ФУНДАМЕНТАЛЬНЫЕ И ПРИКЛАДНЫЕ ИССЛЕДОВАНИЯ В СОВРЕМЕННОМ МИРЕ

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СОДЕРЖАНИЕ

A NUMERICAL AND EXPERIMENTAL STUDY OF PERMEABILITY COEFFICIENT IN LOWER DISCHARGE DUCTS

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ABSTRACT

Drainers are a group of devices that move water from a dam lake to a downstream disposal point. This research aimed to determine the numerical and laboratory permeability coefficients in the lower discharge ducts. The physical model of ducts and valves created in the Soil Conservation and Watershed Management Research Center laboratory was utilized in this study and the relevant testing. The numerical discharge model was simulated using Flow 3D software to compare experimental and numerical results and prior results in this work. The findings revealed that variations in the permeability coefficient up to 50% opening of the service valve did not follow a predictable pattern but increased with increasing openness from 50% onwards. The flow rate via the duct was studied, and it was discovered that raising the opening of the valves increased the flow rate, which logically demonstrates high performance and is compatible with previous models. Compared to experimental data, the quantity of flow rate received from the software has a pretty acceptable accuracy, but the flow rate obtained from the program is always higher than the flow rate recorded in the laboratory. The proportion of mistakes varies between 2 and 16 percent for a single valve and 3 to 15 percent for combined operation, with most errors occurring at the lowest opening, i.e., 30 percent.

Keywords: Dam Lake; lower discharge; permeability coefficient; flow rate.

Introduction

Lower dischargers are employed when the water depth in the dam reservoir is high for downstream water consumption and to drain the dam in emergencies, and in certain cases, to drain the accumulated sediments in the dam reservoir (Hosseini and Abrishami 2008). Drainers are commonly used to redirect water during construction and, if they are reliable, may be utilized to assist with drainage planning. These structures are modest in arched or gravity dams, but they are much larger in earthen dams. A big discharge is frequently separated into two pressurized portions (controlled by a high-head valve) and an exit tunnel to shorten the length of the pressurized section (which transmits subcritical current to the atmosphere).

The two-phase air flow is conveyed at high speed in the lower dischargers. A significant reduction in downstream pressure values occurs due to the separation of the current and its quick conversion from the pressurized to the free condition. One of the most critical difficulties with valves is how to reduce the negative pressures caused downstream of the valve. Negative pressures will eventually cause harm to the structure's foundation and the valve itself. Cavitation is a particularly uncomfortable hydrodynamic phenomenon caused by the negative pressure exerted downstream of the valve. This is normally controlled by injecting air through an aeration tube.

Speed is an important characteristic that, in addition to identifying the downstream flow pattern, is critical in understanding the cause of cavitation and vibration. The Reynolds number of the flow is frequently greater than 10^5, indicating a turbulent flow due to the high velocity of the flow in the duct and beneath the valve. According to research, if the discharge tunnel's flow velocity exceeds 10 meters per second, the flow should be aerated to avoid cavitation (Khosro-

jerdi and Kavianpour, 2001). The flow in the lower discharge duct is extremely sensitive to the duct's geometrical features, and even little changes can alter the findings. The researchers developed a correlation to assess the pipeline network's divergence conversion profile. Researchers compared the results of the sliding valve model of the Maroon Dam's lower drainage tunnel to the aerodynamic model. The results are quite similar to the aerodynamic model's test results. The effect of various factors such as increasing the width and height of the duct section downstream of the valve, the presence of a step immediately after the valve to open and close the valve, and the effect of opening and closing the air shaft installed downstream of the valve on the amount of valve permeability was also examined in the form of various experiments by testing the dam discharge valve.

Safavi (2007) investigated the needed airflow after the valve in the dam's lower discharge tunnels. In his tests, he looked at the process of flow ventilation and the impact of variables like air duct diameter, tunnel length, tunnel filling percentage, and flow rate on the volume of air entering the tunnel and negative pressure behind the valve. By investigating the quantity of aeration on models of evacuators such as Siazakh, Gotvand, and others, Kavianpour et al. (2010) revealed experimental correlations for the number and diameter of aerated tunnels.

Because of the complexity and three-dimensionality of the flow pattern, primarily due to the complexity of the flow path geometry in the areas around the valve, accurate results from theoretical modeling are not practical for many effects. They will not provide the designer and manufacturer with a definite assurance of vibration and cavitation-free operation. As a result, many large dams must test the hydraulic model for valves due to the high cost of dam construction and accompanying infrastructure and damages and human and financial losses caused by prospective valve failure. The permeability coefficient in the lower discharge ducts is examined numerically and experimentally in this work.

Method
Design and construction of experimental models
The descent concept may be used to create a pressurized duct model if the Reynolds number of the flow is more than 105. As a result, using the design flow given by the design consultant, the Reynolds number of the flow was computed and observed as follows: the Reynolds number was in this range.

$$L_m = \frac{L_P}{\lambda} \qquad\qquad \text{Eq. 1}$$

$$P_m = \frac{P_P}{\lambda} \qquad\qquad \text{Eq. 2}$$

$$V_m = \frac{V_P}{\lambda^{0.5}} \qquad\qquad \text{Eq. 3}$$

$$Q_m = \frac{Q_P}{\lambda^{2.5}} \qquad\qquad \text{Eq. 4}$$

$$T_m = \frac{T_P}{\lambda^{0.5}} \qquad\qquad \text{Eq. 5}$$

where L, P, Q, T, and V λ represent the length, pressure, flow rate, time, velocity, and geometric scale, respectively.

Simultaneous Reynolds and Froude number similarity necessitate the creation of a model the size of the actual sample. As a result of the difficulties of this problem, engineering opera-

tions normally make models based on the landing number. Reynolds similarity can also be neglected for high Reynolds numbers (greater than 10^5) (Novak, 1981), and only the Froude number can be employed as a criteria of similarity.

$$R_e = \frac{V_p y_p}{\nu} = \frac{30.36 \times 2}{10^{-6}} = 61 \times 10^6$$

It should be mentioned that the above requirement is true to decrease the prototype up to 72 times, according to the following calculations:

$$Q_{\max} = 85\, m^3/s \Rightarrow V_p = 30.36\, m/s$$

$$\mathrm{Re}_p = \frac{V_p y_p}{\upsilon} = \frac{33.36 \times 2}{10^{-6}} = 6.1 \times 10^7$$

$$\mathrm{Re}_m = 10^5$$

$$\lambda_r^{1.5} = \frac{\mathrm{Re}_m}{\mathrm{Re}_p} = \frac{10^5}{6.1 \times 10^7} = \frac{1}{610} \Rightarrow \lambda_r = \frac{1}{72} \langle \frac{1}{15}$$

In the presented equations mentioned above, the signs used are:

Rep Prototype Reynolds number (actual sample)

yp The height of the duct at the location of the service valve

Vp flow rate in the stream immediately after the service valve.

As a result, the chosen model 1:15 is bigger than the minimum permissible scale, indicating adequate.

Experimental model components

Model of Normashir dam's deep drainage duct, including repair valve, metal cover with rectangular cross-section, duct inlet, valve groove, middle duct, emergency valve, emergency valve chamber, its grooves, service valve, ventilation between two valves, and also at the bottom of the service gate that is made of the transparent sheet (Plexiglas) and in metal parts with full details according to the drawings provided by the design consulting engineer, with a scale of 1:50. The tank for the head A cylindrical tank with a height of roughly 18 meters has been employed to supply the requisite water height and flow, fed by two pumps with 100 liters per second. Figure 1 depicts the reservoir, and energy-retaining grid plates are utilized to moderate the flow and avoid water turbulence entering the reservoir (Hosseini et al., 2010).

Figure 1 – A view of the head supply tank (Hosseini et al. 2010)

Piezometers have been fitted at important spots to correctly examine the flow pattern, sags owing to the design and jet outflow of the valve, investigate the flow between the two valves, and research the effect and quantity of aeration. 13 piezometers are mounted on the valve to

measure pressures. These piezometers are coupled to firmly connected hoses and steered to the outside through open areas inside the valve, where the pressure of the above locations is removed by connecting to vertical manometers.

At the drain pipe's outflow, there is a relaxing pool. The pond's floor level is 1345.5 meters. The relaxation pool's length on the axis and at the upper level is 30 meters, and its width is 20 meters. The pool has a circular floor with a radius of 32.05 meters, and the inner slope of the pool's walls is horizontal to four vertical. As a result, the pool wall to floor level height equals 16 meters. The relaxation pool's last section has a shared construction and a deep discharge exit. This section of the pond that finishes in the river has a width of 25 meters.

The tests included pressure measurements in various areas of ducts and valves and flow rate and air velocity measurements in aerators; in this case, all three levels of the dam reservoir were tested. The tests were carried out at a maximum water load of 670 cm, a normal water load of 636 cm, and a minimum water load of 327 cm. After recording the water level in the model tank, flow and pressure measurements, and air velocities for six service valve openings (10%, 20%, 40%, 50%, 60%, and 80%), as well as a fixed face emergency valve, were taken. Then, for optimal performance, trials were conducted on the head.

A point gage positioned adjacent to the canal was used to measure the overflow. The observed error rate was predicted to be less than 2.6 percent due to variations in water level on the overflow and fluctuations in the water level profile. Inlet pumps and a tank drain control the effective water level in the tank. All of the tests were done with three different tank heads.

By reading the central wire of the camera with the aiming point on a particular millimeter-calibrated ruler, the measurement precision is equal to 50.5 mm in the model (6 mm in the real sample). As a result, the level of various portions of the model is represented in two decimal places. A sharp rectangular overflow drives the flow in the model. Before the flow reaches the measuring point, three factors influence flow measurement error: channel construction error and sharp edge overflow and installation, bar's ash reading error (water blade height reading on the overflow), and model leakage error. A rod scale with an accuracy of ±1 mm is employed in the model to read the height of the water blade on the overflow.

Numerical model

The Flow-3D business code was used to solve the basic equations of fluidity and the equations of continuity and momentum in a three-dimensional way in this study. First, we create the physical model in SolidWorks software, import it into the program (Figure 2), and then mesh the model.
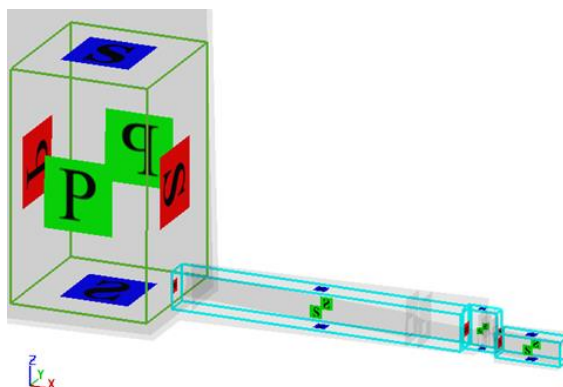
Figure 2 – Showing the number and location of lattice blocks and their boundary conditions

Figure (3) depicts the water-filled sections of the model (Azimian, 1998).
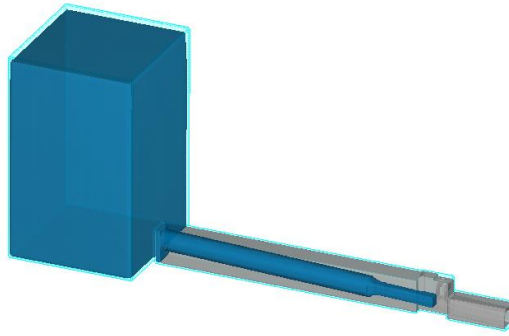
Figure 3 – The initial location of the fluid before starting the analysis

Findings

1. The results of the experiments

1-1- Water permeability coefficient and capacity
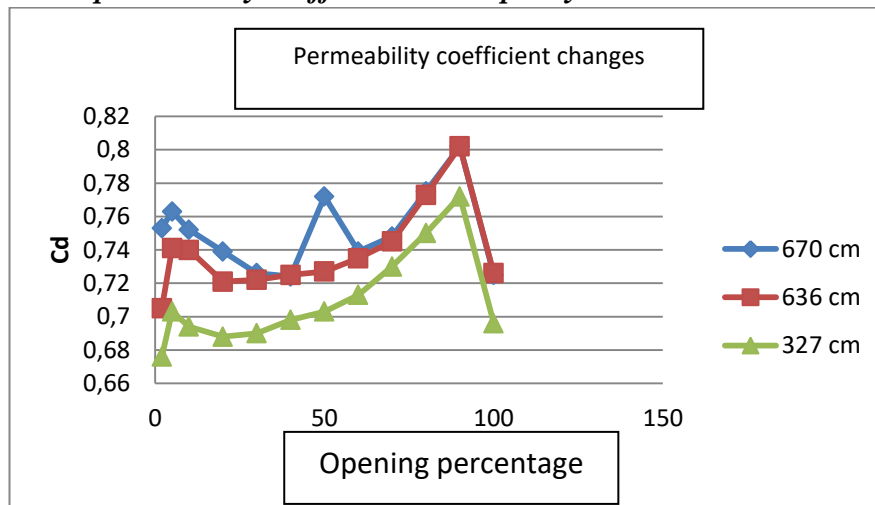
Figure 4 – Changes in permeability coefficient in different heads

The variations in the permeability coefficient in the joint operating mode at the maximum head are shown in Figure (5).
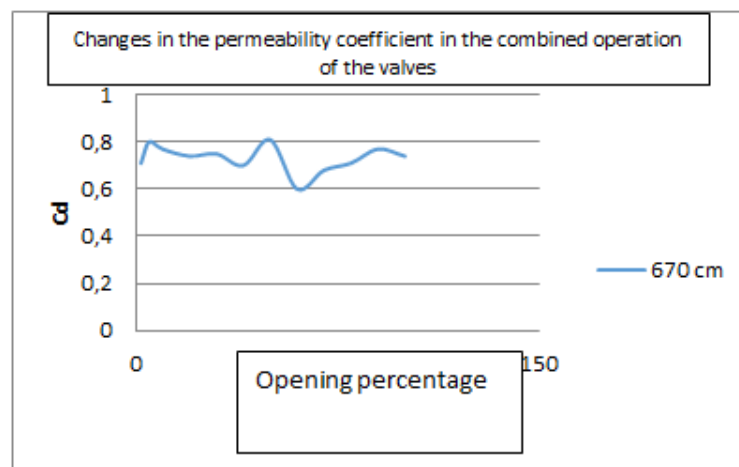
Figure 5 – Changes in the permeability coefficient of the corresponding head

As indicated in the diagram, variations in the permeability coefficient did not follow a consistent pattern up to 50% opening of the service valve, but after that, it rose with increasing open-

ing, which is greater for higher heads. The non-compliance of a pattern's permeability coefficient can be attributed to its reliance on many factors.

Figures (6) and (7) demonstrate how the flow rate through the duct changes in two modes of operation: single-valve service and combined operation. Examining flow fluctuations via the duct reveals that as the valve opening is increased, the flow rate increases, indicating high performance and consistency with previous models. The duct has a maximum throughput capacity of 90 percent openness and a head of 670 cm, which equates to 97.63 liters per second.
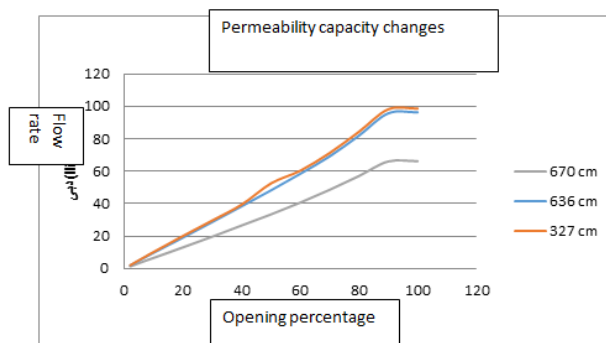
Figure 6 – Changes in the amount of permeability in different heads
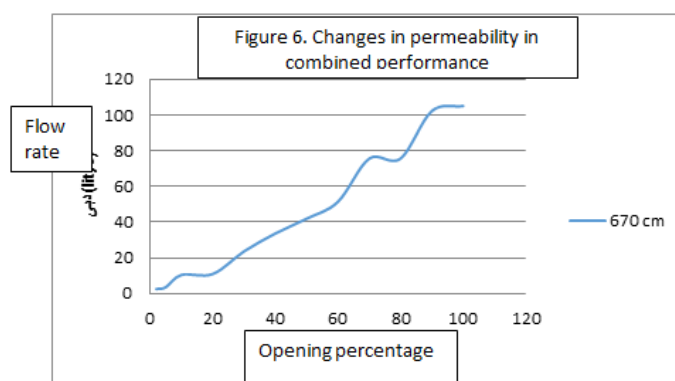
Figure 7 – Changes in the amount of permeability in the relevant head

The variations in permeability capacity are linear with an appropriate approximation, as shown in the graphs, and rise with the increase in reservoir head.

2. Comparing the experimental and numerical results
2.1. Single valve operation mode

Table 1

Comparing the permeability coefficient between experimental and numerical results

Opening percentage	Experimental	Numerical	Error (mm)
80	0.78	0.8	2.56
60	0.76	0.78	2.63
30	0.73	0.74	1.36

2.2. Combined operation mode

Comparing the permeability coefficient between experimental and numerical results

Emergency	Service	Experimental	Numerical	Error (mm)
78	80	0.71	0.8	12.68
57	60	0.6	0.69	15
29	30	0.75	0.86	14.66

3.2. Permeability capacity

When the results are compared, it can be observed that the flow rate acquired from the software has a pretty acceptable accuracy when compared to the laboratory data, although the flow rate produced from the program is always greater than the flow rate recorded in the laboratory. The proportion of mistakes varies between 2 and 16 percent for a single valve and 3 to 15 percent for combined operation, with most errors occurring at the lowest opening, i.e., 30 percent. The powder flow at low apertures produces additional inaccuracies in the software results, resulting in this error.
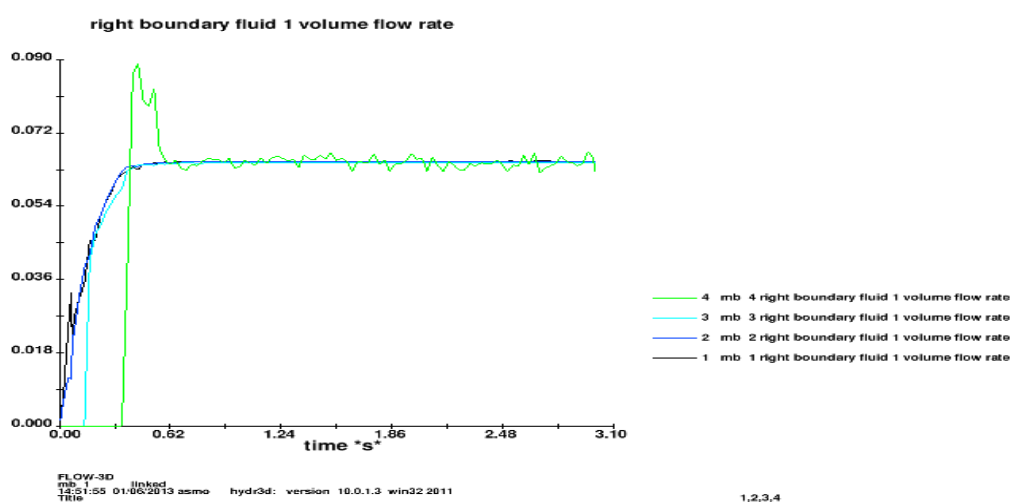
Figure 8 – Software output: The amount of flow at 60% opening in the head is 670 cm

Conclusion

The results revealed that variations in the permeability coefficient did not follow a predictable pattern up to 50% opening of the service valve but that it rose with increasing opening, which was greater for higher heads. The non-compliance of a pattern's permeability coefficient can be attributed to its reliance on many factors. Examining flow rate variations via the duct reveals that as the valve opening is increased, the flow rate increases, indicating high performance and consistency with previous models. The duct has a maximum throughput capacity of 90 percent openness and a head of 670 cm, which equates to 97.63 liters per second. Compared to laboratory data, the quantity of flow rate received from the software has a pretty acceptable accuracy, but the flow rate obtained from the program is always higher than the flow rate recorded in the laboratory. The proportion of errors varies between 2 and 16 percent for a single valve and 3 to 15 percent for combined operation, with most errors occurring at the lowest opening, i.e., 30 percent.

