South American firms. They used a sample of 359 non-financial South American firms during 12 years. The results of their study showed that size, business risk, and the ratio of firm's tangible assets have major positive impact on their debt maturity. Also, the level of financial development is not mainly related to debt maturity.

Mateus and Terra (2013) conducted an extensive analysis about the relationship between financial leverage and capital structure in a study titled "Leverage and debt Maturity Structure in Emerging Markets". Thus, they used the data of Latin American and Eastern Europe firms. It should be noted that the timeframe of their study was 1990 to 2003. The results showed that the relationship between financial leverage and debt maturity structure is reversed in Eastern Europe firms and direct in South American firms.

Little attention has been paid to debt maturity as the main variable in studies conducted in Iran. Mousavi's study in 1390 can be referred to in the available literature. Mousavi (1390) investigated the impact of uncertainty on foreign debt maturity structure and production. Using panel data model, he showed that if foreign debt results in foreign currency and borrowers repay their debts, currency mismatch will occur and it will result in increasing the share of short-term debts from total foreign debts (debt maturity mismatch) and hence will cause production fluctuations and eventually financial crisis.

Hajiha and Akhlaghi (1390) examined the impact of dividend policy, profitability, tax rate, and business risk on debt maturity structure in listed firms in Tehran's Stock Exchange in a study titled "the Impact of Firm-Specific Factors on Debt Maturity Structure". The results of their study showed that there is a positive relationship between dividend policy and profitability with debt maturity structure at the level of the total sample. However, there is a negative relationship between tax rate and debt maturity structure. Also, a significant relationship between business risk and debt maturity structure was not found. The result is consistent with taxation hypothesis but not with signaling hypothesis. Moreover, testing the hypotheses of the study within examined industries led to a variety of results.

**Hypotheses of the study**

Based on the relationships being stated, the following hypotheses are proposed:

Firm's capital structures have a significant impact on its debt maturity structure.

Firm's debt maturity structures have a significant impact on its capital structure.

**METHODOLOGY**

This is a practical study in terms of objective-based classifications, and a correlation study in terms of methodology-based classifications. Thus, multivariate regression and default tests have been used.

**Population and sample**

The population of this study is firms listed in Tehran's Stock Exchange during 1386 to 1392. The sample will be selected by systematic elimination of the population. The sample includes all existing firms in the population which have the following criteria:

Their financial period ends in March 29<sup>th</sup> each year in order to put the data together and use them in pool and panel forms (according to the results of the default tests). Do not have changes in their financial period during the study, so that their financial performance can be comparable.





### Mohammad Vahdani and Zahra Rahimian

The required data for the study variables be available during 1386 to 1392 period, so that calculations can be performed with no flaws to the extent possible.

Be not a part of active firms in the field of financial activities, including investment firms, banks, insurance, and financial institutions, because these institutions differ in terms of the nature of their activities, and their main income comes from investment and are dependent on other firms' activities. Hence, they differ in nature from other firms, and as a result will be removed from the study.

Considering the mentioned conditions led to selecting 97 firms as the sample of the study. It should be noted that each firm has 7 sets of financial information which can be extracted from financial statements and other related information sources during 1386 to 1392.

#### Models and variables

The main models of the study which are used to test the hypothesis are as follows (to test the first hypothesis model one, and to test the second hypothesis model two is used):

$$(1) \text{Maturity}_{i,t} = \alpha_0 + \alpha_1 \text{Leverage}_{i,t} + \alpha_2 \text{Size}_{i,t} + \alpha_3 \text{Growth Oportunities}_{i,t} + \alpha_4 \text{Profitability}_{i,t} + \alpha_5 \text{Business Risk}_{i,t} + \alpha_6 \text{Liquidity}_{i,t} + \alpha_7 \text{Tangibility}_{i,t} + \alpha_8 \text{Tax Effects}_{i,t} + \alpha_9 \text{Maturity}_{i,t-1} + \square_{i,t}$$

$$(2) \text{Leverage}_{i,t} = \alpha_0 + \alpha_1 \text{Maturity}_{i,t} + \alpha_2 \text{Size}_{i,t} + \alpha_3 \text{Growth Oportunities}_{i,t} + \alpha_4 \text{Profitability}_{i,t} + \alpha_5 \text{Business Risk}_{i,t} + \alpha_6 \text{Liquidity}_{i,t} + \alpha_7 \text{Tangibility}_{i,t} + \alpha_8 \text{Tax Effects}_{i,t} + \alpha_9 \text{Leverage}_{i,t-1} + \square_{i,t}$$

#### In which

Maturity= the ratio of long-term debt to total debts.

Leverage= the ratio of short-term debt to equity.

Size= firm's size (natural logarithm of assets).

Growth= growth opportunities and investment (the sum of debt book value and equity market value divided by total assets).

Profitability= operational profit divided by total assets.

Business risk= the ratio of sales to operational profit.

Liquidity= the ratio of current assets to current debts.

Tangibility= the ratio of net fixed assets to total assets.

Tax effects= the ratio of tax to profit before deduction of interest and tax.

## FINDINGS

The findings of the study will be presented in two forms of 1) descriptive statistics and 2) deductive statistics. The examined sample during the period of 1386 to 1392 includes 97 firms. Here, mean, median (central criteria), standard deviation, maximum, and minimum (dispersion criteria) of the variables of are calculated and showed in Table 1. It should be noted that after removing outlier data and sorting the data, the number of firm-years of the variables has faced a slight decrease.

Using generalized torque method and Estimated Generalized Least Squares model, the results of testing the first hypothesis and model are presented in Table 2.







### Mohammad Vahdani and Zahra Rahimian

Given the results of Table 2, since t statistics of capital structure variable is bigger than  $+1/965$  (equal to  $+6/338$ ) and its significance level is less than 0/05, a direct significant relationship exists between capital structure and debt maturity structure, and in fact capital structure have a direct significant impact on debt maturity structure. Thus, the first hypothesis is confirmed.

Meanwhile, t statistics of variables of liquidity, tangibility, and delayed debt maturity structure is bigger than  $+1/965$  and their significance level is less than 0/05, thus they have a direct significant relationship with debt maturity structure as well. As can be seen, Dourbin-Watson statistics is 1/989, which is between 1/5 and 2/5. Also, J statistics is 499, which shows the high power of the model. Another significant point of Table 2 is R-square of the model. The R-square of the model is about 85 percent, which indicates that independent variables can explain high percentage of changes of dependent variables.

Using generalized torque method and Estimated Generalized Least Squares model, the results of testing the second hypothesis and model are presented in Table 3.

Given the results of Table 2, since t statistics of debt maturity structure variable is bigger than  $+1/965$  (equal to  $+5/443$ ) and its significance level is less than 0/05, a direct significant relationship exists between debt maturity structure and capital structure, and in fact debt maturity structure have a direct significant impact on capital structure. Thus, the second hypothesis is also confirmed. Meanwhile, t statistics of variables of growth opportunities, profitability, liquidity, tangibility, tax effects, and delayed capital structure is bigger than  $\pm 1/965$  and their significance level is less than 0/05, thus they have a direct significant relationship with capital structure as well. As can be seen, Dourbin-Watson statistics is 1/986, which is between 1/5 and 2/5. Also, J statistics is 499, which shows the high power of the model. Another significant point of Table 3 is R-square of the model. The R-square of the model is about 94 percent, which indicates that independent variables can explain high percentage of changes of dependent variables.

## CONCLUSION

The results of the study showed that a direct significant mutual relationship exist between capital structure and debt maturity structure. Hence, the established hypotheses were confirmed. Meanwhile, the variables of liquidity, tangibility, and delayed debt maturity structure have a direct significant impact on debt maturity structure. Also, the variables of growth opportunities, tax effects, and delayed capital structure have a direct significant impact, and the variables of profitability, liquidity, and tangibility have a reversed significant impact on capital structure. The direct relationship which is found in this study is consistent with the findings of Flannery (1986), Diamond (1991), Morris (1992), Leland and Toft (1996), Majumdar (2010), and Maetus and Terra (2013) using Latin American data. However, the result of this study is contrary to the findings of Dennis et.al (2000), Terra (2011), Terra and Kirch (2012), Mateus and Terra (2013) using Eastern Europe data.

To justify the obtained results stating that a mutual relationship exists between capital structure and debt maturity structure of firms listed in Tehran's Stock Exchange, the following explanations can be referred to: according to Morris (1992), firms with higher debt rate tend to release long-term debt in order to be at risk of bankruptcy with more delay. Diamond (1991) also believed that firms with high leverage prefer long-term debt to avoid liquidity with low optimality because it gives more time to firms to repay their debt. Moreover, the findings of Flannery (1986) indicated that firms with more debt can minimize the risk of re-financing by borrowing long-term debt.

Given the obtained results of the hypotheses, it was found out that there is a direct relationship between debt maturity structure and capital structure of firms listed in Tehran's Stock Exchange. But given the argumentation of





### Mohammad Vahdani and Zahra Rahimian

Dennis et.al (2000) which stated that financial leverage should have a reversed relationship with debt maturity because agency costs can reduce inefficient investment problem with two strategies: increasing debt level or increasing debt maturity; it can be claimed that the direct relationship found in this study can be an alarm for investors in firms listed in Tehran's Stock Exchange, stating that there is the possibility of inefficient investment in these firms. Thus, it is suggested to the investors in firms listed in Tehran's Stock Exchange to ensure the lack of inefficient investment through using other monitoring mechanisms.

Given this result, it is recommended to the members of the board of directors of firms listed in Tehran's Stock Exchange to reduce the risk of inefficient investment by providing other monitoring mechanisms. Moreover, investors in firms listed in Tehran's Stock Exchange are also suggested to pay necessary attention to the amount of direct relationship of financial leverage and firm's debt maturity when investing and buying and selling stock. It is also suggested that the models of this study be tested again and the results be compared in future studies by using other criteria of measuring financial leverage or capital structure (such as the ratio of debt to equity, the ratio of long-term debt to assets, and so on). The regression relationship of this study is estimated at once for all industries in the sample. Therefore, it is recommended that in future studies this relationship for different studies be estimated separately.

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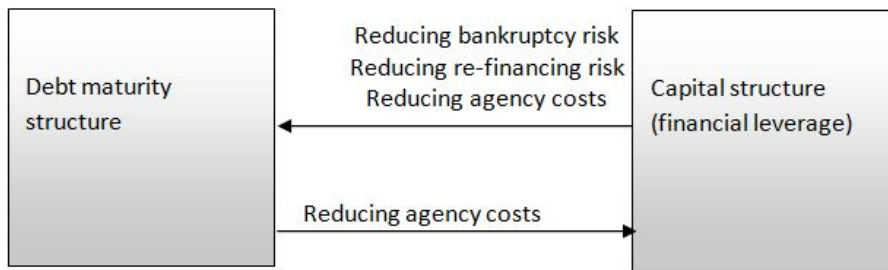
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**Mohammad Vahdani and Zahra Rahimian**

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**Figure1. The relationship of debt maturity structure and capital structure**

**Table 1: Descriptive indices of variables**

Variables	Number	Mean	Median	Standard deviation	Maximum	Minimum
Debt maturity structure	675	0/137	0/085	0.136	0/668	0/005
Capital structure	676	0/314	0/134	0/518	3/939	0/0003
Firm's size	679	13/199	13/113	1/299	18/549	9/821
Growth opportunities	675	1/345	1/2	0/517	3/959	0/57





**Mohammad Vahdani and Zahra Rahimian**

Profitability	678	0/152	0/139	0/121	0/634	<b>-0/19</b>
Business risk	661	6/641	4/695	7/33	46/911	<b>-14/619</b>
Liquidity	676	1/369	1/225	0/632	4/714	0/24
Tangibility	678	0/254	0/216	0/172	0/878	0/024
Tax effects	618	0/14	0/157	0/075	0/277	0

**Table 2: The results of testing the first hypothesis**

Variable	Coefficients	Standard error	t statistics	Significance level
Intercept	<b>-0/066</b>	0/048	<b>-2/03</b>	0/042
Capital structure	0/002	0/006	6/338	0/000
Firm's size	<b>-0/003</b>	0/003	<b>-0/415</b>	0/677
Growth opportunities	<b>-0/015</b>	0/007	<b>-1/129</b>	0/259
Profitability	<b>-0/103</b>	0/034	<b>-0/686</b>	0/492
Business risk	0/0003	0/0006	1/92	0/055
liquidity	0/013	0/006	1/969	0/049
Tangibility	0/07	0/036	3/006	0/002
Tax effects	<b>-0/078</b>	0/005	<b>-1/41</b>	0/159
Delayed debt maturity structure	0/89	0/031	28/141	0/000
J statistics	499/000	R-square		0/685
		Adjusted R-square		0/676
Tool rank	11	Dourbin-Watson		1/989

**Table 3: The results of testing the second hypothesis**

Variable	Coefficient	Standard error	t statistics	Significance level
Intercept	0/228	0/16	14/442	0/000
Debt maturity structure	0/05	0/092	5/443	0/000
Firm's size	<b>-0/011</b>	0/01	<b>-0/094</b>	0/924
Growth opportunities	0/062	0/046	4/666	0/000
Profitability	<b>-0/022</b>	0/231	<b>-7/366</b>	0/0000
Business risk	0/003	0/001	1/354	0/176
Liquidity	<b>-0/017</b>	0/018	<b>-14/535</b>	0/000
Tangibility	<b>-0/003</b>	0/092	<b>-11/544</b>	0/000
Tax effects	0/092	0/214	6/112	0/000
Delayed capital structure	0/925	0/091	24/533	0/000
J statistics	499/000	R-square		0/944
		Adjusted R-square		0/926
Tool rank	11	Dourbin-Watson		1/986





## Evaluating Optimal Positioning of Health-Medical (Hospital) Usage in Ilam based on Integrating DEMATEL, ANP, and GIS

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### ABSTRACT

One of the selected criteria for understanding a healthy urban community is its access to health and medication in every parts of the town and the availability of such facilities to all citizens (Shakooyie 1986:122). Quick and inexpensive access to such centers is significantly important in every community, especially urban areas (EbrahimZadeh 2012: 83). The position of such land usage depends on several criteria and variables. As a result, in order to determine and measure the importance coefficients of these criteria and effective parameters on positioning this kind of usage, the advantages of Multi-Criteria Decision Making (MCDM) techniques were implemented. The process of the study was started with the collection of location data, then a database was compiled, the required maps were supplied, and each criterion was built into an information layer in GIS. Next, each information layer was allocated a specific weight using DEMATEL and ANP, based on the degree of its importance in positioning health centers. Finally, in order for selecting the appropriate location for health and medication centers, the obtained results from integrating the information layers were used to zone Ilami lands. After drawing the features, a desirable condition for positioning health and medical centers was provided.

**Key words:** Positioning, Geographic Information System (GIS), DEMATEL, ANP, Ilam

### INTRODUCTION

A healthy urban planning refers to planning for people. Such a planning disseminates the concepts of a city beyond an idea of buildings, streets, and open spaces. Thus, a town is a living structure which is breathing, and it is a n entity



**Mohsen Rahimi**

whose health relies on the health of its residents (Hugh 2000: 1). Since individuals' mental and body health is among the important criteria of countries and nations' development, the level of access to these services and their optimal distribution throughout the country and region is highly valuable and important. In fact, a desirable access to health and medical services for all regions means the provision of appropriate service at the proper time and place. Therefore, since individuals' conditions affect their ability to benefit from medical and health services, it is necessary to make policies that comply with the equal distribution of services to every member of the society (Taghvaei 2010: 35). The attempts to providing every member of a town equally with their needs, the issue of social justice comes into consideration while the lack of attention to it results in some harsh consequences such as marginalization of communities in slums, excessive density of a region, one-way development of towns, depopulation of some districts, land gambling and several other problems (KhoshRooy 2006: 12). Regarding social values and roles, a land is essentially effective on comfort, security, beauty, well-being, and life quality of human beings (Ziary 2013: 4). Land usage is one of the most sensitive issues in physical development of cities. In general terms, a land program and usage plan clarifies different aspects of its usage. The application and control of land usage includes a wide range of general policies, has noticeable effects on urban development plans, and covers economic, environmental, societal, and political dimensions (Razavian2002: 12). Land usage demonstrates the spatial aspects of human activities on Earth in order for meeting their material and cultural needs (Shokooyie 2008: 253). Urban lands usage plans, spatial organization of activities, and civil practices follow the demands of an urban community and constitutes the heart of urban planning (Pour Mohammadi 2010: 3).

Every activity should be positioned in a suitable location in relation to its application. In doing so, the location of the land and the subdivision of adjacent lands must be considered. In planning for and positioning of different urban establishments, the consideration of adjacencies is regarded highly important and determining. Although the positioning of different establishments throughout the town is determined according to taste, preferences, and underpinnings of spatial planning, the observance of rules and regulations is very important in enhancing the quality of usage (Shi'ah 2012: 202).

In Iran, the rapid physical expansion of cities is one of the noticeable characteristics of urban life. The uncontrolled increase in the number of towns and their unbalanced growth due to excessive immigrations and increase in population constitute a big problem of the country's urban network. This leads to several consequences such as the emergence of slums, destruction of farmlands, increase in urban population, irresponsibility of some urban services and functions, separation of physical contexts, environmental problems esp. pollution and disturbance in urban landscape (HoseinZadehDalir and Hooshyar 2006).

**Statement of Problem**

Ilam City, the capital city of Ilam Province, lies at 46° 26' east longitude and at 32° 37' north latitude, and regarding its geographical location, it is located to the west and south-west of the country. The city is at an altitude of 1363 meters above the sea level. The city is in a mountainous canyon on the southern slopes of KabirKooch in Zagros Mountains (Counseling Engineers of Planning and Logistics 1989: 11). Figure 2 shows the location of Ilam. After the establishment of different provincial entities and firms, the population capacity of the city increased in relation to the relative creation of jobs in service-administrative areas and, as a result, the city relatively prospered due to intra-provincial immigrations (Counseling Engineers of Technique Dimension 2005: 1). Since the city is the administrative-political center of the province and it acts as the provider of service to other parts of the province, it has grown and developed in both population and physical aspects. Consistent with its urban development and the increase in population rates, the population of the city increased up to 10.6% between 1976 and 1986. In addition to the natural process of population, this increase was caused by the imposition of Iraqi war on Iran. Rural people and the residents of borderline cities affected by the enemy's attacks were forced to seek shelter in Ilam. Consequently, while the city's population was announced 89,035 in 1986, it increased to 126,346 in 1996, and 160,355 in 2006.



**Mohsen Rahimi**

The spatial growth and expansion of Ilam is somewhat obviously influenced by the war, village-town immigration from war-ravaged villages and cities on the borders. Immediately after the end of the war, the city has been still growing intrinsically due to extensive construction planning and the significant role of Ilam as the political and service center for deprived regions. The combination of such factors (immigration and centrality) led to the increase in unemployment, unappealing growth of the city, expansion of slums, the disturbance of city landscape, prioritization of urbanization over urban life, increase in social abnormalities; and the increase in population without enough civil infrastructures spelled out the endangerment of urban environment and the uncontrolled consumption of resources and facilities. These problems will expose the life of the current and future generations to shortages and inefficiencies (Maleki 2011: 118).

In other words, the results of analyzing Ilam indicate that the capacity of civil infrastructures in most parts of the city has been saturated by environmental damages and immigration (Maleki 2011: 133). The unbalanced allocation of space and the absence of optimized positioning of service and physical entities – esp. medical centers (hospitals) – resulted in the increase of problems for the city and its citizens. In this study, several criteria were utilized in order to show the current obstacles for health service. In addition, they were used to find appropriate places for the construction of new hospitals in the city to reach individual and social comfort and enhance life quality in Ilam.

**Theoretical Framework**

In general the studies on the scientific positioning of medical centers and hospitals have a historical background in Western Europe and the United States. As an example, the studies conducted by Cowon (1963, 1965, 1967, 1969) deeply examined the relationship between the spatial models of hospitals and the strict regulations of market, gas companies, cemeteries and other factors. These studies led to a theory of hospital space from the existing model (Jamali 2012: 25).

Among the studies carried out on this matter, the following articles can be mentioned:

In 1993, JafarTaghiNezhad, University of Tabriz, studied the positioning of Tehran's hospitals in his M.A. dissertation of Geography and urban planning.

FirouzJamali and his colleagues investigated the spatial model of Tabriz's hospitals in their article the Evaluation of hospitals positioning model in Tabriz City, using GIS and AHP model.

Isa EbrahimZadeh and his colleagues used GIS and investigated the positioning model of Zanjan City in their article - Spatial Planning and organization of medical and health services using GIS, a case study on Zanjan City.

Ahmad Pour Ahmad studied the distribution and disparity of hospitals in Tabriz City in modeling the positioning of hospitals using Fuzzy logic combining AHP and TOPSIS in ARCGIS medium.

JavadMikaniki studied the spatial pattern of medical centers in Birjand in Positioning of health-medical centers (hospitals) in Birjand City through the combination of ANP and paired comparison in GIS medium using GIS integrated with ANP.

**METHODOLOGY**

The method of this applied study is based on a descriptive-analytic design. In order for reaching the study objectives, the Multi-Criteria Decision Making (MCDM) model based on Geographic Information System (GIS) was utilized. At



**Mohsen Rahimi**

first, the measurable criteria were identified through the statement of the problem and examination of similar experiments. Next, the map of current land usage in Ilam was created; then a particular layer was allocated for each factor effective in the optimized positioning of medical-health services (hospitals). Next, the information layers corresponding to the study subject were produced using GIS. In the next phase, the comments of 16 experts were employed regarding the weight of the criteria. Cochran's Theorem was used to determine the sample size. The study population was extracted from the results of 2011 consensus of population and housing from Statistical Center of Iran, which included 2666 individuals graduated with Ph.D., M.A. or general doctorate degrees from universities and institutes of higher education in Ilam (Statistical Center of Iran 2011). The study sample consists of 656 individuals holding degrees in engineering, manufacturing, and humanities majors. The study sample was calculated with 98% confidence ( $\alpha = 0.02$ ). z or t value in Cochran's theorem was considered 1.96 with 95% confidence. d value (allowable error) was 0.02, p and q values were calculated 0.24 and 0.76 respectively. The statistical sample was calculated using the following equation:

In this procedure, specialized samples and nonrandom method were used so that, at first, they would select every available individual covered by the sample size without any presuppositions regarding specific ones and, second, they would have similar characteristics and common specialties with regard to the study subject (Hafez Nia 2010: 162). The importance factor of the criteria was determined by DEMATEL method in MATLAB software or by ANP model in SuperDecisions software. Next, with the help of GIS, the information layers were integrated and overlapped in order to make the optimal positioning of hospital locations possible. The procedure by which the study was conducted is presented in Figure 1.

## RESULTS AND DISCUSSION

### Evaluation of Usage

Evaluation of various types of urban usage is conducted in two quantitative and qualitative forms in to ensure their logical establishment and observance of necessary measures of congruence.

**Quantitative evaluation:** This type of evaluation is conducted according to the comparison of existing capitations of usage with related standards or through the analysis of current or future needs of study region for space.

**Qualitative evaluation:** In this phase, the qualitative features are determined and their relationships with each other are studied according to the following matrices:

1) Compatibility matrix, 2) Suitability matrix, 3) Capacity matrix and 4) Dependency matrix (Pour Mohammadi 2010: 109). In this study, the three matrices of compatibility, suitability, and capacity were used to evaluate the land usage.

### Compatibility Matrix

Any type of usage which is established in a region must not bother or hinder other existing activities. When we try to determine the level of compatibility or incompatibility of two types of usage, we, firstly, need to identify their various requirements for doing their routine activities; then we should compare such features and detect the instances of compatibility or incompatibility. The elements which can be examined in this way are land size and dimensions, land inclination, connecting network, facilities and equipment, subordinate usage, air quality, sound quality, light degree, smell, sight and sceneries. In addition, the requirements of each type of usage are identified according to quantitative and qualitative standards and are compared with each other. Finally, when the detected characteristics are the same or similar, the considered types of usage are compatible, and they become more and more incompatible with the





**Mohsen Rahimi**

decrease in similarities (Pour Mohammadi 2010: 110). With respect to the types of land usage in Ilam, the compatibility matrix of the City is as represented in Table 2. Based on this table, the compatibility layer or land priority was compiled (Map 2).

**Capacity Matrix**

Every type of urban activity (usage) has an allotted span. Since the structure of a town bears several physical levels, when two considered spans are compatible with each other, every type of usage would have a suitable performance and each level of the town would take advantage of services in an effective way. Nevertheless, when such spans are not compatible, various problems will rise for both phenomena. As an example, a medical-health activity has the following levels: General practitioner, general clinics, specialists, specialized clinics, general hospital, and specialized hospital. Furthermore, an educational type of usage can be divided into the following levels: Nursery school, primary school, junior-high school, high school, university faculty, college, and university. On the other hand, every level of urban spatial structure can only hold an appropriate level of activities. Therefore, spatial structure can be divided as follows: adjacent buildings, small neighborhood, neighborhood, town district, town.

**Suitability Matrix**

In this matrix, the compatibility of land usage with its location is evaluated. According to this matrix, we can state that any type of usage is suitable for a specific location after considering its characteristics, and every location needs a specific usage as well. In order to create this matrix, the characteristics and necessities of a given type of usage have to be in accordance to its location of establishment. The characteristics of a location may be land size and dimensions, position, slope, physical features (soil type, topography etc.), accessibility, facilities and equipment, sound, air, smell, and types of adjacent usage. Through comparing the mentioned factors it can be concluded that the location of any type of usage may be fully suitable, relatively suitable, or fully unsuitable, and the following decisions must be based on such observations.

For examining this matrix in the present study, we considered slope, effective performance range, streams, and access to communication networks, and population density for hospitals.