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THE NUMERICAL AND EXPERIMENTAL INVESTIGATION OF FROUDE NUMBER IN BOTTOM OUTLET CHANNEL

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ABSTRACT

The bottom outlet is a series of structures that are used to transfer water from the dam reservoir to the downstream. The purpose of the present study was to numerically and experimentally investigate the Froude number in the bottom outlet channel. In this research, the physical model of conduit and gates constructed in the laboratory of the Soil Conservation and Water Management Research Institute (SCWMRI) was applied, and the necessary tests were performed. The numerical model of the discharger was simulated using the Flow 3-D software and the experimental and numerical results were compared with each other, and also, the previous results were compared in this research. Based on the obtained results, the change of Froude number at different heads was similar. The rate of change in the initial openings was high, and the intensity of the changes increased with the increase of the reservoir head. Then, the Froude number decreased with increasing opening, and after the 50% opening, it tended to be linear with almost identical slopes at different heads.

Keywords: Transfer of dam water; bottom outlet channel; Froude number; reservoir head.

1. Introduction

Designing the bottom outlets is one of the most important issues for dam designers, who need to ensure sufficient discharge capacity, proper conduit operation, hydraulic installations such as gates, and hydromechanical installations. In the bottom outlets, there is a pressurized valviferous conduit with two service and emergency side gates. The main variables in the pressurized conduit include geometric parameters such as length, width, height, and slope, and hydraulic parameters such as velocity, flow rate, upstream head, and pressure. Due to the momentum and high rate of the fluid flow, the pressure decreases along the bottom surface of the gate and behind it in each position of the gate, while the pressure upstream of the gate changes slightly. In cases where the water depth in the dam reservoir is high, bottom outlets are used for downstream water consumption, discharging of the dam in emergency situations, and in some cases for discharging the sediments accumulated in the dam reservoir (Hosseini and Abrishami 2008). Basically, the bottom outlet channel operates under pressure, and it is necessary to consider the drop values in the hydraulic design of a pressurized conduit. The energy drop in a pressurized

flow is primarily due to the frictional resistance of the conduit wall against the flow, and the lateral drops such as curves, valves, gates, transitions and etc. are other causes of energy loss. If a gate is installed at the inlet of the conduit that does not interfere with the flow lines when fully open, the drop due to the gate can be considered "0". When the installed gate in the conduit is in such a way that the walls, floor, and ceiling of the conduit in upstream and downstream of the gate are in a similar level with the gate opening, the drop due to the installation location of the gate can only be considered. Many flow regimes in nature and industry are two-phase flows. The phase is represented as one of the physical states of matter (solid, liquid, and gas). According to the above, two-phase flows are divided into three states: liquid-gas, liquid-solid, and gas-solid. A two-phase flow means that two compressible and incompressible fluids flow into a pipeline. If the water and air are subjected to the same hydraulic gradient, the gas phase moves faster than the liquid phase. The large difference between the compressibility of the liquid and gas phases causes the gas to expand and slide rapidly over the liquid phase (Falloy, 1980). Numerical methods for solving governing equations and rules for these types of flows are very complex and in most cases, two-phase flows show an inherent oscillating behavior that requires solving costly algorithms (Gray, 2006). In 2007, Safavi investigated the amount of required air for flow after the gate in the bottom outlet tunnels of the dam. In his experiments, the mechanism of flow aeration and the effect of air conduit diameter, tunnel length, tunnel filling percentage, flow rate on the amount of air entering the tunnel, and negative pressure behind the gate were studied. By examining the amount of aeration on the model of outlets such as Siazakh and Gotvand in 2010, Kavianpour et al. could provide the experimental relationships for the number and diameter of aerator tunnels. According to the investigations, if the flow rate in the outlet tunnel is more than 10 m/s, the flow should be aerated to prevent cavitation (Khosrojerdi and Kavianpour, 2001). Despite recent advances in the designing and calculation of dams and their installations using computational software, obtaining accurate results by theoretical modeling for many things is practically impossible due to the complexity and 3-D flow patterns. The cause is mainly due to the complexity of the flow path geometry in the areas around the gate. So, it will not give the designer and builder full assurance of proper performance. Hence, due to the high costs of construction of dams and their installations and damage and loss of life and property due to possible failure of gates, testing the hydraulic model for the outlets of many elevated dams is practically necessary. Therefore, in our country, in cases such as Alborz, Gavoshan, Jegin, Gotvand dams, etc., the required models of bottom outlets have been made and their performance has been evaluated. Despite recent advances in the design and calculation of dams and their installation using computational software, due to the complexity and 3-D flow pattern, which is mainly due to the complexity of the flow path geometry around the gate, accurate results from theoretical modeling It is practically impossible for many people and will not give the designer and builder full assurance of proper performance. Therefore, due to the high cost of construction and installation of dams and the loss of life and property due to possible damage to the gates, testing the hydraulic model for the output of many high dams is practically necessary. Therefore, in our country, in cases such as Alborz, Gavoshan, Jagin, Gotvand dams, etc., the required models of lower outputs have been built and their performance has been evaluated. Thus, in order to investigate the hydraulic performance of the bottom outlet channel of dams, the outlet model of the Narmashir dam was developed in the present study and tested in the laboratory of the Soil Conservation and Water Management Research Institute (SCWMRI). Then, the effective parameter on the flow field (Froude number) was investigated. The aim of the present study is to numerically and experimentally investigate the Froude number in the bottom outlet channel.

2. Materials and methods
2.1 Design and construction of laboratory model

The pressurized conduit model can be designed based on the Froude principle when the Reynolds number of the flow is greater than 10^5. In the present investigation, the Reynolds number of the flow was calculated using the design flow rate provided by the design consultant as follows, in which the Reynolds number was in the above range. Thus, the model was designed based on the Froude scale. For a Froude model, the scale relationships were as follows:

$$L_m = \frac{L_P}{\lambda} \tag{1}$$

$$P_m = \frac{P_P}{\lambda} \tag{2}$$

$$V_m = \frac{V_P}{\lambda^{0.5}} \tag{3}$$

$$Q_m = \frac{Q_P}{\lambda^{2.5}} \tag{4}$$

$$T_m = \frac{T_P}{\lambda^{0.5}} \tag{5}$$

Where,
L: Length
P: Pressure
Q: Flow rate
T: Time
V: Speed
λ: Geometric scale

The simultaneous similarity of Reynolds and Froude numbers requires the construction of a model with the original sample size. Because of this impossibility, models are usually based on the Froude number in engineering operations. Also, in high Reynolds numbers (more than 10^5) the similarity of Reynolds can be ignored (Novak, 1981) and only the Froude number can be used as a criterion of similarity.

$$R_e = \frac{V_p y_p}{\nu} = \frac{30.36 \times 2}{10^{-6}} = 61 \times 10^6$$

It should be noted that the above condition, according to the following calculations, is valid for up to 72 times reduced prototype:

$$Q_{\max} = 85 \, m^3/s \Rightarrow V_p = 30.36 m/s$$

$$\text{Re}_p = \frac{V_p y_p}{\upsilon} = \frac{33.36 \times 2}{10^{-6}} = 6.1 \times 10^7$$

$$\text{Re}_m = 10^5$$

$$\lambda_r^{1.5} = \frac{\text{Re}_m}{\text{Re}_P} = \frac{10^5}{6.1 \times 10^7} = \frac{1}{610} \Rightarrow \lambda_r = \frac{1}{72} \langle \frac{1}{15}$$

Where,
Rep: Reynolds number of prototype (actual sample)
yp: Conduit height at the service gate location

Vp: Flow rate in the conduit, immediately after the service gate

Thus, it is observed that the scale of the selected model was 1:15 larger than the minimum acceptable scale and so was appropriate.

2.2 Components of laboratory model

The model of the bottom outlet channel of the Narmashir dam included a repair valve, a metal cover with a rectangular cross-section, a conduit inlet, a gate groove, a middle conduit, an emergency valve, an emergency valve chamber, its grooves, a service valve, aerator between two valves and also downstream channel service gate, This model was made of a transparent sheet (Plexiglas) in metal parts according to the drawings provided by the design consulting engineer (in detail) with a ratio of 1:15. A cylindrical tank with a height of about 18 m which was fed by two pumps with a capacity of 100 l/s was used to supply the required water height and required flow rate. Fig. 1 illustrates a schema of this tank, in which energy-retaining grilles were used to calm the flow and prevent turbulence of the water entering the tank (Hosseini et al., 2010).

Figure 1 – A view of the supply tank of head (Hosseini et al.)

To accurately study the flow pattern and drops due to the design and exit jet from the gate, and to investigate the flow between the two gates and the effect and amount of aeration, the piezometers were installed at critical points. A number of 13 piezometers were installed on the gate to measure the pressures on the valve. All piezometers were connected to strong interface hoses and guided out through open spaces inside the valve. The pressure of the above points was determined by connecting piezometers to vertical manometers. There was a stilling basin at the exit section of the outlet channel. The floor level of the basin was 1345.5 m. The length of the stilling basin on the axis and at the above level was 30 m and its width was 20 m. The floor of the basin was a circular curve with a radius of 32.05 m. The inner slope of the walls of the stilling basin was selected in a ratio of 1 horizontal to 4 vertical. Thus, the height of the basin wall to floor level was equal to 16 m. The final part of the stilling basin had a common structure with a bottom outlet channel. The outlet width of this part of the basin that ends in the river was 25 m. Measurement of pressure at different points of the conduit and gate, as well as the measurement of flow rate and air velocity in the aerators were on the agenda. All experiments were performed at three levels of the dam reservoir. The experiments were performed at the maximum level at an elevation of 670 cm, the normal water load level at 636 cm, and the minimum level at an elevation of 327 cm. Initially, after recording the water height in the model tank, flow, pressure, and air velocity measurements were performed for six service gate openings, including 10, 20, 40, 50, 60, and 80%, and a fixed emergency valve. Finally, a series of experiments were performed on the maximum head for simultaneous operations. The overflow was measured using a point gage installed next to the channel. The measured error rate was less than 2.6% due to changes in

the water surface in the overflow and fluctuations in the water surface profile. The water effective height in the tank was adjusted by inlet pumps and an outlet discharge valve in the tank. All experiments were performed based on three different tank heads. The measurement accuracy of the model was ±0.5 mm (6 mm in the actual sample) based on the reading of the middle wire of the camera with reference to a special ruler calibrated in millimeters. Thus, the level of different parts of the model was reflected up to two digits. The flow rate in the model was measured by a sharp-edged rectangular overflow. The discharge measurement error depends on three parameters, including (i) the channel construction error and the sharp-edged overflow and its installation, (ii) the bar scale reading error (reading the water blade height in the overflow), and (iii) model leakage error before the flow reaches the measuring point. A bar scale with a reading accuracy of ±1 mm was used in the model to read the height of the water blade on the overflow.

2.3 Numerical model

In the present research, the Flow-3D business code has been used to solve the basic equations governing fluidity and the equation of continuity and momentum in a 3-D method. The physical model was first drawn using SOLIDWORKS software, then loaded into the software (as shown in Fig.2), and meshed.
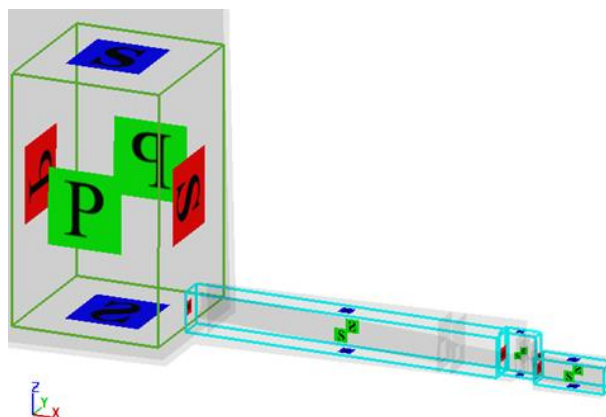
Figure 2 – A display of the number and location of meshed blocks and their boundary conditions

Fig. 3 shows the part of the model that is filled with water (Azimian, 1998).
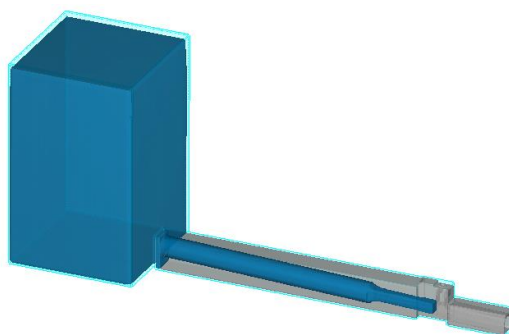
Figure 3 – The initial location of the fluid before starting the analysis

3. Results
3.1 Study of Froude number

Figs. 4 and 5 show the Froude number of flow at different heads and for different operations of gates at different openings.
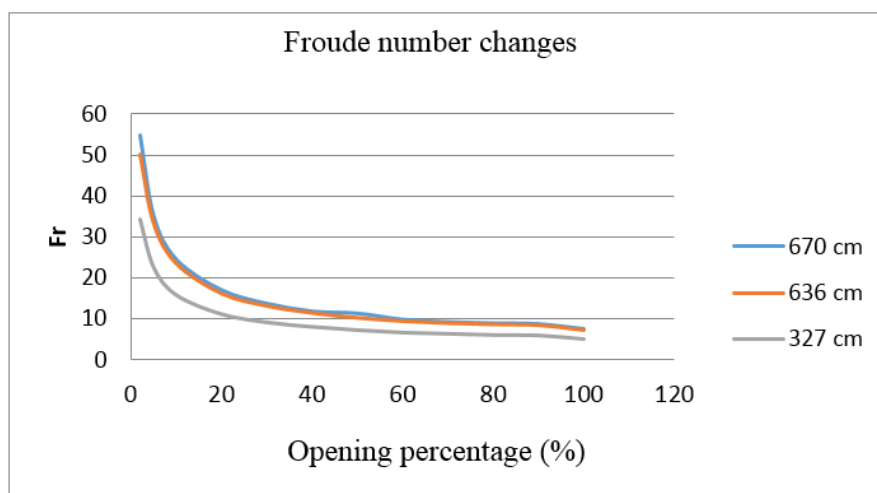
Figure 4 – The change of Froude number for different heads
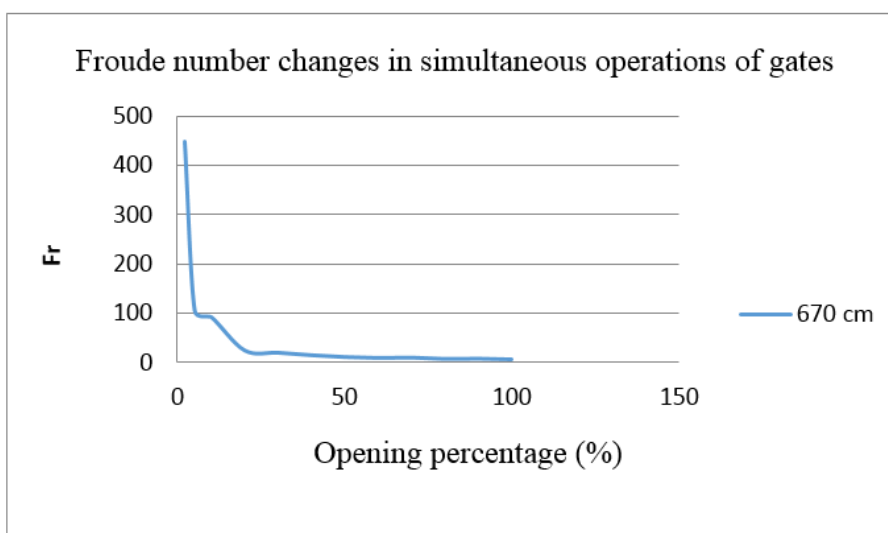
Figure 5 – The change of Froude number for related heads

As shown in Fig.5, the changes of the Froude number at different heads were similar. In the initial openings, the rate of change was high and the intensity of the changes increased with increasing of the tank head. As the opening increased, its value decreased and from the opening above 50%, it went to a linear state whose slope was almost equal at different heads.

3.2 A comparison between experimental and numerical results

Table 1

A comparison of Froude number between experimental and numerical results

Opening percentage (%)	Experimental	Numerical	Error (mm)
80	8.9	10	12.36
60	9.89	11.5	16.5
30	13.79	16.5	19.65

Table 2

A comparison of Froude number between experimental and numerical results

Emergency	Service	Experimental	Numerical	Error (mm)
78	80	8.04	7.51	6.55
57	60	10	10.74	7.4
29	30	20.57	23	11.8

Figs. 6 and 7 show the changes of Froude number in the longitudinal direction of the conduit for 60% opening.
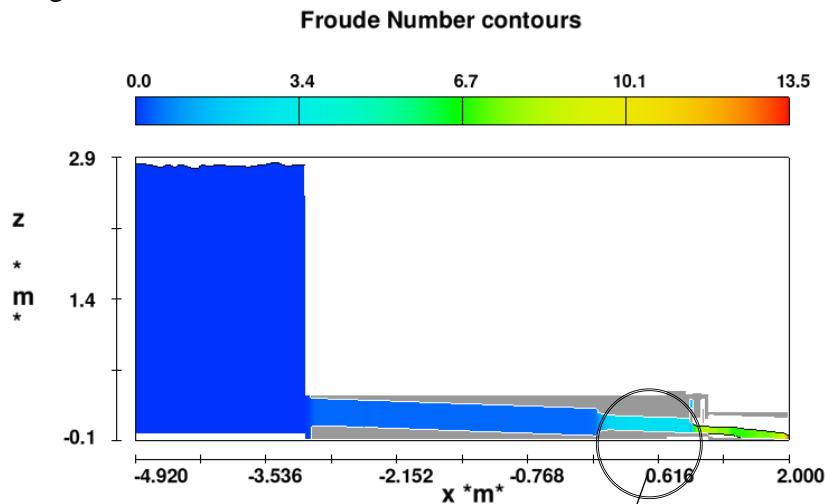
Figure 6 – The changes of Froude number in the longitudinal direction of the conduit for 60% opening.
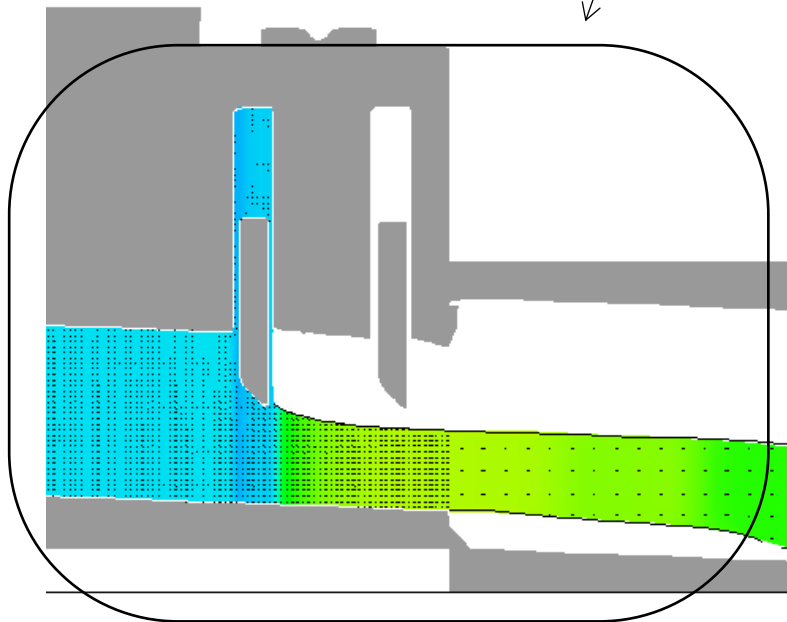
Figure 7 – The changes of Froude number in the range between two gates for the 60% opening

4. Conclusions

The purpose of the present study was to numerically and experimentally investigate the Froude number in the bottom outlet channel. In this research, the physical model of conduit and

gates constructed in the laboratory of the Soil Conservation and Water Management Research Institute (SCWMRI) was applied, and the necessary tests were performed. Based on the obtained results, the change of Froude number at different heads was similar. The rate of change in the initial openings was high, and the intensity of the changes increased with the increase of the reservoir head. Then, the Froude number decreased with increasing opening, and after the 50% opening, it tended to be linear with almost identical slopes at different heads.

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USE OF SOLAR ENERGY

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ABSTRACT

Currently, electrical energy generation in the world relies heavily on coal, oil and natural gas. Fossil fuels are not renewables as they are derived from limited resources which are being gradually used up. In contrast, renewable energies, such as wind and solar energies are being used as alternatives that never dry up. Most renewable energies are obtained from the sun, both directly and indirectly. Sunlight or solar energy can be utilized to warm and light houses and other buildings, generate electricity, heat water, and for solar heaters. This type of energy has also economic and industrial usages. Not all renewable energy resources are derived from the sun. Geothermal energy is the gateway for the internal heat of the earth for various applications including generating electrical power and heating and cooling buildings. Also, oceanic tidal energies are derived from the gravitational pull of the moon and the sun on the earth. This study now investigates the usages of solar energy.

Keywords: solar energy; solar constant; solar thermal systems; photovoltaic devices.

Introduction

There are also some questions about the energy sources: "How will the energy situation look like in the next few decades?" "What are the most economical sources of energy?" and "Will the solar energy be introduced as a source of energy or economic profession?". It is clear that energy for all is a necessity and this is more noticeable with the growing technological advancements and rising world's population. Available data suggest that the world's energy con-

sumption is increasingly growing and see demand levels double every 14 years, though this level for electrical energy has almost doubled every 10 years; in the meantime, this level has been an upward trend in developing countries, doubling every 7 years (Fardin, 2003). The rising population and technological advancements that have improved quality of life have caused demands for electricity to grow. Looking at demands for electricity supply from world's existing resources from 1960 to 1990, it is concluded that these resources have utilized fossil fuels to supply electrical energy.

Fossil fuels greatly contribute to many of the environmental problems we are faced with, e.g., greenhouse gases, air, water and soil pollution; however, renewable sources have little impacts on these problems and related pollutions. Greenhouse gases, carbon dioxide, methane, nitrous oxide, hydrocarbons and chlorofluorocarbons have surrounded the earth's atmosphere like a warm and transparent blanket, allowing warm solar radiation to come in to entrap the heat in proximity of the earth's surface. The impacts of these natural greenhouse gases keep the average earth's temperature around 60° F (33°C). However, increasing fossil fuels have significantly increased greenhouse gas emissions.

Considering climate changes within a year, it will not be economical to utilize systems that use solar heat, and it is best to use some secondary energy like fossil fuel alongside these systems; thus, the system will be able to operate under bad air conditions and situations where there is no sun. In other words, the solar system functions along the day (sunny hours), while the fossil energy is used when the sun is gone. The cost of energy generation or the ratio of energy and consumption cost to the energy generated is lower than the system whose total energy is supplied by the sun. The costs from making and maintaining a solar thermal system fall under costs of making and installation equipment, fuel, maintenance, and system design. System equipment includes various parts such as collectors, support system, and energy transfer systems including pumps, tubes or ducts as well as energy storage system. As stated, this study now investigates the usages of solar energy.

Solar constant

The following is a solar constant equation which specifies the solar constant spectrum:

$$S_\lambda = constant \times B_\lambda\left(T\right)$$

Here, a fraction of energy (F), transmitted by wavelengths ranging from 0 to λ, is proportional to the area under curve of the blackbody that lies between these two boundaries. This value can be calculated from the solving the following integrals:

$$f_\lambda\left(T\right) = \frac{\int_0^\lambda B_\lambda\left(T\right)d\lambda}{\int_0^\infty B_\lambda\left(T\right)d\lambda} = \frac{\int_0^\lambda a d\lambda / \left[\lambda^5\left(e^{b\lambda I} - 1\right)\right]}{\int_0^\infty a d\lambda / \left[\lambda^5\left(e^{b/\lambda T} - 1\right)\right]}$$

(1)

Equation (1) reveals that the integrals can be solved and examined for types of temperature with no exception. However, this is not the case by changing the integrals and replacing the $X = \lambda T$. Using Equation (1), the following Equation (2) can be written as follows:

$$f_\lambda\left(T\right) = f\left(\lambda T\right) = f\left(X\right) = \int \frac{a dx}{\delta x^5\left(e^{b/x} - 1\right)}$$

(2)

Thus, if the integral is solved and f(x) can be tabulated, a fraction of energy lying between 0 to λ can be calculated for the black body curves at every temperature.

The value of this fraction for

$$x_1 = \lambda_1 T = (0.4\mu m)(5760k) = 2304\mu m - k$$

Is equal to:

$$f(x_1) = f(2304\mu m - k) = .121 = 12.1\%$$

Note:

This fraction will be for the similar wavelengths at temperature lower than 3000K.

$$[x_1 = (0.4)(3000) = 1200\mu m - k] \quad f(1200)_{\mu m - k} = 0.002 = 0.2$$

A fraction of energy for the wavelength between λ_1 and λ_2 is calculated as follows:

$$f_{\lambda_1, \lambda_2} = f_{\lambda_2} - f_{\lambda_1}$$

For example, to determine the fraction of energy for the wavelengths between $\lambda_1 = 0.4$ and $\lambda_2 = 0.7$, μm is used, while to determine k = 5760 T, the following is used:

$$367 = \%37. = 00.121488 - .) = 0k - m^{\mu} (2304 \text{ f}) - k - m^{\mu} (4032 \text{ f}$$

The residual fraction that is determined by wavelengths longer than $\lambda_2 - 0.7 . m^{\mu}$ is calculated as follows:

$$51 = \%51. \ 0 \cong 488 . = 1 - 0^{f_{\lambda_2}} \ 1 -$$

To approximate the solar spectrum by the distribution of a blackbody at 5760 K, almost 12% of the energy will be transmitted at wavelengths shorter than 0.4 m^{μ}. This will mainly take the form of ultraviolet radiation, as the visible part of the solar spectrum includes 37% energy, while wavelengths longer than 0.7 m^{μ} (mostly infrared) involve 51% energy. Therefore, almost two-thirds of the solar energy received will be invisible to the human eyes.

To sum up, solar flux that reaches the upper parts of the earth's atmosphere has basically electromagnetic property. Its spectral distribution is fully similar to the spectrum that is emitted by a surface of a blackbody at 5760K. Almost, half of this energy will reach the earth in the form of infrared rays, while 1/3 of which lays on the visible region of the spectrum. This ray-like flux takes a unidirectional radiation form whose divergence angle is almost 1/2°. The total flux (average seasons of the year) that radiates over a surface facing the sun is called solar constant which is numerically as follows:

$$S = 1352 w/m^2 = \frac{1.94 Ly}{\min} = \frac{429 Btu}{hr - ft^2}$$

Where $1 - 252 \text{ cal} - 2.929 \times 10^{-4} \text{ kwhr}$ is the British thermal unit (BTU) and $1 - 1 cal / cm^2$ is Langley (Ly).

To predict the abundance and accessibility of the solar energy on earth, it is required to consider the apparent solar motion of the sun on a celestial sphere. The subject of the sun throughout the day and also the length of the day itself will both determine the amount of solar energy, provided to solar collectors.

Solar Thermal Systems

Unlike concentrators which usually require daily tracking systems, flat panels operate at fixed directions. Although the tracking system improves the efficiency of a flat panel, the resulting efficiency will increase by increasing expenses spent on making and maintaining the tracking system. A fixed array of flat panels should be arranged in a way that the received flux will have the highest daily efficiency during the working period (seasonally adjusted). The size of an array of the panels is determined by ambient conditions, need for heating, array and sunlight-capturing

levels. Suppose, for example, the daily thermal need of a house in a cold season is 100kw-hr/day (or approximately 3.4×105 BTU/day) and the daily sunlight-capturing level on the panel set is 4kw-hr/m2-day. Also, suppose the area of each panel is 1.5 square meters; thus, the total efficiency will be 50%, while one-third of which comes from secondary heaters. Therefore, the solar thermal amount needed will be 66.7kw-hr/day, because the array efficiency is 50%. Areas needed is thus equivalent to:

$$A = \frac{P(daily)}{F(daily) \times \eta} = \frac{66.7}{4 \times 0.5} = 33.3 \text{ Square meters}$$

And since the area of each panel is 1.5 square meters, the number of panels required amounts to 22.

Every solar panel array includes thermal panels which are positioned in series and parallel forms or combined. The temperature generated by each large array is not higher than that produced by a single collector; however, an array with an n number of panels to collect an n times as much thermal power as produced by a single panel, is more powerful. To collect this volume of heat, the level of fluid flux applied to the set must be an n times as many. In a series array, a panel's outlet is directly connected to the inlet of the next panel.

As a result, the increased flux must pass through all the panels of an array. As the fluid rate increases, its resistance against the flux will increase. Moreover, the longer the total length of a tube through which the fluid passes, the more the flux will be. Thus, a series and long array of panels could exhibit higher resistance against the transmitting fluid flow. To keep the fluid flowing, the pumps must produce much pressure so that at the inlet, it is much more than the pressure at the outlet. This will create strain at the pump and panels of an array. Furthermore, not all panels of a series array will yield a similar efficiency rate. The panels that are closer to the inlet operate at a lower temperature and have thus greater yield, while those close to the fluid's outlet will have lower efficiency.

In a solar thermal system, some measures are usually adopted to store heat. The energy received at times when the sunlight is high can be stored, while it can be used at times when the sun is gone. When heat is stored in a medium, the medium's energy increases and this increase can take the form of a potential where the molecular structure changes, like a chemical change; a phase change (e.g., melting or evaporation). When the added heat only increases the ambient temperature, the thermal energy is said to be stored as tangible heat. Unless there is a phase change, the increase in temperature will be almost proportional to the stored heat, but disproportional to the mass.

Capturing sunlight on the earth's surface

The amount of solar energy on the earth's surface will be considerably lower than the energy that reaches upper layers of the earth's atmosphere. The reduction in solar energy by the time it enters the earth's surface is basically determined by the light state of the earth's atmosphere. The combined components of the atmosphere affect the sunlight by two processes of absorption and scattering. The amounts of absorption and scattering that occur in a definite component of a solar spectrum depend on combining the atmosphere and its wavelength. In certain regions of the spectrum, solar energy is mainly scattered, while major parts of which are absorbed in other regions. Thus, the spectral combination of sunlight-capturing on the earth's surface significantly varies from the features of the blackbody curve of solar constant at 5760 K. It is also important to note that sunlight-capturing at the earth's surface cannot be considered equivalent to a unidirectional ray. This subject also held true of the radiation reaching the upper layers of the atmosphere. An amount of scattered radiation reaches the earth in the form of scattered radiation. Scattered radiation refers to components that travel at different directions; thus, the total solar

radiation over the earth's surface includes a direct unidirectional component that causes atmospheric scattering.

The constituting components of the atmosphere, including such molecules as N2, O2, CO2 and H2O, ozone and larger particles such as fog droplets, soot or dust can affect the radiation by the two processes of absorption and scattering. In the absorption process, the radiated energy converts to another form of energy which is usually heat. Part of the absorbed energy is, to some extent, determined by the cross-section of the mass absorption $\sigma^a(\lambda)$. This parameter varies from one molecule to the other. It also depends on the wavelength of the radiation received. As noted, N2 and O2 molecules cannot be considerably absorbed into the solar spectrum. On the other hand, CO2 and H2O can be greatly absorbed into selected areas of the infrared regions of the solar spectrum. These regions are called absorption bands. Scattering is more complicated than absorption. Like absorption, a fraction of energy radiated is also dissipated in scattering.

This amount is calculated by the cross-section of the mass scattering $\sigma^a(\lambda)$ which is an ingredient component. Unlike absorption, scattering does not convert radiation energy into heat; rather it emits it again into other directions. Atmospheric scattering of the solar energy within a clear day is basically created by oxygen and hydrogen. Some particles cause scattering which take back and forth directions (e.g., Rayleigh scattering), while other particles of radiation are scattered more homogenously. Particle matter inside the atmosphere such as dusts, soot and fog scatter the radiation in a more complicated form, than predicted by the Rayleigh law. The red color of the sky by the sunset is a result of the radiation scattered by dust particles around the earth's surface. The radiation that is not affected by the absorption and scattering processes is called direct or attenuated component which is calculated for a simple and relatively layered atmosphere. This component is demonstrated to be calculated by a singular atmospheric parameter which is a function of wavelength, called optical thickness, T_λ. This parameter and the way it affects the radiation direction will be discussed in detail in the next section.

Scattered flux

The total solar flux that radiates over the sea surface includes a direct unidirectional ray and a component pf scattered flux. A scattered component composed of radiation is either a reflection of the constituting components of the atmosphere or radiation reflected from the earth below it. A formula for the behavior and reaction of the scattered component is intricate, and a simple formula similar to Equation (3) for a flat-layer atmosphere is lacking. Thus, rather than trying to find accurate solutions to the scattered flux, an analysis is provided here to estimate it and also to demonstrate how factors affect the environment.

The term intensity is used to describe directional radiation distribution. It also reveals how much radiation power is emitted at a surface unit in different respects around a point in space. Here, a specific direction is determined as a unit vector Ω . For a layered

flat atmosphere, the spectral intensity is written as $I_\lambda(Z,\Omega)$ or

$$\frac{Radiation\ power}{Length - Angle - Area}$$

This figure suggests that the spectral intensity is both a function of height and the direction used. The function of intensity is defined as follows:

$$I_\lambda(Z,\Omega) = \frac{dp}{dA - d\Omega - d\lambda}$$
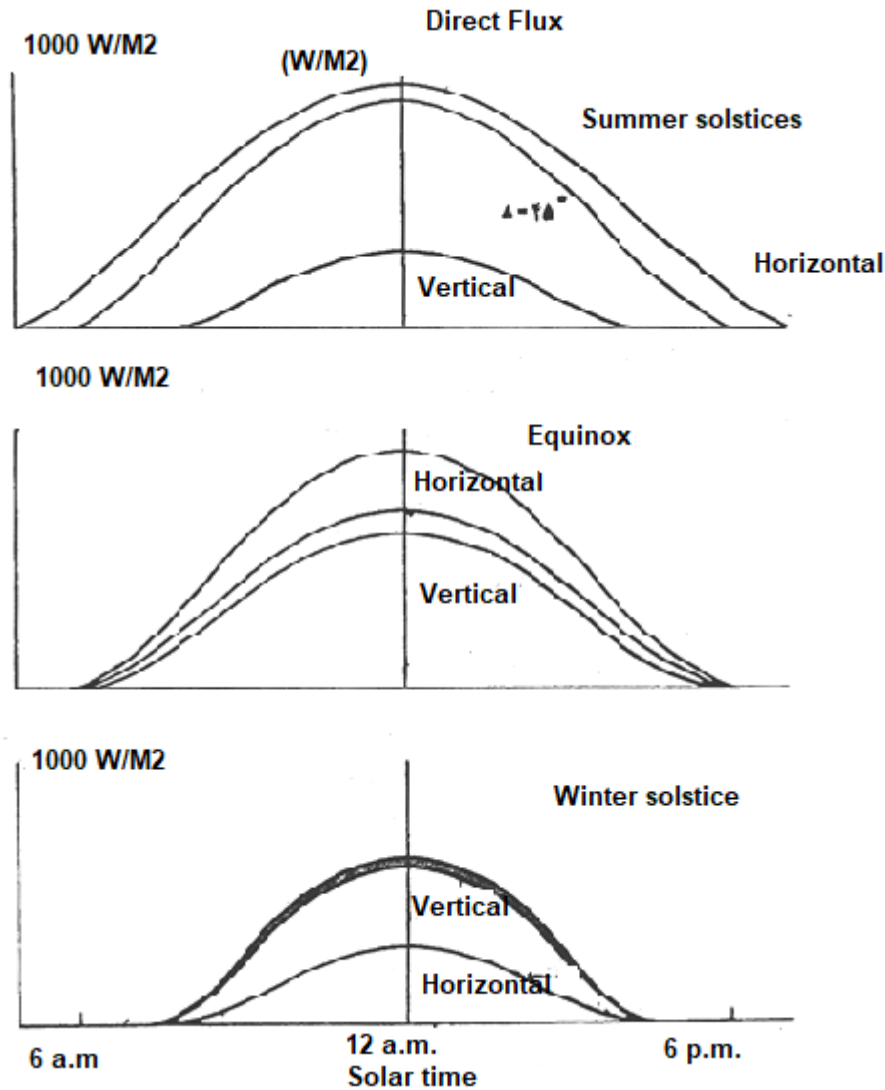
Figure 1 – Direct hourly flux on surfaces with different angles of skewness in different seasons, all these cases have been calculated for the observer at colatitude $\Gamma\text{-}49°$ and optical thickness J = 0.3.