**Green space:** Due to population increase and increasing pollution of urban environment, the vital role of green spaces become obvious day by day. As a natural filter, green space reduces environmental pollutions such as smoke and sound and relatively ensures the individual and societal health of urban residents and the comfort of the surrounding environment (Pour Mohammadi 2010: 38). The regional green space is the priority of this usage (Habibi and Masaeli 1999: 31). One of the problems that Ilam faces is the lack of green space in every level of its physique, especially regional green spaces. As a result, the neighborhood green spaces of the town are classified as the indifferent types of usage in relation to hospital usage.

**Fire department:** Today, human life is blended with various kinds of chemical substances such as oil, gas, electricity, radioactive material, and other types of dangerous substances. Consequently, the danger of fire and explosion has escalated. Urban safety is so critical that a second of ignorance would lead to disastrous environmental and social consequences (Specialized Center for Urban and Rural Studies and Services 2006: 27). In Table 3, the span of fire departments' compatibility is provided and the fire department layer is compiled based on this table (Map 3).

**Military camps:** Military lands are propounded only on the level of town and beyond including garrisons, camps, bases, shooting ranges, depots, military airports, and staff departments of armed forces. In a circular issued by Iran's Supreme Council for Urban Development and Architecture, the evacuation of all military lands, which were majorly training and military camps, was demanded, especially in Tehran (Razavian 2002: 180). Military centers, with the



**Mohsen Rahimi**

exception of staff departments, must be located at least five kilometers far from towns because of the noise they make. As a result, the researchers of this study have applied the current location of military lands relative to hospitals and have provided the recommended distance in Table 3 from which the military layer was compiled (Map 4).

**Passenger terminals:**In this day and age, the increasing growth of urban population and the necessity of intra-city and inter-city trips have highlighted the obvious role of passenger terminals in regulating urban traffic and, particularly, in creating facilities and accelerating service providing to passengers. Terminals play a significant role in transportation and deliverance of passengers to their destinations. In this study, suburban terminals have been analyzed (Map 5).

**Slope:**Slopes are among the most important factors of the change in Earth's roughness and, as a result, have direct and indirect effects on human life and their activities. The construction of each facility needs a certain degree of slope while it is highly influenced by the changes in slopes and unsteadiness of surfaces (Zomorodian 1997: 25). Evidence shows that Ilam is limited by mountains in every direction. Regarding its altitude, Ilam is in the range of 2150 meters in southern and south-western areas which goes down to 1550 meters in northern and north-eastern areas. Regarding its inclination, Ilam is located on slopes of zero to 15% while higher degrees of slope are due to the existence of higher lands (Ansari Lari, Najafi and Nourbakhsh 2010: 5). The appropriate slope for hospital spaces in Ilam was determined according to the known latitude sites in the city and interpolation operations followed by reducing error coefficient in GIS and finally the city's inclination was modeled (Map 6).

**Water streams:**Out-of-order changes in surface shape, damaging vegetation, and construction on natural streams have intensified the threat of floods (Bahraini 2011: 172). Rivers hinder different stages of a city's physical expansion. Among others, the construction of urban buildings out of rivers' vicinity is a vital factor in preventing river floods (Shia 2012: 238). Considering the relative roundness of Ilam's drainage basin, in times of heavy precipitation, such a feature causes the shortness of concentration time and together with impenetrable surface of the town ends in outburst of floods and waterlogging of passages and urban streams. Therefore, the limits of the position of hospitals on streams was applied (Map 7).

**Communication network accessibility:**First class arterial roads provide the fast connection between far regions in large cities as well as the connection between intra-city roads and inter-city roads. While first class arterial roads are used for short trips as well, the main role of such routes is the provision of fast transportation for far and relatively far trips (Organization for Planning and Preparing Regulations 1996: 1). The unwanted environmental effects caused by roads include pollution of air surrounding roads and in towns, increase in noise, pollution of underground water, pollution of agricultural soil, fracture of soil by water, reduction of the water capacity of streams and rivers etc. (Organization of Planning and Preparing Regulations 1995: 128). Being located on first class arterial roads is one of the general criteria for the positioning of hospitals (pour Mohammadi 2010: 61). The determination of the adequate vicinity for roads and preventing the establishment of sensitive types of usage around roadways is one of the techniques, from the viewpoint of urban development, which is capable of controlling or breaking the load of sound waves. Given that roads and streets the main sources of spreading noise pollution, the observance of the suitable distance from streets – at least 50 meters – is necessary (Mohammad Zadeh 1997: 9). The preparation of the information layer and the information related to the layer of accessibility was carried out after the detection of the method of access and weighing.

**Population density:**The estimation of the study area is the paramount data for every type of planning, especially land usage planning, because the required amount of the areas for housing, communication, industry, well-being facilities, and services are determined based on this estimation (Pour Mohammadi 2010: 21). In this study, the basis for weighing was in four classes based on which the density of individuals per hectare was resolved (Map 9).





### Mohsen Rahimi

**Effective performance range:** Accessibility is an indication of a good city. Accessibility has a close relationship with usage because the distribution of various types of usage is the antecedent of accessibility among them. Fast, secure and cost-effective accessibility to certain areas has become a very complicated and expensive issue due to the expansion of cities and scattering of usage types (Bahraini 2011: 203). A neighborhood is a physical embodiment of a place holding 700-1250 households with the accessibility range amplitude of 300-375 meters (4-5 minutes) which is characterized with mosques and a primary school as its manifestations (Habibi and Masaeli 1999: 13). In this study, the effective performance range of hospitals on urban scale was considered 1000 meters from residential neighborhoods (Map 10).

#### Distance from existing health centers

$$X = s.Z$$

$$z = \min \left\{ 1 / \max_{1 \leq i \leq n} \sum_j a_{ij}, 1 / \max_{1 \leq j \leq n} \sum_i a_{ij} \right\}$$

Consequently, when there is a consistency between the two mentioned scales, the desirable balance is achieved and activities are reflected on according to their capacities or both will be each other's obstacles. Complying with appropriate distance is necessary for avoiding such distractions among hospitals (Map 11).

**Centrality in relation to the region:** Zoning is a method by which urban lands would be used properly after considering the internal usage instances of cities. In this way, enough space is provided for different kinds of urban activities, urban development, and urban functions, and every important part of urban activities finds its place and works with regard to other functions and activities. In zoning, it is attempted to make urban services such as hospitals, schools, mosques, streets, and leisure sites as much accessible to people as possible (Shakooei 2008: 241). In this study, the municipality's zoning was utilized and the center of each region was determined. Then the centrality of each region was resolved by defining vicinities (Map 12).

#### DEMATEL Method

This method was introduced during the years between 1972 and 1976 by Battle Memorial Institute in Geneva (Gabus 1972). In this method, the causal relationships between indices in decision making topics are rendered into tangible structural models (Tzeng, Chiang, and Li 2007). The final output of DEMATEL is the dividing of actors into causes and effects. The rationale for using this method in this study is as follows:

1. Finding the causal relationships between criteria, and
2. Finding an estimation of the internal weight among criteria for their final ranking by ANP method.

In order for investigating the internal relationships between criteria, experts are asked to conduct two-by-two comparisons between the criteria in this study. To make the comparisons possible, the expert group was asked to fill out a questionnaire and give scores to questions on a scale of 1, 3, 5, 7, and 9. Then their opinions were combined by mathematical averaging method and Z matrix was produced, which is in fact the preliminary input of DEMATEL. Then, Equation 2 is calculated to find X matrix – or direct relationships matrix shown in Table 5.





### Mohsen Rahimi

In the final phase, T matrix of general relationships – final result of DEMATEL – is calculated by equation 3. In this equation, I is an identity matrix (a matrix in which the main diameter's elements are 1 and other elements are 0) (Tzeng, Chiang, and Li 2007).

T matrix, shown in Table 6, was used to draw causal diagrams by finding the points with coordinates ( D + R, D – R) for each criterion in Cartesian coordinate system as well as to achieve the final ranking of the indices as the internal weight of the criteria in ANP.

#### Composing Causal Diagram of T Matrix

The sum of elements in the rows and columns of T matrix, or the final result of DEMATEL, are nominated for each criteria in the forms of  $D_n \times 1$  and  $R_{1 \times n}$  respectively (n refers to the number of the problem criteria).

In the composition of the causal diagram of the criteria, the value of the horizontal axis – named “importance axis” and indicates the degree of importance of a certain criterion regarding its interaction with the system through affecting other criteria and being affected by them – indicates sum of R and D vectors (D + R). The vertical axis of the diagram – called dependency axis – shows the values from D – R for each criterion. The values for each criterion drawn from D + R and D – R are calculated separately. When D – R is positive for a criterion, it belongs in the cause group; otherwise, it belongs in the effect group (Zebardast, Khalili et al. 2012).

As we can see in Figure 2, the criteria were divided into four groups. The first group is comprised of population density, access to communication network, effective performance range, and distance from fire department usage, which have the highest level of interaction with other criteria. This group's being on top of the cause axis means that its criteria have the highest effect on other criteria. The most casual criterion in this group is land compatibility which is at the highest point in the diagram; in other words, it affects the most and is affected the least.

The second group is comprised of centrality in relation to other areas, distance from existing health centers, distance from military camps, land inclination, and distance from terminals, which affect lower than being affected. These criteria are located under the effect axis. The most affected criteria is streams, which is at the lowest point in the diagram. This criterion affects the least and is affected the most. Following the determination of causal relationships between study criteria, those criteria which are effective on the positioning of hospitals were analyzed by ANP so that their importance coefficient would be detected.

#### ANP Method

Thomas L. Saaty proposed Analytic Hierarchy Process (AHP) for the first time in 1980, which has had various applications in different disciplines.

One of the significant limitations of AHP is that it does not take into consideration the mutual dependencies among decision elements – i.e. criteria, sub-criteria, and options – and assumes their relationship as being hierarchical and one-way. These major limitations of AHP had its innovator to introduce Analytic Network Process (ANP) in which the complicated relationships between the components of decision-making are addressed through replacing the hierarchical structure with a network one (Zebardast 2009: 80).

In network mode, a network and its clusters are not distributed regularly. In addition, in a cluster, there is the possibility of that cluster being affected by itself (internal dependency) or affect another cluster (external dependency). In network structure, a system can emerge from a hierarchy when its relationships gradually increase.





### Mohsen Rahimi

In other words, a pair of connective parts may connect to each other randomly and some of its components may have internal ring dependencies (Dadaspour 2012: 115). The difference between AHP and ANP is illustrated in Figure 3.

Analytic Network Process can be summarized in the following three steps:

1. Building model and rendering problem into structure: the problem must be clarified and be analyzed in a logical system such as a network. This network structure can be created by decision makers through several techniques including brainstorming or mathematical processes such as DEMATEL.
2. Building binary comparison matrix and determining priority vectors: this step is similar to Analytic Hierarchy Process. In this way, the degree of importance or priority of the criteria or sub-criteria is investigated on a continuum of 1 to 9 (or in reverse order) through asking experts. Then the degree of incompatibilities between judgments is measured by I.R. In case the factor is smaller than 0.1 the judgments are accepted. When the calculations are carried out by SuperDecision software, a specific method called eigenvectors method (according to equation 3) is used to find out matrix priority.

Where

A: Binary matrix for comparing criteria

w: eigenvector (importance factor), and

$\lambda_{max}$ : biggest  $Aw = \lambda_{max}w$  numeral eigenvalue (Dadashpour 2012: 116).

3. Building supermatrix and rendering it into limit supermatrix: In order for achieving the general priorities in a system with mutual interactions, the internal priorities vectors – i.e. calculated w's – are identified, in the matrix in which each part indicates the relationship between two clusters in the system. For example, a three level structure including goal, criteria, and options is provided in two hierarchical (a) and network (b) form in Figure 3. The supermatrix related to hierarchical mode can be illustrated in the following figure.

In this supermatrix,  $W_{21}$  is a vector that shows the goal's effects on the criteria, and  $W_{32}$  is a vector that shows the criteria's effect on the options. In case the criteria have mutual effects on each other, the hierarchy process changes into a network process. The mutual effects on the criteria on each other would become possible by inserting  $W_{22}$  matrix into Wsupermatrix (Figure 4).

This matrix is called preliminary supermatrix. After replacing the internal priorities vector (importance factors) of elements and clusters in the preliminary matrix, the asymmetric supermatrix is created. In the next phase, the symmetric supermatrix is created by multiplying the asymmetric supermatrix by the cluster matrix. Then, through normalizing the symmetric supermatrix, the supermatrix changes into random mode in its columns (Saaty 1999). In the third (final) phase, the limit supermatrix is calculated by the exponentiation of all elements in the symmetric supermatrix until divergence is reached (through repetition); in other words, until all elements in the supermatrix are the same (Zebardast 2009: 82):

$$\lim_{k \rightarrow \infty} W^k$$

#### Final weight of criteria and Layer Overlapping

In order for calculating the degree of importance of the effective factors in the study subject, eleven effective factors were identified. Then, experts were asked to compare pairs of criteria. In addition, the inputs of ANP method are





### Mohsen Rahimi

completed through the completion of ANP symmetrical supermatrix by normalized T matrix (the matrix reached from DEMATEL in which the sum of its columns is 1) (Table 7). The normal T matrix in fact substitutes the internal weight between the criteria in ANP method. T symmetrical supermatrix of ANP is displayed in Table 7. The dark part shows the T symmetrical matrix of DEMATEL method. This supermatrix is put into SuperDecision software to come up with limited supermatrix (Table 8) in which the final weight of each criterion is included. As we can see in Figure 5, the results of the final evaluation of the criteria – i.e. the final output of ANP – are achieved. The criteria were ranked based on their importance respectively as land compatibility, first class arterial routes, population density, effective performance range, distance from fire department, centrality in relation to other areas, distance from health centers, distance from military lands, distance from terminals, land inclination, and distance from streams.

After going through the mentioned phases, the weights would be applied on the layers appropriate to each index. This was done in GIS medium by overlapping layers. After exporting the final map, the value of each cell was determined, in a way that the higher-value cell was in a better place and the lower-value cell was in the inappropriate place. At the end, the exported map divides the city area into five classes: fully compatible, relatively compatible, indifference, relatively incompatible, and fully incompatible. This map is an indication of appropriate locations for establishing health and medical centers for citizens in future planning as well as for indicating the level of the consistency of the existing centers in the city with standards developed in this study (Map 13).

## CONCLUSION

Various criteria intervene in the positioning of health-medical centers (hospitals). Failing to consider such criteria would lead to the irregularities in different types of usage, disturbance in functioning, lack of balance between mass and space, and failing to achieve proper standards.

The combination of GIS and Analytic Network Process and DEMATEL would be very helpful in urban management and planning activities and would reduce costs because of the possibility of applying every effective factor and benefiting from expert comments in positioning.

In this study, hospitals of Ilam City were evaluated by utilizing a combination of DEMATEL, ANP and GIS designed for founding hospitals. In this evaluation, we found out that hospitals were distributed asymmetrically; there were parts of town with no access to hospitals, and other parts with high levels of overlapping in reaching several hospitals.

The density in District One was 142, District Two 157, District Three 61, and District Four 75. Such results indicate that population in Ilam is not symmetrically distributed. Further, while population and density are the stimulators of the number of hospitals and the reduction of distance from hospitals based on urban development standards, District Two is deprived of a hospital as the second populated region of the city with 41213 residents.

In investigation per capita, the balance between population and the number of hospitals is absent, too. District one holds places hospitals with 294 beds, which accounts for 75 per cent of the available beds in the city. However, District Two lacks any hospitals, and Districts Three and Four together hold 25 per cent of the available beds (Table 9). These figures clarify the lack of any balance regarding providing service in Ilam.

On the final map, the appropriate and inappropriate locations for health-medical centers were highlighted. Those locations labeled as fully compatible on the map are in fact the most optimal locations for founding such centers.





### Mohsen Rahimi

#### Solutions and Suggestions

With regard to the fact that the establishment of various service centers, such as health-medical centers is among the most important factors of a city and its future population's development, it is necessary to reserve the selected points on the final map for the establishment of medical centers.

- It is necessary to invest in the establishment of suitable medical centers with experienced staff throughout the city and the province to reduce population movement in the city and from other parts of the province to Ilam.
- It is necessary to prohibit any licensing of incompatible types of usage near medical centers.
- It is necessary to take more advantage of the effective capabilities of Geographical Information System (GIS) in spatial planning of medical centers.
- It is recommended that the proposed map be used in the management of providing urban health service.
- It is recommended that decision making models be used since they can provide ways of logical decision making through considering different criteria for some contradictory decisions.
- It is necessary to pass regulations specific to the positioning of hospitals and have strict monitoring on their enforcement.

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### Mohsen Rahimi

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Figure 1: Ilam's location







**Mohsen Rahimi**

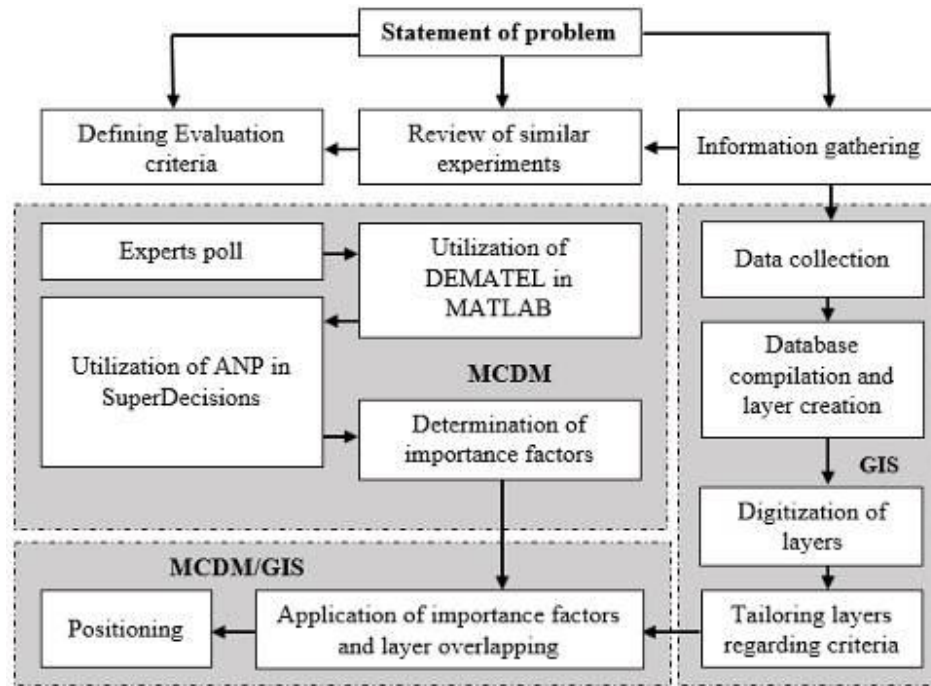
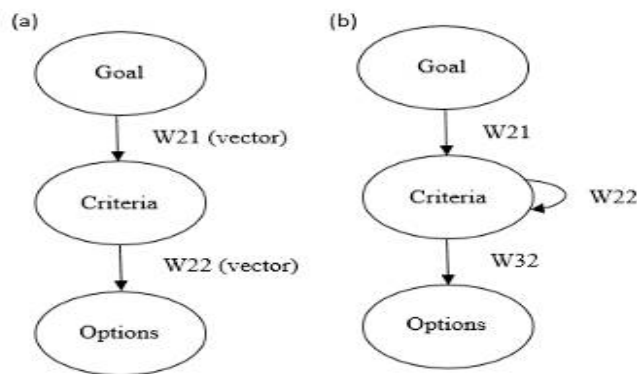


Figure 2: Study Process



Based on Saaty (1999: 4)

Figure 3: Hierarchy structure (a) and network structure (b)

Table 1: Population change in Ilam

year	households	population	household size	increase	
				number	percent
1956	1366	8346	6.11	-	-
1966	2543	15943	6.09	7147	6.4





**Mohsen Rahimi**

1976	5747	32476	5.65	16983	7.7
1986	15886	89035	5.6	65559	10.6
1991	19779	116428	5.89	27393	5.5
1996	22732	126346	5.56	9918	1.65
2006	34634	160355	4.6	34009	2.4
average annual growth between 1956 and 2006					5.7

Source: Statistical Center of Iran; General censuses of population and housing 1956-2006; Feasibility report on Perspective of Ilam's Comprehensive Plan, April 24, 2005

**Table 2: Compatibility matrix of types of land usage compared with hospital**

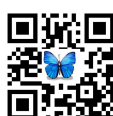
Component	Usage
Fully compatible	1. Offices 2. Empty lands 3. Gardens 4. Fire department
Relatively compatible	1. Medical centers 2. Health centers 3. Higher education institutes
No difference	1. Commercial 2. Farming 3. High school 4. Green space
Relatively incompatible	1. Historical 2. Religious 3. Cultural 4. Sports 5. Residential 6. Junior-high school
Fully incompatible	1. Urban facilities 2. Industry-workshop 3. Warehouse 4. Military 5. Police 6. Passenger terminals 7. Primary school 8. Nursery school

**Table 3: Utilized layers and priorities**

components	fire department	terminals	population density	access to communication network	effective performance range	inclination	distance from	military lands	centrality in relation to road	streams
Fully compatible	0-300	> 1500	>150	50-100	>3000	0-3	>1200	>200	0-500	>300
Relatively compatible	300-600	1000-1500	100-150	100-150	2000-3000	3-8	900-1200	1500-3000	500-1000	200-300
Indifferent	600-900	500-1000	---	150-250	1500-2000	8-12	600-900	1000-1500	1000-1500	150-200
Relatively incompatible	900-1200	200-500	50-100	250-400	1000-1500	12-15	300-600	500-1000	1500-2000	75-150
Fully incompatible	>1200	0-200	0-50	>400 and 0-50	0-1000	15-20	0-300	0-500	>2000	0-75

**Table 4: Effectiveness of criteria**

ineffective	least effective	less effective	more effective	most effective
1	3	5	7	9





**Mohsen Rahimi**

**Table 5: Direct relationships matrix (X) after combining expert opinions**

0.0112	0.1011	0.0112	0.0337	0.0337	0.1011	0.1011	0.1011	0.0562	0.1011	0.0112
0.0112	0.0112	0.0112	0.0112	0.0112	0.0337	0.0112	0.0112	0.0112	0.0337	0.0112
0.1011	0.1011	0.0112	0.1011	0.1011	0.1011	0.1011	0.1011	0.1011	0.1011	0.787
0.1011	0.1011	0.0112	0.0112	0.1011	0.1011	0.1011	0.1011	0.1011	0.1011	0.0112
0.0787	0.1011	0.0112	0.0337	0.0112	0.1011	0.1011	0.1011	0.1011	0.1011	0.0112
0.0112	0.0337	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112	0.0337	0.0112
0.0112	0.0787	0.0112	0.0112	0.0112	0.0337	0.0112	0.0562	0.0112	0.0787	0.0112
0.0112	0.0562	0.0112	0.0112	0.0112	0.0337	0.0112	0.0112	0.0112	0.0562	0.0112
0.0337	0.1011	0.0112	0.0112	0.0112	0.0337	0.1011	0.0562	0.0112	0.1011	0.0112
0.0112	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112
0.0787	0.1011	0.0112	0.1011	0.0787	0.1011	0.0787	0.1011	0.0787	0.1011	0.0112

**Table 6: T matrix**

D-R	D+R	Criterion	D											T
0.291	1.714	Fire dep.	1.002	0.025	0.159	0.082	0.139	0.136	0.141	0.054	0.051	0.022	0.155	0.036
- 1.046	1.610	Terminal	0.282	0.016	0.051	0.021	0.024	0.024	0.047	0.019	0.018	0.014	0.028	0.020
1.504	1.955	Population density	1.730	0.103	0.217	0.163	0.188	0.185	0.189	0.146	0.139	0.031	0.212	0.156
0.875	1.936	Arterial	1.406	0.052	0.191	0.144	0.166	0.164	0.167	0.130	0.040	0.027	0.187	0.138
0.564	1.768	Range	1.166	0.027	0.172	0.131	0.149	0.148	0.150	0.036	0.055	0.024	0.168	0.106
- 0.794	1.358	Inclination	0.282	0.016	0.051	0.021	0.024	0.024	0.025	0.019	0.018	0.014	0.050	0.020
- 0.537	1.507	Health centers	0.485	0.018	0.104	0.024	0.073	0.028	0.053	0.022	0.021	0.017	0.102	0.023
- 0.696	1.430	Military	0.367	0.017	0.076	0.022	0.026	0.025	0.050	0.020	0.019	0.015	0.075	0.021
- 0.065	1.504	Centrality	0.720	0.021	0.141	0.029	0.084	0.124	0.063	0.026	0.025	0.019	0.138	0.050
- 1.155	1.606	Stream	0.225	0.015	0.027	0.020	0.023	0.023	0.023	0.018	0.017	0.014	0.026	0.019
1.060	1.745	Compatibility	1.402	0.032	0.191	0.126	0.167	0.143	0.169	0.113	0.127	0.027	0.187	0.121
				0.342	1.380	0.785	1.063	1.022	1.076	0.602	0.531	0.225	1.328	0.712

**Table 9: Hospitals per capita in Ilam**

District	Population	Area	Density	Number of hospitals	Number of available beds
One	58849	413.263	142	2	294
Two	41213	261.073	157	0	0
Three	35773	581.839	61	2	75
Four	39165	519.927	75	1	24





## The Necessity to Setup VTS in Kharg Oil Terminal

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### ABSTRACT

The high volume of traffic by vessels, especially oil tankers, in the Kharg oil terminal is always considered as a potential danger and a threat to the marine environment and safety of workers in the maritime sector, as well as residents and visitors to the facility and oil docks. This documentary field study used a descriptive survey to evaluate the need for a VTS in the Kharg oil terminal by questionnaire. The participants included 160 marine workers in Kharg oil terminal. Data was collected by field studies and archival studies. This study examined the factors such as the role of VTS to enhance safety and security of ports and oil terminals, as well as reduce pollutions of the marine environment and the need to establish this system in this region, which in fact forms the hypotheses of this study. Then, the maritime experts were asked to complete the questionnaire. Reliability was assessed using Cronbach's alpha (0.852); the obtained value indicates the high reliability of the questionnaire. This study used descriptive statistics in the form of tables, pie charts and columns to analyze the demographic data and describe questions. The Kolmogorov-Smirnov test was used to test the normality of data; the Student's t test was used to examine hypotheses using the SPSS software V21. Analyses show that VTS will increase safety and security of navigation and maritime activities and reduce the risk of environmental pollutions resulting from the transport of oil products and their derivatives by tankers. Therefore, it is essential to setup this system in the Kharg Island.