Where $d\Omega$ is the differential spatial angle around the direction Ω

If $I_\lambda = I_\lambda(Z)$, i.e., if the intensity does not depend on Ω, the radiation is thus said to be uniform (all directions are uniform). In this case, the radiated energy is equally emitted in all directions. On the other hand, if the function $I_\lambda = (Z, \Omega)$ is found to be very intense along a single direction, such as $\Omega_\circ$, and zero in other directions, that radiation is said to be ray-like and unidirectional. Although the direct solar component is basically unidirectional, the scattered component is not simply made of homogenous radiations. The spectral flux received by this surface is as follows: $F_\lambda(Z, \hat{n}) = \int_{(n, \hat{\Omega} \geq 0)} I_\lambda(Z.\Omega) \hat{n}.\Omega d\Omega$ (4)

Where the product of $\hat{n}.\Omega$ is the cosine of the angle between $\Omega, \hat{n}$. The integral index suggests that integration is performed on spatial angles where $\hat{n}.\Omega > 0$. This ensures that the only radiation that is transmitted in the hemisphere to the said surface is inserted in Equation 5-8. Equation (4) shows that the flux received by a surface, even for the scattering radiations, generally depends on the said surfaces and their positions in the atmosphere. With respect to ray-like radiations, Equation (4) is simplified as follows:

$$F_i^{Ray} = F_i^{Perpendicular} \hat{n}.\Omega_\circ = F_i^{Perpendicular} G\theta \qquad (4a)$$

Where θ represents the angle of inclination between the ray of the line perpendicular to the said surface. $F_i^{Perpendicular}$ is a ray flux radiated over a surface whose direction is perpendicular to the ray. For homogenous radiation, Equation (4) can be integrated to derive the following formula:

$$F_i^{Homogenous} = I_i^{Homogenous} \int_{(n.\hat{n} \geq 0)} \hat{n}.\Omega d\Omega = \Pi_i^{Homogenous} \qquad (4b)$$

In this case, reception is independent from the surface direction. Scattered radiation is not generally homogenous, and received flux depends on the surface direction, to some extent. This dependency is not clear as was seen about the direct flux.

Measuring sunlight capturing on the earth's surface
Most energy measurement devices fall under one of the two following categories:
1. Photovoltaic devices
2. Radiometric devices

The first group includes means with receptor or sensor parts whose electrical features change by the solar radiation. As for example, when the sunlight radiates over photovoltaic means, such as silicon or selenium cells, voltage is generated. The short-circuit current of these devices are used to measure the intensity of the irradiated radiation. Optical conductive detectors, including cadmium sulfide or cadmium silica change resistance in response to the electromagnetic radiation when the detectors are connected to batteries. They also convert into a criterion to measure the level of intensity in the circuit. In addition, there are devices with vacuum tubes, known as phototubes which are coated by specific elements, which, when radiated over by light, they emit electron. In the meantime, changing the tube's conductivity, performed by optical electrons, can be used to measure the intensity of radiation.

Despite the fact that photovoltaic transistor devices are durable, small and cheap to make, and are less affected by ambient conditions, they have disadvantages, also. These devices tend to be interrupted or saturated at high-intensity surfaces. More importantly, these photovoltaic devices do not provide a uniform response across solar spectrum. This is to suggest that the equal amounts of solar energy received in different spectral regions generate different signals. Also, if a device is sensitive to a visible spectrum, it will not detect the presence or changes of solar energy in the infrared.

The second group includes radiometric devices which absorb radiation in a black absorber and use heat generated to create a receptor. This change is measured and connected to sunlight capturing surfaces. One radiometric device used in the U.S. is the black and white pyranometry whose receptor part is made of two adjacent plane surfaces, a black one and a white (silver) one. To each of these parts is connected a thermal sensor (of a thermocouple). The sensors generate a voltage signal which is directly proportional to difference of heat between black and white surfaces. When the solar energy is radiated over this device, the black color surface will absorb the radiation and get warmer than the white surfaces which reflect the radiation and remain at around

the ambient temperature. The greater sunlight capturing, the larger the difference of heat and the voltage signal.

Direct conversion of the solar energy into work; photovoltaic devices

Photovoltaic devices first use solar thermal devices to convert radiation into heat which parts of it get into work; although, theoretically speaking, all solar energy can be converted into work, heat cannot be fully converted into useful work, while some part of the heat must be returned to a colder source. In the meantime, the conversion efficiency is restricted by the ratio of cold source temperature to the warm source temperature, and the less this ratio, the greater the efficiency (Roger et al. 2000). In the direct conversion process, the solar energy is used without converting the electro-magnetic radiation into heat. This process does not need cold and warm sources. Although conversion efficiency may entail practical limitations, it is not limited by the Carnot formula. To demonstrate how a beam of radiation can be directly converted into mechanical energy, a Crookes radiometer is used.

There are processes that directly convert the solar energy into chemical energy. Green plants use soar energy to convert water carbon dioxide into complicated hydrocarbons. This is an incremental process where only a small fraction of sunlight radiated over the plant is converted into chemical energy. Chemical fuels are suggested to be obtained at lower costs from a living mass, i.e., from kinds of plants grown specifically for this purpose. The mass production of alcohol from corns and sugar for vehicle fuel is now being developed. One of the most promising methods to generate electricity is to use photovoltaic devices. A photovoltaic device is an instrument that generates voltage when irradiated by the sunlight. A common category of these devices, which are known as P-N junction devices, is being investigated. For example, tools made from silicon are capable of generating 0.5 V in each cell under intense sunlight, yielding 10-12% efficiency.

P-N junction photovoltaic devices

Suppose a single P-N junction, made of a silicon wafer of p type, on which a thin layer of silicon of n type is deposited. The wafer is called bottom and the deposited layer is surface layer which connect electrodes into the external layer of the device. Electrodes are made of very thin metal deposit for the surface layer. These electrodes must be transparent to allow the sunlight to reach the surface layer at the lowest attenuation. The surface layer is also thin; as a result, the sunlight can reach the junction. As the sunlight radiates over the photovoltaic device, some of the photons form electron-hole pair whose impacts are light current that transmits from matter type n to matter type p. To make photovoltaic terminals short-circuit, the whole photonic current returns through the external circuit, and the junction current reaches zero. Thus, as expected, the terminal voltage becomes zero (Yu et al. 198).

Manufacturing silicon photovoltaic devices

Currently, silicon photovoltaic devices are among the most effective solar cells. They are made at the purest degree of available silicon (solar degree). This silicon is taken from the more impure silicon (semiconductor degree) used to make electronic parts. The final stage is called regional melting where molten silicon regions move through the matter mass and take away with them small residual impurities. The residual solar degree purity in mass of matter is 990999.

This pure silicon is kept molten in a crucible by waves with radio frequencies similar to the waves used in a microwave oven. This causes the said matter to be uniformly heated. The molten matter is kept in a neutral gas medium. The impure matter is carefully added to the molten matter to obtain the matter type n or p. The molten matter is then crystallized. The commonly used crys-

tallization technique is the Czochralski technique. A small crystal grain, connected to a special clip, is added to the molten matter. By removing the grain, a crystalline silicon made cylindrical ingot is formed which is gradually taken out of the molten matter. The diameter of the   ingot depends on the rate of taking the grain out of the molten matter. Later, silicon ingots (type n or p) are made in the form of round wafers of approximate thickness of 0.075 cm at solar degrees. These wafers form the solar panels. Of the bottom matter is type p, photovoltaic devices can be produced at lower prices, as suggested by recent literature on V-shaped thin (uncrystallized) semiconductors. Another method under investigation is to use plastic prismatic concentrators that allow large amounts of the flux to radiate over low-area cells. If the costs of making cells can be reduced by a 100 factor, i.e., to 40 dollars per each square meters, the total efficiency of generating electrical power will be greater, especially because fossil fuel are costing more.

Conclusion

The significance of renewables is due to their advantages. Renewable energy technologies are clean sources of energy which are less affected by environmental pollutions, compared to conventional energies. Renewable energies never exhaust. However, other energy sources are limited and could dry up these days. Investment on renewable energies is mainly made on preparation of raw material (goods and appliance), consumer and structural goods to make and maintain devices, rather than on costly importation of energy. This denotes that the money you will pay for the energy will, instead of being transferred to a foreign nation, remain in our country, create employment and save fuel consumption. Compared to conventional energy sources which rely on fossil fuels, renewable energy technologies are more environmentally friendly. Renewable energy technologies generate heat and electricity by emitting (generating) small or zero amounts of carbon dioxide. Also, fossil fuel energies serve as major sources for air, water and soil pollution. Pollutants such as carbon monoxide, sulfur dioxide, nitrogen dioxide, particulate matter and lead are posing threats to the environment we are living in. In other words, most renewable technologies generate small or zero pollution. Earth warming and pollution both pose grave risks to the future human generation. The long-tern impacts of the earth warming may also be more severe. Fatalities are correlated with very warm air, i.e., as temperature climbs, diseases can produce stronger latent energy. Finally, renewable energy technologies can help us change conventional patterns of energy consumption in order to improve our environment.

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IMPROVING THE REDUCTION OF ENERGY CONSUMPTION AND INCREASING THE BALANCE IN THE INTERNET OF THINGS USING THE ANT COLONY ALGORITHM

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ABSTRACT

Today, the use of wireless sensor network is increasing. This is because the network is made up of nodes that can be used anywhere. That is, they can be used in industry, military, medicine and other fields. The physical nodes that are scattered in the sensor network have several parts: the communication part, the power supply part, etc. In terms of power supply, the nodes supply their power consumption from the battery, so they have limited energy. For this reason, and because these nodes are not available, all researchers have turned to research into routing and clustering protocols that reduce energy consumption and provide better coverage. There is a lot of research in the field of routing in this field, which is sometimes done by using meta-heuristic algorithms or combining these algorithms with others. But the complexity of algorithms is different in all areas. In this article, a combined method is used Reduce energy consumption and increase load balance of this network by using the ant colony algorithm.

Keywords: wireless sensor network; routing; ant colony algorithms; coverage.

1-Introduction

With the advent of the Internet of Things and the equipping of devices with sensors, there was a significant difference in life. In fact, the interaction between the physical world and the digital world is made possible through the Internet of Things. With the advent of the use of the Internet of Things in smart homes, energy consumption has also become very important in this area. The Internet of Things refers to a set of devices that operate in a field and communicate with each other over the Internet. According to the global concept, all objects around the world have small computer capabilities and intelligence and can exchange information with each other. The Internet of Things includes various components called architecture, sensor, coding, transmission, data processing, network, and so on. The most challenging topics in the Internet of Things, which has a large number of devices connected to the Internet. In the IoT, there are a number of sensors in different parts of the house that communicate with each other through the base station [1]. The Internet of Things (IoT) is the new revolution of the Internet. This allows objects to be recognizable, to obtain information, to send information about themselves, and to be able to access information collected by other objects. The Internet of Things allows people and objects to communicate with anything, anytime, anywhere. This means addressing elements such as convergence, content, collections, communication and connectivity [2]. In addition to all the benefits of the IoT, it has several challenges: Establishing security is perhaps the biggest challenge in the IoT. - The concept of privacy has always been used in conjunction with security, but in this discussion it is appropriate to pay special attention to it; Because in the Internet of Things more private information is placed on the network than the current situation. - Increasing demand for network-connected equipment will increase competition in this area. - energy consumption - The load balance Load balances are divided into static and dynamic categories based on network topology and available resource information. Static algorithms are not dependent on the current state of the system and require intermittent knowledge of the system, such as resource work, connection time, and processing power. System nodes, memory, etc. These algorithms use pulling methods, such as the rotation algorithm. This method is simple and uses less resources, but the disadvantage of this method is that it can not detect connected servers. Algorithms are not suitable for distributed systems where system modes change dynamically. In contrast, algorithms

are dynamic algorithms that use unpredictable methods based on the current state of the system and methods and algorithms. In this algorithm, tasks can be moved dynamically from a crowded node to a more secluded node and the system mode can be changed intermittently. This method is more suitable for most systems and is more efficient [3]. Due to the challenges in this field, this article focuses on reducing energy consumption and balancing the load in this network. To do this, two proposed methods of clustering and meta-heuristic algorithms have been used. In the proposed method, in addition to clustering, ant colony is also used. This has the advantage that because it uses the shortest path to send and receive information, it creates less energy consumption and more balance in the network. In this regard, in this study, we face the following questions: 1. Can using ant colony improve energy consumption in the Internet of Things? 2. Can using ant colony increase the lifespan of the network? 3- Can using ant colony improve the load balance in the network? In the second part, an attempt is made to acquaint the reader with the literature of the subject and also some of the existing methods in this field of research are presented. In this chapter, the most important and most practical algorithms developed in this regard are discussed. The third part is dedicated to presenting the proposed method and the fourth part contains the results of the practical implementation of the proposed approach. The collected results are presented. The fifth section provides an overview of the leading dissertation and the proposed approach, as well as suggestions for improving system performance for future work.

2- Related works:

In 2013, Qiu et al. [4] proposed an advanced GEAR network protocol that not only reduced network stress but also improved network energy utilization. The authors used a multi-layered strategy to organize nodes in an efficient and effective manner. One of the works done in this field is HVAC technology. Smart grid is one of the most important applications of the Internet of Things (IoT) paradigm. In this context, this paper refers to the management of energy consumption of heat, ventilation and air conditioning (HVAC) in smart retail with variable energy prices. Thus, first, an energy scheduling method is proposed in which the cost of energy consumption for a certain time interval, according to the energy price and a set of convenience constraints, so that the range of temperature according to the user settings Given for a room. Then, an energy scheduler is provided in which the user can relax the temperature constraints to save more energy. In addition, thanks to the IoT parameter, the user can interact remotely with the HVAC control system. In particular, the user can remotely determine the comfort temperature, while energy and heat consumption information is sent over the Internet and displayed on the user's device. The proposed algorithms are implemented indirectly [5]. [20] An energy-saving architecture is proposed for the IoT that includes three layers: measurement and control, information processing, and presentation. Architectural design allows the system to predict the sleep distance of sensors based on their remaining battery life, previous use history, and the quality of information required for a particular application. The predicted value can be used to increase the utilization of cloud resources by reusing dedicated resources when the relevant sensory nodes are dormant. This mechanism allows the use of energy saving in all IoT resources. Experimental results show a significant amount of energy savings for sensor nodes and improved use of cloud resources [6].

In 2014, an algorithm was introduced for the relationship between sources and load balance in the computing unit, which placed the two in two separate units, and each node was equipped with a load balancing unit and source discovery. By exchanging the message, the load balancing unit shifted the source status information, and based on this, more precise decisions were made by the source discovery unit. In this method, load balancing was a method of extract-

ing processor behavior and could be used in several ways. This model can reduce the connection between units and has high scalability. In this method, the response time is short and the source discovery time increases[7]. In [8] an algorithm was developed using two phases, in the first phase the cpu performance and the memory required for each task and the available memory for each virtual machine were measured, and in the second phase the available resources were compared with the available resources. And if the required resources were available, he would have allocated them, otherwise he would have rejected the request. In 2014, classifications based on various parameters were presented to analyze these techniques. These parameters include comparison of models and future chats and tasks, etc. were analyzed for use in a dynamic grid environment. Finally, a new load balancing algorithm was proposed to complete the chat research and the grid field was performed [9]. In 2015, an analysis for two grid and cloud environments was presented based on five parameters: ACO ant colony optimization and GA genetic algorithm PSO particle swarm optimization Champions League algorithm or LCA and BAT algorithm. This algorithm was mostly used in the field of metaheuristic algorithms [10].
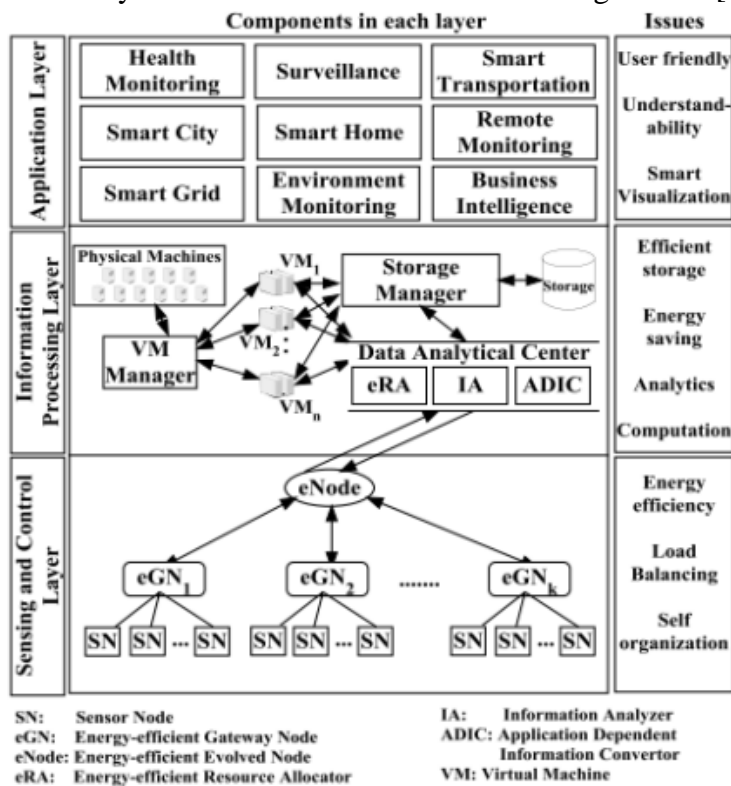
Figure 1 – An energy-saving architecture[6]

3-proposed method:

The proposed new algorithm is similar to the cluster-based routing algorithm in the Internet of Things in terms of reducing energy consumption. This proposed algorithm actually presents a clustering method based on point and region coverage. The whole proposed method has two important parts:

• Cluster formation

•data transfer The base station is a node (usually off-grid) assumed to have no limit on energy and processing resources. The performance of the proposed algorithm, like the LEACH algorithm, is divided into several cycles. Each cycle begins with the installation phase (cluster formation) in which the clusters are organized. Following each installation step, the data transfer step begins, during which data is sent from normal nodes to headers. Each header integrates or

combines the data received from the member nodes and sends it to the base station in the form of a data packet. The base station also generates a table for multiple access with time division (TDMA) for each cluster, which affects the headers. The TDMA table is used to schedule node node data transmissions [11]. The proposed algorithm performs its work in two basic stages, which are:

• Clustering stage
• Data transfer stage

3.1 Local information collection:

An average number of nodes are randomly distributed near the targets to be activated according to specific schedules for performing tasks and identifying predefined targets and sending the information to the CPU node. In the figure below, you can see the dot coverage. In this figure, the black dots represent the points of interest for refinement and the red dots represent the refined points and the blue circles represent the sensed area of each node. We denote the radius of this region by rs and the relation radius by rc and the number of nodes by N. In this type of coverage, two important definitions can be expressed [12]: If the Euclidean distance between si and pj is less than rs, then pj is covered by si. If the Euclidean distance between node si and sj is less than rc, then sj is adjacent to node si. According to the above definition, the range of each node can be defined as follows:

$$C\,(s1) = \{p1, p2, p3, p4, p5, p6\}$$
$$C\,(s2) = \{p4, p5, p6, p7, p8, p9, p10\} \tag{1}$$
$$C\,(s3) = \{p3, p5, p7, p11, p12, p13\}$$

According to the above definition, we obtain a range called o, which includes the following definition [12]:

$$O\,(si) = C\,(si) \cap (C\,(s1)\,UC\,(s2)\,U\,\ldots\ldots\,UC\,(si-1)\,UC\,(si+1)\,\ldots\ldots\,UC\,(sn)) \tag{2}$$

Initially, each node recipient will calculate their coverage area using the following formula [12]:

$$CIP\,(si) = \frac{|C(si)| - |O(si)|}{|U_{i=1}^{n}\,C(si)|} \tag{3}$$

3.2 compute remaining energy:

It will calculate the average remaining energy of its neighbors according to the following formula[12]:

$$Eave(si) = \frac{1}{|ND(Si)|}\sum_{j=1}^{|ND(Si)|} Ecur(Sj) \tag{4}$$

At this point, the neighbors are identified one step away from each node. Neighbors with a distance step denoted by NB (s¬i) are called nodes that have the following condition:

$$NB(si) = \{sj|\,d(si,sj) \le rc\} \tag{5}$$

In other words, neighbors with one step distance are nodes whose distance from the corresponding node is less than or equal to their coverage distance and the number of nodes with one step distance is expressed by ND (si).