**Key words:** Kharg Island, maritime, oil terminal, VTS.

### INTRODUCTION

Kharg oil terminal plays a unique role in the global supply of fossil fuels (oil in particular). Annually, numerous oil tankers, passenger ships and cargo ships enter and exit the oil, passenger and logistic terminals of Kharg Island. This



**Mohammad Reza Hassanvand et al.**

high volume of vessel traffic requires precise control, guidance, management and maritime security to prevent the risks of collision of ships with each other and with barriers and harmful potential pollutions of the marine environment and to prevent unexpected accidents by correct information and fast guidance as well as relief and rescue operations. Moreover, it is essential to receive the required information of ships such as specifications, cargo, direction and emergency messages and provide them with their need information including weather conditions, the position of other vessels and marine barriers. This requires an interconnected network of marine and terrestrial communications systems and navigation aids. Therefore, the purpose of this study is to evaluate the different aspects of a vessel traffic system (VTS) in Kharg oil terminal to eliminate the problems. Obviously, no previous study has implicitly addressed this concept. This study examines this system scientifically and practically and explains the problems to fill the gap in this regard. According to literature, there is no previous research conducted on this subject; therefore, it seems essential to reveal the vague aspects. Undoubtedly, it is vital to consider a VTS for the Kharg oil terminal, because Kharg Island is one of the high traffic islands. However, this needs to be carefully analyzed to achieve desirable results and eliminate the existing problems and gaps. Theoretically, this study determines the role of VTS in facilitating marine communications and transportation and ultimately carrying out the mission of oil terminals, namely the safe and effective operation of processes related to oil exports. Practically, the results of this study can be used to inform the Kharg oil terminal about the negative effects of the lack of this system on activities of the terminal and provide opportunities for its implementation. In general, the purpose of this study is to address the requirements for installation of this system in Kharg considering the marine traffic, especially oil tankers.

**Theoretical Background**

Vessel traffic service (VTS) refers to services provided by competent authorities to enhance safety, improve vessel traffic and protect the marine environment. These services should be given the ability to provide the appropriate response to traffic situations arisen in the area covered by VTS (Don Harry, 2012). A preventive VTS can prevent the spread of accidents, prevent accidents, prevent disasters and minimize those conditions which cause incidents, accidents, and disasters. More than 80% of maritime accidents are due to human error. VTS can reduce human error by providing timely information extracted from precision navigation aids and by giving advice, instructions and warnings. This system can also play an important role after the occurrence of the accident. For example, it can provide maritime assistance, shelter, search and rescue, fire-fighting, anti-pollution operations and salvage (Salari, 2008). A VTS needs to consider the potential conflict between security and trade and eliminates these conflicts before they appear seriously. Therefore, ports need to act in a time efficient manner and meet the needs of users; however, this should not prevent safe operation of ports (Javedan, 2007). A safe port, whether as large as a mega port or as small as a fishing port, is a haven and a shelter where vessels are able to enter safely and harbor in safe conditions and exit safely (Omarai, 2012). Analysis of accidents shows that people are associated with all aspects related to maritime transport; therefore, most of the accidents are related to human factors. More than 90% of accidents are related to humans directly or indirectly. Human error which is originally systemic is the reason for accidents occurred in marine activities (Moradi, 2008). Another study conducted in 2011 by the Danish government evaluated the effect of the Great Belt Traffic Control Center on the number of marine accidents occurred in the studied area. To do this, this study compared the 5-year accident records before deployment and 5-year records after deployment. According to results, 19 accidents occurred in the first period which reduced to seven in the second period; this suggests that VTS was effective in reducing accidents by 60 percent (Lehn Schiøler, 2011). Shipping goods by the sea has many economic benefits for countries. Rising demand for safe and efficient ship transport requires navigational equipment which helps the fast growing increase in merchant shipping. The first navigational equipment which was installed on the shore included lighthouses, beacons and buoys. Over the years, this equipment was upgraded in terms of vision and coverage. Not long after the World War II, it became clear that the available navigational equipment was not sufficient to cover and control ports at full capacity. Weather conditions and traffic resulting from the delay in ship transport during port operations caused traffic and congestion in other parts of the transportation (Kazemi, 2012). Organizations and international communities decided to use both audio, video and electronic navigational aids and a



**Mohammad Reza Hassanvand et al.**

combination of other methods which could improve the safety of navigation. These included separating vessel traffic zones, prohibited areas, speed limits and the proposed routes for ships. These methods improved vessel traffic and increased safety of navigation and protection of the marine environment in coastal waters; however, they were not enough to overcome the problems and improve the safety of navigation. Thus, communication systems became common to broadcast maritime leaflets and safety recommendations. Finally, a system was developed to interact with shipping and provide ships with services for safer navigation (Safarzade, et al., 2003). A coastal VTS provides services for the safe and rapid passage of ships in coastal waters, especially where the vessel traffic is due to environmental sensitivity or in waters where there are geographical constraints for navigation or due to offshore exploration (Qaragozloo, 2013). Authorities will need to decide whether other officials have sufficient technical competence for planning VTS. Where the VTS authorities do not have these experiences, the experiences of other countries need to be available. When using the experiences of others, it is necessary to ensure that individuals or companies whose experiences are used are independent and neutral. It is also considered that the expertise required to describe a system is different from the experience required for monitoring the implementation and quality requirements of a system (Abdollahmani & Habibzade, 2010). In general, experiences can be divided into three groups: transparency of goals, description of system and monitoring of effective quality control (Abdollahmani & Habibzade, 2010). Operating procedures are defined for all current operations of VTS and current performance of personnel in every situation. Procedures are determined as a set of measures to interact with ships and with other parties under unexpected national and international circumstances. Senior management of VTS first have to decide what level of decision can be made in the traffic control center before referring to the foreign organization, the organization itself or the government. This may consider the decision on the border of current and emergency measures in the provision of emergency procedures in the region (Daliri, 2009).

**MATERIALS AND METHODS****Population, Sample Size and Hypotheses**

The participants of this study included 160 personnel and navigation experts at Kharg oil terminal. The Krejcie-Morgan table was used to determine the sample size (112). The samples were selected by convenient sampling method, because the personnel and experts were equally available. The hypotheses of this study are as follows:

Considering the volume and variety of vessel traffic in Kharg Island, it is essential to install a VTS system in this area.

VTS will improve safety.

VTS will improve security.

VTS will reduce environmental pollution.

**Materials**

To collect data, a questionnaire was used to evaluate the need for a VTS in the Kharg oil terminal. The questionnaire contained two types of questions:

A) General questions: regarding demographic information including education, age, work experience and expertise

B) Technical questions: containing understandable questions

In order to develop this questionnaire, articles, reputable foreign sources as well as relevant professors were referred. The questionnaire contained 40 questions.



**Mohammad Reza Hassanvand et al.****Validity and Reliability**

Despite using a standard questionnaire which has been used in multiple studies, theorists were asked to confirm the formal validity and content validity. Reliability was calculated by Cronbach's alpha for each component. To determine reliability, 40 questionnaires were distributed among the samples; the coefficients of variables and the questionnaire, as a whole, were calculated by SPSS software. The coefficients were  $>0.7$ ; therefore, the questionnaire is valid.

**Data Analysis**

The descriptive data including demographics was used to analyze data and describe the questions. The Kolmogorov-Smirnov test was used to examine the normality of the data. Hypotheses were evaluated by Student t-test using SPSS software, V21.

**Demographics**

The demographic distribution of participants is presented in the form of tables and charts. The education of participants varied from secondary diploma (2.7%), associate degree (5.4%), bachelor's degree (71.4%), to master's degree and higher (20.5%). Therefore, a higher percentage of respondents had bachelor's degree. The respondents aged 18-25 (2.7%), 25-35 (45.5%), 35-50 (38.4%) and more than 50 years (13.4%). Therefore, a higher percentage of respondents aged 25-35 years. The work experience of respondents varied from less than 5 years (15.2%), 5-10 years (30.4%), 10-15 years (11.6%) and more than 15 years (42.9%). Therefore, a higher percentage of respondents had more than 15 years of experience. The expertise of respondents ranged from maritime affairs (21.4%), ship operations (10.7%), ship guide (8%), ship's commander (3.6%), towboat commander (6.3%), import and export operations (25.9%), ICT (23.2%) to management (0.9%). Therefore, a higher percentage of respondents were expert in import and export operations.

**RESULTS**

This section examines the hypotheses and explains the tests used to examine hypotheses. Parametric tests can be used for normal variables; otherwise, non-parametric tests are used. All four variables including the need for VTS, safety, security and environmental pollution were normal; thus, parametric tests and Student t-test were used to examine hypotheses.

**First Hypothesis**

$H_0$ : considering the volume and variety of vessel traffic in Kharg Island, it is not essential to setup VTS in this area ( $\mu \leq 3$ ).

$H_1$ : considering the volume and variety of vessel traffic in Kharg Island, it is essential to setup VTS in this area ( $\mu > 3$ ).

$H_0$  is supported if  $\text{sig} > 0.01$  (error value); otherwise,  $H_1$  is supported.

According to Table 1,  $\text{sig} = 0.000$  which is  $\text{sig} < 0.01$ ; therefore,  $H_0$  is rejected and  $H_1$  is supported. Thus, there is a significant difference between mean value of the need for VTS and the value 3. Given that  $t\text{-value} = 29.506$  which is  $> 1.96$  and the lower and upper limits are positive, the mean value of this variable is  $> 3$  at 99% confidence. Therefore,  $H_1$  is supported; thus, it is essential to setup a VTS in Kharg Island considering the volume and variety of vessel traffic.



**Mohammad Reza Hassanvand et al.****Second Hypothesis**

H<sub>0</sub>: VTS does not improve safety ( $\mu \leq 3$ ).

H<sub>1</sub>: VTS improves safety ( $\mu > 3$ ).

H<sub>0</sub> is supported if sig > 0.01 (error value); otherwise, H<sub>1</sub> is supported.

According to Table 2, sig = 0.000 which is sig < 0.01; therefore, H<sub>0</sub> is rejected and H<sub>1</sub> is supported. Thus, there is a significant difference between mean value of safety and the value 3. Given that t-value = 23.575 which is > 1.96 and the lower and upper limits are positive, the mean value of this variable is > 3 at 99% confidence. Therefore, H<sub>1</sub> is supported; thus, VTS will improve safety.

**Third Hypothesis**

H<sub>0</sub>: VTS does not improve security ( $\mu \leq 3$ ).

H<sub>1</sub>: VTS improves security ( $\mu > 3$ ).

H<sub>0</sub> is supported if sig > 0.01 (error value); otherwise, H<sub>1</sub> is supported.

According to Table 3, sig = 0.000 which is sig < 0.01; therefore, H<sub>0</sub> is rejected and H<sub>1</sub> is supported. Thus, there is a significant difference between mean value of security and the value 3. Given that t-value = 30.773 which is > 1.96 and the lower and upper limits are positive, the mean value of this variable is > 3 at 99% confidence. Therefore, H<sub>1</sub> is supported; thus, VTS will improve security.

**Fourth Hypothesis**

H<sub>0</sub>: VTS will not reduce environmental pollution ( $\mu \leq 3$ ).

H<sub>1</sub>: VTS will reduce environmental pollution ( $\mu > 3$ ).

H<sub>0</sub> is supported if sig > 0.01 (error value); otherwise, H<sub>1</sub> is supported.

According to Table 4, sig = 0.000 which is sig < 0.01; therefore, H<sub>0</sub> is rejected and H<sub>1</sub> is supported. Thus, there is a significant difference between mean value of security and the value 3. Given that t-value = 29.273 which is > 1.96 and the lower and upper limits are positive, the mean value of this variable is > 3 at 99% confidence. Therefore, H<sub>1</sub> is supported; thus, VTS will reduce environmental pollution.

**DISCUSSION AND CONCLUSION**

Considering the volume and variety of vessel traffic in Kharg Island, it is essential to setup VTS in this area. In relation to the first hypothesis, 0.3% of respondents disagreed, 4.3% had no comment, 8.2% relatively agreed, 39.3% agreed and 47.9% totally agreed. Thus, a higher percentage of respondents totally agreed to the first hypothesis. The results derived from the questionnaire are in fact the summarized views of experts in sailing and marine operations as well as the experts in management and support of current sailing processes in Kharg Island. The results are indeed derived from experience and expertise of respondents and their knowledge on maritime and port affairs; therefore, they can be used as a valid indicator of future decisions on the need for VTS in Kharg Island. The high volume of vessel traffic, including oil tankers, passenger ships, cargo ships, fishing vessels and logistic ships, requires a communication system and navigation aid for control and surveillance on current processes of oil terminals as well as loading and passenger docks; this plays an influential role in reducing the risk of maritime accidents, reducing environmental pollution and increasing the efficiency, effectiveness, safety and security of the port and personnel. Hence, an added control system, namely VTS, can ensure the health of staff, facilities and the marine





**Mohammad Reza Hassanvand et al.**

environment as well as safety and protection of the national interests. Therefore, it is essential to set up a VTS in Kharg Island; this is consistent with another study in USA in which the performance of seventeen ports using VTS was evaluated. According to results of this study, these seventeen ports saved \$2 billion for users of the VTS in preventing maritime accidents, environmental pollutions, loss of cargo, dangerous goods, etc. (National University Press Washington, DC 1996). In addition to its economic advantages, therefore, VTS can be used to improve safety and security of navigation operations in ports and reduce adverse environmental effects. To validate the role of VTS in improving safety of marine transportation in ports, note a study conducted in 2011 by the Danish government to examine the effect of the Great Belt VTS on the number of marine accidents occurring in that region. For this purpose, this study compared the 5-year accident records before VTS was set up and the 5-year record after the setup. According to results, 19 accidents occurred in the first period which reduced to seven in the second period; this suggests that VTS was effective in reducing accidents by 60 percent (Lehn Schiøler, 2011).

In relation to the second hypothesis, 4.9% of respondents relatively agreed, 36.4% agreed and 49.3% totally agreed. This means that 90.6% of respondents were aware of the effective and decisive role of VTS in improved maritime safety. As an example of a valid indicator to validity of the hypothesis, note the *Developments in Marine Transportation* written by Dr. Omaraei. In his book, he provides solutions for maritime safety and explicitly points out the role of VTS in improving maritime safety. To improve safety, he considers various options, some based on new European rules and some based on control and guidance facilities. Some areas have set up VTS for informing and providing safety. The new automatic identification system (AIS) improves the ability to track and guide vessel traffic (Omaraei, 2012). This is consistent with Moradi who evaluated the threat to the safety of maritime transport (hidden unsafe parameters which cause failure in safety of harbor processes). According to Moradi, there are hidden unsafe parameters in activities and processes which lead to the failure in safety and cause systemic accidents. Analysis of accidents shows that people are associated with all aspects related to maritime transport; therefore, most of the accidents are related to human factors. More than 90% of accidents are related to humans directly or indirectly. Human error which is originally systemic is the reason for accidents occurred in marine activities (Moradi, 2008). Fatigue, stress and psychological pressures are the most important factors to threaten maritime safety and management processes. Therefore, the best solution for reducing the risk of human error is to automate the control processes and monitor the navigation systems such as VTS in ports. To verify the validity of the second hypothesis, note a study conducted in 2008 by Jouni Lappalainen to examine the increased volume of crude oil transfer in the Gulf of Finland, probable increase in oil pollution and increased number of near miss incidents. The purpose of this study was to find the significant risks in maritime safety and provide solutions to eliminate them in the Gulf of Finland. Results of this study indicated that the fatigue of sailors was the most important threat to maritime safety. Effective measures to reduce oil accidents included the development of VTS, mandatory application of guidance services and increased capacity to deal with oil pollution in the Gulf of Finland.

In relation to the third hypothesis, 2.9% of respondents had no comment, 6.6% relatively agreed, 42.1% agreed and 48.4% totally agreed. Therefore, 98.1% of the respondents agreed to the third hypothesis and the positive role of VTS in improving maritime security. Currently, 90% of international trade is through the sea from the ports. This trade happens via sea freight by 92 thousand ocean liners with a gross tonnage of more than 1000 GT and more than one million and two hundred thousand sailors in more than 6500 ports and oil and non-oil terminals. That is why the shipping industry is considered as the main carrier of international trade between countries and an essential component of the economy (Omaraei, 2012). Clearly, the preservation of this important international economic lifeline is of great importance. Therefore, countries and international organizations try to update the existing conventions and impose new ones, if necessary, to ensure the security. Because of terrorist attacks and increased threats of terrorism and piracy, security is of great importance for marine societies and ships. Along with air transport, maritime transport is one of the frontiers of transportation security. Using navigation aids and communication equipment and monitoring current activities of the port and terminal as well as identifying vessels, VTS can play a decisive role in maintaining and promoting the security of human resources, port, facilities, docks and vessels.





**Mohammad Reza Hassanvand et al.**

In relation to the fourth hypothesis, 0.2 of respondents had no comment, 11.4% relatively agreed, 43.4% agreed and 45%totally agreed. Therefore, 99.8%of respondents agreed to the fourth hypothesis and the role of VTSin reducingenvironmental pollution. To validate the fourth hypothesis, note the study conducted by Salari. According to Salari, the pollution caused by oil tankers and oil spills are generally the most serious environmental threat of ports; that is why environmental protection is one of the main purposes of VTS. VTS is one of the four methods and basic requirements for establishment and identification of marine areas(Salari, 2008). Given the importance of VTS, the IMO Resolution A.857 (20) enacted on November 27, 1997, by the General Assembly of the International Maritime Organization (IMO) predictedand announced items that should be considered in the design and implementation of VTS. Given the fact that Iran has been a member of IMO and committed to the requirements of IMOconventions and other international and regional treaties and agreements on environmental preservation, Iran will be required to consider the decisions of IMOon implementation of VTS in ports and terminals.

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**Table 1:T-test for the first hypothesis**

Mean	t-value	Degrees of freedom	Sig.	99%confidence interval	
				lower limit	upper limit
4.282	29.506	111	0.000	1.196	1.369

**Table 2: T-test for second hypothesis**

Mean	t-value	Degrees of freedom	Sig.	99% confidence interval	
				lower limit	upper limit
4.282	23.575	111	0.000	1.113	1.317

**Table 3:T-test for third hypothesis**

Mean	t-value	Degrees of freedom	Sig.	99% confidence interval	
				lower limit	upper limit
4.361	30.773	111	0.000	1.273	1.448





**Mohammad Reza Hassanvand et al.**

**Table 4:T-test for fourth hypothesis**

Mean	t-value	Degrees of freedom	Sig.	99% confidence interval	
				lower limit	upper limit
4.364	29.273	111	0.000	1.272	1.456





## Concept of Freedom in Human Right Law and the Rule of Law in Iran

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### ABSTRACT

Freedom has long been a wish of human being and has proper place in human thought and mind. Due to changes in human being and his life and thoughts and perceptions, many discussions and difficulties have been raised and discoveries have been found. Freedom is promise of dignity, which makes him distinctive from any other creature. Human being worships freely and voluntarily the God, because The God has not put anything in his composition which forces him to faith, and nor allowed him to force others to have faith. Freedom and its related concepts have been among considerable and main concepts in all schools, works of wise, and human promises over the history. Current work attempts to investigate freedom in the view of Iran's law and human rights.

**Keywords:** Freedom, Rights, Iran, Human Rights.

### INTRODUCTION

Freedom is among definitions which have been faced by human being since his birth and it has been always one of main global issues during different eras of human life. Thus, the states and nations attempted to specify formulated rules and regulations for it. In democratic states, the government's commitment to preserving legitimate rights and freedoms of the people is the first conditions, and limitation of domination and tyranny and practical commitment to provision of social and political liberties of law are legal obligations of the government. In Iran, concept of freedom has been manifested in constitution. In fact, it can be stated great revolution of Iranians can be analyzed and investigate in line with freedom-seeking and "rejection of oppression and injustice, plumb and submissiveness" (Article 2, Paragraph 6) and independence and establishment of Islamic Republic. According to the introduction of constitution: "in the view of Islam, ruling approach does not results from class-based and individual or group

9939





### Seyedeh kiana Banikamali

domination situation, rather it is manifestation of political ideal of a nation which is of the same thinking. It is such manifestation which organizes it so that it moves toward ultimate goal (moving toward the God) in the process of intellectual change", and then it is read: "the constitution ensures elimination of any intellectual and social tyranny and economic monopoly, and it attempts in the breaking of authoritarian system, and granting destiny of people to themselves."

#### Concept of Freedom

##### Etiology

Various definitions have been given for freedom, from "Hurriyet" meaning liberation of slavery to mystical, political and social meanings. Concept of freedom based on dictionaries is defined as follows: "freedom" means liberation, release, power of choice, against slavery and bondage and force (ShahidMotahari). According to Dekhoda Dictionary, freedom means: Atgh, Hurriyet, authority, against slavery and bondage and force, power to act and stop action, choice, and free (Dekhoda, 1999).

In other English and French dictionaries, freedom has various definitions. For example, inKinsine Dictionary, Oxford Dictionary, following definition is given for term Free: "Freedom and free from the bondage of others, abandoned, unlimited, free from the constraints or obligations, unimpeded, unrestricted practice, allowed to remain independent (Kerteston, p. 44)."

In French dictionary, its equivalent is Leberte and its German equivalent is freiheit, and above meanings has been given in both terms too. Ikhtiar, Hurriyet and Ataq are Arabic equivalentsfor freedom. Regarding freedom, it can be said accurate and comprehensive definition for it is difficult and perhaps impossible, so that Inraberlin reported over 200 definitions for freedom. Jaspers, a contemporary thinker, believed there is no convincing definition of freedom. He emphasized that freedom always remains far from understanding (Jaspers, p.173).

##### Idiomatic Meaning of Freedom

Freedom concept which is common today in various areas such as philosophy, ethics, politics, law, sociology as the single meaning, so that it is available in all interpretations and definitions. To this end, freedom has three basic components which constitute its concept: 1. Subject; freedom of whom?, 2. Obstacle; freedom from whom or what?, 3. Goal; freedom for what goal? Considering these components, freedom can be defined in this way: freedom of one from other's bond to perform specific action and behavior (Bayat, 2002). Anyway, there is a "privative" and "positive" concept in these definitions and interpretations. Its privative part is "lack of obstacle and release from the other" and positive part is "human subjectivity toward his own actions". Or freedom is defined as: the right by which people are able to use their natural talents and abilities, if it does not harm others (Hashemi, p. 196).

##### Concept of Freedom in Iran's Rights

In terms of rights, to what extent is human being free? Legal issues are different from ethical issues, including ethical issues are also raised in totally personal cases, while legal issues are raised where social relations are raised or others are concerned. Regulations are specified for setting social relations and the government guarantees its implementation. Since, foundation of legal rules can be found in constitution of each country, thus constitutions should be understood in order to have proper understanding of freedom concept in Iran's rights.

Considering Islamic – human criteria considered in registration of Iran's constitution, assumptions of constitution about freedom include:





### Seyedeh kiana Banikamali

1. Human is selective and free.
2. Human makes system and can move towards happiness which is the ultimate ideal.
3. Any monopoly and intellectual, social, and economic tyranny is rejected and banned, and there is self-determination of the people.
4. Freedom and dignity and high value of man and human beings are the goals of the Islamic Republic.
5. Human freedom is coupled with responsibility. Because the man is free, he is responsible and accountable for their actions.

In constitution, personal freedoms are emphasized in some cases, and sometimes political and social aspect of freedom is emphasized. The main point is that according to constitution, no one can use his right or harm the other or violate general interests (Article 4). Thus, freedom can be enjoyed within framework of law, if applying right of freedom does not disturb others or public interests. Considering this assumption and limitation in enjoying freedom, various spaces in constitution include as follows: freedom of action and personal behavior has been included in the constitution as a main and basic principle: "No one may be arrested except by the order and in accordance with the procedure laid down by law. In case of arrest, charges with the reasons for accusation must, without delay, be communicated and explained to the accused..." (Article 32). Article 37 emphasizes freedom of action: it provides for the presumption of innocence, stating: "Innocence is to be presumed, and no one is to be held guilty of a charge unless his or her guilt has been established by a competent court." Article 33 states about freedom in selection of housing and residential place: "No one can be banished from his place of residence, prevented from residing in the place of his choice, or compelled to reside in a given locality, except in cases provided by law." Thus all citizens are entitled to select their residence place and no one can prevent from it. According to Article 28 regarding freedom on selection of job and ownership security, "everyone has the right to choose any occupation he wishes, if it is not contrary to Islam and the public interests". Of course, in addition to compatibility with Islam and public interests, population growth and economic recession and increased unemployment are among limitations in freedom of job selection. According to Paragraph 1 in Article 43, "respect for the right to choose freely an occupation; refraining from compelling anyone to engage in a particular job; and preventing the exploitation of another's labor" is regarded as rules of economic system in Islamic Republic. Also, "elimination of poverty and abolishing all forms of deprivation and the provision of social insurance for all" is advised in this Article. Logical result of choosing occupation is ownership security: "Private ownership, legitimately acquired, is to be respected" (Article 47). According to Article 46, "Everyone is the owner of the fruits of his legitimate business and labor, and no one may deprive another of the opportunity of business and work under the pretext of his right to ownership", thus, illegitimate ownerships can be held up by the law.

Regarding freedom of belief according to Article 23, "The investigation of individuals' beliefs is forbidden, and no one may be molested or taken to task simply for holding a certain belief". Of course, it does not mean that the constitution accepts legitimacy of other beliefs; rather it means people cannot be investigated for their different beliefs and thoughts, and something cannot be imposed on them which are in contrasted to their will. Also, regarding freedom of religious minorities, it is considered that "The official religion of Iran is Islam and the Twelve Ja'fari school" (Article 12), however, some measures are regarded in constitution for other religions which live in Islamic Republic system: "Other Islamic schools are to be accorded full respect, and their followers are free to act in accordance with their own jurisprudence in performing their religious rites. These schools enjoy official status in matters pertaining to religious education, affairs of personal status (marriage, divorce, inheritance, and wills) and related litigation in courts of law." (Article 12). In addition, this Article states "In regions of the country where Muslims following any one of these schools constitute the majority, local regulations, within the bounds of the jurisdiction of local councils, are to be in accordance with the respective school, without infringing upon the rights of the followers of other schools". Regarding followers of other divine religions living in Iran, Article 13 states: "Zoroastrian, Jewish, and Christian Iranians are the only recognized religious minorities, who, within the limits of the law, are free to perform their religious rites and ceremonies and to act according to their own canon in matters of personal affairs and religious education" (Article 13).





### Seyedeh kiana Banikamali

Regarding freedom of voting and elections, Article 6 states: "In the Islamic Republic of Iran, the affairs of the country must be administered on the basis of public opinion expressed by the means of elections, including the election of the President, the representatives of the Islamic Consultative Assembly, and the members of councils, or by means of referenda in matters specified in other articles of this Constitution."

Regarding freedom of formation of parties, associations, and societies, Article 26 states: "The formation of parties, societies, political or professional associations, as well as religious societies, whether Islamic or pertaining to one of the recognized religious minorities, is permitted provided they do not violate the principles of independence, freedom, national unity, the criteria of Islam, or the basis of the Islamic Republic. No one may be prevented from participating in the aforementioned groups, or be compelled to participate in them."

Regarding freedom of expression and press, Article 24 states: "Publications and the press have freedom of expression, except when it is detrimental to the fundamental principles of Islam or the rights of the public. The details of this exception will be specified by law." Also, freedom of expression of thoughts in IRIB is emphasized in Article 175: "The freedom of expression and dissemination of thoughts in the Radio and Television of the Islamic Republic of Iran must be guaranteed in keeping with the Islamic criteria and the best interests of the country." Regarding human rights, due to importance of freedom at level of governances, various organizations are active and rules are formulated in various forms, some of which are described here.

#### Freedom in Universal Declaration of Human Rights

On December 10, 1948, a declaration was approved in UN General Assembly, singers of which reaffirmed faith in fundamental human rights, and dignity and worth of the human person" and committed all member states to promote "universal respect for, and observance of, human rights and fundamental freedoms for all without distinction as to race, sex, language, or religion. This declaration was formulated in 30 articles, half of which are associated to human freedoms, and some articles are some related to freedom issues. Some articles of the declaration on freedom are expressed here:

Article 1 states: All human beings are born free and equal in dignity and rights. Article 2 refers Everyone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind, etc. according to Article 3, Everyone has the right to life, liberty and security of person. Article 4 states: No one shall be held in slavery or servitude; slavery and the slave trade shall be prohibited in all their forms. Article 12 in Frist and Second Paragraphs is allocated to freedom of movement and free residence in any country. Article 16 talks about the freedom and right to marry and to found a family. Article 18 refers to the fact that everyone has the right to freedom of thought, conscience and religion. According to Article 19, Everyone has the right to freedom of opinion and expression. Article 20 refers to the right to freedom of peaceful assembly and association. Article 23 is allocated to freedom of occupation choice. Article 27 states: Everyone has the right freely to participate in the cultural life of the community. Article 29 states: Everyone has duties to the community in which alone the free and full development of his personality is possible. Article 30 states: Nothing in this Declaration may be interpreted as implying for any State, group or person any right to engage in any activity or to perform any act aimed at the destruction of any of the rights and freedoms set forth herein.

As it is clear, freedom has basic role in Universal Declaration of Human Rights and it has place in different ways in most articles of the declaration. Considering other articles of the declaration which are somehow related to freedoms, it can be said Universal Declaration of Human Rights is declaration of human rights and freedoms.

According to first article of declaration, all human beings are born free which is a human and Islamic principle, and it again refers to freedom in the last article, and it rejects and condemns any misinterpretation of declaration articles for destruction of any of the rights and freedoms.





## Syedeh kiana Banikamali

### Freedom in International Covenants on Human Rights

Commission on Human Rights, which was founded after the Second World War (1946) by the United Nations Economic and Social Council, and formulated Declaration of Human Rights (1948) and other international conventions, was replaced by the Human Rights Council from 16 March 2006. The Council is one of the subsidiary organs of Economic and Social Council which directly acts under the General Assembly of the United Nations and gives reports to the Assembly. The aim for establishment of the Human Rights Council with new organization and composition was promoting and empowering international supports for human rights and freedoms and continuous supervision on them. Following publication of Universal Declaration of Human Rights, Commission on Human Rights immediately was certain to approve conventions which are binding in terms of national and international rights for the signing states, since this declaration lacked necessary guarantee for implementation.

In 1966, International Covenants on Human Rights were put in practice and after 20 years following approval of Universal Declaration, UN General Assembly could approve an implementation guarantee system for human rights. This class of human rights is subject to economic development and social progress of countries which should be accomplished gradually. However, Covenant on Civil and Political Rights, embodying traditional rights and freedoms, relegated implementation of this class of human rights to a committee with 18 members called Human Rights Committee. Importance of approval of these covenants is that human rights for the first time gained an internal support and implementation system, and these measures and supports are regarded as an evolutionary stage and right of international community supervision on human rights implementation in terms of international laws in current conditions of the international community.

### International Covenant on Civil and Political Rights

According to the first part of this document, all peoples have the right of self-determination and the right to freely determine their political status and freely pursue their economic, social and cultural development. In the second part, the state parties are committed to apply the rights recognized in the present Covenant, without distinction of any kind, and make sure that any person whose rights or freedoms as herein recognized are violated shall have an effective remedy, and it does not allow none of articles in Covenant is interpreted in such a way that provides rights for a state or a group or individuals which violate recognized rights and freedoms in this Covenant or limit it as more specified in this Covenant.

In the next part, it bans the death penalty, slavery and torture, as well as medical tests on individuals without their free consent and the imposition of forced labor. It also declares everyone has right for personal freedom and security and no one can be arrested arbitrarily and no one's freedom cannot be prevented unless it is specified by law. Article 10 is about persons deprived of their liberty who shall be treated with humanity and with respect for the inherent dignity of the human person. In the next article, it states no one shall be imprisoned merely on the ground of inability to fulfill a contractual obligation. Freedom of thought and belief is emphasized in Article 18. In article 21, the right to form peaceful associations is recognized and according to Article 22, everyone shall have the right to freedom of association with others, including the right to form and join trade unions for the protection of his interests. Article 23 emphasizes the right to marry and find family for women and men and states no marriage shall be entered into without the free and full consent of the intending spouses. Article 25 respects for freedom of elections and to be elected in the elections by public votes.

### International Covenant on Economic, Social and Cultural Rights

Similar to International Covenant on Civil and Political Rights, this document identifies political status and provision of economic and social development for various nations without any discrimination.





**Seyedeh Kiana Banikamali**

Then, in Article 6 it recognizes the right to work, which includes the right of everyone to the opportunity to gain his living by work which he freely chooses or accepts. Article 8 recognizes the right of everyone to form trade unions and join the trade union of his choice, and right of trade unions to function freely and the right to strike. According to Article 10, the marriage should be done with free consent and tendency of spouses. According to Article 13, the States Parties to the present Covenant recognize the right of everyone to education. They agree that education shall be directed to the full development of the human personality and the sense of its dignity, and shall strengthen the respect for human rights and fundamental freedoms. They further agree that education shall enable all persons to participate effectively in a free society, promote understanding, tolerance and friendship among all nations and all racial, ethnic or religious groups, and the activities of the United Nations for the maintenance of peace. Article 15 bounds state parties to respect for freedoms to do scientific and innovative research and activities.

**CONCLUSION AND RECOMMENDATIONS**

Freedom is one of issues which have always been sought by the human being, thus human beings attempt to achieve and preserve it. Iran after the revolution explicitly specifies this important issue in its constitution due to its Islamic democratic governance. According to the constitution, since human being is born free, and essence of freedom is place in his nature, Islamic Republic is bound to provide legitimate freedoms specified in the constitution and three bodies are responsible to ensure, develop, and respect for basic freedoms of people. Violating freedom even with specification of regulations is not allowed, as abusing freedom and infringing the independent and territorial totality of the country is not allowed. According to Article 177 in the Constitution, on revision of the Constitution, some matters including “the religious footing” of the Islamic Republic of Iran, which freedom is one of them as well as “administration of the affairs of the country based on national referenda” and “the democratic character of the government” are unalterable. Anyway, freedom has high status in the constitution of Islamic Republic of Iran and it is considered as one of the basic elements and belief foundations of the system and necessary mechanisms for provision of public freedoms have been provided. Importance of freedom in the Iran’s constitution can be summarized in one article. In Article 5 in Iran’s Constitution it is read: “In the Islamic Republic of Iran, the freedom, independence, unity, and territorial integrity of the country are inseparable from one another, and their preservation is the duty of the government and all individual citizens.” Declaration of Human Rights also gives similar results regarding freedom, as none of articles in this declaration should be interpreted in such a way that provides a right for a state or group or person thereby they violate rights and freedoms mentioned in the declaration or act for it. Also, overall view in the mentioned international covenants is that articles of the covenants should not be interpreted in such a way that prevents from enjoyment of people of the recognized freedoms. As observed in Article 47, “Nothing in the present Covenant shall be interpreted as impairing the inherent right of all peoples to enjoy and utilize fully and freely their natural wealth and resources.”

Comparison of Iran’s constitution with mentioned international documents show though this constitution covers most basic rights and freedoms except in limited cases (e.g. Abolition of execution punishment), practical mechanisms for respecting freedom concept in all individual and social aspects, whether in domestic laws of states or at international level, is the issue which needs separate investigation. Thus, it should be concluded concept of freedom in Iran’s law and documents of human rights under study is respected.

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**Seyedeh kiana Banikamali**

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RESEARCH ARTICLE

## Health literacy, Self-Care, Medication Adherence and Health Status: a Cross-Sectional Survey in Iranian Patients with Type 2 Diabetes

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### ABSTRACT

This study aimed to assess the health literacy of patients with type 2 diabetes in three domains of functional, communicative and critical and to examine their specific relationships with self-care behaviors, medication adherence and health status. We conducted a cross-sectional observational study of 187 patients with type 2 diabetes. Participants completed the FCCHL scales as a multidimensional instrument (measured health literacy), the Summary of Diabetes Self-Care Activities (measured self-care behaviors), The Morisky Medication Adherence Scale (measured medication adherence), a single self-rated question (measured health status) and a demographic questionnaire. Among the three subscales of



**Mahnoush Reisi et al.**

FCCHL, communicative health literacy had the highest and functional HL had the lowest mean score. Limited functional, communicative and critical health literacy were more prevalent in participants with older age, poorer educational attainment, lower income and living alone. In multivariate regression models, Functional HL was not associated with diabetes self-care behaviors, critical HL was significantly associated with diet, and communicative HL was related to all aspects of self-care behaviors. There were not any significant relationships between FCCHL subscales and medication adherence. All three domains of health literacy were positively associated with self-reported health status. Skills related to functional HL are not sufficient for successful self-management and navigating more complex health systems, so communicative and critical HL skills should be taken into account. It is essential that Health care providers assess patient's levels of health literacy and address this issue as part of everyday practice in order to provide relevant levels of health education to patients.

**Key words:** Health literacy, diabetes self-care behaviors, medication adherence, health status, health education, Iran.

## INTRODUCTION

Type 2 diabetes mellitus (T2DM) is approaching epidemic proportions and affected close to 285 million people worldwide (1, 2). The prevalence of T2DM ranges from 1.2 to 14.6% in Asia, 4.6 to 40% in the Middle East and 1.3 to 14.5% in Iran(3). The outcome of diabetes control is highly dependent on the self-care activities of the patients, and it is estimated that patients are expected to conduct 95% of their own diabetes care(4). Self-care behaviors that patients with type 2 diabetes must learn or modify to effectively cope with their disease include eating healthily, exercising regularly, adhering to medical treatments and self-monitoring of blood-glucose levels(5). Without proper self-care, T2DM can cause serious complications such as cardiovascular diseases, retinopathy, and neuropathy. Although, Self-care behaviors are vital for controlling T2DM and for reducing long-term complications, but according to previous literature few patients(15.1%) engage in the full set of self-care behaviors at recommended levels in Iran(6).

Recent studies suggest that health literacy (HL) plays a significant role in self-care among individuals with T2DM(7).The need for patients to be 'health literate' in today's society is greater than ever before. Patients are required to participate in more complicated preventative health care and self-care regimes, understand more complex health information, and navigate more complex health systems.This is especially true for diabetic patients, who need to have ongoing self-care(8).

World Health Organization defines HL as "the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use information in ways, which promote and maintain good health"(9). Based on this definition, Nutbeam describes a model for HL concept with three skill levels, which progressively increase individuals' decision making and empowerment. According to this model, HL has the following three levels: Functional HL ( the basic skills in reading and writing and capacity to apply these skills in everyday situations); communicative HL (the advanced cognitive and literacy skills, greater ability to obtain relevant information, derive meaning and apply new information to changing circumstance); and Critical HL (the most advanced cognitive and literacy skills, critically analysis of information, and ability to use information to respond, adapt and control life events)(10).

The most previous researches, focused mainly on basic reading and writing skills to understand and follow simple health messages, which are the functional concept of HL, and the other levels of HL have received limited attention. Those studies indicated that lower levels of functional health literacy are associated with limited understanding of health information and medical instructions (11-13), less healthcare knowledge(14), inadequate self-management of



**Mahnoush Reisi et al.**

diseases(15), poor medication adherence(16), decreased use of preventive services and routine physician visits(17, 18), increased hospitalizations(19) and healthcare costs(20). Studies involving patients with T2DM have reported that those with limited functional HL have poor knowledge of their disease(1) find it more difficult to interpret food labels and estimating portion sizes(21) and have more diabetes-related complications(22). These findings did not support in another studies(23) and it is suggested that optimal health outcomes may not depend exclusively on patients' functional HL skills.

In recent studies that most of them have been conducted in developed countries, the importance of communicative and critical HL has been emphasized as a strong asset to enable people to take part actively in healthcare and health promotion(24, 25). In diabetes context, Communicative and critical HL has been demonstrated to be associated with understanding of diabetes care(26), better self-care(7) and improved glycemic control(27). It seems that effective communication, abilities to extract information, derive meaning, and critically analyze health-related information contribute to better self-care and play a significant role in better diabetes management and optimal health.

So far, little research on health literacy has been conducted in Iran and other developing countries and little is known about the level of health literacy and its effects on health outcomes as well. Improving adherence to self-care behaviors is the first step towards helping diabetic patients to manage their disease appropriately. It is important to examine and understand factors affecting self-care behaviors of diabetic patients and factor affecting perceived health status such as HL. Considering the importance examining self-care activities with health literacy and the fact that such research has not been performed till now in Iran, the present study was designed to assess the health literacy of patients with T2DM in three domains of functional, communicative and critical and to examine their specific relationships with self-care behaviors, medication adherence and health status. The Results can be helpful for health care workers to provide relevant levels of health education to patients in order to fully inform them and to promote empowerment rather than simple compliance among T2DM patients.

## METHODS

### Study population and setting

In the three months of April to June 2014, we conducted a cross-sectional survey of 200 patients with T2DM referred to the diabetes clinic at Hazrat-Ali health center (in the city of Isfahan, Islamic Republic of Iran). From this population, thirteen dropped out because of difficulty in filling out the questionnaires and did not meet the inclusions criteria. Therefore, the final sample consisted of 187 patients. Inclusion criteria of participant patients were: (1) age 25 years and above (2), diagnosis of T2DM diabetes  $\geq 1$  year, (3) having proper physical situation to answer the questions (4), absence of cognitive problems and mental disease (5) voluntary participation in the study. The sample of the present study was a convenience sample. All participants provided a written informed consent. Ethical approval for the study was given by the Ethical Committee of Isfahan University of Medical Sciences in Iran.

### Measurements

#### The multidimensional scale of Health literacy

The multidimensional scale of Functional, Communicative and Critical Health Literacy (FCCHL), developed by Ishikawa *et al.* was used to assess health literacy skills. FCCHL measure of HL for T2DM patients, covering the three constructs of HL introduced by Nutbeam. It was one of the first self-report questionnaires to measure more than functional HL. FCCHL has five items for each functional and communicative HL subscales, and four for critical HL subscale. Response options rated on a 4-point Likert response scale ranging from 'never' to 'often'. The scores for the items in each sub-scale were summed and divided by the number of constituting items in the subscale to give a score. Scores were recoded for functional HL. A total score can also be calculated with higher scores indicating higher levels



**Mahnoush Reisi et al.**

of HL. The original scale showed satisfying internal consistency with Cronbach's  $\alpha = 0.84, 0.77$  and  $0.65$  for the three different dimensions. Cronbach's  $\alpha$  of the total HL scale reported  $0.78$ . The simplicity and comprehensibility of the items were tested and found acceptable. Correlation analysis showed that the three dimensions are fairly independent(28).

For the Persian version, Cronbach's alpha was acceptable ( $\alpha = 0.82$ ) and for the functional, communicative and critical it was acceptable as well ( $\alpha = 0.91, 0.80, 0.76$  respectively). The test-retest reliability coefficient was  $0.85$  ( $p < 0.01$ ). The mean and variance scores of each item were examined through descriptive statistics for item analysis. The range of the mean score for the scale was from  $1.84$  to  $2.65$  and the range of variance score was from  $0.88$  to  $1.21$ . The item-total correlations were all positive and ranged  $0.84-0.89$  for functional HL,  $0.73-0.82$  for communicative HL, and  $0.71-0.78$  for critical HL. The mean and variance scores of each item and item-total correlation confirmed that the items were homogenous to the scale. Construct validity of the FCCHL was assessed through factor analysis. We conducted an exploratory factor analysis to identify underlying constructs. Using Promax rotation, a three-factor solution explaining  $65.77\%$  of the variance was identified. The results supported a three-factor structure for the instrument, and all items loaded above  $0.40$ .

**Self-care behaviors**

To measure diabetes Self-care behaviors, we used The Summary of Diabetes Self-Care Activities (SDSCA) questionnaire(29). The tool consisted of 11 items, which assesses the frequency with which a patient followed a diabetes routine over the previous 7 days in five domains: diet(item 1-4), exercise(item 5-6), blood-glucose testing(item 7-8), foot care(item 9-10) and smoking status (item 11). Response options range from 0 to 7 to correspond to the number of days in a week. The last item focuses on smoking habits and assesses the average number of cigarettes smoked per day. Since no participant reported smoking habits, for the analysis the eleventh question was omitted. In the present study, the Cronbach's alphas internal consistency coefficients were  $0.79$  for the overall scale and  $0.65, 0.79, 0.69,$  and  $0.85$  for the diet, exercise, blood glucose testing, and foot-care subscales, respectively. The test-retest reliability coefficient was  $0.78$  ( $p < 0.01$ ) for the total scale.

**Medication adherence**

The Morisky Medication Adherence Scale (MMAS-8-Item)(30), is a well-validated self-report measure of medication adherence(31). Response choices are yes/no for items 1 through 7 and a 5-point Likert response scale for the last item. The total score on the MMAS-8 can range from 0 to 8. Scores of less than 6 reflect low adherence, scores of 6 to  $< 8$  reflect moderate adherence, and score = 8 reflect high adherence. In the present study, the Cronbach's alphas internal consistency coefficients were  $0.70$  for the overall scale. The test-retest reliability coefficient was  $0.76$  ( $p < 0.01$ ).

**Health status**

Patients' health status was assessed by asking participants to self-rate their health over the past six months on a 3-point Likert scale, ranging from 1 (poor) to 3 (good). There is evidence that self-assessment of health status strongly predicts future morbidity and mortality(32).

**Socio-demographic characteristics**

Socio-demographic attributes, including age, sex, marital status, education level, household income and T2DM duration were collected. Levels of education were categorized into four: (1) illiterate (2) primary school (1-5 years of schooling), (3) secondary/high schooling (6-12 years of schooling) and (4) education above high school. The number of years between the diagnosis of diabetes and point of data collection were obtained as T2DM duration.



**Mahnoush Reisi et al.****Statistical analysis**

The internal consistency for the measurements was calculated using Cronbachs' alpha coefficient. Pearson correlation coefficient was used for Test–retest reliability. 30 subjects completed the questionnaires twice, with a 2-week interval between assessments. Construct validity was examined by performing Principal Axis Factoring with a Promax rotation method. Descriptive statistics (mean, SD, and percentage) were used to describe the participants' socio-demographics and study variables. Pearson correlation was performed to analyze the relationship between continuous variables. Bivariate associations between the FCCHL and socio-demographic characteristics and health status were tested using one-way ANOVA and independent sample T-tests. Linear regression models were used to determine the relationships between the three HL scales, and diabetes self-care behaviors, medication adherence and health status. All statistical analyses were performed using SPSS Version 17.0 (SPSS Inc.).

**RESULTS****Participant characteristics**

Descriptive results show socio-demographic characteristics of 187 patients with T2DM, which are presented in Table 1. The mean age of the participants was  $57 \pm 11.7$ , 67% were women and 80.5% were married. Average duration of diabetes was  $8.39 \pm 6.8$  years. Most participants (54%) had T2DM for more than 5 years. 23% reported poor health status, and 56% perceived their health to be average.

**Diabetes self-care behaviors and medication adherence**

The total SDSCA score averaged at  $3.84 \pm 1.56$ , indicating that patient's adherence to self-care tasks was about 4 days a week. The mean sub-scale scores were  $3.99 \pm 1.33$  for diet,  $2.50 \pm 2.07$  for physical activity,  $1.66 \pm 1.99$  for blood-glucose testing and  $3.27 \pm 2.22$  for foot care. The results indicated that, during the past week patients had best adherence to diet and worse adherence to blood-glucose testing. 43% of patients had moderate medication adherence (Table 1).

**Health literacy scores**

The mean scores for each HL subscale are presented in Table 1. The patients' FCCHL scores ranged from 1.13 to 3.55, with a mean  $2.28 \pm 0.57$ . Among the three subscales, communicative HL had the highest mean score, and functional HL had the lowest mean score. In reading instructions or leaflets from hospitals/pharmacies, often or sometimes: 65% of the participants indicated that they have trouble with reading printed materials, 73% have found Unknown words in written materials, 85% have found the content too difficult, 73% needed a long time to read and understand materials, and 79% needed someone to help them to read printed materials. Since being diagnosed with diabetes, never or rarely: 57% of respondents have collected information from various sources, 56% have extracted the information that they wanted, 36% have understood the obtained information, 58% have communicated about their disease to someone, and 44% have applied the obtained information to their daily life. 46% have considered the applicability of information to their situation. 55% have considered the credibility of the information. 59% have checked whether the information was valid and reliable and 63% have communicated about their disease to someone.

**Relationships between FCCHL, socio-demographic characteristics and health status**

Health literacy scores in communicative and critical subscales were found to be significantly higher in married participants than participants living alone. Age was negatively associated with functional and critical health literacy. Low Level of health literacy in functional, communicative and critical subscales were found to be more prevalent in participants who had low educational attainment and had low income. The participants who had high



**Mahnoush Reisi et al.**

functional, communicative and critical HL were more likely to report good health status. Neither sex nor T2DM duration was associated with HL levels (Table 2).

**Relationships between FCCHL, self-care behaviors and medication adherence**

Bivariate relationships between functional, communicative and critical HL and diabetes self-care domains are presented in Table 3. The results showed that the bivariate correlations between communicative HL, and all aspects of self-care behaviors were positively significant. Critical HL was associated with all self-care domains, except diet. No significant correlations were found between any domain of self-care behaviors and functional HL. We did not find an association between functional HL and medication adherence, but there were significant correlations between medication adherence and communicative and critical HL (Table 3).

Table 4 shows the multivariate linear regression models with understanding of diabetes self-care behaviors, medication adherence and health status as the outcome variables. Communicative HL displayed the strongest correlations with all aspects of self-care behaviors. Critical HL contributed to optimal diet, while it did not contribute to Exercise, Blood-glucose testing and Foot care. There was no significant relationship between functional HL and self-care behaviors. The regression models did not identify any significant associations between any domains of HL and medication adherence. In general, Patients with higher communicative and critical HL were more likely to report optimal diet, exercise, Blood-glucose testing, and foot care but not medication adherence.

**DISCUSSION**

In this study, we assessed the health literacy of patients with T2DM in three domains of functional, communicative and critical. We also investigated their specific relationships with self-care behaviors, medication adherence and health status. Based on findings, Iranian patients with T2DM produced highest scores for communicative HL and lowest for functional HL. These findings were similar to the previous study conducted at a renal organization providing dialysis treatment to end-stage renal disease patients in Singapore(7), and in contrast to the other studies utilizing the FCCHL scale. In the most previous studies scores of FCCHL showed an increasing trend, with the highest scores on functional HL and lowest on critical HL and providing support for Nutbeam's framework(26, 33). One possible explanation for the difference is that the previous studies were conducted in developed countries, where the basic literacy rate is generally high and in contrast to our target group, most of the population completed primary school. With a considerable overlap between general literacy and functional HL, it is not surprising that subjects in our study, produced lowest scores for functional HL. On the other hand, as Lai et al suggested, highest scores for communicative and critical HL can be due to the long illness duration and chronic nature of T2DM, that might have allowed patients to accumulate more experiences with searching for T2DM related health information from various sources, discussing those with others, and learning how to critically evaluate the applicability of obtained information(7).