Nodes whose distance is greater than the value expressed in the above formula are called neighbors with two steps and their number is expressed by ND2 (si). After identifying and completing this step, the nodes send the message 2_Node_Msgs so that the neighbors can identify their distance difference with two steps [12].

$$Eave(si) = \frac{1}{|ND2(Si)|}\sum_{j=1}^{|ND2(Si)|} Ecur(Sj) \tag{6}$$

After collecting information about neighbors, this information is stored in a table called NT. At the end of this phase, after collecting information about the neighbors, ninety heads should be determined. To do this, the nodes wait for the head-msg message to be received according to the following time. If during this time they receive the head-msg message from another node, it means that the node is happy, and if they did not receive the head-msg message, each node sends the head-msg message to the other nodes and the node is selected as happy. It may have more residual energy. Each node must calculate the waiting time for the eclipse message to be propagated according to the following formula [13]:

$$\text{ti=}\begin{cases}\left[\alpha\dfrac{Eave(Si)}{Eave(Si)}+(1-\alpha)CI\right]T2Vr1 & Ecur(Si)\geq Eave(Si)\\ T2Vr1 & Ecur(Si)<Eave(Si)\end{cases} \tag{7}$$

3.3 Cluster formation:

At this point, if the Ti node has not received a message to select the eclipse through the other nodes, then it will send a message claiming eclipse to the other nodes, but if this message is received, then the node that sent this message It makes me happy. The point here is that this message must be sent at Ti time, otherwise the nodes will enter the competition to be selected as the header, which must be considered the following parameters, which in Time T2 is done: • A node with the maximum energy level; Because the overhead node of the cluster is higher than the other nodes, the node must be selected as a block with sufficient energy, otherwise the nodes of that cluster will be disconnected from the base station due to the death of the node. • The nearest node to the base station; The closer the eclipse node is to the base station, the less energy it needs to send data packets. The nearest node to the center of gravity of the cluster; In fact, it is a node from which the average distance of other nodes in the cluster is the minimum. In fact, the centrality of the cluster reduces the energy consumption to establish intracranial connections (between the nodes of the cluster and the cluster). At the end of this phase, the eclipse is selected and the total time is t2. 3.4 Cluster selection: After the above step, each node selects the nearest header and sends the join_msg message. In this message, there are id nodes along with the remaining amount of node energy. Each node prepares a list for its cluster members called a schedule so that each member of the cluster can be in a temporary sleep mode to reduce their energy consumption when they are not being used to transmit information.

3.5 Intra-cluster communication:

Inside each cluster, the nodes collect information and transmit it directly to their head.

3.6 Extra-cluster communication:

In extra-cluster communications, the connection between the central station and the node is eloquent. If this distance is in one step, this information will be sent directly, but if the distance from head cluster to the central station is more than one step, then first according to the ant colony, the best head cluster route to the central station is found and then the information is sent along this route.

4-evaluate:

MATLAB environment is used for simulation. In MATLAB environment and using coding, the method mentioned in the pre-section is implemented and analyzed. In this method, there is no need to use a pre-prepared database. For simulation, a ground with dimensions of 250 by 250 is used, in which we set the position of the base station equal to 250 and 100. Consider the

number of nodes in this environment to be 100. Other simulation parameters can be seen in Table 1:

Table 1

Simulation parameters

Parameter	value
ground environment simulation	250 * 250
base stations	250 and 100
Node count	100
packet sizes	500

At the beginning of the work, we scatter 100 nodes on a 250 x 250 field. This scattering is random. You will see this in Figure 2:
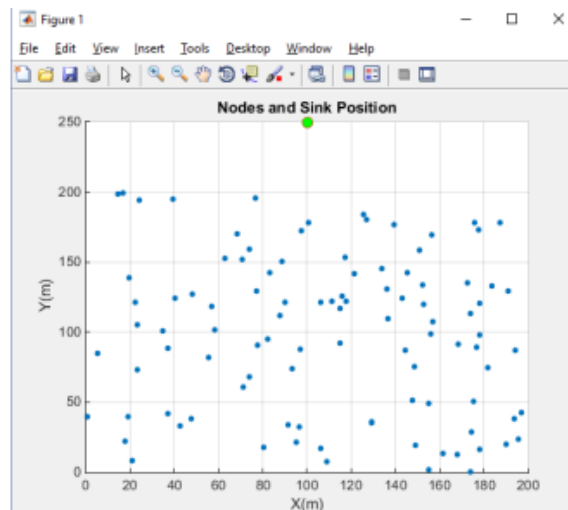
Figure2 – Scattering nodes

In this environment, to send information, each node is first checked whether the node is dead or not? This is measured using the s (i) .Ecur parameter, and if the node is alive, it sends a message to its neighbors and measures its distance to the other node, using the s (i) parameter. At this stage, the nodes are clustered.

In Figure 3, the black circles represent the clusters and the blue circles represent the head of the cluster. To select a node as a header, the node must meet the following three conditions: 1. The energy level of the node is more than the other nodes. 2. It is located in the center of the cluster. 3. This node should be closer to the base station.

Now, to send information, each node sends its information to head cluster, and if the distance of head cluster to the base station is one step, this sending is direct, otherwise, an ant colony is used for sending. Figure 3 shows the pink lines sending directly. Figure 4 shows how to send directly or based on ant colony:
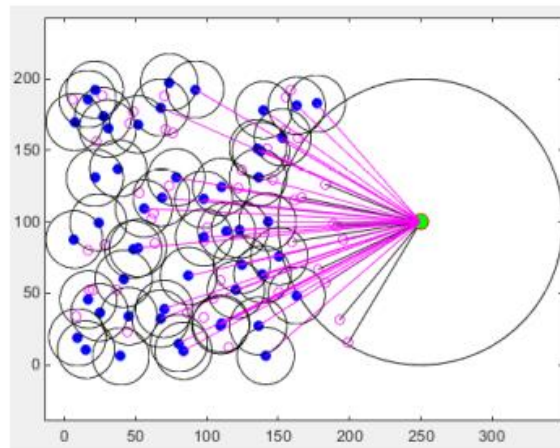
Figure3 – Clustering nodes
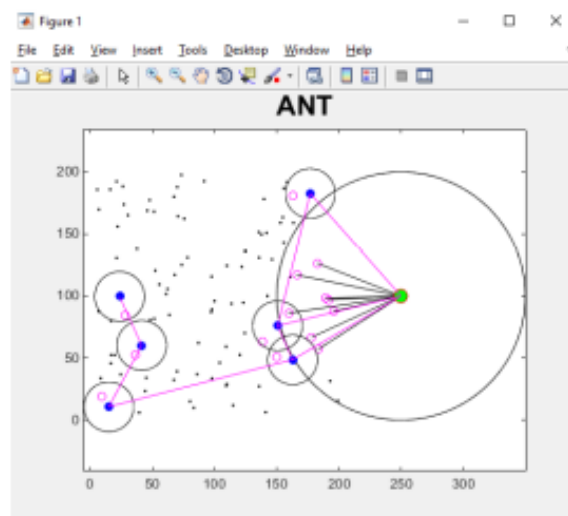
Figure4 – Ant colony routing

In Figure 5, you will see the best cost rate, and as you can see, this rate decreases with increasing repetition, which indicates finding the best route.
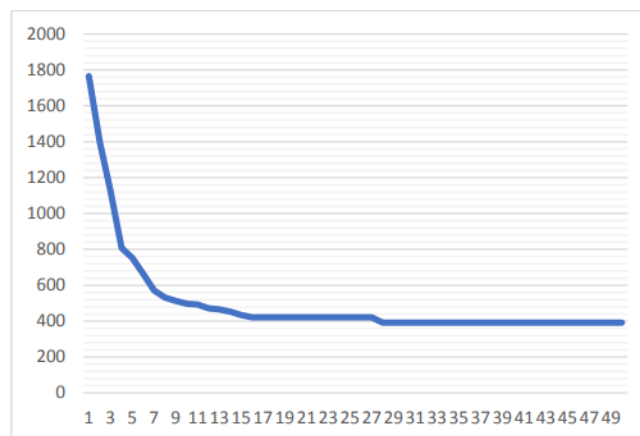
Figure 5 – Cost chart

We will compare the proposed method with the other two methods. These two methods are:
1. Clustering and genetics

2. LEACH algorithm
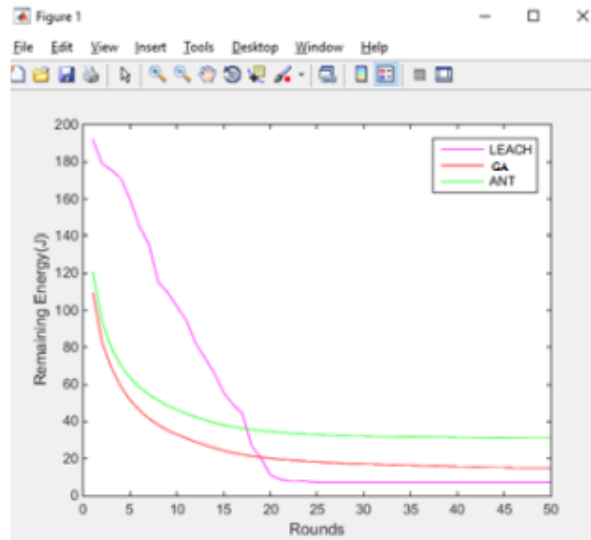
Figure 6 – Remaining energy

The second comparison is in the number of live nodes in the network.
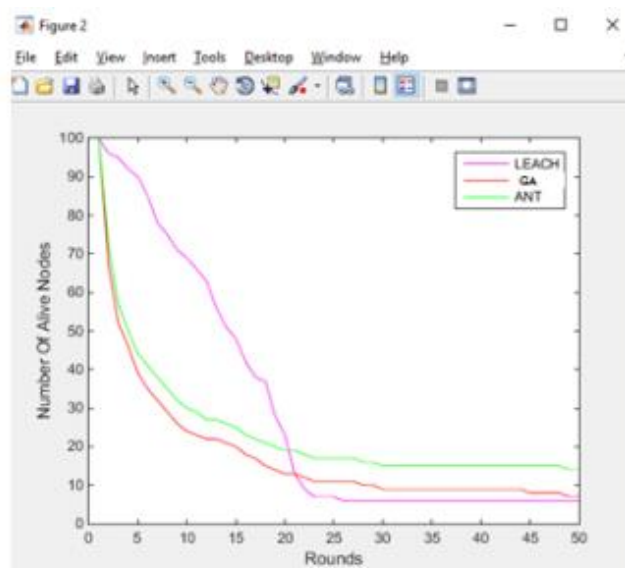
Figure9 – Live nodes

As you can see from the figures above, in all cases the number of live nodes remaining in the network and the amount of energy remaining in the nodes in the proposed method is better than other methods.

5-Conclusion

The proposed method to reduce energy consumption and increase load balance in the Internet of Things has been proposed. In this method, because communication is not always done from one route and we are always looking for a short route, it does not impose traffic on the route and allows communication in this network to take place from different directions. Therefore, this method does not waste the energy of the nodes in the path. Because the short path is chosen and as a result the amount of energy loss will be less. Because the energy loss is lower, the nodes in the path can survive longer. This will extend the life of the existing network.

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PRESENTING A WAY TO IMPROVE TASK SCHEDULING IN CLOUD COMPUTING USING ANT COLONY ALGORITHM

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ABSTRACT

Cloud computing has emerged as a high-performance distributed computing architecture that allows access to a pool of shared resources depending on demand through the Internet in recent years. Cloud computing is still in its infancy, and considerable study on a wide range of areas is required to reap its full benefits. Task scheduling is one of the essential aspects that should be researched in order to obtain optimal cloud performance. Due to the huge solution space and, as a result, the long time it takes to discover an

optimal solution, scheduling in cloud computing is classified as an NP-hard issue. The scheduler algorithm's goal in this study is to process users' tasks in the shortest amount of time and for the least amount of money. In order to minimize overall completion time and maximize resource efficiency, all tasks should be evenly allocated across available resources. To achieve the desired goals and address the task scheduling problem, the Ant Clone Algorithm (ACO) was applied. Simulations and comparisons of the suggested method's results with those of the genetic algorithm (GA) and particle swarm optimization (PSO) reveal that the proposed methodology has been able to satisfy consumers while also maximizing resource use.

Keywords: cloud computing; virtual machine; task scheduling; ant colony algorithm.

Introduction

Cloud computing is a type of parallel computing, distributed computing, and grid computing that allows users to safely store and process data over the Internet. In the cloud computing environment, services are delivered at three levels: infrastructure as a service (IaaS2), platform as a service (PaaS3) and software as a service (SaaS4). This segmentation enables distinct management support and virtualization technologies for each level (Dillon et al., 2010).

At the IaaS level, task scheduling is a critical procedure that tries to efficiently execute system demands on resources so that other aspects of the cloud environment may be taken into account. Virtual machines are used as scheduling units to assign diverse physical resources to complete tasks in task scheduling. Each virtual computer in the cloud is an abstract unit of computation and storage capacity (Ghorbannia and Arian, 2011).

The issue of scheduling tasks according to the various requirements of service quality index parameters such as bandwidth, cost, time, and availability, as well as resource mapping to tasks with the goal of optimizing bandwidth usage, reducing completion time, lowering costs, increasing interest in resource transfer, and achieving a goal function with greater efficiency and less complexity in the cloud computing environment, is critical. As a result, choosing the right scheduling mechanism can have a big influence on system performance. An effective scheduling algorithm may suit the user's demands while also improving resource productivity, boosting the cloud computing environment's overall performance (Ghaffari, 2010).

For an automated scheduling policy, Hai Zhong et al. (2010) applied an upgraded genetic algorithm. Their method employs the shortest genes and introduces the concept of dividend policy in economics to determine if a demand allocation is optimum or undesirable. In their fitness function, they used a basic sum of CPU, RAM, and hard drive. Sellami et al. (2013) suggested a five-objective evolutionary algorithm for taskflow scheduling to handle the problem of satisfaction limitations in the context of task planning restrictions. For the Cloud Computing Federation, Zhang Z et al. (2010) suggested a load balancing technique based on ant colony optimization. Lee et al. (2011) employed the ant colony load balancing (LBACO) method to schedule independent tasks in all virtual machines with the goal of reducing maketime and taskload.

A hybrid ant algorithm and particle swarm method were used to plan resources in cloud computing in research given by Xiaotang Wen et al. (2012). The particle swarm optimization method picks the next repetition site to lead the particles utilizing information, local extreme information, and global extreme information, whereas the ant algorithm employs a pheromone to transfer information. At the virtual machine level, Medhat Tawfeek et al. (2013) employed ant colony optimization to assign batch input taskloads to virtual machines (VM scheduling).

Medhat Tawfeek et al. (2013) employed ant colony optimization to assign batch input taskloads to virtual machines (VM scheduling) at the virtual machine level. By submitting their computer tasks to the cloud system, millions of users desire to access pooled cloud resources. The cloud computing environment has a hurdle in scheduling these millions of tasks. The optimal resource allocation or task scheduling in the cloud should be determined by the desired number of cloud systems in order to reduce total costs. The user and system levels of cloud ser-

vice scheduling are separated. There are issues with transactions in user-level planning, such as how to deliver services between suppliers and clients. Resource management in data centers is linked to system-level planning (Fangzhe C et al., 2010). According to what mentioned above, this study aims is to use the ant colony method to optimize task scheduling in cloud computing.

Proposed algorithm

A novel strategy based on the ant colony algorithm was utilized to optimize task scheduling in cloud computing in this study. The goal of this and the suggested method is to arrive at the best answer in the shortest amount of time possible using various operators. For the goal function, many factors have been evaluated in order to decrease machine idle time and hence boost machine efficiency. Furthermore, in order to improve customer satisfaction, their expectations are taken into account, such as reducing the time it takes to complete all operations and lowering the cost of processing and executing tasks.

The suggested algorithm's general phases are depicted as a flowchart in Figure 1. The suggested technique begins by numbering the system's input tasks and creating a pheromone table. The colony population is then established by forming the required number of ants. The target function is used to determine each ant's fitness value. The method then does a global pheromonerization, and if the termination condition is fulfilled, the algorithm finishes, and the best feasible response based on the objective function is shown. Each of the steps will be introduced and discussed in the following chapters.
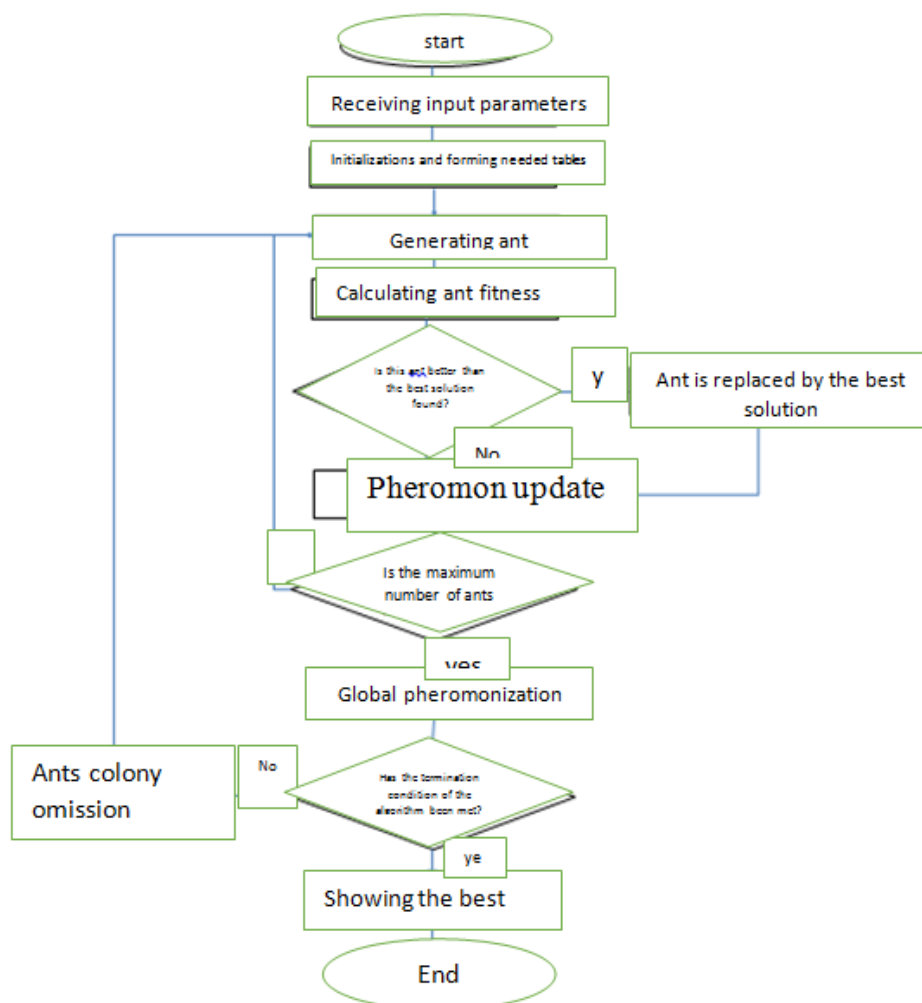
Figure 1 – Flowchart of the proposed algorithm steps

The magnitude of the problem parameters is first given to the suggested method. The system then begins coding each task from a single request because one user request may include several tasks. Consider Table 1 to help you comprehend this section (1). There are four columns in a table. The task number, which is unique, appears in the first column. The username appears in the second column, the request number appears in the third column, and the processing status of each task appears in the fourth column. The processing status for all tasks is zero when the table is first created, and after processing is complete, it is set to one.