Our result supports a previous finding that Low Level of health literacy in functional, communicative and critical subscales were more prevalent in participants with older age, poorer educational attainment, lower income and living alone(11, 34, 35). These factors are needed to be considered when healthcare professionals communicate with such people and provide patient education. Because these patients have fewer capacities to make decisions and actions in order to cope with a health problem or to improve their health. Therefore, they need additional supports.

We found that FCCHL had a significant association with self-reported health status. This is consistent with previous studies on functional HL(11, 36) and communicative and critical HL(25). Cho et al determined that functional health literacy was directly and positively related to self-rated health status(11). Furuya et al found that good self-reported health was significantly associated with higher communicative/critical HL scores(25). It seems that, functional,





**Mahnoush Reisi et al.**

communicative and critical HL are strong assets that enable patients to participate actively in healthcare and health promotion and making decisions that are consistent with promoting or maintaining good health.

We also found that functional HL was not associated with T2DM self-care, but critical HL was significantly associated with some, and communicative HL was related to all aspects of self-care behaviors, providing support for the weaker role of functional HL than communicative and critical HL in the relationship between HL and T2DM self-care found in previous studies(7, 33). The results indicated that communicative and critical HL and skills related to them are needful for better diabetes self-care and clearly demonstrated the strongest relationships between communicative HL and self-care behaviors. It may have important implications in the provision of patient care. Tailored education according to communicative and critical HL level may be helpful to improve self-care behaviors in patients with T2DM.

We did not identify any significant relationships between FCCHL subscales and medication adherence. This is consistent with previous study on functional HL in clinical setting (1) and in contrast to what was reported in another previous study(37). It is possible that among Iranian patients with T2DM, other unmeasured factors may be mediating these relationships such lack of self-efficacy (38). In order to better understand the mechanisms through which HL is related to medication adherence, further investigations are required.

Overall, the major contribution of this study is that among Iranian diabetic patients, communicative and critical HL are the most important factors associated with self-care behaviors and health literacy in all domains predicted more of the variance in health status of diabetic patients than did the demographic characteristics of patients.

This study has some limitations that are worth mentioning. The limitations also point to opportunities for future research. First, this was a cross-sectional study and conclusions about causality cannot be drawn. Second, this study was conducted at a single health center in the city of Isfahan, Islamic Republic of Iran, and it is possible that our findings may not be representative of other diabetic patients across the nation. Third, we assessed HL with a self-report instrument and which could lead to an overestimation of the HL level, as individuals often are ashamed of their inability to read and try to hide it. Fourth, it is possible that refusal to participate in the study was based on the participants' poor HL, and we have no data on socio-demographic characteristics of those who refused to participate.

## CONCLUSION

This may be the first study in Iran that measures health literacy by using specific multidimensional instrument. According to the findings, basic reading and writing skills to understand and follow simple health messages, which is the functional concept of HL, are not sufficient for successful self-management and navigating more complex health systems. Hence, communicative and critical HL skills should be taken into account. It should be noted that Striving for improved self-management and health outcomes without the co-operation and active contribution of care providers within health systems cannot occur. Therefore, it is essential that Health care providers assess patient's levels of health literacy and address this issue as part of everyday practice in order to provide relevant levels of health education to patients. In this way they can provide effective communication with patients, to fully inform them and to obtain patient feedback and control patients' understanding and reasoning in order to promote empowerment rather than simple compliance among T2DM patients. It is vital that strategies identifying and addressing health literacy are included in organizational and governmental policy and hope that this initial study will contribute to putting health literacy on the agenda in Iran.



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**Mahnoush Reisi et al.**

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**Mahnoush Reisi et al.**

**Table 1: Socio-demographic characteristics of patients and descriptive findings (n = 187)**

Patient characteristics	
Age (years)	Mean age: 57.4 years(SD=11.07)
	Range: 28-84 years
Sex	Women: 127 (67.9%)
	Men: 60 (32.1%)
Marital status	Single (1.6%)
	Married (80.5 %)
	widowers or divorced(17.9)
Education	Illiterate: 45 (24.1%)
	Primary school: 107 (57.2%)
	Secondary/High schooling: 11 (9.1%)
	Above high school: 24 (9.6%)
Annual household income (million Rail)	<6 (27.2)
	6-11.9(58.2)
	12-17.9 (10.9)
	>18 (3.8)
T2DM duration	Mean: 8.39 (SD=0.95)
	Range: 1-35 years
Functional HL	Mean:1.98 (SD=0.95)
	Range: 1-4
communicative HL	Mean:2.44 (SD= 0.74)
	Range: 1-4
Critical HL	Mean:2.43 (SD= 0.82)
	Range: 1-4
Total HL	Mean:2.28 (SD=0.57)
	Range: 1.13-3.55
Health status	Poor(23.5)
	Average(56.1)
	Good(20.4)
Medication adherence	Low(24.6)
	Moderate (43.9)
	High(31.5)





**Mahnoush Reisi et al.**

**Table 2 :Bivariate relationships betweenFCCHL and different characteristics (N = 187)**

	Functional HL			Communicative HI			Critical HL		
	Mean(SD)	r	p	Mean(SD)	r	p	Mean(SD)	r	p
<b>Age</b>		-.15	<.05		-.07	(ns)		-.19	<.01
<b>Sex</b>			(ns)			(ns)			(ns)
Female	1.95(.97)			2.40(.74)			2.42(.85)		
Male	2.00(.83)			2.52(.73)			2.43(.74)		
<b>Marital status</b>			(ns)			<.001			<.001
Single	2.80(1.03)			1.6(.57)			1.6(.57)		
Married	2.02(.90)			2.5(.70)			2.5(.77)		
widowers or divorced	1.7(.96)			2.28(.85)			2.0(.91)		
<b>Education</b>			<.001			<.001			<.001
Illiterate	1.5(1.05)			2.05(.60)			1.9(.76)		
Primary school	1.8(.71)			2.6(.70)			2.6(.80)		
secondary/High school	2.6(.43)			2.5(.64)			2.6(.62)		
Above high school	3.1(.77)			2.0(.86)			2.1(.64)		
<b>Income</b>			<.001			<.001			(ns)
<6	1.6(.87)			2.6(.78)			2.3(.77)		
6-11.9	2.0(.88)			2.4(.66)			2.5(.82)		
12-17.9	2.25(1.01)			2.5(.80)			2.5(.93)		
>18	3.02(.80)			1.2(.44)			1.7(.70)		
<b>Health status</b>			<.001			<.001			<.001
Poor	1.4(.60)			1.9(.57)			1.8(.62)		
Average	1.9(.93)			2.3(.63)			2.4(.74)		
Good	2.5(.88)			3.1(.67)			3.1(.69)		
<b>Diabetes duration</b>		.03	(ns)		-.04	(ns)		-.04	(ns)





**Mahnoush Reisi et al.**

**Table 3: Bivariate relationships of FCCHL with diabetes self-care behaviors and medication adherence (N = 187)**

	Functional HL		Communicative HL		Critical HL		Total HL	
	r	p	r	p	r	p	r	p
SDSCA (Total score)	-.02	.703	.45	.001	.29	.001	.28	.001
Diet	-.08	.258	.22	.002	.07	.315	.08	.269
Exercise	.02	.770	.24	.001	.14	.046	.19	.009
Blood glucose testing	-.11	.131	.44	.001	.27	.001	.20	.004
Foot care	-.06	.937	.34	.001	.24	.001	.22	.002
Medication adherence	.13	.062	.14	.055	.20	.005	.20	.005

**Table 4: Results of multivariable linear regressions on self-care behaviors and medication Adherence (N = 187).**

Model		Diet		Exercise		Blood glucose testing		Foot care		Medication adherence		Health status	
		β	p	β	p	β	p	β	p	β	p	β	p
1	Age	-.034	.656	-.143	.074	.012	.879	.176	.024	.196	.010	.059	.453
	Marital status	.273	<.001	-.132	.095	.269	<.001	.098	.202	.273	<.001	-.076	.327
	Education level	-.090	.315	-.095	.307	.082	.359	.089	.328	.275	.002	.274	.002
	Household income	.248	.003	.002	.977	.032	.694	.061	.464	-.125	.125	-.131	.118
	R <sup>2</sup>	.113		.037		.114		.089		.135		.065	
2	Age	-.068	.364	-.154	.055	.020	.775	.177	.021	.208	.008	.084	.180
	Marital status	.257	.001	-.136	.082	.281	<.001	.117	.116	.298	<.001	.004	.947
	Education level	-.072	.453	-.184	.072	.113	.207	.075	.438	.271	.007	-.006	.942
	Household income	.378	<.001	.121	.174	.194	.014	.183	.031	-.111	.204	.003	.961
	Functional HL	-.158	.077	.118	.214	-.150	.074	-.026	.776	.032	.729	.407	<.001
	Communicative HL	.450	<.001	.480	<.001	.558	<.001	.429	.001	.036	.776	.376	<.001
	Critical HL	.283	.016	-.194	.117	-.127	.244	-.027	.820	.159	.190	.218	.024
	R <sup>2</sup>	.220		.118		.314		.203		.151		.450	





## Articulation of the Islamic Revolution Discourse in the Constitution of the Islamic Republic of Iran

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### ABSTRACT

Islamic Revolution can be regarded as a revolution in meaning, sign and language; some have called it the revolution of message. In this regard, Islamic Revolution causes the evolution of language and the emergence of a new language within its cultural geography that is not necessarily limited to a geographical location such as Iran. This article tries to found the language having been created by the Islamic Revolution and its effect on the existing language. In other words, it will find the semantic system having been created by Islamic Revolution and the articulation of this semantic system. The article aims to describe the role of language in the development of the discourse of Islamic Revolution. Hence, this article investigates the Constitution of the Islamic Republic of Iran as a cultural declaration of the Islamic Revolution. The study of this text shows that creation of new language containing Muslim people, world unified ummah, ideological army, guardianship of the jurist, etc have established a new semantic system around the nodal point of the Muslim people. Muslim people enables defining, syntagma, and redefinition of elements and floating signifiers with opposite meanings within the discourse by discursive articulation. Islamic Republic meaning the rule of God-people or the rule of God through the people is an example of floating signifiers where synthesis and articulation have not been possible in other discourses. Creation of a new discourse has empowered Islamic Revolution for the synthesis and articulation.

**Keywords:** articulation, constitution, discourse of the Islamic Revolution, language.



**Mohammad Sadegh Mahdavi et al.****Statement of the Problem**

Islamic Revolution can be regarded as a revolution in meaning, sign and language; this implication is close to the idea that regards this Revolution as the revolution of message. The Islamic Revolution has been a cultural revolution or the revolution of message; contrary to other revolutions, it introduces its goals as promotion of monotheism, justice, human excellence and dedication to the values of God and spread Islamic law (Sediq, Zayeri, 2010). Some believe that Islamic Revolution of Iran was wonderful phenomenon and the last revolution of the twentieth century overshadowed the last twenty years of this century. The Revolution has not only economic and political roots. It was a cultural revolution rooted in the long tradition and culture of Islamic Iran; it had profound effects on the body of contemporary Iranian community (Soltani, 2005). The end of leaders of Islamic Republic of Iran is to establish an Islamic society that behaves, is governed, is organized based on Shiite Islam criteria, and is laid based on the will of the people. The establishment of a religious state based on law is at the center of this view. Religious model of governance is a way through which individuals reach salvation. Duality of land of faith and land of disbelief is the measure for distinguishing the world in this view. The religious logic of believers and unbelievers on the classification of people at the micro level and countries with arrogance name is at the macro level are evident in this perspective (Sediq, Zayeri, 2010). A large portion of the realization of the Islamic Revolution discourse has been possible through manipulation of the language system and the creation of a new language as well as the creation of new semantic system. Thus, one can count the language change strategy as one of the central policies for managing social changes at the macro level and advancing the goals of the Revolution. For example, a significant portion of incident management in 2009 was carried out following this policy of manipulation and the creation of language using concepts such as sedition, insight, elites and soft war. The creation of new language can be tied to the identity of Islamic revolution discourse so that articulation of the discourse of Islamic revolution and synthesis of conflicting concepts such as Islamic Republic was not possible without creating new language and redefining existing language system. This article tries to find the semantic and language system has made the articulation of Islamic Republic possible; this language contains which new concepts and what semantic system is possible in this new articulation.

**Significance of the Study**

It is important to study the discourse of Islamic Revolution because giving meaning to all organs of state and its behaviors are carried out within the framework of this discourse. In other words, if a clear image of the discourse were not available, all activities to establish and deepen it would be nonsense. In addition, some erroneous interpretations of the discourse of the Revolution cause incorrect views that regard Imam Khomeini as the nodal point of Islamic Revolution; thus, it sees as a set of opposite elements (Moghadami, 2011; Soltani, 2005). Although this group does not refer directly to the point, but this view connotes that the discourse of Islamic Revolution has been collapsed with the death of Imam Khomeini. In this manner, each party emphasizes on one of the controversial aspects. The erroneous interpretation of the discourse of the Revolution proves the need to pay more to this topic. Moreover, justifying the unity of opposite elements by a person seems irrational.

**Theoretical Framework**

The fundamental assumption of discourse analysis is explanation of social transformation and changes due to a change in language and meaning of social life. In other words, discourse analysis attempts to show how the fluidity of meaning in social life and lack of its permanent consolidation have led different discourses to change social life by changing the meaning of community and identity. In this manner, "The aim of discourse analysis is to map out the processes in which we struggle about the way in which the meaning of signs is to be fixed, and the processes by which some fixations of meaning become so conventionalized that we think of them as natural" (Jorgesen, Phillips, 2002). Theories of Laclau and Mouffe about analytical position of discourse analysis and the description provided for discourse structure is the most suitable theoretical framework for understanding the structure of a discourse. These "approaches are more concerned with general, overarching patterns and aim at a more abstract mapping of the





**Mohammad Sadegh Mahdavi et al.**

discourses that circulate in society at a particular moment in time or within a specific social domain" (ibid: 20). As mentioned, for Laclau and Mouffe, discourse is a structured body emanating from articulation. A discourse is formed by the partial fixation of meaning around certain nodal points. A nodal point is a privileged sign around which the other signs are ordered; the other signs acquire their meaning from their relationship to the nodal point. Nodal point in political discourses is 'democracy' and in national discourses a nodal point is 'the people'. A discourse is established as a totality in which each sign is fixed as a moment through its relations to other signs (ibid: 26). This is done by the exclusion of all other possible meanings that the signs could have had. Laclau and Mouffe called all the possibilities that the discourse excludes the field of discursively. The field of discursively is a reservoir for the 'surplus of meaning' produced by the articulatory practice – that is, the meanings that each sign has, or has had, in other discourses, but which are excluded by the specific discourse in order to create a unity of meaning. Nevertheless, discourse's unity of meaning is in danger of being disrupted by other ways of fixing the meaning of the signs. Laclau and Mouffe defined elements as floating signifiers with potential meanings and the signs whose meanings have not yet been fixed. Discourse attempts to impose its intended meaning on the signifier and create meaning fixation. With the emergence of the meaning fixation, discourse will temporarily stop to the fluctuations in the meaning of the signs. This stopping in the fluctuations of the signs is called closure. The point is that this stopping and closure is never definite and final. Signifiers, even the nodal point, have not a meaning, but they acquire meaning in relation to other signifiers; this is called the process of articulation. Fixation of meaning in social life and language or its fluctuation is carried out due to the discourse movement through articulation of signifiers. Articulation is any action that creates a relationship among elements, changes their meaning and creates a new meaning.

Floating signifiers are the signs that different discourses struggle to invest with meaning in their own particular way. Nodal points are floating signifiers, but whereas the term 'nodal point' refers to a point of crystallization within a specific discourse, the term 'floating signifier' belongs to the ongoing struggle between different discourses to fix the meaning of important signs. In fact, calling a signifier either floating or nodal point relates to its position in a specific discourse in relation to other discourses.

Discourse reproduction or change is done through specific articulations of every discourse. Articulation makes reproduction possible by the logic of equivalence and the logic of difference. In this regard, articulation is a kind of practice, not a name for a set of related signifiers (Laclau, Mouffe, 1985). The logics of equivalence and difference make separation between "us" and "you" or insiders and outsiders possible based on the equivalents and differences. In this manner, discursive boundaries are determined based on the similarities with insiders and their differences with all outsiders. However, these boundaries are not fixed and they are always changing. For them, science aims to understand the ways of discourse formation and change. Therefore, studying the ways of discourse articulation is necessary. Nevertheless, some meaning may be so fixed in time pass that seems obvious and natural. Through the hegemonic intervention, the meanings are forced to be fixed in discourse. The process of hegemonic intervention suppresses alternative meanings and signifiers to show that the present meaning is obvious and natural. The main function of discourse is to form the subjective place of individuals. Separation of subjective and structural places enables Laclau and Mouffe to be away from reductionism and the essentialism of Marxist theories.

Structural positions shape the opportunities for lives of people. In other words, people will be organized structurally within the framework of economic, political, social and cultural systems due to requirements and institutions preceded by their willingness. According to Gramsci, it is argued that nobody can experience his structural position directly; he only experiences his organizational position through political discourses. Discourses provide the necessary conceptual frameworks enabling us to interpret the symbolic order in which we live (Smith, 1998, Qtd. in Rezaee, 2006).





### Mohammad Sadegh Mahdavi et al.

With these lines, discourses are important because they are significant media of interpreting the structural position, its reproduction and lack of its reproduction. In other words, reproduction of a social order requires the prevailed discourse to be able to form the subjective position of individuals. If it loses to do so, social order will be transformed.

#### Research Method

Laclau and Mouffe's theory of discourse analysis can be applied in two different ways. In the first approach, the process of emergence, peak and decline of discourse is examined. This approach analyzes discourses with respect to three periods of "emergence," "peak" and "decline (Tabatabaee, 2010).

Therefore, the first implication of Laclau and Mouffe's theory of discourse investigates the evolution and transformation of discourses; it shows the process of discourse emergence, peak and decline are shown in discourse analysis. The important point in the application of this model is attention to the processes. The second approach, which is used in this study, describes the ways to articulate discourse.

Discourse theory suggests that we focus on the specific expressions in their capacity as articulations: what meanings do they establish by positioning elements in particular relationships with one other, and what meaning potentials do they exclude? The articulations can be investigated in relation to the discourses by addressing the following questions. What discourse or discourses does a specific articulation draw on, what discourses does it reproduce? Alternatively, does it challenge and transform an existing discourse by redefining some of its moments? As a starting point for answers to these questions, the nodal points of the specific discourses can be identified: what signs have a privileged status, and how are they defined in relation to the other signs in the discourse? ... What signs are the objects of struggle over meaning between competing discourses (floating signifiers); and what signs have relatively fixed and undisputed meanings (moments)? (Jorgesen, Phillips, 2002).

Various materials can be used as the basis for discursive analysis. This article uses the Constitution as a national social convention. Hence, the researcher assumes the Constitution as social manifesto of the Islamic Republic of Iran that introduces cultural policies of Iran with 176 Articles, especially from Articles 1 to 30; these principles are generated in other Articles. In this manner, discourse analysis of the Articles of the Constitution provides evidence for the articulation of the cultural discourse of Islamic Revolution. Due to some limitations in text of the Constitution, some words of Imam Khomeini have been used to support evidence of analyzing the Constitution.

#### The creation of a new language and articulation of the discourse of the Islamic Revolution in the Constitution

##### Idoltrous and arrogance as the other discourse in Islamic Republic discourse

Study of the Constitution text shows that concepts such as world imperialism, arrogance, and dictatorship have been used to describe the opposite discourse of Islamic Revolution discourse. For instance, the dawn of the movement in the preamble, the Constitution argues, "The devastating protest of Imam Khomeini against the *American conspiracy known as the "White Revolution,"* which was a step intended to stabilize the foundations of despotic rule and to reinforce the political, cultural, and economic dependence of Iran on world *imperialism*. It adds, "This great movement, which attained victory through reliance upon faith, unity, and the decisiveness of its leadership at every critical and sensitive juncture, as well as the self-sacrificing spirit of the people, succeeded in upsetting all the calculations of imperialism and destroying all its connections and institutions, thereby opening a new chapter in the history of all-embracing popular revolutions of the world. On 12 and 13 Feb 1979, the world witnessed the collapse of the monarchical regime. Domestic tyranny and foreign domination, both of which were based upon it, were shattered."

However, the language that enables Islamic Revolution discourse to redefine floating signifiers and positioning them in the new discourse is idoltrous. All these items are manifestation of idoltrous. Hence, the preamble concludes,





### Mohammad Sadegh Mahdavi *et al.*

“The Constitution of the Islamic Republic of Iran, setting forth as it does the political, social, cultural, and economic institutions and their relations that are to exist in society, must now provide for the consolidation of the foundations of Islamic government, and propose the plan of a new system of government to be erected on the ruins of the previous idolatrous order.” Therefore, idolatrous is the most important outsider in the discourse of Islamic Revolution that may have different manifestos (in forms of Imperialism, Marxism, totalitarianism and dictatorship). It says, “Our nation, in the course of its revolutionary developments, has cleansed itself of the idolatrous dust and impurities that accumulated during the past and purged itself of foreign ideological influences, returning to authentic intellectual standpoints and world-view of Islam.” (Preamble of the Constitution of the Islamic Republic of Iran).

#### Muslim people: the nodal point in the Constitution of the Islamic Revolution discourse

Discourse analysis of the Constitution shows that the rule of God and its integration with the participation of the people in the community having been established through a hegemonic intervention is the intended meaning of the Revolution discourse. “Muslim people” is regarded as the nodal point of Islamic Revolution discourse and Islamic Republic is defined by this nodal point. Contrary to the idea that regards “Imam Khomeini” or “guardianship of the jurist” as the nodal point, Muslim people is the nodal point of the discourse. This signifier defines Islamic republic and fixes its meaning in discursive struggles. The boundary determined in this regard through this policy distinguishes the discourse with other types of governance. The importance of this signifier is inferred from recurrent emphasis and various references in the preamble of the Constitution. In addition, Article 177 of the Constitution that relates to revision of the Constitution stipulates that the Islamic and republic aspects of the Constitution are unchangeable.

The Muslims and their wills make redefining the signifier Welayat (guardianship) possible. Thus, movement toward God has been introduced as the will of people. The Constitution of the Islamic Republic of Iran advances the cultural, social, political, and economic institutions of Iranian society based on Islamic principles and norms, which represent an honest aspiration of the Islamic Ummah. This aspiration was exemplified by the nature of the great Islamic Revolution of Iran, and by the course of the Muslim people's struggle, from its beginning until victory, as reflected in the decisive and forceful *calls* raised by all segments of the populations. Now, at the threshold of this great victory, *our nation, with all its beings, seeks its fulfillment*. This call is proposed as the ultimate goal of the Iranians. (Preamble of the Constitution). “Absolute sovereignty over the world and man belongs to God, and it is He Who has made man master of his own social destiny. No one can deprive man of this divine right, nor subordinate it to the vested interests of a particular individual or group. The people are to exercise this divine right in the manner specified in the following articles” (Article 56). Moreover, the first Article of the Constitution stipulates, “The form of government of Iran is that of an Islamic Republic, endorsed by the people of Iran *based on their longstanding belief* in the sovereignty of truth and Koranic justice, in the referendum of 29 and 30 March 1979, through the affirmative vote of a majority of 98.2% of eligible voters” (Article 1). The second article counts ideological principles endorsed by Islamic Republic. Article 3 determines the objectives that should be attained according to Article 2. Fourth article stipulates the necessity of corresponding all rules and regulations with Islamic criteria as the duty of the Guardian Council. Articles 6, 7, and 8 try to explain other aspects including the position of the people in the Islamic Republic or government of God. Chapter III, especially Article 19 to 42, counts the rights of the people. The preamble of the Constitution has also emphasizes on the participation of the people as a ground for the Revolution as it declares, “to create favorable conditions for the emergence and blossoming of man's innate capacities, so that the theomorphic dimensions of the human being are manifested (in accordance with the injunction of the Prophet (S) “Mould yourselves according to the Divine morality”); this goal cannot be attained without the active and broad participation of all segments of society in the process of social development.” (Preamble of the Constitution).

Thus, the rule of Gode based on the votes of the people, or Islamic republic, is defined around the signifier of “Muslim People” and makes the synthesis of Islamic republic possible. Indeed, people allow Islamic Republic discourse to pass the contradictions having not been resolved by other discourses (ie. Contradiction of integrating





### Mohammad Sadegh Mahdavi et al.

God and man in one discourse without marginalization of one) and articulate Islamic Republic discourse on the basis of God-people center. In the language of this discourse, Muslim people and their inner will makes the definition and articulation possible so that the meaning of government changes. It is redefined based on the will of people; "In the view of Islam, government does not derive from the interests of a class, nor does it serve the domination of an individual or a group. Rather, it represents the fulfillment of the political ideal of a people who bear a common faith and common outlook, taking an organized form in order to initiate the process of intellectual and ideological evolution towards the final goal, i.e., movement towards Allah." (Ibid: 70)

#### Ideological status

The signifier ideological status paves a large way for redefining elements of other discourses and articulating them in the discourse of Islamic Republic. Ideological status makes the emergence of institutions such as army and Judiciary possible. In fact, reproduction of ideological status as a signifier is important for defining other signifiers like independence, freedom, guardianship of the jurist, etc. Therefore, the preamble pays much attention to this meaning. On the one hand, it introduces non-ideological status as the main cause of failure of the movements in Iranian history; on the other hand, introduces it as the distinctive feature of Islamic Republic, as says, "The basic characteristic of this revolution, which distinguishes it from other movements that have taken place in Iran during the past hundred years, is its ideological and Islamic nature. After experiencing the anti-despotic constitutional movement and the anti-colonialist movement centered on the nationalization of the oil industry, the Muslim people of Iran learned from this costly experience that the obvious and fundamental reason for the failure of those movements was their lack of an ideological basis" (Ibid: 66).

Islam is introduced as the main inspiration of the Revolution, "Throughout this time, the conscious and responsible segment of society was bringing enlightenment to the people from the strongholds of the mosques, centers of religious teaching, and universities" (ibid: 67). The plan of Islamic government is set to pave the way for ideological fight; "The plan of the Islamic government as proposed by Imam Khomeini at the height of the period of repression and strangulation practiced by the despotic regime, produced a new specific, and streamline motive for the Muslim people, opening up before them the true path of Islamic ideological struggle, and giving greater intensity to the struggle of militant and committed Muslims both within the country and abroad" (ibid: 68).

Defense and military forces, which seem to have less relationship to ideology due to their specialized realm, are redefined under the dominance of ideological status, "In the formation and equipping of the country's defence forces, due attention must be paid to faith and ideology as the basic criteria. Accordingly, the Army of the Islamic Republic of Iran and the Islamic Revolutionary Guards Corps are to be organized in conformity with this goal, and they will be responsible not only for guarding and preserving the frontiers of the country, but also for fulfilling the ideological mission of jihad in God's way; that is, extending the sovereignty of God's law throughout the world" (ibid: 72).

Even the philosophy of formation of the judiciary is defined in this regard, "Provision has therefore been made for the creation of a judicial system based on Islamic justice and operated by just judges with meticulous knowledge of the Islamic laws. This system, because of its essentially sensitive nature and the need for full ideological conformity, must be free from every kind of unhealthy relation and connection" (ibid: 73).

#### Religious leaders: selective guardianship of the jurist

Having been regarded as a specific signifier in the Islamic Revolution discourse, 'guardianship of the jurist' enables the discourse to propose its own articulation in struggles about the relation between religion and government, its nature or its form. Religion and its position in society as well as the role of clergy in the newly established system have been controversial points, "In the post-revolution government, religious figures as the official interpreters of Islam whose ideas have a special authority should be present at key responsibilities of the country's macro





### Mohammad Sadegh Mahdavi et al.

management according to their religious status to ensure the rule of Islamic provisions? Isn't their religious position higher than some governmental positions and should not they accept some of the major executive or legislative, judicial responsibilities? In principle, is it essential for the government to be ruled by a person called 'guardianship' while he is monitoring other branches of government through its representatives or is it contrary to national sovereignty and democratic and bureaucratic conventional methods? (Mir Salim, 2005).

What was finally accepted and defined by the signifier of 'guardianship of the jurist' is that "In the post-revolution government, religious figures as the official interpreters of Islam whose ideas have a special authority should be present at key responsibilities of the country's macro management according to their religious status to ensure the rule of Islamic provisions ... it is essential for the government to be ruled by a person called 'guardianship' while he is monitoring other branches of government through its representatives" (ibid: 40).

It is stipulated in the preamble of the Constitution, "In keeping with the principles of governance and the perpetual necessity of leadership, the Constitution provides for the establishment of leadership by a holy person possessing the necessary qualifications and recognized as leader by the people (this is in accordance with the saying "The direction of affairs is in the hands of those who are learned concerning God and are trustworthy in matters pertaining to what He permits and forbids"). *Such leadership will prevent any deviation by the various organs of State from their essential Islamic duties*" (Preamble of the Constitution). In addition Articles 5, 57, 109, and 110 of the Constitution relates to this issue.

Therefore, the absolute guardianship of the jurist (as a signifier) is imposed on the government type (signified); it takes its meaning from the rule of God to the rule of people. Hence, the preamble mentions having been qualified as well as having been known by people. As said, nodal point has the duty to define other signifiers; here, 'guardianship of the jurist' is defined around the concept of the rule of God-people as a signifier.

#### World unified Ummah

Pahlavi regime regards relation to others as unity and similarity on the West so that he tried to foreground common linguistic ethnic roots; it sees this path as a means to achieve a great civilization (Adib Zadeh, 2008). Nevertheless, the discourse of the Islamic Revolution introduces the formation of world unified Ummah as the purpose of its relation to the outside world. In other words, the formation of world unified Ummah can be another floating signifier in Islamic Revolution discourse that is defined around the nodal points of Muslim people the rule of God. It tries, "to prepare the way for the formation of a single world community (in accordance with the Koranic verse "*This your community is a single community, and I am your Lord, so worship me*" [21:92]) (Preamble of the Constitution). Chapter X, titled "Foreign Policy," determines mechanisms of communication with other discourses in Articles 152 to 155.

#### Islamic economy

While non-Islamic Revolution discourse focus on increasing wealth and benefits admission as signifier, Islamic Revolution discourse rejects this meaning expressly. By explaining economy as means, it introduce economy merely as a means to flourish human talents. As a signifier, Islamic economy enable this type of definition as it argues, "In strengthening the foundations of the economy, the fundamental consideration will be fulfillment of the material needs of man in the course of his overall growth and development. This principle contrasts with other economic systems, where the aim is concentration and accumulation of wealth and maximization of profit. In materialist schools of thought, the economy represents an end in itself, so that it comes to be a subversive and corrupting factor in the course of man's development. In Islam, the economy is a means, and all that is required of a means is that it should be an efficient factor contributing to the attainment of the ultimate goal. From this viewpoint, the economic program of Islam consists of providing the means needed for the emergence of the various creative capacities of the human being. Accordingly, it is the duty of the Islamic government to furnish all citizens with equal and appropriate





### Mohammad Sadegh Mahdavi et al.

opportunities, to provide them with work, and to satisfy their essential needs, so that the course of their progress may be assured" (Preamble of the Constitution).

Chapter IV of the Constitution titled "Economy and Financial Affairs" says that the base of economy in the country is "achieving the economic independence of the society, uprooting poverty and deprivation, and fulfilling human needs in the process of development while preserving human liberty." Man's growth and perfection is the center of economy. Articles 43 to 55 are linguistic hegemonic interventions to achieve this type of economy in society.

Signifiers of independence, freedom, and justice are the main signifiers of Islamic Revolution discourse; but they are not particular discourses of the revolution. These signifiers are defined and articulated around the nodal point of Islamic Revolution discourse and other floating signifiers like ideological status. In fact, the most struggles have been risen in terms of three signifiers of independence, freedom, and justice; they have been accepted by common people. In this regard, the constitution emphasizes, "In the Islamic Republic of Iran, the freedom, independence, unity, and territorial integrity of the country are inseparable from one another, and their preservation is the duty of the government and all individual citizens. No individual, group, or authority, has the right to infringe in the slightest way upon the political, cultural, economic, and military independence or the territorial integrity of Iran under the pretext of exercising freedom. Similarly, no authority has the right to abrogate legitimate freedoms, not even by enacting laws and regulations for that purpose, under the pretext of preserving the independence and territorial integrity of the country" (Article 9). Chapter III explains freedom, justice and establishment of guarantees for their observance. The constitution focus on many issues including from the equality of rights of all people to the right to hold jobs. Designing judicial system and the executive agencies has also been carried out with respect to the meaning and the need to preserve legitimate freedoms and independence of the country.

#### **An exception: an amalgam of social activist housewife**

Despite the success of Islamic Revolution discourse in articulation and defining almost all struggled signifiers, *woman* is an exception. Articulation and definition of this signifier is an amalgam of modern and traditional definitions. Competitor discourses of Islamic Revolution have defined woman as a housebound element in the discourse of traditional Islam or a free social activist outside the home. Contrary to these interpretations, Islamic Revolution discourse disagree both housebound woman and stray woman. Therefore, the signifier of 'social activist housewife' has been defined to keep both social responsibilities as well as housekeeping. This duality of active participation of society and housekeeping is clear in the preamble of the Constitution, "The widespread solidarity of men and women of all segments of society and of all political and religious factions played a clearly determining role in the struggle. Especially the women were actively and massively present in a most conspicuous manner at all stages of this great struggle. The common sight of a mother with infants in their arms rushing towards the scene of battle and in front of the barrels of machine-guns indicated the essential and decisive role played by this major segment of society in the struggle" (preamble of the Constitution).

Article 10 of the Constitution stipulates, "Since the family is the fundamental unit of Islamic society, all laws, regulations, and pertinent programs must tend to facilitate the formation of a family, and to safeguard its sanctity and the stability of family relations on the basis of the law and the ethics of Islam."

Therefore, restrictions related to unveiling (non-hijab issues) and other unlawful items are defined as the protection of women's social presence. In this regard, Article 21 of the Constitution has obliged the government to ensure the rights of women in all respects, in conformity with Islamic criteria. Restoration of her both the material and intellectual rights, the protection of mothers, particularly during pregnancy and child-rearing, establishing competent courts to protect and preserve the family, the provision of special insurance, and the awarding of guardianship of children to worthy mothers are the efforts of Article 21 of the Constitution to ensure both aspects of housekeeping and social activities.





### Mohammad Sadegh Mahdavi et al.

This paradoxical defining has led the signifier of woman to be emerged as the central field of discursive struggle and to lose its meaning rapidly in the articulation of Islamic Republic discourse. In Laclau and Mouffe's words, woman loses its meaning fixation and enters the field of discursively. Source of the struggles, efforts to define woman, and lack of its meaning fixation in the articulation of the Islamic Revolution should be explored in its defining at the moment of the revolution and the text of the Constitution.

## CONCLUSION

Analyzing the text of the Constitution show that using a particular language and revision of some concepts in Shiite beliefs and philosophy have made defining and articulation of many signifiers possible in Islamic Republic discourse. The rule of God through the will of people is regarded as the central core and nodal point of Revolution discourse and all chapters of the Constitution are strives to develop a structure for organization of society according to these ideas. The identity of discourse has been separated in the preamble of the Constitution. In this text, the reader encounters a kind of antagonism while text of the preamble does hegemonic intervention in favor of religious identity. Islamic Republic is located in the syntagmatic chain of people, self-determination, world unified Ummah, and guardianship of the jurist. The importance of discursive articulation using a particular language relates to the fact that language is effective in the fixation of signifiers' meanings. Hence, a struggle riser in terms of a signifier, which is woman, that has not used the particular language; the whole articulation of Islamic Revolution articulation is challenging in this manner. Thus, discursive struggle for semantic revival and discourse articulation is largely related to people and linguistic revival. However, the text of the Constitution is a specific and very creative text.

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Mohammad Sadegh Mahdavi et al.

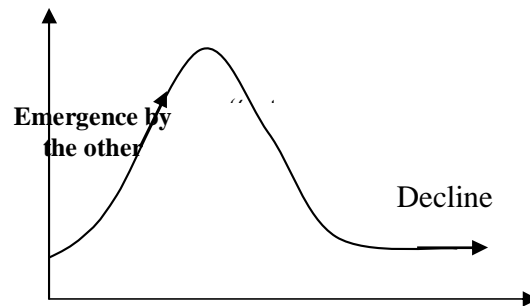


Figure 1. Movement of a discourse







## An Approach to the Concept of Guardianship and its Meaning by Contemporary Jurists

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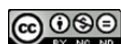
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### ABSTRACT

The term guardianship is one of the most important jurisprudence and political concepts namely among Shia people. The contemporary era has observed many semantic changes and with the concept of jurisprudence in political jurisprudence of Emamie has great position as he was substitution of infallible Imam and had all power of The Prophet. In a minimum or combinational approach, it can not have such meaning. Thus, the changes and meaning of this concept are the most important questions since Qajar era. This study is descriptive-analytic design and it shows the change of concept of guardianship from minimum to maximum.

**Keywords:** Guardianship, Guardianship of the Jurist, Political jurisprudence, Shia

### INTRODUCTION

“Guardianship” is a term that besides literal application is used in various fields of Islamic sciences as speech, philosophy, jurisprudence and mysticism. “Guardianship” in various fields of jurisprudence as retaliation, advice, Hojr and Makaseb is common and this term with its derivatives is replicated 233 times in Quran (Moghimi, 2009). In its literal meaning, “guardianship” is based on “guardian” meaning “closeness. Guardianship meaning assistance and “Guardianship” meaning supervision (Ragheblsfahani, Quran terms, 885). “Guardianship and its other derivatives is applied in many meanings and the most important ones are owner, friend, assistance, aid, king, supervision, dominance, kingdom, government and thought. This term is a homonym or non-verbal and some lexical experts consider it as homonym (IbnMansur, 1996). Guardianship and Guarding are regarding possession in others





### Zahra KhajooeiNejad and KhadijehYadollahi

affairs , two things beside each other affect each other. There are various meanings for MOIa. Being beside another person to have the responsibility of some aspects and compensation of his disadvantages is called guardianship (Montazeri, 1989). The intention of the Prophet in “ Whoever I am the guardian, Ali (pbuh) is guardian” and it proves guardianship in possession as mentioned in the verse “النبى أولى بالمؤمنين من أنفسهم” (Al-Ahzab verse, 6) and both sentences have the same meaning. If the Prophet only tried to express friendship to Ali (pbuh), stating his priority right was not necessary. The friendship statement was not important to wait 120 thousands people in Ghadirkhom (Montazeri, 2004). Thus, most Shia jurists believe that guardianship of Imam Ali after the Prophet besides religious affairs consisted of political and social affairs including governing right for him and other Imams. During occultation, jurists can organize people affairs and have guardianship. According to Jafarpishe, besides the obvious intention of lexical experts in guardianship meaning and thought is one of the meanings of guardianship, by referring to main Arabic books, this reality is revealed that guardianship in political governance has specific application. We can also consider the meaning of guardianship equal to thought, unless there is a barrier to it. For example “IbnGhatibe” in (AL-EmameValsiase” refers to the governance of kings as guardianship. For example, guardianship of Omar IbnKhatab (second caliphate), guardianship of Valid, Guardianship of Hojaj, Guardianship of YazidIbnAbdolmalek, Guardianship of HishamlbnAbdolmalek, Tabari and IbnAsir for political governance and the term guardianship is used and some titles as VelayateAbdollahIbnAmer, VelayateZiad, VelayatMarvanIbn Mohammad and in all these cases, the meaning of guardianship is the supervision of government (2009). There are disagreements regarding the domain of guardianship of jurists and power on jurists in occultation era. We can distinguish between maximum, minimum and combinational dimensions. In a general division, we can divided the various meanings into four types as: 1- Closeness, 2- affection or friendship, 3- Helping or aid, 4-Supervision (Moghimi, ibid). This paper is regarding the concept of guardianship and its changes in the fourth meaning with political aspects and regarding government and supervision. The study design is descriptive-analytic. The greatest shia jurists in contemporary era who presented great views regarding guardianship and Guardianship of the Jurist are Sheikh Ansari, MirzaShirazi, AkhundKhorasani, MirzayeNaini, Sheikh FazlollahNuri and then in Pahlavi era and Islamic Republic of Iran, some jurists as Brojerdi, Imam Khomeini, Mohammad Bagher Sadr, Imam Musa Sadr and others. In Qajar era, the semantic explanation of guardianship in political jurisprudence of Shia is considered. Based on the review of this study, the most important sources in this regard are MohyeldinHaerishirazi, Tehran: Office of TahkimVahdat, first edition, 1981. Seyed Mohammad Ali Hosseinizade, political thought of MohagheghKarki, Qom: BustanKeta institute, second edition, 2008. Safi Golpaygani, leadership system, Tehran: Al-Imam Al-Mahdi institute. Second edition, 1982. Hassan TaheriKhoramAbadi, Guardianship of the Jurist and governance of nation, Islamic publications affiliated to community of teachers of religious center of Qom. Bita. HabibollahAzimi, history of jurisprudence and jurists, Tehran. Asatir publications. First edition. 2006. JamileKadivar, The change of political discourses of Shia in Iran. Tehran. Tarh No publications. First edition. 1999. Mohsen Kadivar, Government theories in Shia jurisprudence. Tehran: Ney edition, Fifth publication. 2004. MesbahYazdi, a review of Guardianship of the Jurist, Qom, educational and research institute of Imam Khomeini, 1999. Mohammad JafarHarandi, jurists and government, Tehran: Rozane publications. First edition. 2000.

The present study had different approach to guardianship and its changes.

#### Theoretical basics and aspects of guardianship

##### The aspects of external fulfillment of guardianship

Due to external fulfillment, guardianship has some aspects as:

- 1- Intrinsic or acquired qualification to have guardianship in his position and based on the real qualification, considering guardianship is correct. God gives prophet hood to the qualified one and this rank of guardianship is based on intrinsic perfection and external reality and it can not be possessed or delegated.





### Zahra KhajooeiNejad and KhadijehYadollahi

- 2- Sometimes guardianship is the contract from an authority and is considered for a person but maybe the expected effect is not considered. Like a person is an agent of another one to do the works. This rank of guardianship is based on credit and its consideration is based on the qualification of a person and decision of guardian.
- 3- The guardianship as created based on people promise as it was occurred for Imam Ali after the death of Osman. This rank of guardianship has two aspects:
  - a. The position with many followers.
  - b. The trust from God and people as brining responsibility (Montazeri, 2004).

By referring to his torn shoes, Imam Ali said: "والله لهي أحب الي من امرتكم الا أن اقيم حقا أو أدفع باطلا" (Nahjolbelaghe, sermon 33) "I take oath to God, this invaluable shoe is more important than governing you, unless I establish justice by this government or reject falsehood. Indeed, if guardianship had external reality and physical perfection, he never said the torn shoe is much valuable than science, virtues for which he was appointed for this position. Also, he didn't intend the position stated for him Ghadirkhom as given from God to the Prophet and he meant the worldly dimension and governing the people and in Shaghshaghie sermon: "... لالقيت حبلها علي غاربها... و لالقيتم دنياكم هذه أزهد .....". "عندي من عفة عنز" (Ibid, Sermon 3). I would have cast the rope of Caliphate on its own shoulders, and would have given the last one the same treatment as to the first one. Then you would have seen that in my view this world of yours is no better than the sneezing of a goat. It was said that "والله ما كانت لي في الخلافة رغبة و لا في الولاية اربة". O takes oath to God, I am not inclined to govern on you and I don't need it (Ibid, Sermon 205).

#### Legislative and genesis guardianship

Guardianship means power on dominance as "genesis" and "legislative" and it has some ranks and its perfect rank is dedicated to God. A rank of genesis guardianship for The Prophet, Imam and some prophets and for some of men of God based on their mental excellence in physical power and science and their relationship with God as miracles of Prophet and Imam are possession in genesis, although they perform the affairs along their destiny. The birds revitalization by Ibrahim (pbuh), the rod of Moses is transformed into a snake, making birds of mud and Resurrection of the dead by Jesus, bringing Sheba queen throne by Asef Ibn Barkhia are some examples of genesis guardianship in Quran. Legislative guardianship is the right of legislation of divine rules for people and law making and this right belongs to God and is delegated to the Prophet and Imam. In a tradition, Imam Reza (pbuh) in Ololamr interpretation (Al-Nissa, verse 83) said to AL-Mohammad (pbuh): "These are those inferring God orders from Quran and distinguish between evil and good (Nurolsaghalein, Vol. 1, 523, Tradition 429). In another tradition, their dignity is the dignity of prophet except the previous prophets were not ordered evil and good (Ibid, Vol. 1, 500, tradition 334). Genesis and legislative guardianship are fixed for prophet (Montazeri, 1989). Their authorities in this case are regarding divine orders and their guardianship is based on God guardianship. Appointing legislative guardianship for the prophet is not in contradiction with originality of Islam as first, appointing this guardianship is in Islam and based on Quran verses and the Prophet as in Saghalein tradition. Second, according to infallibles, their tradition, is the tradition of prophet and based on God words, Hosham Ibn Salim and Hemad Ibn Osman and others narrated of Imam Sadigh as: My tradition is the tradition of my father, the tradition of my father is the tradition of my grand father his tradition is the tradition of Hossein, tradition of Hossein belongs to Hassan and tradition of Hasan to Amirolmomenin and tradition of Amirolmomenin is the tradition of prophet and tradition of prophet is the word of God (Koleini, Kafi, Vol. 1, 53, Tradition 14).

The role of prophet is transferring the words of prophet, Quran interpretation, resistance against deviation, taking model of learning and details of tradition. As the Prophet had the role of transferring divine revelation and its expiation for people (و ما ينطق عن الهوي ان هو الا وحي يوحى) (Al-Najm verse, 3, 4). Nor does he speak from [his own] inclination.

It is not but a revelation revealed. (و انزلنا اليك الذكر لتبين للناس ما نزل اليهم). (Al-Nahl, verse 16).





### Zahra KhajooeiNejad and KhadijehYadollahi

And we revealed to you the message that you may make clear to the people what was sent down to them. Based on their lack of sin and speech, their views are all true for us.

#### Guardianship in occultation era

The views of jurists regarding guardianship in occultation era are based on two views:

- 1- Lack of delegation of guardianship in occultation era  
Based on this view, guardianship as political governance in occultation is not delegated to anyone and guardianship in this meaning only belongs to the Prophet and infallibles. In other words, by referring to infallibles words, we can not prove such guardianship for jurist. This view doesn't accept guardianship and continuity of guardianship is not considered (Mirahmadi, 2009).
- 2- Delegation of guardianship in occultation era  
Based on this view, guardianship means political governance and possession in others affairs in occultation. We can say that this guardianship is delegated to others and the reason of wisdom is transferred to occultation era and the reason of wisdom is not dedicated to the presence of Imam. The opinions based on this theory beside their basic differences, they include two important points:
  - 1- The lack of guardianship of a person on another one and proving guardianship requires valid reasons.
  - 2- There is no deterministic texts regarding the guardianship in occultation era and there is a reason including various interpretations (Mirahmadi, 2009).

#### The views of jurists in delegation of guardianship in occultation era

Most of Shia jurists believe in delegating guardianship in occultation with many verbal and principal knowledge in various interpretations of reasons and it has various views.

#### Guardianship of the Jurist in non-litigious affairs

The second view about Guardianship of the Jurist believes that jurists has guardianship only in non-litigious affairs. In this view, besides accepting the principle of delegating guardianship in occultation era, by referring to the reasons of infallibles, only guardianship is proved in non-litigious affairs for jurist.

After Sheikh Ansari and AkhundKhorasani, Kashef Al-Ghata accepted Guardianship of the Jurist in non-litigious affairs.

#### Guardianship jurisprudence in performing Hodud and judgment

Guardianship of the Jurist has guardianship in performing Hodud and judgment and this view based on the infallibles states hat based on this reason, Guardianship of the Jurist is only in Hodud and judgment. In other words, this view accepts principle of guardianship but believes that in occultation era, this guardianship is not delegated as absolute and we should refer to the word of infallibles and prove Guardianship of the Jurist. We can say that guardianship as governance right and leadership of society is not delegated and jurist has not such governance right.

#### General jurist guardianship in the framework of minor divine orders

This view accepts general Guardianship of the Jurist in occultation era and believes that based on traditions, it is proved. The followers of this view refer to the infallibles traditions and try to prove such guardianship.

- Appointed absolute guardianship of jurist: Another view accepting general guardianship of jurist and doesn't restricting it to non-litigious matters and Judgment or in the framework of minor divine orders is the absolute Guardianship of the Jurist theory. This theory was emphasized by Imam Khomeini after Islamic Revolution in Iran.





### Zahra KhajoeiNejad and KhadijehYadollahi

- Selective guardianship of jurist: Another view not considering Guardianship of the Jurist restricted to non-litigious matters, verdict ion or judgment and accepting political leadership in the concept of guardianship is selective guardianship of jurist.

#### General guardianship of jurist

In this view, guardianship is delegated absolutely to jurist in occultation. We can say, in occultation era, guardianship of jurist is continuance of guardianship of Prophet and infallibles. Like the prophet and infallibles, jurist has three duties: 1- Propagation of religion and divine orders via verdict, 2-Performing the Hodud and judgment based on divine rules, 3- Political-social affairs of society and enjoying political governance. According to general guardianship, As Islamic king and infallible, Prophet has some authorities in leadership of society, jurist has also the same authorities as Islamic king (Mir Ahmadi, Ibid, 23-25).

#### The concept of guardianship from the view of Qajar era jurists

Before Qajar dynasty took power and even before constitutionalism era, political views of jurists were mostly about inviting to virtue and forbidding vice, Jihad, Khoms, Qaza, Marriage, divorce, Hodud, Haj and there was no independent chapter in politics and guardianship and jurists views in public issues were individual. The government issues were raised in the form of king duties and who is the king, not his method of ruling.

Thus, in Qajar era, before formation of constitutionalism, only judgment and non-litigious matters were the most important social issues as considered by jurists. Judgment as based on religious issues and in non-litigious affairs, its examples to constitutionalism era didn't get beyond the supervision of the orphans, the insane and they include security, health and public education in constitutionalism era.

#### Molla Ahmad Naraghi

He was the first jurist in Qajar era who gave meaning of guardianship in the framework of general guardianship of jurist and general guardianship of jurist was raised in the book " Avaed Al-Ayam":

By referring to some traditions, he attempted to use " Statement principle" and proved these traditions in general guardianship of jurist. He referred to the limit of power and guardianship of jurists and stated that : All responsibilities of just jurist are based on two points:

- 1- What has the prophet and Imam- kings of people and castles of Islam- jurist has guardianship also, except those excluded based on general agreement and Islamic texts.
- 2- Any act associated to the human being affairs in the world and hereafter (Naraghi, 1996).

Mollah Ahmad Naraghi in this framework considered some affairs under guardianship of jurist and the most important items are 1-Verdict, 2-Judgement, 3-Performing Hodud, 4-Keeping the property of orphans, 5-Keeping the property of the insane, 6-Keeping the property of those absent in cities, 7-Guardianship of marriage and marriage of the insane, immature, 8-Guardianship in fulfilling the rights of the orphans and the insane, 9-Possession in property of Imam Zaman, (Naraghi, ibid, Mirahmadi, 2009).