Table 1

Coding tasks for processing

Processing status	Application Number	User's name	Task (execution) number
0	1	U1	0
0	2	U1	1
0	3	U1	2
0	1	U2	3
0	2	U2	4
0	3	U2	5
0	1	U3	6
0	2	U3	7
0	3	U3	8
0	4	U3	9

The pheromone table is then constructed based on the table produced for numbering the tasks. The ant colony algorithm's pheromone table is a n×n matrix, where n is the number of rows in the coding table. Each cell i × j in the pheromone table depicts the ant's movement from the task I to source j. The initial pheromone value for each component of the pheromone table is defined in this phase. The method is provided the starting pheromone value through the input parameter, which is a modest positive constant value.

Findings

The suggested technique is implemented using the CloudSim simulator. On a machine with an Intel (R) Pentium (R) 4 3.00GHz CPU and 4.00GB of main memory, the method executes. The suggested approach will be put to the test using 11 test datasets. In order to be suitable for the real world, this dataset has been examined in terms of the size of small, medium, and big habitats. It should also be done in a fashion that pleases all users, with tasks distributed among appropriate processors to handle more tasks in less time and decrease downtime in the cloud.

Designing environment simulation parameters

The Cloudsim software is utilized to simulate the suggested approach in this study. Cloudsim, in fact, is a frametask developed by the GRIDS lab at the University of Melbourne that allows for modeling, simulation, and implementation of cloud computing infrastructure architecture. At the vm level, the ant colony method will be utilized to assign input to virtual machines (VM scheduling).

Ant cloning algorithm simulation parameters

The parameter values should be evaluated in Table after developing the ant colony algorithm and evaluating the parameters that impact the algorithm computations (3). The parameters were set to default values of $\alpha = 1$ ، $\beta = 1$ ، $\rho = 0.5$ ، $Q = 100$, and the maximum number of iterations was 1000. To acquire the right values, just one of the parameters was altered in each experiment.

Table 2

Cloudsim simulator parameters

Type of entity	Parameters	Values
Datacenter	Number of data centers	10
Virtual machine	Total number of virtual machines	50
	Number of instructions per second	500-2000
	Bandwidth	500-1000
	RAM Virtual machine memory	256-2048
	Operating system type	Windows, Linux, Unix
	Number of required processors	1-4
	Cost of CPU usage	100-300
Task	Task duration	1000-20000
	Total number of tasks	100-1000

Table 3

Parameters of the proposed algorithm

PARAMETER	VALUE
α	0.3
β	1
ρ	0.4
Q	100

Designing test dataset

Ten test datasets covering small, medium, and large cloud environment systems are created to assess the outcomes of the proposed technique. Table 1 shows the test dataset (4).

Each user can offer values for processing their tasks based on the values in Tables (3) and (4). Cloud computing, as previously said, is based on a contract between the user and the service provider. For instance, according to the pricing range specified in Table (4) for CPU consumption, the user provides a payment in the range of [1000 and 10000]. The major cost is then computed. In addition, the user includes in his request the time he wants his delivery to be processed and completed in a certain time period, which is a number in a specific period.

Simulation results of the proposed algorithm

The results of the suggested algorithm's implementation for the test dataset in Table (5) are shown in Table (5). (5). The suggested technique was ran 20 times on each example of the test dataset to determine the average fitness value.

Table 4

Designed test dataset

Total number of tasks	Total number of users	Test set name
100	30	Test01
290	48	Test02
320	60	Test03
498	110	Test04
400	100	Test05
350	90	Test06
235	80	Test07
756	130	Test08
600	75	Test09
960	200	Test10

Table 5

The results obtained from the implementation of the proposed algorithm

Mean 20 fitness	Best fitness	Best implementation time	The number of the best iteration	Test set name
105.6	102.5	14	493	Test01
299.3	286.3	33	854	Test02
401.9	100.1	49	902	Test03
1264.8	1078.3	85	995	Test04
500.1	481.3	70	803	Test05
423.8	419.6	75	881	Test06
317.4	313.8	78	863	Test07
782.5	756	128	971	Test08
306.9	305.9	83	743	Test09
946.2	923.5	193	950	Test10

One of the objectives of this study was to lower the time it took to complete all tasks. As a result, in Figure (2), you can see the Makespan diagram, which illustrates how long it took each of the test datasets to complete the whole task processing using the suggested genetic algorithm and the particle swarm optimization method. The suggested method was able to process the desired tasks faster than the other two algorithms, as seen in this diagram. This minimizes the time it takes for tasks to be processed, which lowers the system's maintenance costs. Reducing the time it takes to accomplish all requested activities allows limited resources to be allocated to other tasks sooner. This will also help service providers since an increase in the number of tasks handled will boost their profits.
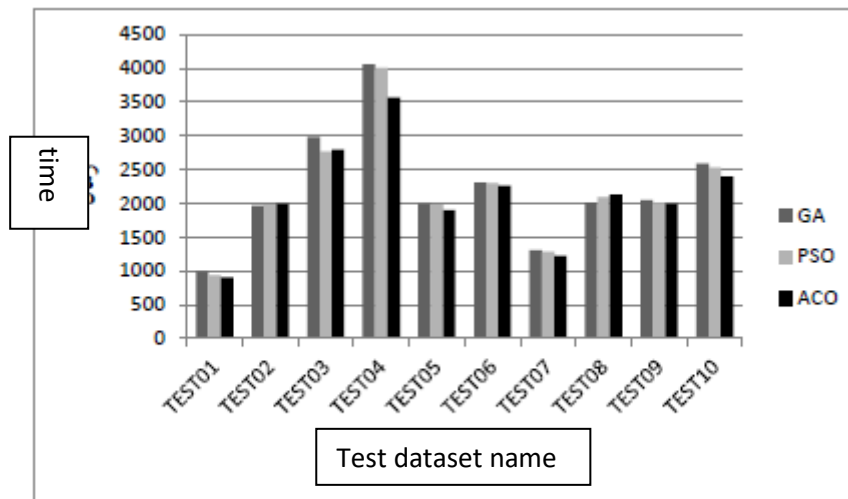
Figure 2 – The completion time of total processing of test dataset tasks listed in Table 5

It is preferable to utilize the value obtained from the fitness in different iterations of the test data set to compare the performance of the proposed method with the genetic algorithm and the particle swarm optimization algorithm. The suggested method for - Test05, as shown in Figure (3), was able to lower the Fitness value very rapidly in the same starting repeats, and this reduction process continues until the middle repetitions, yielding superior results to the other two algorithms. This indicates that the proposed strategy is effective for small-scale scheduling issues. He sought to choose a task for each machine to complete that minimized the processing time of all tasks at the start of the journey.
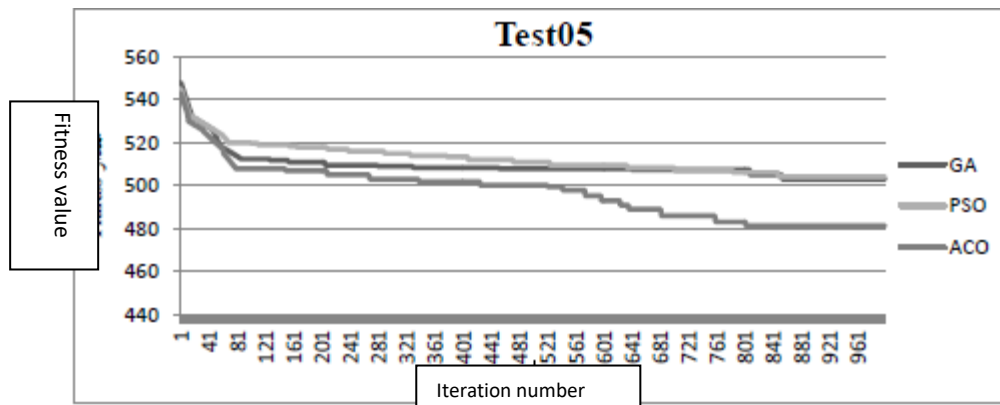
Figure 3 – Comparing the fitness chart for Test05 test data

For the Test07 test data, as shown in Figure (4), the proposed method outperformed the other two algorithms and was able to improve the best solution in the same number of iterations.

Figure (5) shows how the suggested method improves the best response in each iteration for the Test09 test data. The other two algorithms, like the suggested approach, improved the best answer achieved in the final iterations, and the algorithms are in tight competition. The suggested method, on the other hand, was able to win the competition and obtain a superior result. The fact that the response improved in the last rounds suggests that the suggested algorithm did not reach a point of early convergence.
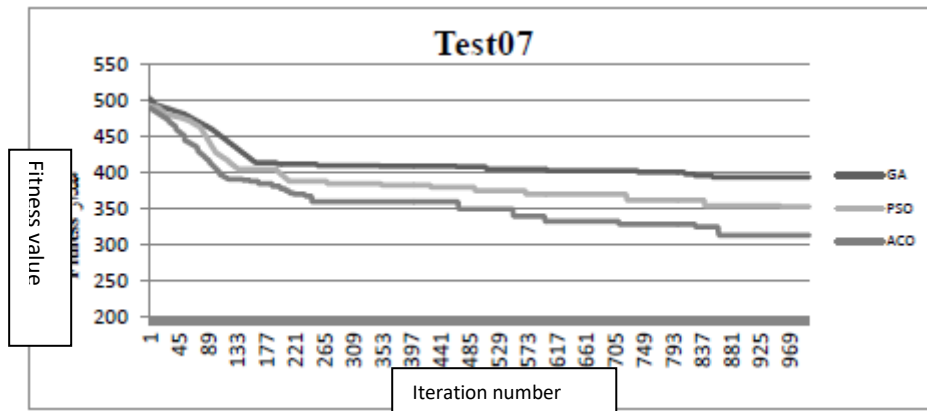
Figure 4 – Comparing the fitness chart for Test07 test data
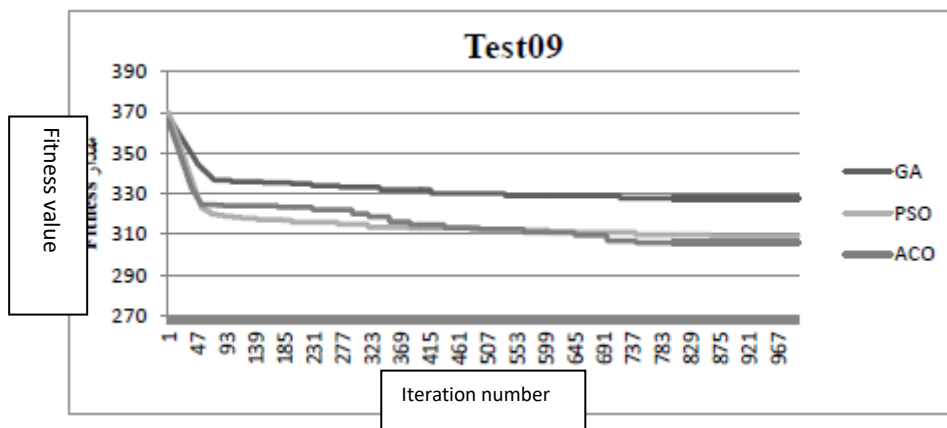
Figure 5 – Comparing the fitness chart for Test09 test data

After establishing that the proposed technique has accomplished our aims, the algorithm's stability should be examined (reducing execution time and reducing costs). Stability is defined as a minor variation in the values of the objective function achieved by the algorithm after multiple runs with the same settings on test data. In other words, the algorithm's resistance to the results it has acquired. The suggested approach outperformed the competing algorithms in each iteration, as shown by the Test03 stability diagram in Figure (6). In the last iterations, the best response is acquired. The results acquired in each iteration, however, were less complicated than those obtained in the other two methods.
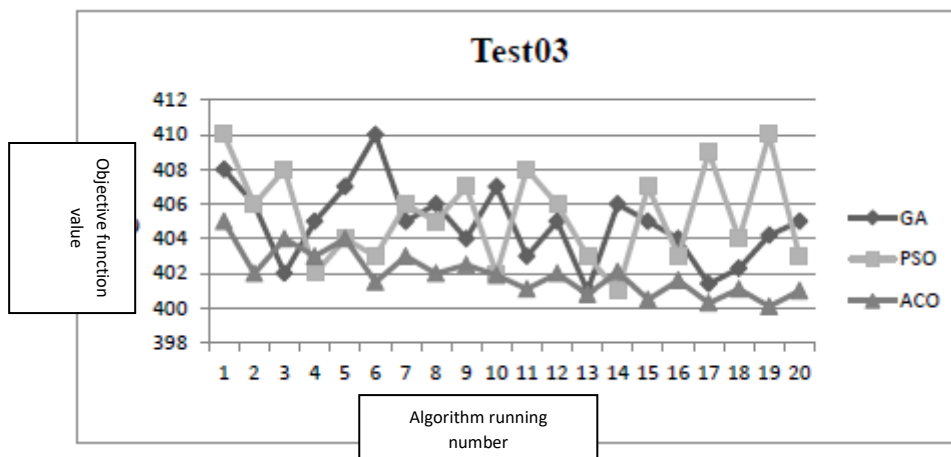
Figure 6 – Comparing the stability diagram of algorithms for the Test03 test dataset

The stability comparison chart for - Test06 is shown in Figure (7). The suggested algorithm yielded somewhat varied results, indicating that it has a high level of reliability. The solutions acquired by the particle swarm optimization method, on the other hand, are dispersed, indicating that it is not particularly stable, and its responses are substantially different from the suggested algorithm's replies. The genetic algorithm outperformed the particle swarm optimization technique in this study.
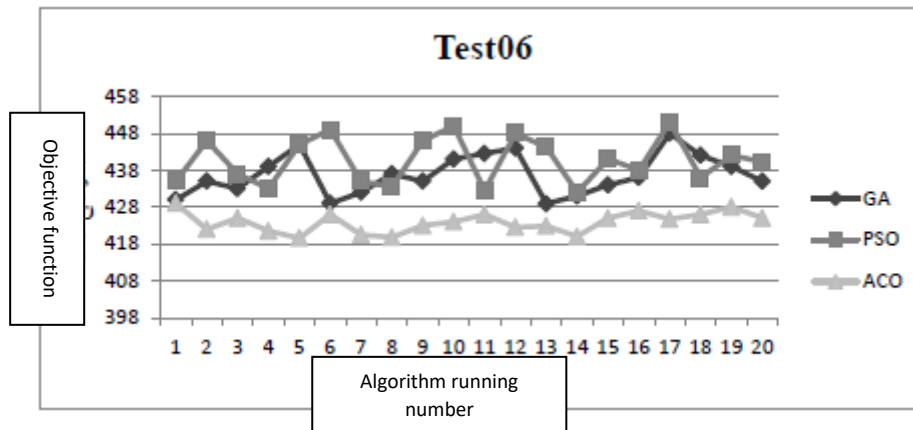
Figure 7 – Comparing the stability diagram of algorithms for the Test06 test dataset

The suggested approach has higher stability than the other two algorithms, as shown in Figure (8), which is connected to the Test09 test data set, and the difference between the responses is less than the best answer of the other two algorithms. For this test dataset, the genetic algorithm and the particle swarm optimization technique are both unreliable, with considerable differences in the solutions obtained in each iteration.
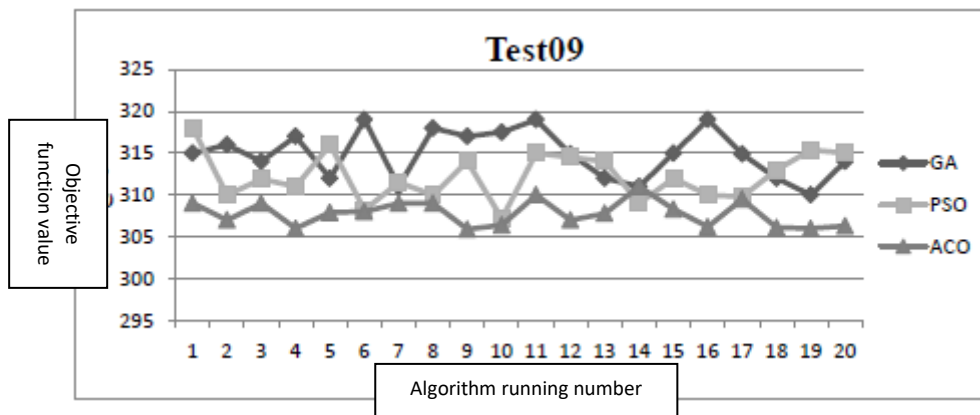
Figure 8 – Comparing the stability diagram of algorithms for the Test09 test dataset

According to the diagrams above, the suggested algorithm performs significantly better, allowing user activities to be handled in less time. Processors' profitability and efficiency will improve in the cloud if task time is reduced.

Conclusion

Following an examination of the problem of task scheduling in the cloud environment, a model was suggested in which users' requests in terms of cost and time were taken into account. Many studies have found that getting the optimal solution takes a long time and that all aspects of the cloud environment in the real world, such as bandwidth, cost of utilizing each processor, processing capability of each processor, and so on, have not been taken into account. In this paper, an ant colony algorithm-based technique for job scheduling is given. The suggested ap-

proach aims to take into account the majority of the factors in order to produce an effective job scheduling algorithm. The results of the suggested approach were compared to those of the genetic algorithm and the particle swarm optimization algorithm in the CloudSim simulation environment. The findings indicated that the suggested method is very efficient and can shorten the time it takes to complete a task. Also, to please consumers by striking a balance between time and cost, which are two of the most important factors for service quality.

The utilization of the ant colony optimization method, one of the newest task scheduling techniques in cloud computing, is a novel component of this study. It was also attempted to be examined in this study, unlike many other studies that did not take into account the critical criteria of bandwidth. All efforts in this study are focused on making the most of cloud computing resources, which will boost resource efficiency and lower consumption costs. Furthermore, the suggested cloud environment model was studied in such a manner that it can represent the real environment while taking into consideration all of the criteria required by a user as well as the features of cloud resources.

The suggested method's shortcoming is the ant colony algorithm's entrapment in local optimization and its early convergence. However, with more research, this flaw can be avoided. It is preferable to employ a mix of the two methods to overcome the meta-heuristic algorithm's shortcoming of early convergence and avoid falling into the optimum local trap. When the first algorithm encounters an issue, it employs a mix of ant colony and other local search algorithms to conduct local searches in the problem space, assisting the algorithm in finding a better solution. However, this technique has problems, one of which is that it increases the algorithm's execution time, which is also offered as a remedy to the problem.

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EXAMINATION OF PHYSICO-CHEMICAL CHANGES OF INDUSTRIALLY PRODUCED MEAT CHIPS UNDER AMBIENT TEMPERATURE

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ABSTRACT

Considering the growing number of diseases caused by consuming high-fat levels in unlawful foods, it is important to produce low-fat or fat-free products. Meat chips and fast foods are increasingly consumed by most people, especially children and young people in society; these products, unfortunately, contain high levels of oil and are detrimental to consumers' health. Thus, the production of low-fat chips with good properties can effectively increase public health. The research found that various variables such as starch concentration, glutamate and temperature had a significant impact on the chemical properties of meat samples. An examination of the effect of different starch concentrations on the Total Volatile Basic Nitrogen (TVB-N) and peroxide suggested that different concentration levels had an additive effect on this index. The temperature was also found to affect the TVB-N index. As the glutamate content increased, the TVB-N index and peroxide increased, also. This means that sodium glutamate can increase amino-peroxide compounds in meat samples.