#### Sheikh Mohammad Hassan Najafi:

Sheikh Mohamad Hassan NajafiSahebJavaher emphasized mostly on "appointed general guardianship of jurist" and put it as the basis of power and authorities of jurist and based on jurist guardianship, his guardianship was necessary issues not being reasoned (Najafi, 1981, 21, 397) and some terms of SahebJavaher are used and besides wisdom principle, guardianship of jurist is one of the necessary issues and its denial leads to apostasy (Najafi, 1988, Vol. 21, 399). To prove general appointed guardianship of jurist, he has used general agreement and wisdom and





### Zahra KhajooeiNejad and KhadijehYadollahi

narration reasons (Najafi, 1988). Among the traditions, we emphasized on two with the sentence "فأئهم حجتي عليكم و أنا" (Najafi, 1988) and another one Maghbule Omar IbnHanzale with emphasis on the sentence "فأني قد جعلته عليكم" and more than other traditions are considered and these two traditions emphasize on appointed general guardianship of jurist. According to SahebJavaher, for the first time, jurists were appointed by Imam Sadigh and another time by Imam Zman and these appointments eternal and continued after the martyrdom of Imam (Najafi, 1988). He had some opinions about some traditions as the famous tradition "اللهم ارحم خلفائي" and believed that as tradition is not reliable, it has some problems in terms of referring and it refers to specific prophet or specific attributes and there is no reason for appointment (Najafi, 1988).

#### Kashefolghata

Regarding guardianship, there is an important principle in jurisprudence as principle is based on non-guardianship, no one has any guardianship on another one and anyone based on wisdom is responsible for himself. This principle was raised for the first time by Sheikh Jafarkashef Al-ghata. Kashefolghata writes according to traditions: What is based on reasons, jurists have guardianship on public affairs and what social system needs and traditions of infallibles (affairs are managed by clergymen and clergymen are heir of the messengers and like these traditions) and in Sharia principle, non-litigious matters are considered (Kashefolghata, 1982).

#### Sheikh Morteza Ansari

Like other great jurists including AkhundKhorasani in the margin of the book of Almakaseb of Seyed Mohsen Hakim Seyed Ahmad KHansari and Ayatollah khuyi, Sheikh Morteza Ansari criticized the political guardianship of jurisprudence and believed that jurisprudence reasons couldn't fulfill such duty.

By dividing the appointment of jurist to Efta, judgment and possession guardianship, he believed that the third appointment is based on two forms:

- 1- Independence of possessing guardian
- 2- Non- independence of non- possessing guardian

After the evaluation of verses regarding the guardianship of Prophet and infallibles and accepting their guardianship, it is believed that in affairs their legitimacy is deterministic, if there is no jurist, people are obliged to establish them (Al-Makaseb, AljozeSani, 50).

As sheikh Ansari considered giving verdict and judgment as fixed duties of jurist, a new approach is presented regarding the appointment of guardianship in the life and property and divided this type of guardianship into independence guardianship and permission guardianship and considered two types of guardianship as fixed with Quran and tradition for infallibles but Sheikh presented 10 narrations about independence guardianship of jurist and raised general forms of MohagheghMaraghi with a little difference in narration on jurist guardianship and by considering the traditions, they show that these narrations show the duty of clergymen in propagating the Halal and Haram, not their guardianship. Also, Sheikh added Maraghi that if the traditions are general (including guardianship of life and property), we are obliged to dedicate to the orders propagation, otherwise we are faced with maximum allocation problem as we know the jurist has guardianship only in rare cases on property and life of people and proving such guardianship for jurist "Picking thorns with bare hands is nothing compared to this". (Borji, 2010, 23).

#### AkhundKhorasani

AkhundKhorasani in the margin of Makaseb by criticizing the reasons given by Sheikh Ansari for referring to jurist in non-litigious matters is necessary and "reasoning to independence and non-independence guardianship [jurist] was clarified and this reasoning among those their views [in non-litigious matters] is valid considers jurist as obliged and in case of lack of jurist, permission and words of a just person among the believers are used (AKhundKhorasani,





### Zahra KhajooeiNejad and KhadijehYadollahi

1406, 96). He believed that difference in belonging of guardianship doesn't make any difference in principle of guardianship and despite the views of Sheikh, obedience of infallibles in personal issues outside of important issues of society to sharia and political issues are not clear. We can say AkhundKhorasani accepts guardianship of jurist in non-litigious affairs as it is proved as necessary. The holy king should appoint a person and this person is all Muslims or only the just. Each of three first titles as appointed, jurist is include and if the jurist is not appointed, the titles are not included and proving guardianship is deterministic for jurist. In other words, jurist is among those their permission in society is valid and the others are doubtful and non-guardianship is used for them(AKhundKHorasani, 1406, 93).

#### Sheikh FazlollahNuri

Sheikh FazlollahNuri believed in guardianship with kingdom and it is called "legitimate kingdom". This theory is based on two principles: Appointed guardianship of jurists in non-litigious affairs (the obligatory affairs) and kingdom of Muslim King can achieve power by any means but the important point is to be Shia and respect the guardianship of jurists. In this theory, jurist and kings are separated powers. According to Sheikh FazlollahNuri, people are managed in major occultation by "just jurists" and Islamist kings" and he believes that: appointing law totally or partially is contradictory with Islam and it is the work of prophet. Muslim can not appoint law, validity of majority vote to Emamie religion is false. What is the meaning of writing law? constitution and validity of majority vote in some affairs as based on law are sharia forbidden and innovation in religion and if Mobah is obliged to it, it is forbidden. Some items as dividing the power to legislative and it is pure innovation as in Islam no one should appoint orders, Islam is not incomplete to be completed. In some aspects we should refer to orders of Imam (pbuh) and he should infer from Book and tradition, not legislation (Tazkere Al-Qafel, Ershad Al-Jahel, 56-58).

#### Ayatollah MirzayeNayini

By dividing guardianship into three ranks, MirzayeNaini believes that a rank belongs to prophet and infallibles and is not delegated. This rank is the guardianship as proving their propriety to believers as in verse "النبي أولى بالمؤمنين من انفسه". There are two other ranks as delegated. These two ranks are a: Guardianship in verdict and judgment, b) Guardianship in political affairs by which the king gives order to people affairs in society. He believes that there were many kings and judges in Islam history and the king was not judge and vice versa. He said: there is no ambiguity in fixed position of judgment for jurist in occultation era and judgment belongings (NajafiKhansari, Bita 35). To prove common guardianship as including guardianship in political affairs, we can refer to the traditions and by their evaluation, besides accepting the guardianship of judgment, "public guardianship" is summarized as: Proving public guardianship for jurist as by saying Friday prayer or appointment of Imam Jome, Jome prayer can be obligatory and it is difficult (Ibid, 327).

MirzayeNaili doesn't consider "genesis guardianship" of the Prophet including jurists and gives meaning of jurist guardianship in the form of combinational discourse as jurists guardianship in occultation era from deterministic issues view in " non-litigious affairs" is fixed and government is also in "non-litigious matters" (Naili, Bita, 32). There are some criticisms of this reason. Nayini considered the highest means to keep the reality of government as " purity" and as in occultation era, purity is away, the government is based on two issues:1- Constitution, 2- Council parliament In addition, the interference of non-jurists in public affairs is legitimate and obligatory as Islamic government is based on council and inviting to virtue and banning vice are obligatory for Muslims and based on the taxes paid by people, they can consume it (Ibid, 78-79).

High supervision of jurist on law making and guardianship substitution is considered. Based on this theory, government is reasoning not based on obedience. Islamic nature is performed by high supervision of jurists and government is on jurists.





### Zahra KhajoeiNejad and KhadijehYadollahi

#### The term guardianship from the view of jurist in Pahlavi and Islamic Republic era

In this discussion, guardianship in political dimension is raised from the view of jurists as Ayatollah Brojerdi, Ayatollah Khuyi, Ayatollah Golpayegani and Imam Khomeini as dominant among other jurists.

#### Ayatollah Brojerdi

Ayatollah Brojerdi is the greatest religious jurist at his time after Sheikh Morteza and MirzayeShirazi, the third "absolute jurist" of Shia world as being inspired by traditional jurists. He analyzed the traditions of jurisprudence guardianship based on the Islam rules and the role of guardianship jurist in religious orders. For better perception of traditions of guardianship of jurist, namely Maghbule Omar IbnHanzale, four introductions were considered. First, in each society, there are some works not in individual duties and they are leadership and government duties. Second, Islam is a religious, political and social religion as its orders are not summarized in religions. Most of these orders are about managing country, society and fulfilling security of individual and society. Third, political duties are not separated from religious orders and men of religion are not separated from political men and fourth, After Prophet, infallibles are guardians (Barji, Ibid).

We can say Ayatollah Brojerdi, more than considering government affairs were concerned about religion and Shia religious basics. In case of guardianship of jurist, in case of providing conditions, they believe in authorities of jurists but they were disagree about this action. Ayatollah Brojerdi with majority of jurists in this era (20, 30 decades) as Ayatollah Khansari, Ayatollah Sadr and Ayatollah HOjat and others accepted the separation of religion from politics and had no interference in political and government affairs (Abdoli, 2009, 42).

#### Ayatollah Khuyi

Regarding the definition of concept of guardianship, Ayatollah Khuyi believed that "guardianship is the ability in occupation of property of self or others" (Khuyi, 1410, Vol. 33, 251). Thus, the concept of absolute or general guardianship includes dominance of a high position in all fields of life, even private. The view of Khuyi includes dominance of a high position in all aspects of life, even private aspect as "Lives and property". He believed that the prophet and his narrations had guardianship from three aspects, in terms of obedience from Prophet in Sharia orders and its propagation, in terms of obedience of personal orders and in terms of guardianship on life and property of people. Regarding jurist, except orders propagation, all agree about lack of obligation of obedience from him, otherwise he can possess people property independently as selling the house of Zeid or marriage of girls to others and other financial and life possession, no guardianship is proved for jurist. Compared to some contemporary people of Sahib Javaher, it is said that general guardianship for jurist and possession of jurist in in life and property of people....(Touhidi, 1417, Vol. 5, 37).

Thus, we can say that Ayatollah Khuyi believes that in occultation era, guardianship for jurist is not proved and by referring to traditions and verses, we can not prove such guardianship and the reasons only prove possession in non-litigious matters based on deterministic view. Guardianship for jurist in occultation era is not provide with any reason and this guardianship is dedicated to prophet and infallibles. According to traditions, influence of judgment and his order and verdict and [jurist], can not have any possession in the property of the minor as shown in guardianship unless in non-litigious matters. jurist has guardianship in these affairs but not by the meaning as claimed, by the meaning of influence of his possession and possession of agent or resignation of his agent with death and this permission is based on deterministic issue as without personal permission, possession in property is not permitted [...] and deterministic issue of those God is satisfied with their possession and this is qualified jurist. What is fixed for jurist is possession permission not guardianship (QoraviTabrizi, 1410, 424). Ayatollah Khuyi as one of the greatest jurists considered the power of jurist as limited and believed that jurist can not have absolute power like prophet and infallibles and the power of jurist is restricted to verdict and destiny.







### Zahra KhajooeiNejad and KhadijehYadollahi

#### Ayatollah GolpayganiTabrizi

Ayatollah Golpaygani is one of the great jurists in contemporary era with interesting view about the concept of guardianship and its meaning. He writes about guardianship of jurist in public and political issues : Indeed, qualified guardianship jurist is used in public and political issues of people. Indeed, society and its order are not fulfilled unless with some rules as appointed and dominated (SaberHamedani, 2004, 46). Regarding this view based on “lack of texts” and using “statement principle” writes that “ according to the evidence of people as tradition ( العلماء ورثة الانبياء ) (يا امناء الله و خلفاء الرسول) and resort to all the positions of Prophet and Imams, jurists have the same position, unless the positions they are only dedicated to prophet and infallibles as necessity of following the affairs for them and Jihad for inviting people to Islam (Initial Jihad) or it is said that although the absolute guardianship of jurists and positions if prophet-except the positions not included- we can not use general reasoning but we can refer to this guardianship in public affairs of their order and protection against oppression. Thus, it is emphasized on proving guardianship jurist in the affairs regarding the politics of society except the affairs excluded as Jihad to invite to Islam as they are only dedicated to Prophet and Imam or the one permitting from them (Ibid, 46, 47).

#### Imam Khomeini

After great jurists as AkhundKhorasani, MirzayeNaini and Ayatollah Brojerdi as using guardianship in its minimum meaning and avoided interference in politics and government by jurist, Imam Khomeini by giving meaning to guardianship in its maximum meaning and formation of Islamic government by jurists started new era in Shia political jurisprudence and believed that guardianship of jurists was not dedicated to supervision of orphans and the insane and Imam Khomeini by writing jurist guardianship book (Islamic government) considered formation of government by jurists in occultation era as permitted for jurists and by narration and wisdom reasons developed this thought. Finally, it led into Islamic government formation under the supervision of jurist absolute guardianship and Islamic republic s ystem in Iran.

principles of his theory are as:

- 1- To implement a part of required orders, Islam needs government.
- 2- Governing by jurists and helping people are necessary.
- 3- Guardianship of just jurists from God in all prophet and Imam had guardianship, they have also the same authority.
- 4- Islamic government is the initial orders of Islam and is prior to minor orders.

In the book guardianship of jurist , Imam kHomeini defines guardianship as “ Jurist guardianship is one of the issues that has no need of reasoning and anyone receiving Islamic orders, by reaching jurist guardianship, it is proved and obvious. Today, guardianship of jurist is not considered mostly and it needs reasoning and it is due to social condition of Muslims generally and in religious centers, specifically (Imam Khomeini, 1978, 14).

Jurisprudence guardianship is the basis of political order of occultation era in thought system of Imam Khomeini. In occultation era, jurist and his agents as qualified jurists for judgment can manage government issues and other affairs of infallibles except initial Jihad. At the same time with guardianship of jurist in Iran constitution, guardianship of jurist is guardianship on the affairs controlling these affairs and all systems.

In Imam though, Islamic government is divine law government and Islamic ruler should have two attributes and they are the bases of legal government, without which two legal governments are not logical, one as science attributes, the other is justice.

#### Guardianship of jurist

In the meaning of the term “guardianship of jurist” Imam kHomeini believes that “guardianship of jurist is one of the issues as proved and it doesn’t need reasoning”(Imam Khomeini, 1978, 6). He didn’t create such meaning but re-created a new “maximum” and “appointing” concepts.





### Zahra KhajooeiNejad and KhadijehYadollahi

He considered the most important conditions for governing in occultation era as two components:

- 1- Knowledge of law as it is jurisprudence.
- 2- Justice as necessary for belief and moral perfection

Thus, the one not having the above qualifications, can not be ruler. Government is dedicated to jurists and the ruler can not be non-jurist as if the ruler imitates, his power is broken and if there is no imitation, there is no qualification for governing.

By some reasons in Quran and traditions, Imam Khomeini proved political government of jurists and concluded that real kings are jurists and governance should belong to jurists not those who should follow the jurists (Ibid, 60). By believing in "genesis guardianship" and maximum view, jurists guardianship is along the government of the Prophet and infallibles and all their government powers are protected for jurists. This is false that we believe all authorities of the Prophet were more than that of Imam Ali or the authorities of Imam Ali more than jurists (Ibid, 54). Thus, guardianship of jurist as king of Islamic government gets its legitimacy not from people but from God and as prophet is appointed by God, guardianship of jurist is appointed by God and obedience of people is enforcing.

#### Islamic government

In the book of Islamic government (guardianship of jurist) summarizes the most important reasons of Islamic government in three factors as 1- Tradition, 2- Rules, 3- Nature of rules of Islam. As in maximum jurisprudence view "jurisprudence can fulfill all human needs" and have deterministic response for all human problems by referring to the "text" and jurisprudence, we can establish a full social and political system without needing other human sciences. Imam Khomeini writes: First, sharia orders have various rules making a general social system and the needs of human being are provided. Via communication with neighbors, children and family and citizens and private affairs and marital life to the rules of peace, war and relationship with other nations, from penal rules to legal rules of trading and industry and agriculture have some rules for marriage and infant formation and the method of marriage, human being food, duties of parents, education of child and behavior of men and women and children have some orders in law (Imam Khomeini, 1978, 32). Regarding the explaining of Islamic orders requiring formation of Islamic government, three types of orders are referred as 1- Financial orders as Khoms, Zikat, Jazie and tax, 2- Defensive and military rules, 3- Legal and penal rules (Imam Khomeini, 1978, 32-38). Imam Khomeini considered "genesis guardianship" of prophet and jurists and formulated their guardianship jurist theory in this framework.

#### CONCLUSION

In this study, the concept of guardianship and its meaning changes are discussed from the view of contemporary jurists in Qajar era and Pahlavi and Islamic republic of Iran. Based on various meanings of guardianship, political and government aspects of guardianship are discussed among contemporary jurists. This dimension of guardianship regarding jurist guardianship is also considered. We can say that by formation of Shia political jurisprudence to the early Qajar, guardianship had not specific position in Shia jurisprudence and most principles were based on judgment and non-litigious affairs. In constitutionalism era, Shia jurists were faced with modern concepts as people law, freedom, justice, supervision, separation of power, equality and agency and this caused two different approaches, one legitimate government with agency of Sheikh Fazlollah Nuri with emphasis on appointed guardianship of jurists in non-litigious affairs and kingdom of Muslims in common law and another one as constitutional government theory based on permission of jurists by Ayatollah Naini. Guardianship of jurist was remained at supervision but in Pahlavi era, Imam Khomeini wrote Guardianship of jurist not only in meaning of jurisprudence, the highest duties and political, social and economic affairs were considered but in Shia political jurisprudence, a new era was opened and it is maximum political jurisprudence. By believing in "genesis guardianship" and maximum view, the guardianship of jurists is along the government of the Prophet and infallibles and all their authority powers are considered for jurists. Finally, it leads to Islamic government under the





### Zahra KhajooeiNejad and KhadijehYadollahi

guardianship of absolute jurist in Islamic Republic of Iran. This is the maximum development of guardianship in contemporary era.

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RESEARCH ARTICLE

## Investigating the Relationship Between Service Recovery and Customer Satisfaction and Loyalty

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### ABSTRACT

Impact of service recovery on customer satisfaction and loyalty in a financial institution in Iran is investigated in the current work. Research statistical population includes all customers and directors and assistants of the branches of a credit institution in Iran. Statistical sample size was specified as 370 using this method. Cronbach's alpha coefficient was used to determine the validity of the questionnaire and correlation coefficients and F-test and t-test were used for testing research hypotheses. Pearson correlation coefficient and factor analysis were used to test the relationships between variables and research hypotheses. LISREL software and SPSS software were used to investigate statistical parameters in this work. Results indicate service recovery influences communications. In addition, communications influence conflict management. Also, conflict management influences satisfaction with complaint handling.

**Keywords:** service recovery, loyalty, customer, financial institution





**Seyed Amir Abedi and Kewmars Falahi**

## INTRODUCTION

Globalization and free trade is continually changing work environment and make it more globally competitive. Managers in today's commercial environment pays high attention to meeting customer needs in order to survive in competition and providing satisfactory financial benefits to shareholders. According to research works, customer satisfaction influences retaining customers and thus profitability and success of the company in completion arena. According to Estoner and Edward in Management book, cost of absorbing a new customer is five times higher than retaining old customer. If customer needs are considered from the beginning, utilization of quality improvement tools would lead to production of products and services which no one purchase them (Tax, 1998). Most theorists and researchers agree on importance of customer satisfaction and service quality concepts and they are considered as basic concepts in service management so that Cutler states that marketing is based on manufacturing possibilities which is founded on customer satisfaction (Cutler, 2004). Customer satisfaction is a key for preserving customer loyalty and top financial performance of the company. On the other hand, service quality in today's competitive world is one of the grounds through which the organizations can achieve competitive advantage. Eservice quality is defined as an attitude about superiority and preference of a service which results from comparison between customer expectations and their perception of the real performance of services. Most studies clearly showed importance of both concepts (Javadin, 2005). Investigating quality of services provided in banking industry and service recovery methods in case of customer dissatisfaction and measurement of service recovery methods impact on customer satisfaction and loyalty are major topics of the current study. Some general points are given in this section. Managers in today's competitive world should pay high attention to meeting customer needs in order to stay in competition and provide satisfactory services to shareholders. The main strategy in marketing is preserving current customers and absorbing new customers. However, errors, problems, and dissatisfaction may occur in service delivery process. If the companies do not consider service deficiencies, they may face bankrupt. Service recovery includes those acts which are carried out in order to solve problems, change negative attitudes of dissatisfied customers and retain the customers (Miller and Karwan, 2000). As service quality is especially important, service recovery strategy and competitive advantage are also important, thus they should be understood so that poor services can be strengthened (Boshoff, 1997; Bahia and Natel, 2000; Jamal and Naser, 2002).

The main issue which is discussed along with customer loyalty is being economical and costs of a brand or store (Gee, 2008). According to the research study by Anderson (2001) below 50 percent of complaints receive response and most customers are dissatisfied with response of the organization to the complaints. Slowness in responding and not respectful response was mentioned as the main dissatisfaction factors. Only 30 percent of the customers who complained the company were satisfied with the company's attempt to respond them (Michel and Meuter, 2008). Complaining customers would become angrier when they are ignored. They may feel blame and are forced to fight so that their voice is heard (Varela-Neira et al., 2010). The main studies on customer dissatisfaction and complaints have been focused on the reason and the way of customer responding to dissatisfaction with the goods and services, and less attention was paid to effects of service recovery on customer satisfaction and loyalty. In addition, there is low understanding about utilization of the strategy and impact of such strategies of customer perception and attitude, especially in service environments.

Service recovery is regarded as an attempt by the organization in order to compensate negative effects of a deficiency or defect. In case of service inefficiency, effective use of the service recovery strategies is very important to attract customer satisfaction. Trust is an important variable in relationships logically and experimentally. Distrust to the seller company highly reduces loyalty. According to Wood and Ashil (2000), trust sometimes is considered as a major point: performance or reliability or credibility of trust and benevolence of trust (Morrison and Huppertz, 2010). As service quality is considered as marketing strategy and more competitive advantage, attempt for service recovery for low quality services as drawn more attention in the current literature (Boshoff, 1997; Swanson and Kelley, 2001; Hocutt et al., 2006; Morrison and Huppertz, 2010). If the services of the companies do not manage service recovery



**Seyed Amir Abedi and Kewmars Falahi**

properly, their long term success outlook would be damaged. If the companies handle complaint management effectively, it would have strong impact on customer retention (Morrisson and Huppertz, 2010).

Parasorman et al.: service quality is defined by the difference between customer expectations from the performance of service provider and their evaluation of the services which they perceive (Morrisson and Huppertz, 2010). Tendency to service quality has major role in service industries such as insurance services, banking services and etc., since service quality is critical for survival and profitability of the organization. In banking services, service quality is defined as the belief or attitude of the customer regarding superiority of the service which is delivered in the bank environment (Alhavari et al., 2004). Customer loyalty is critical for business in today's competitive world, and banks are no exception. Thus, commercial banks have initiated various management strategies for promoting customer loyalty (Bahia and Natel, 2000; Jamal and Naser, 2000). According to Shith et al. (2000), service recovery refers to the measures taken by the organization aiming at solving problems which led to failure of the service delivered to the customer. Impact of service recovery would lead to satisfaction and return of the complaining person (Karatepe and Ekiz, 2004; Lin & Wang, 2006). Overall six aspects of the organization responses for recovery can be mentioned:

Cosenza's speed (1981), facilities by Kandel and Roos (1981) (Granbois, 1977; Richins, 1983), compensation (Zahmatkesh, 2012), Apology, reliability and attention (Barlow and Moller, 1996) Customer response to service recovery can be observed at several aspects:

Repurchase intention (Zahmatkesh, 2012), word of mouth behavior which is informal communications of customers regarding ownership, use or features of a product or service or its suppliers (Germler et al., 2001), satisfaction and loyalty, conflict solving (Kagit and Norris, 2000), communications (Michel and Meuter, 2004; Ball and Meuter, 2008) Swanson and Kelley (2001) in a study entitled Service recovery attributions and word-of-mouth intentions attempted to find relationship between service recovery process duration and customer perceptions toward service quality and behavioral intentions (advertisement and repurchase). Their findings indicate customers' behavioral intentions are more optimal in stable service recovery processes. Employee-oriented service recovery processes cause that customer have better evaluations and more positive word of mouth advertisement regarding the service deliverer. Loyal customers help the business promotion through word of mouth, referring to the organization, providing sources, or services for consulting boards (Richlend, 2003). In addition, loyal customers act as a great marketing agent who provide recommendations and extend positive speech loyalty (Johnston and Michel, 2008). The company can perceive relationship between economic benefits resulting from customer speech loyalty and the company's growth (Richard, 2003). However, service failure is inevitable and it may occur in both the process and results taken from service delivery. They include when the service cannot meet customer expectations (Michel et al., 2009; Johnston and Michel, 2008). Loyalty means a positive attitude toward a phenomenon (brand, service, store or seller) and supportive behavior toward it. However, there is also a more perfect definition of loyalty proposed by Oliver (1999): loyalty is defined as a strong commitment for repurchase of a superior service or product in the future, so that the same brand or product will be repurchased despite of potential attempts and marketing of the competitors (Lin & Wang, 2006). Often two approaches are observed in the loyalty definitions: 1. Attitude Approach: various emotions in person create feeling attachment to the organization, services or product. Such feeling specifies degree of the customer loyalty, which is totally cognitive. Attitude loyalty scales include word of mouth advertisement, tendency to recommending and encouraging others to use the product and services. 2. Behavioral Attitude: it is customer tendency to repurchase of the services and products and retaining relationship with the product and service supplier (Miller and Rawin, 2007).