Keywords: meat chips; glutamate; starch; low-fat products.

Introduction

Today, lack of enough time and occupational problems have made people increasingly turn to eat fast foods. Consistent with the rising demands, the production of fast foods has also increased. Today, people in society suffer from such diseases as diabetes, obesity, cardiovascular diseases, etc., with most nutritionists and health experts warning that high levels of fat in people's diets may account for such diseases. Fast foods and chips are products that are increasingly consumed by most people, especially children and young people in the community. Red meat, which contains high protein, energy, vitamin B, minerals, and amino acids, is considered a valuable nutritious food source (Cheraghi et al., 2010).

Since aquatic meat also contains minerals such as iron, selenium, iodine, calcium, magnesium, etc., and omega-3 fatty acids such as icosapentaenoic acid and docosahexaenoic acid, they have a special nutritious meat status. Consistent with clinical studies, consuming fish and aquatic products can considerably impact the prevention and even treatment of many diseases (Azizi et al., 2001). In addition to protein, chicken meat contains various vitamins and minerals, including selenium, niacin, the amino acid tryptophan and phosphorus (www.seemorgh.com).

Today, processed meat products take a big chunk of the family's food basket. One of the meat products is sausage, which is widely consumed because of its cheaper price and more favorable taste than conventional meat and its easy and fast preparation. One of the factors that cause an undesirable taste and reduce the quality of meat products is fat oxidation due to the degraded fat-soluble vitamins and unsaturated fatty acids (Gray et al., 1996). Processed meats, including sausages, largely use sodium or potassium nitrite as preservatives which prevent the growth and production of neurotoxins by clostridium botulinum, prevent the spread and production of spoilage microorganisms, and delays the spread of oxidative degradation; it also stabilizes the color of the red meat and affects the color and taste of the product by reacting with myoglobin (Cammack et al., 1999).

However, high nitrite consumption is detrimental to human health as it causes allergic effects and vasodilation and produces metmyoglobin in tissues. Furthermore, nitrous acid may react with secondary amines and amino acids naturally found in meat foods to form N-nitroso

compounds, especially nitrosamines. These compounds are highly active and toxic and cause carcinogenic and neurological effects (Karl-Otto et al., 2008).

According to Iran's National Standards, the authorized consumption level of sodium or potassium nitrite is 120 mg/kg in the final product. Chips and fast foods are products increasingly consumed among most people, especially children and youth in the society (Amir Daraei et al., 2008). Meat chips, produced from types of meats such as fish, poultry, etc., are easily consumed types of meat. Today, because the consumption of fast foods is on the rise, the production of low-fat, low-cholesterol, high-protein, and high-nutrient foods is becoming a critical factor (Elena M. & Morales Sosa, 2006). Produced in some countries of the world, meat chips are made of pieces of meat mixed with water, starch, flavorings, etc., then producing paste. Having been dried, the paste is cut into thin layers that are dried and then fried in hot oil (Conley & Piaomak, 1965).

Chips (food snacks) are one of the globally unique fast-food items whose biological properties increase when produced from meat containing a high biological value. Converting meat to products such as chips provides a new solution to consuming dry, solid and low-water meats, making fast food products easy to digest.

Red Meat and its Perishability

Meat is considered to be one of the most important sources of protein. The fact that meat is rich in valuable proteins with essential amino acids for the body, minerals, especially iron and zinc, types of vitamins, and adequate energy make it one of the perfect foods. The meat obtained from the slaughter of halal-meat domestic animals such as bulls, buffalo, sheep, goats and camels have a red-pink color as it is rich in myoglobin and is thus called red meat. Data from the Statistical Center of Iran suggest that the production of red meat in Iranian slaughterhouses was 403 thousand tons in 2009, and the imports were 105 thousand tons by the same year. Because the data do not provide any information on unauthorized slaughter, if the missing figure stands at about 30% of the total slaughter, as experience has shown, the total amount of red meat produced domestically will amount to 524 thousand tons, while the total amount of red meat consumed will be 629 thousand tons (Shekarforoush et al., 2012).

From 2008 to 2013, red meat production dropped by 30% due to various reasons such as the old production technology, rising prices, and declining exports and imports (The Statistical Center of Iran).

From an economic and nutritional perspective, the importance of consuming meat has led to extensive studies on microbial contamination and regional diseases in various countries. This is because healthy nutrition is one of the main elements of public health, and lacking solutions warrant critical solutions to analyze and test meat (Farshchian et al., 2010).

The microbial status of red meat and poultry meat depends on animal husbandry, slaughtering and processing. Slaughtering is the most critical stage regarding meat contamination, with a significant part of the contamination also seen in subsequent operations. The initial contamination of the meat surface of healthy livestock is affected by livestock conditions and the slaughterhouse environment. Following the slaughtering stage, subsequent stages, including transportation, cooling, drying, processing, packaging, and storage of the carcass, determine which bacteria survive from the original microbial population of the carcass and form the dominant population.

Different studies have suggested that the decortication operation causes the bacteria to transfer to the carcass. In the post-decortication process, the number of bacteria increases slightly on the carcass but displacing the carcass and performing operations on it cause the bacteria to spread on the carcass, as the number of bacteria on the carcass follows a natural logarithmic rule

(Ekhtiarzadeh & Jahan Pima, 2002). As a result, meat can be easily contaminated with various microorganisms, and if transportation and storage conditions are not met, spoilage and pathogenic bacteria will grow, thus, reducing the quality of meat and endangering public health (Vernozy-Rozand et al., 2002). Refrigerated storage is the most prevalent method of storing meat and meat products. In some countries, antimicrobials and antioxidants, often used in synthetic forms, increase the shelf life of meat and meat products. Today, however, consumers are gaining more knowledge of the side effects of chemical preservatives and are thus demanding fresher, more natural, and more controlled foods (Akgul and Kivanc, 1988).

Given the health hazards caused by pathogenic bacteria in foods, it is becoming important to gain knowledge of the past and present situation of bacterial contamination of food of animal origin with food-borne bacteria and to evaluate these contaminants to provide appropriate solutions to eliminate or reduce them.

Food-borne illnesses are among the most notorious public health problems across the world. Despite modern technologies such as high-quality production, health and quality control, and the establishment of Hazard Analysis Critical Control Point (HACCP), the number of food-borne illnesses has risen compared to the past decade. The rising trend of food sales across the world, the introduction of new foods, modern food processing and the rising public demand around the world for the consumption of foods as well as fast foods, less subject to different processing methods, have largely increased the microbial contamination of foodstuff (Garcia et al., 2010).

Monosodium Glutamate

Monosodium glutamate or MSG has the chemical formula of $C_5H_8NNaO_4$ and a white crystalline powder form used as a flavor enhancer and intensifier. Monosodium glutamate is widely used to produce meat products, chips, canned goods and broth tablets. Monosodium glutamate (MSG) is one of the most popular flavor enhancers whose health and consumption is under question. The appearance of this substance is like salt or sugar crystals, which has no taste by itself, though it intensifies other tastes and creates a good taste. Monosodium glutamate is the sodium salt of glutamic acid, one of the twenty nonessential natural amino acids for the human body, almost found in all foods, especially foods rich in proteins such as dairy products, meat, fish and many vegetables. Hydrolyzed vegetable protein (HVP), soy sauce and many other fruits such as tomatoes and grapes and other conventional foods such as cheese and mushrooms contain high levels of free glutamate. Some scientists maintain that glutamate is the fifth taste, i.e., savoriness in addition to saltiness, sweetness, sourness and bitterness.

Literature Review

Salam et al. (2004) examined the antioxidant and antimicrobial effects of garlic against fat oxidation and microbial growth in chicken sausages, concluding that the use of fresh garlic (30 g/kg) or garlic powder (9 g/kg) could significantly reduce the overall aerobic bacteria count, and consequently increase the shelf life. However, the addition of GO or BHA made no significant difference to APC compared to the control sample. Sensory analysis suggested that FG created a more significant odor and flavor than other substances. Consistent with the findings, fresh garlic and garlic powder were potentially useful to preserve meat products because of their antioxidant and antimicrobial properties.

Cherian et al. (2005) demonstrated that chicken meat and eggs are widely available and relatively cheap, which can also be major sources of essential nutrients, especially for the poor; they also concluded that the prevalence of metabolic diseases caused by deficiencies of vitamin nutrients could be compensated for by consuming chicken meat.

Cudahy (2005) used pork to produce chips. He processed the pieces of the meat at the cooking temperature of 130°F (54.4°C) to bring it out of the raw meat, which helped it be used again. The chips were placed in a package, and then the moisture, protein and fat of the intended product were analyzed.

Zhang and Barbute (2005) examined the effect of adding potato and tapioca starch on DFD, PSE of chicken breast. Following the addition of starch and cooking at 75°C and then cooling to 30°C, they found that the DFD product was experiencing more brittleness than the PSE product; however, on the other hand, the product texture improved with the addition of starch because of the increased water absorption and water holding capacity, increased binding of protein and water, and increased viscosity of meat paste. Meanwhile, the added starch could compensate for the functioning of the protein in the PSE product.

In a study, Devalakshmi et al. (2010) examined the physicochemical, microbial and sensory quality of chicken meat chips. Ingredients such as baked potatoes (starch) (15%), cornflour (3%), common salt (2%), baking powder (0.5%), spices (1.5%), ginger and garlic (2%) were added to the chips, and the final product was exposed to the hot air of 100°C for 2 hours; then the chips were packed in 60-piece packages. Considering the control and storage processes, the intended packages were stored at 37°C and 7°C for eight weeks. The results suggested that chips made of 15% flour formulation were more acceptable for up to 8 weeks at both 37 and 7°C in the storage process.

Izci et al. (2010) examined the production of fish chips from sand smelt (Atherina boyeri), noting some qualitative changes during the storage period at -18°C for six months. Here, the mixture was made from 60% minced fish, 11% starch, 21% cold water, 5.5% potato flour, 1.85% salt, and 0.65% monosodium glutamate. The mixture had a length of 10 cm and width and thickness of 1 cm, which, having been fried in sunflower oil at 190°C for 6 seconds, was subjected to a cold shock, i.e., -18 ° C, and then stored at this temperature. Microbial and chemical analyses were subsequently carried out on it. The findings showed a significant difference in the values of moisture, ash, protein and crude fat of raw fish and fish chips. The initial frying process reduced all fatty acids except oleic acid and linoleic acid. An insignificant difference was noted between the values of thiobarbituric acid and pH of raw meat samples and initially fried chips, while a significant difference was noted in the values of Total Volatile Basic Nitrogen. Later, a microbiological analysis was carried out on it, demonstrating a reduced number of microorganisms at the end of the storage time. Chemical analysis results suggested that the microbiological sensitivity of fish chips was at an acceptable level during the frozen storage at -18°C after six months. This was thought of as one of the first processing technologies for fish species.

Considering the health and nutritional hazards of fried potato chips, Parsapour et al. (2004) examined the possibility of removing the frying stage of producing potato chips. Results of various production methods found that the drying method can be good for this end. To this aim, the chips, having been dried, were sprayed on with the hot and cold (75-80) oil of 0, 5 and 10% rates. Six samples were evaluated, showing no significant differences from the control sample regarding sensory properties.

Methods and Procedure
Substances and Equipment

Chips paste was prepared from beef, corn flour, corn starch, sodium chloride, antioxidants, sodium glutamate, garlic powder, ginger, and spices. Chemicals including nitrobenzene, 4N nitric acid, potassium ferrocyanide, zinc acetate, 0.1n silver nitrate, potassium thiocyanate, ammonium

sulfate, hexane, 4N ric chloride, sulfuric acid, methyl red reagent, crystalline copper sulfate, selenium dioxide and 2% boric acid were purchased from the German company of Merck.

Peroxide Number Measurement
The Egan et al. (1997) technique measured the peroxide index.

TVBN (Total Volatile Basic Nitrogen) Measurement
The measurement was carried out based on the AOAC technique (2002).

Data Analysis Method
Microsoft Excel (version 2010) was used to plot the curves, while the Minitab software (version 14) was used to perform the statistical analysis. Mean data was compared by the Duncan test, with the statistical difference considered to be less than 5% of the significance level. Sensory evaluation results were analyzed using a 9- point Hedonic Ranking Scale.

Results and Discussion
Examining the response surface diagram of the simultaneous effect of starch and glutamate concentrations on The TVBN (Total Volatile Basic Nitrogen) in the third month under ambient temperature

Figure (1) illustrates that initially, as the glutamate concentration increases from 0.5 to 0.6%, the TVBN index decreases; however, as the concentration increases from 0.6 to 0.7%, the TVBN index increases upwards. Starch also had a similar trend on the TVBN variations, with a concentration of 10 to 12.5% causing the index to decrease, while a concentration of 12.5 to 17.5% caused the index to increase. Generally, these two compounds had an increasing effect on the TVBN. Regression coefficient results suggested that the effect of these two compounds on TVBN variations was not significant. The presence of amino acids in glutamate's structure can increase this index.
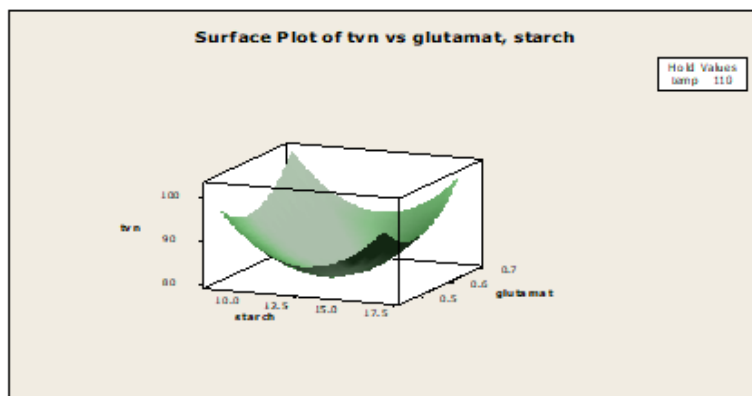
Figure 1 – Mutual effects of starch and glutamate concentrations on the TVBN in the third month at ambient temperature

Examining the response surface diagram of the simultaneous effect of starch concentration and temperature on the TVBN in the third month under ambient temperature
Figure (2) illustrates that the TVBN index first decreases and then increases as temperature increases. Also, a review of starch concentration variations on the TVBN found that low concentrations of starch cause this index to decrease, but higher starch concentrations increased the index. Regression coefficient results determined that the effect of these two compounds on TVBN variations is significant at the 5% level. Heat also causes denaturation and the production of vol-

atile compounds such as ammonia. Degradation of protein compounds and peptide bonds was found to increase with temperature increase.
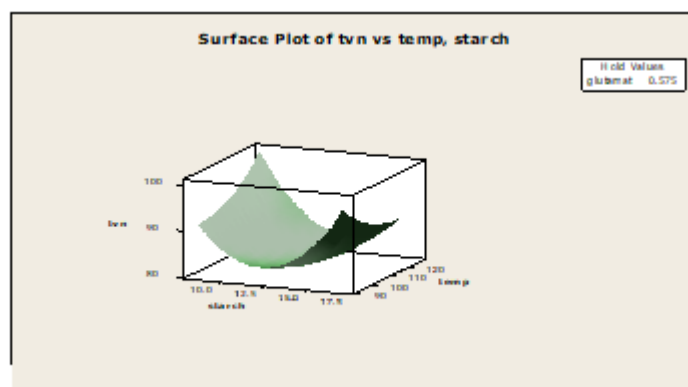
Figure 2 – Mutual effects of starch concentrations and temperature on the TVBN in the third month at ambient temperature

Examining the response surface diagram of the simultaneous effect of glutamate concentration and temperature on the Total Volatile Basic Nitrogen (TVBN index) in the third month under ambient temperature

Figure (3) illustrates that initially, as temperature increases, this index decreases, then increases. A similar trend was noted of glutamate concentrations. Regression coefficient results determined that the effect of these two compounds on TVBN variations is not significant. Both compounds increased TVBN.
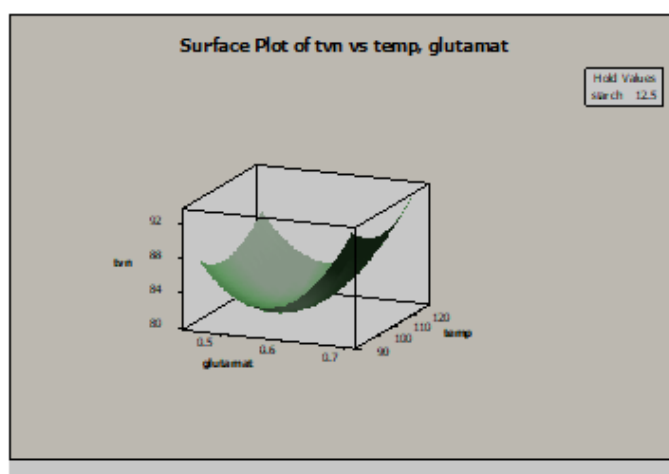
Figure 3 – Mutual effects of glutamate concentrations and temperature on the TVBN in the third month at ambient temperature

Examining the response surface diagram of the simultaneous effect of glutamate and starch concentrations on peroxide index variations in the third month under ambient temperature

Figure (4) shows that as glutamate concentration increases, the peroxide level increases and also, as starch increases, the peroxide index first decreases and then increases. Regression coefficient results suggest that the effect of these two compounds on the peroxide index variations is significant at the level of 5%. Glutamate absorbs moisture to increase the peroxide index.
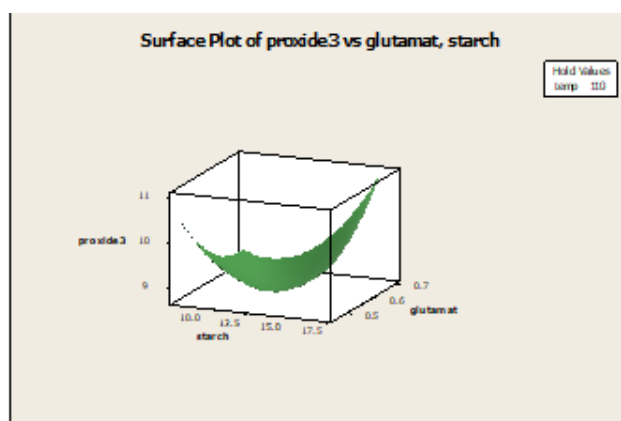
Figure 4 – Mutual effects of glutamate and starch concentrations on peroxide index in the third month at ambient temperature

Examining the response surface diagram of the simultaneous effect of starch concentration and temperature on the peroxide index variations in the third month under ambient temperature