Dewit and Brady (2003) conducted a study entitled Reviewing service recovery strategies. They tested relationship between Understanding and service recovery strategies using 4 hypotheses. Research variable included: A.satisfaction, B. repurchase intention, C. negative advertisement, D. intention for complaint, and E. evaluation of service provider. Seven-point Likert scale was used in order to measure the variables. Hypotheses were supported at confidence level  $P < 0.05$  using One-factor and multi-factor analysis of variance. It was found that a compatible



**Seyed Amir Abedi and Kewmars Falahi**

relationship between customer and service provider can increase customer satisfaction following occurrence of service inefficiency, increase repurchase intention and reduce negative advertisement by the customer. Samadi, Hajipour and Farsizadeh (2008) in a study entitled Deficiency in service delivery, service recovery strategies and their impact on consumer behavior determined perception of foreign guests of the hotel regarding deficiency in service delivery and service recovery strategies. They also investigated relationship between service deficiencies, service recovery strategies and behavioral intentions of subjects. They used the questionnaire proposed by Lin to measure behavioral intentions, service deficiencies, and service recovery strategies. Statistical population included all foreign guests of 4-star hotels in Tehran and statistical sample included 116 guests. Results of the research indicated there is significant relationship between aspects of service deficiencies and service recovery strategies and between recovery strategies and behavioral intentions of the foreign guests. In addition, their findings showed perception of the guest regarding service deficiencies and service recovery strategies are factors affecting behavioral intentions of foreign guests of the hotel. Thus, current work attempts to test relationship between service recovery, customer satisfaction and their loyalty in one of the service industries, that is, TOSE Finance and Credit Institution.

**Research hypotheses**

1. There is significant relationship between service recovery and customer loyalty in TOSE Finance and Credit Institution.
2. There is significant relationship between communication with customers and customer loyalty in TOSE Finance and Credit Institution.
3. There is significant relationship between service recovery and customer satisfaction in TOSE Finance and Credit Institution.
4. There is significant relationship between service recovery and customer satisfaction and loyal behavior to TOSE Finance and Credit Institution.

**Data Collection**

Statistical population of the research study includes all customers and directors and assistants of the branches of the credit institution in Iran. Since active customers of the institution were target of the research statistical population, active customers were selected using this filter: at least once increase or decrease other than interest of short-term and long-term deposits in deposits. Hence, the number of active customers was reduced to 16,621 and it was the basis for estimation of statistical sample. The number of statistical population of employees was 150. Considering it is limited, the whole statistical population was entered into the sample. Finally, in order to determine the sample size of active customers, De Morgan Table was used and the sample size was 370 using this method.

**Independent Variable**

Customer loyalty is independent variable in this research. Effective improvement of problems in service delivery to customers may lead to positive evaluation of the customers about the company. In order to evaluate loyalty of customers in this work, the questionnaire was provided in the form of customer loyalty behavior and tendency.

**Dependent Variable**

Relationships with customers, customer satisfaction and service recovery were considered as effective indexes which influence behavioral and attitude loyalty of customers. They are dependent variables or the variables which are changed by independent variable. Communications with customers mean various types of relationships, directly or indirectly, in order to attract customer satisfaction and increase word of mouth advertisement. In addition, customer satisfaction refers to customer judgment toward receiving products and services from the company.





### Seyed Amir Abedi and Kewmars Falahi

#### Research Conceptual Model

According to model of Michele et al. (2009), conflict management refers to the ability of the business unit to avoid conflicts and solving customer dissatisfaction before it turns to a problem, and investigate the problems, which is the last step. The main issue in this model is that how management and customer dissatisfaction management conflict can lead to customer loyalty to the products and services and the company. Overall customer satisfaction is described as follows: it occurs when the customer purchases products and services regularly over the time or has optimal attitude toward them and the company and it is an important factor for success of the company.

#### Research Validity

Research variables and questionnaire were judged by elites in marketing and service recovery field and the questionnaire was confirmed by the Supervisor and Consultant professors.

#### Research Reliability

In order to test reliability, Cronbach's alpha coefficient was used, which is a standard statistical method. This statistics will be formulated as follows:

$$\alpha = \frac{k}{k-1} \left[ 1 - \frac{\sum s_i^2}{s_{sum}^2} \right]$$

Where,  $s_i^2$  is variance of  $i^{th}$  item and  $s_{sum}^2$  is variance of total items and  $k$  is the number of items in questionnaire.

The closer alpha is to 1, reliability is higher and the smaller value it has, it suggests lower reliability for measurement tool. Following data collection through questionnaire, binomial test was used to confirm or reject the hypothesis and Excel and SPSS 19 software were used for statistical calculations

In order to analyze collected data, firstly demographic characteristics were extracted and described using statistical indexes at descriptive level. Then at analytical statistics level, confirmatory factor analysis was used in order to test significance of the relationships and fitting measurement models. Also, structural equation modeling (SEM) was used for investigating relationship between research variables using LISREL software. Friedman test was used for ranking research variables using SPSS software.

## RESULTS AND DISCUSSION

As observed in Fig 1, 54.5 percent of respondents were male and 45.5 percent were female.

Fig 2 indicates frequency of educational level in respondents. As observed in Fig 2, 4 percent were under graduate, 65 percent had Bse degree, 28.5 percent had Mse degree and 2.5 percent had PhD degree.

Fig 3 indicates frequency of income level in respondents. As observed in Fig 3, 1 percent has income under 10 million Rials, 52.5 percent had income between 10 – 20 million Rilas, 42.5 percent had income between 20 – 50 million Rilas and 4 percent had income over 50 million Rials

Fig 4 shows frequency of duration for using institution services. As observed in Fig 4, 9.5 percent of respondents used services under 1 year, 7 percent used services for 1-2 years, 32 percent used services for 2-5 years and 51.5 percent used services for more than 5 years.





**Seyed Amir Abedi and Kewmars Falahi**

Table 1 gives frequency of respondents' satisfaction with the institution services. As observed in Table 1, 88.5 percent of respondents were satisfied with the services and 11.5 percent were dissatisfied.

Investigation of measurement model for service recovery variable suggests relative fit of the item in questionnaires. In testing research hypotheses using structural equation modeling, output of software indicate suitability of structural fitted model for testing hypotheses (ratio of  $\chi^2$  to df is smaller than 3). RMSEA = 0.099 suggest suitability of structural model fit. In other words, observed data are highly compatible to research conceptual model. GFI, AGFI and NFI as 0.94, 0.89, and 0.90 suggest high model fit.

Fig 5 showed research model in standard estimation coefficients state and Fig 6 indicates research model in significance coefficients state. Considering data in the figures it can be found model factor loads indicate influence of variables or constructs in description of variance of variable scores or main factor in standard estimation coefficients state. In other words, factor load indicates correlation of each observer variable (questionnaire item) with latent variable (factors). Considering significance coefficient of the item related to CO2 index in communication variable, it is clear that its value is not significant. Thus, it is excluded from the questionnaire items and confirmatory factor analysis of communication variable is investigated again.

One of the strongest and most suitable analysis methods is multi-variable analysis, because nature of such issues is multi- variable and they cannot be solved with two-variable method (each time one independent variable is considered with a dependent variable). Thus, structural equation model is used in the current work for supporting or rejecting hypotheses.

In order to investigate effects of independent variables on dependent variables, a hypothetical model is provided based on the literature reviewed. Hypotheses in Chapter 1 denote causal relationship between variables of the model. Hence, simultaneous evaluation of hypotheses in the form of primary model is done. In order to evaluate the hypothetical model, firstly parameters are estimated using Maximum likelihood method. Estimated parameters include impact factors. Finally, indexes of model fit evaluation and fitted model shape are reported.

In determining priority of indexes of research variables using Friedman test, it is clear that test statistics of all variables is smaller than 0.05, considering Table 7-4, and null hypothesis is rejected. Thus, it can be concluded prioritization of factors of these variables is different. Considering mean of rank of the variables' indexes, order of priorities can be specified.

Considering test of H1, following results were obtained:

As observed in final research model and following table, it is shown that: Impact factor of service recovery on communications is 0.88 and t-value is positive and larger than 1.96. Thus, impact of service recovery on communication is supported. Thus, service recovery influences communications.

Results for testing H2

Considering results for testing H2, following results can be found:

As shown in final research model and following table, impact factor of communications on conflict management is 0.89 and since t-value is positive and larger than 1.96, impact of communications on conflict management is supported. Thus, communications influences conflict management.

Results for testing H3

Considering results for testing H3, following results can be found:





### Seyed Amir Abedi and Kewmars Falahi

As shown in final research model and following table, impact factor of conflict management on satisfaction resulting from complaint handling is 0.84 and since t-value is positive and larger than 1.96, impact of conflict management on satisfaction resulting from complaint handling is supported.

Thus, conflict management influences satisfaction resulting from complaint handling.

Results for testing H4

Considering results for testing H4, following results can be found:

As shown in final research model and following table, impact factor of satisfaction resulting from complaint handling on customer loyalty is 0.85 and since t-value is positive and larger than 1.96, impact of satisfaction resulting from complaint handling on customer loyalty is supported. Thus, satisfaction resulting from complaint handling influences customer loyalty.

## CONCLUSION

Considering results for hypothesis testing and figures obtained from analysis, it can be said hypothesis model is confirmed with high coefficient.

Thus, considering supported hypothesis, banks and financial institutions are recommended to create conditions for increasing customer loyalty with recovery of their services and paying attention to customer needs and expectations and solving cases resulting in customer dissatisfaction. It leads to increased customers through word of mouth advertisement. Because each satisfied customer leads to absorption of new customers and the main point is that each dissatisfied may lead to disconnection of customer relationship. Thus, organization's success can be expected by investigating needs of capital market and customers and providing suitable services as well as following-up conflicts. Recruitment of employees with adequate knowledge and ability to communicate with customers and ability to avoid conflicts and solving conflicts is also recommended. Paying profit suitable to real economic conditions of the country is suggested. Fulfilling promises would lead to creating trust in customers to the organization. Conducting researches in relation with services delivered by other banks and financial institution leads to tendency of customers to them.

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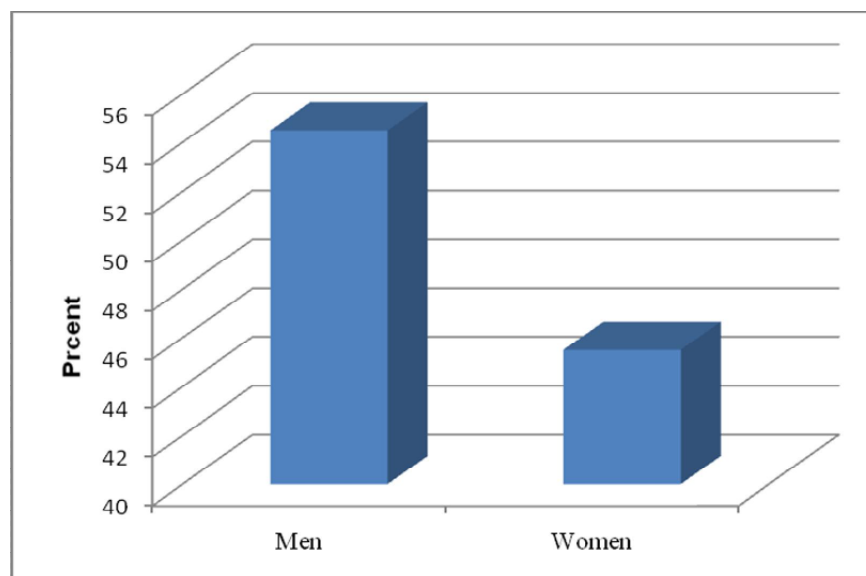
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**Seyed Amir Abedi and Kewmars Falahi**

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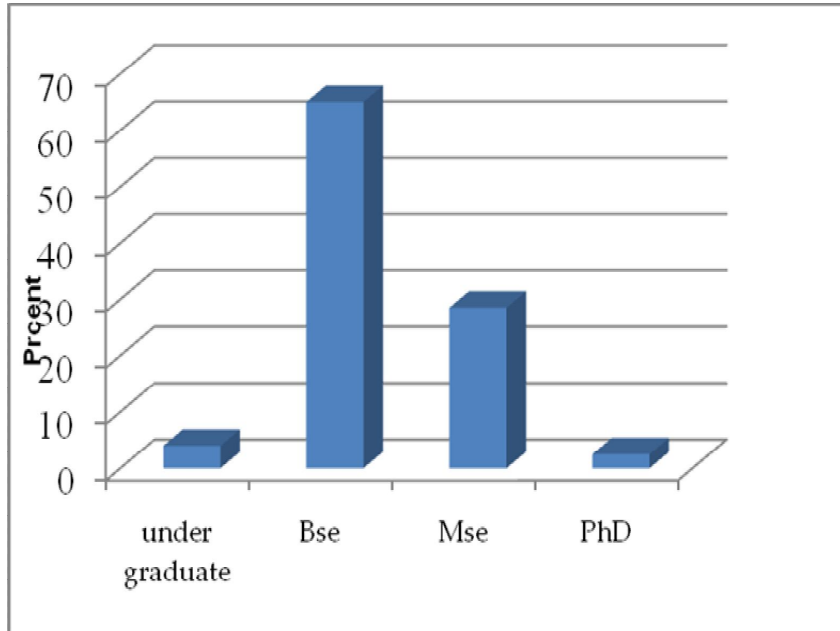


**Fig 1. Frequency of respondents' gender**

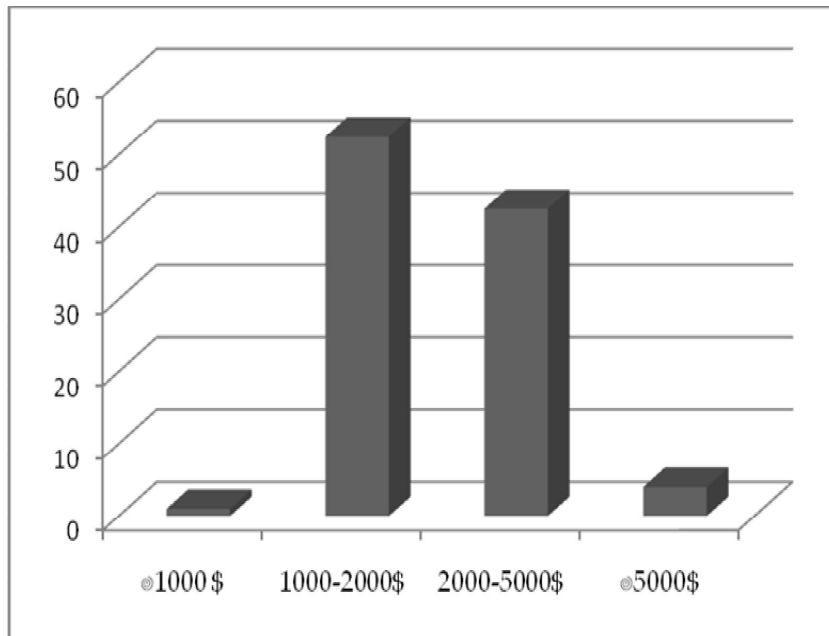




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**Fig 2. Frequency of educational level in respondents**

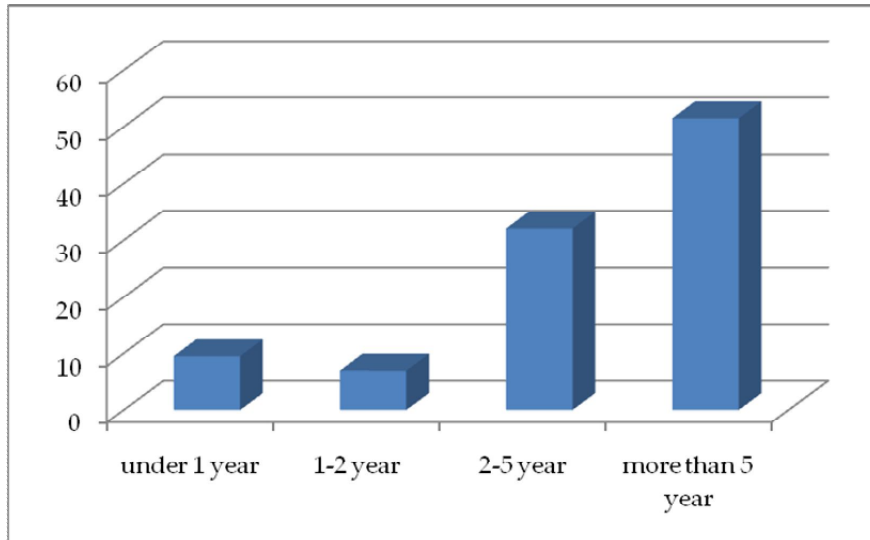


**Fig 3. Frequency of income level in respondents**





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**Fig 4. Frequency of duration for using institution services**

**Table 1. Frequency of respondents' satisfaction with the institution services**

	Frequency	Percent	Valid percent	Accumulative percent
Yes	177	88.5	88.5	88.5
No	23	11.5	11.5	100.0
Total	200	100.0	100.0	

**Table 2. Results for support or rejection of research hypotheses**

	Research Hypothesis	Impact Factor	t-value	Result
H1	Impact of service recovery on communications	0.88	5.74	Support
H2	Impact of communications on conflict management	0.89	5.83	Support
H3	Impact of conflict management on satisfaction resulting from complaint handling	0.84	8.88	Support
H4	Impact of satisfaction resulting from complaint handling on customer loyalty	0.85	7.97	Support





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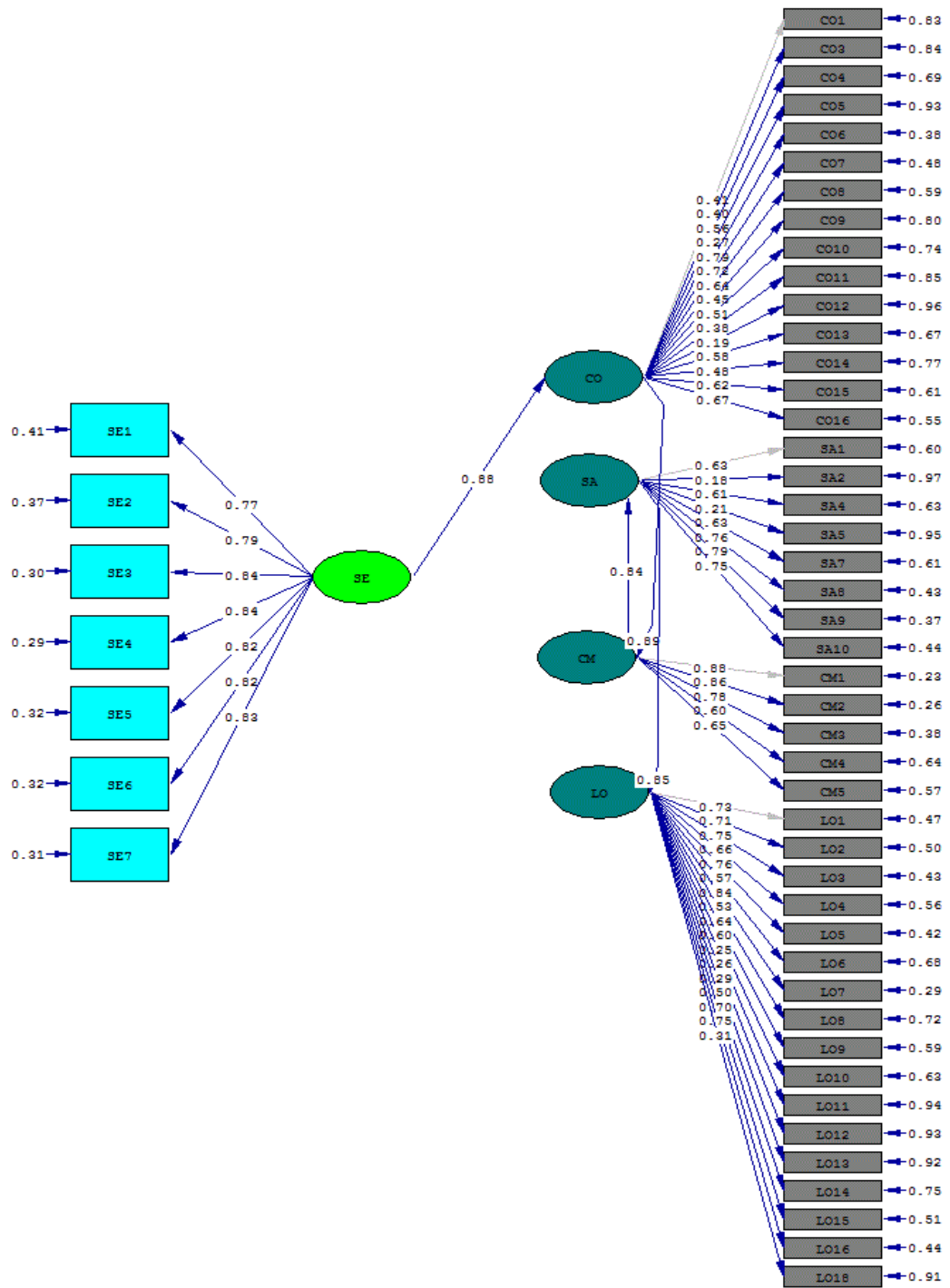
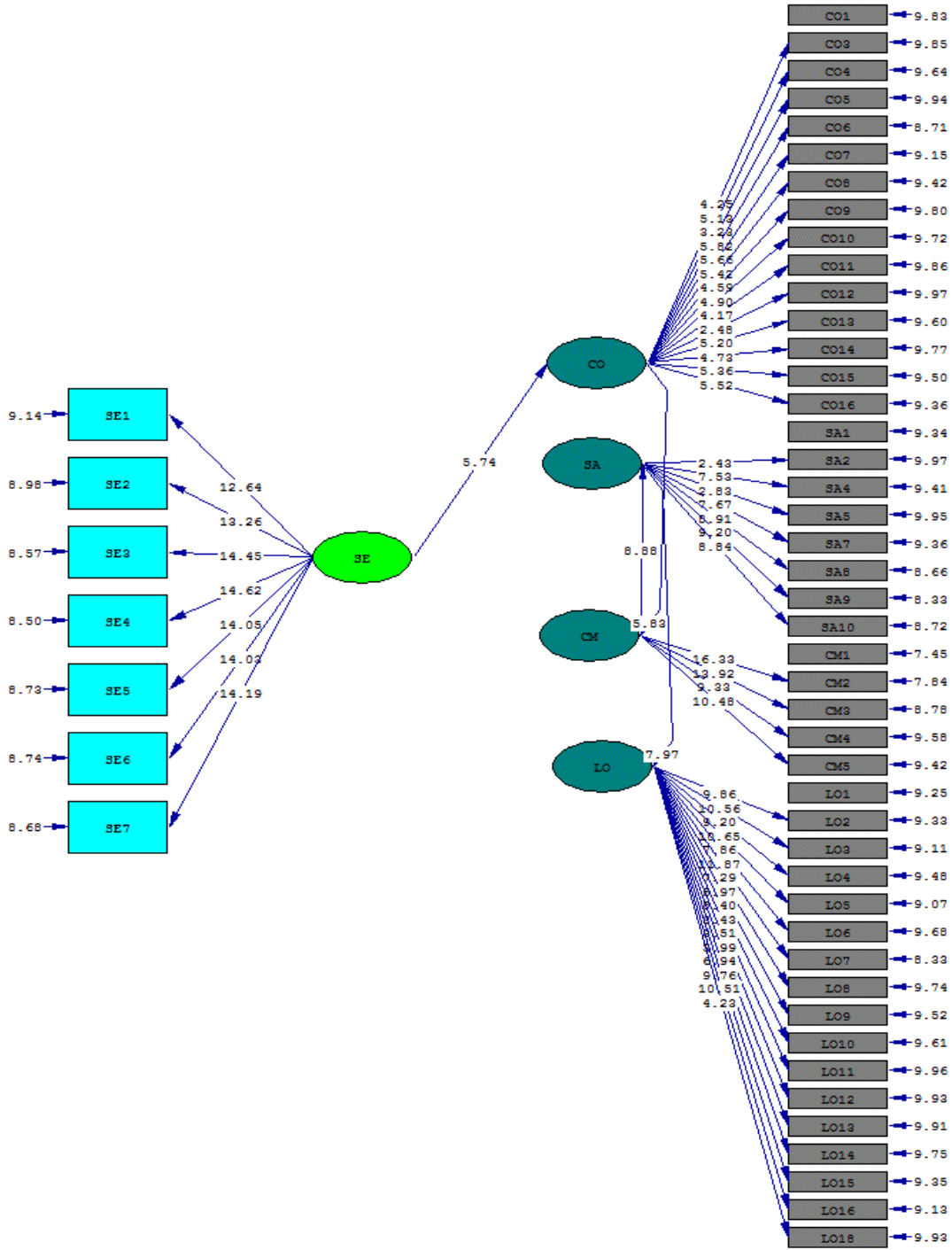


Fig 5. Research model in standard estimation coefficients state





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Chi-Square=3800.88, df=1270, P-value=0.00000, RMSEA=0.099

Fig 6. Research model in significance coefficients state





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	Research Hypothesis	Impact Factor	t-value	Result
H1	Impact of service recovery on communications	0.88	5.74	Support

	Research Hypothesis	Impact Factor	t-value	Result
H2	Impact of communications on conflict management	0.89	5.83	Support

	Research Hypothesis	Impact Factor	t-value	Result
H3	Impact of conflict management on satisfaction resulting from complaint handing	0.84	8.88	Support

	Research Hypothesis	Impact Factor	t-value	Result
H4	Impact of satisfaction resulting from complaint handing on customer loyalty	0.85	7.97	Support