Figure (5) illustrates that as starch concentration increases, the peroxide level increases. Temperature also directly affects the level of peroxide, which, with the increased temperature, the level of peroxide increases. Regression coefficient results showed that the effect of these two factors on peroxide index variations is significant at the 1% level. Temperature degrades double bonds and creates free radicals to form hydroperoxide. Moisture trapped in the three-dimensional structure of the starch molecule increases the decomposition of unsaturated fatty acids and the production of peroxide compounds.
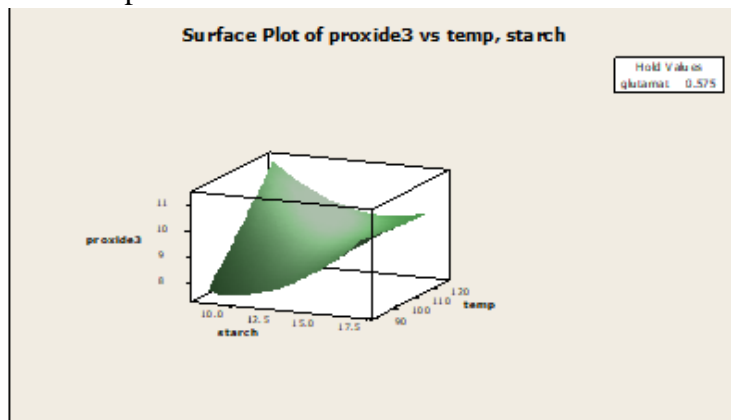
Figure 5 – Mutual effects of temperature and starch concentrations on peroxide index in the third month at ambient temperature

Examining the response surface diagram of the simultaneous effect of glutamate concentration and temperature on peroxide index variations in the third month under ambient temperature

Figure (6) illustrates that as temperature increases, peroxide increases, but as glutamate concentration increases, the level of peroxide decreases. Regression coefficients show that the effect of these two compounds on the peroxide index variations is significant at the level of 1%. Glutamate was found to reduce the production of hydroperoxide. Since it lacks lipid composition, this compound cannot directly increase the index.
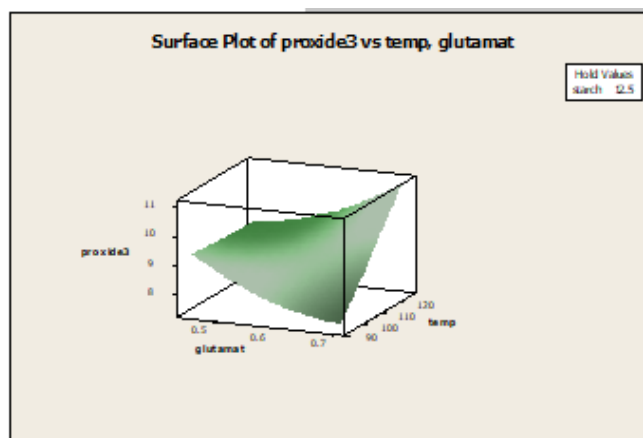
Figure 6 – Mutual effects of temperature and glutamate concentrations on peroxide index in the third month at ambient temperature

Conclusion

The research found that various variables such as starch, glutamate and temperature had a significant effect on the chemical and sensory properties of meat samples. The examination of the effect of various concentrations of starch on the Total Volatile Basic Nitrogen (TVBN) determined their increasing effects on this index. Temperature also affects the TVB-N index, as when temperature increases, the breaking-down rate of peptide bonds increases, thus increasing the production of ammonia and volatile amino compounds. The TVB-N index was found to increase with increasing glutamate content. This suggests that sodium glutamate can increase amino compounds in meat samples. Also, a review of samples stored in the refrigerator and ambient temperatures determined that the TVB-N index decreases at refrigerator temperature due to reduced microorganism activities. Peroxide index results showed that as temperature increases, the level of peroxide compounds increases. This is due to the role of heat in breaking down the double bonds which contain high levels of fatty acids in meat tissue. Also, as starch content increased, the level of this index increased. One of the factors affecting oxidation is moisture, as starch and glutamate play an important role in absorbing the moisture of the product. As a result, as these two compounds increased, the peroxide index increased, also.

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LOCATING EARTHING IN AN IMBALANCED LOW-VOLTAGE DISTRIBUTION NETWORK TO REDUCE IMBALANCES AND LOSSES

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ABSTRACT

One of the problems of the three-phase four-wire distribution network is the network load imbalance and the high current of the neutral conductor, which causes a drop in the neutral conductor voltage and many problems for the subscribers of these systems. The effect of the imbalance load on the neutral conductor voltage in all busbars in a sample network was investigated in the present paper. It was shown that in an imbalance and asymmetric system, the imbalance load in a busbar can be in the direction of (i) decreasing the

voltage of the neutral network and earth equivalent conductor and (ii) increasing the neutral network voltage. Four-wire distribution systems, earthing, fault current, voltage drop, and overvoltage was investigated in the present study. Three-phase four-wire distribution network with multiple protective earthing is widely used in the current distribution network due to more sensitivity protection and fault clearing compared to three-phase three-wire systems. Four-wire systems operate in an imbalance condition due to asymmetric loading. Imbalance is dangerous for the safe operation and safety of a system. In the present study, the possibility of employing an electrical earthing system in the voltage balance of a distribution system and its losses were investigated. The simulation process was performed on a sample distribution system in a MATLAB environment, and the Particle Swarm Optimization (PSO) algorithm was used for locating.

1. Introduction

The earthing (grounding) is an important technical and safety system in the distribution networks. Due to the current conditions and sometimes uneven situation in distribution companies, it is necessary to investigate the earthing system in distribution networks and observe the technical principles of standards to increase the assurance (safety) factor in the proper and safe operation of the networks and prevent the risks of incomplete protection for humans and facilities. The present paper focuses on this topic and introduces electrical earthing systems and protection. Then, the method of using an earth electrode around a grounding distribution station and additional protection measures to prevent dangerous contact voltage in case of a connection to the frame in the devices and machines were investigated. An electrical earthing system means connecting real or virtual neutral points of electrical networks to the earth that is part of an electrical circuit, for example, earthing the transformer winding star center (real neutral point) and earthing the triangle winding transformers through the virtual neutral point neutral bobbin. The importance of the earth point appears when a phase-to-earth connection occurs in the electrical networks. Here, the fault phase current returns to the neutral point of the transformer through the ground and the connection circuit can be cut off by inexpensive-protection devices such as fuses. If the neutral point is not connected to the earth, the phase-to-earth connection current will be negligible and much lower than the normal phase current due to the lack of return path, and the fuses used for normal current will not cut off the circuit. This leads to a rise in the voltage of the healthy phases relative to the earth, which will cause disturbances in the insulation of the network. In this case, it is necessary to use expensive protection devices to cut off the faulty phase circuit in such a system. To protect a system and ensure safety, each transformer substation must be equipped with a secure electrical earthing and the total resistance of the neutral conductor earthing should not exceed 2 ohms. An earthing system can be used for protection and safety in the following situations: At least one basic earthing system be constructed near each substation, and other earthing systems shall be constructed at the end of the power supply lines with the main boards after the transformer substation. If the medium-voltage input and output lines in a transformer substation are all cable and the length of each line before the substation is not less than 3 km, an earth electrode can be used for both purposes (system protection and ensure safety). The reason is damping step voltage in the cable path equipped with metal armor. However, when there is a possibility of transferring high-voltage (especially lightning) to low-voltage equipment, two earth electrodes are used, and the distance between two electrodes should not be less than 20 m. Hence, a suitable location for installing an earthing system can improve protection in distribution systems. Generally, the networks around each distribution substation are constructed aerially and do not meet the conditions mentioned above. Because the length of medium-voltage cable lines in the substation area does not exceed 3 km, so, it is necessary to separate the earthing system related to medium-voltage equipment from the low-voltage systems. Thus, a low-voltage earthing system is installed separately and at a farther point from each of the distri-

bution low-voltage feeders [1,8]. The protection of distribution systems and appropriate protective equipment for this purpose has been studied in many papers. Important issues of the generation, transmission, distribution, consumption of electrical energy, the earthing system of electrical equipment (and metallic non-electrical), protection against electric shocks, dangerous overvoltages, stabilization of voltage of neutral point in electrical circuits, and their standards and defined methods were investigated in the literature [2], and these investigations and methods were evaluated and tested by simulation for the main problem by connecting a 400 V generator to the 20 kV distribution network of Tafresh University, which finally a suitable earthing system that could provide network safety (when occurring error) was provided. The intrinsic characteristics of the imbalance three-phase four-wire distribution systems were investigated in the literature [3], and the effects of the neutral conductor, earthing system, transient overvoltages, or voltage drop due to a fault in the system were described. The effects of neutral conductor and earthing system on the characteristics of three-phase four-wire distribution systems such as imbalanced voltage, voltage rise or drop due to a fault in the system, and the voltage profile improvement in both permanent and transient states compared to three-phase three-wire distribution systems were examined and evaluated by simulation process, and the desired results were finally obtained. In literature [4], increasing the harmonics in the various standards system was introduced to improve the quality of the electrical power network. In these standards, restrictions are imposed on harmonic injections by nonlinear loads into the network. Due to the problems mentioned above, different methods for removing harmonics were proposed from the beginning. The most basic and common method for this purpose is to use passive filters. With the development of power semiconductor components manufacturing technology, active filters have been welcomed and used. In these filters, non-linear loads are reduced by proper injection of voltage or current. A new method for controlling the current of the voltage source inverter used in the parallel compensator was presented in the literature [5] to improve the imbalanced loads in the three-phase four-wire system. The proposed method is simple, and in addition to performing the usual tasks of a parallel compensator including power factor correction, reactive power compensation, and attenuation of current harmonics, it enables the parallel compensator to compensate for a significant percentage of the network current imbalance. It also ensures proper stability of the DC junction voltage under extremely imbalanced conditions for a network current or sudden changes in load. Simulations performed in the Simulink environment of Matlab software on the parallel compensator and integrated parallel compensator in different distortion and imbalance conditions for a network voltage and load current showed the ability of the proposed method to improve the network current imbalance. According to the literature [6], one of the most important problems in connecting these sources to the distribution network is the change of short-circuit levels at different points of the network, the disruption in the network protection system, and the malfunction of this system. Installation location, generation rate, type of technology, and network topology will have different effects on the protection system. In this paper, by connecting the DG sources to the IEEE 13-bus test distribution system, the problems caused by this equipment in the protection of the distribution network were investigated in PSCAD/EMTDC software. In the literature [7], the effect of the presence of distributed generation sources on the coordination of protective equipment especially recloser fuses was first investigated, then a new method was proposed to study the effect of the presence of distributed generation sources on the coordination of recloser fuses. Based on the evaluation process of the network protection in different states and the classification of protection coordination status, this method was divided into two categories, including coordination maintenance and loss of coordination. According to the results obtained from this process, the network operator will be able to make the right decision.

Then, two complementary solutions were proposed to reduce the number of the non-coordination state. The first solution was to connect the DG to the best busbar (in terms of the number of states in which coordination is maintained), and the second solution was to change the recloser settings. The proposed method was implemented using DIgSILENT and MATLAB software on one of the real electricity distribution networks in Iran. The results showed that the proposed method significantly reduces the number of non-coordination states and prevents interruption of distributed generation sources at the moment of a short-circuit.

Modeling earthing system and location objective function with PSO algorithm
The objective function of the problem

As mentioned, the purpose of this article is to minimize losses and imbalances in the distribution network. Therefore, we define the following objective function:

$$Min\{F\} \qquad (1)$$

Which, the F function is defined as follows:

$$F = \omega_1 \frac{P_{loss}}{P_{loss\,0}} + \omega_2 \frac{\sum_{i=1}^{n} dqv_i}{\sum_{i=1}^{n} dqv_{o0}} \qquad (2)$$

$P_{loss\,0}$: Initial losses

P_{loss}: Losses considering the earthing system

ω_1 , ω_2 : Weighting coefficients of the objective function, which : $\omega_2 + \omega_1$

dqv_i: The voltage balance index in the initial state.

dqv_o: The voltage balance index considering the earthing system which is defined for each bus as follows:

$$dqv = \sqrt{\frac{1 - \sqrt{3 - 6\beta}}{1 + \sqrt{3 - 6\beta}}} \qquad (3)$$

Which, the coefficient is defined as follows:

$$\beta = \frac{|V_{ab}|^4 + |V_{bc}|^4 + |V_{ca}|^4}{[|V_{ab}|^2 + |V_{bc}|^2 + |V_{ca}|^2]^2} \qquad (4)$$

This problem is considered as Fig. 1
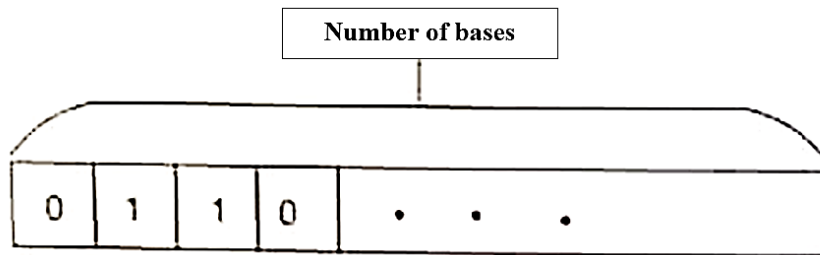
Figure 1 – Structure of a proposed particle

A particle is an array with a length equal to the number of bases, of which "0" means that there is no earthing system, and "1" means choosing the base as the installation location of the earthing system.

Particle distribution in the unbalanced four-wire network

A characteristic of a low-voltage distribution network is that it is imbalanced, and this imbalance passes through the neutral conductor. Thus, an algorithm that can consider this imbalance is needed for load distribution. The Backward Sweep (BS) method was used in the present

study for load distribution, which was implemented in three steps and according to a single-line diagram (as shown in Fig. 2).
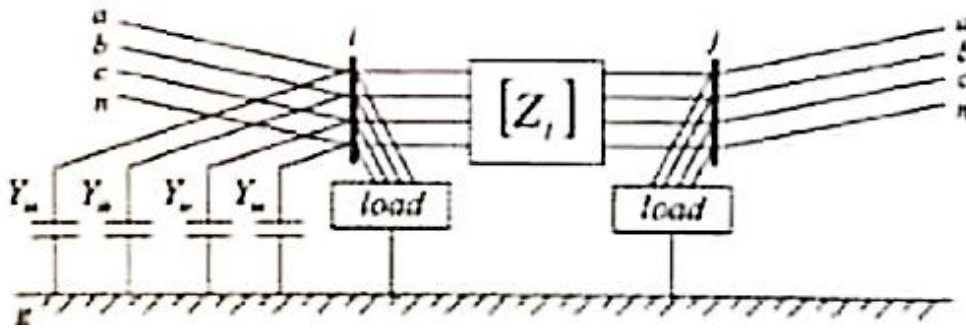
Figure 2 – A section of the low-voltage four-wire network

In the load distribution algorithm, the three phases of each node or part of the line are defined by a single index, regardless of the number of phases of these nodes or lines. Fig. 4 shows distribution L between nodes i and j with shunt impedance, Z_L, and nodes load.

$$Z_L = \begin{bmatrix} Z_{aa} & Z_{ab} & Z_{ac} & Z_{an} & Z_{ag} \\ Z_{ab} & Z_{bb} & Z_{cb} & Z_{nb} & Z_{bg} \\ Z_{ca} & Z_{cb} & Z_{cc} & Z_{cn} & Z_{cg} \\ Z_{an} & Z_{nb} & Z_{nc} & Z_{nn} & Z_{ng} \\ Z_{ag} & Z_{gb} & Z_{gc} & Z_{gn} & Z_{gg} \end{bmatrix} \qquad (5)$$

Where,

a,b,c: Phase lines

n: Neutral conductor

g: Earth

If each of the phases, neutral conductor, or related earth does not exist, the corresponding rows and columns in the matrix will be all "0". The capacity of the shunt LV can be omitted.
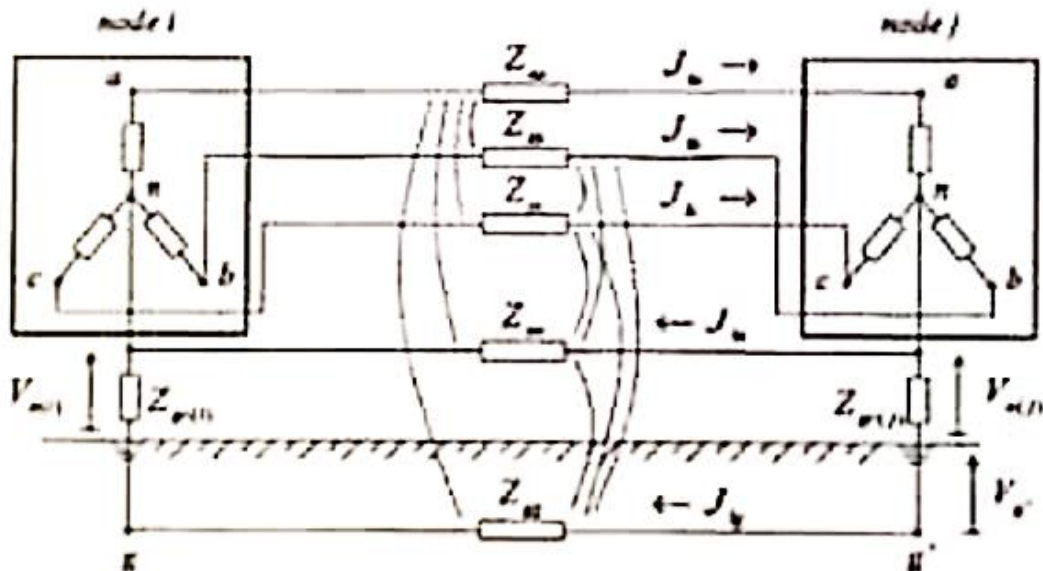
Figure 3 – Four-wire network model

Step 1: Calculation of the currents

$$
\begin{bmatrix} J_{ia} \\ J_{ib} \\ J_{ic} \\ J_{in} \\ J_{ig} \end{bmatrix}^{(K)}
=
\begin{bmatrix} \left(\dfrac{S_{ia}}{V_{ia}}\right)^{(k-1)^*} \\[6pt] \left(\dfrac{S_{ib}}{V_{ib}}\right)^{(k-1)^*} \\[6pt] \left(\dfrac{S_{ic}}{V_{ic}}\right)^{(k-1)^*} \\[6pt] \dfrac{Z_{ig}}{Z_{nin+Z_{ig}}}\left(S_{ia}^{(k)} + I_{ib}^{(k)} + I_{ic}^{(k)}\right) \\[6pt] \dfrac{Z_{nin}}{Z_{nni+Z_{gi}}}\left(S_{ia}^{(k)} + I_{ib}^{(k)} + I_{ic}^{(k)}\right) \end{bmatrix}
\begin{bmatrix} Y_{ia} & & & & \\ & Y_{ib} & & & \\ & & Y_{ic} & & \\ & & & Y_{in} & \\ & & & & 0 \end{bmatrix}
\begin{bmatrix} V_{ia} \\ V_{ib} \\ V_{ic} \\ V_{in} \\ V_{ig} \end{bmatrix}^{(K-1)}
\qquad (6)
$$

Where,

I_{ia}, I_{ib}, I_{ic}: The Injected currents to the ith busbar

S_{ia}, S_{ib}, S_{ic}: The apparent power of electricity subscribers in the ith busbar

V_{ic}, V_{in}: V_{ib}, V_{ia}: The voltages of ith busbar

Y_{ic}, Y_{in}: Yib, Yia: Admittance of shunt elements of ith busbar

Z_{gri}: Earth impedance in i-th busbar, which $Z_{gi}=Z_{gri}+Z_{ggi}$

Step 2: Calculation of the lines current

At this step, as known, the process starts from the last layer (or bottom line) and goes back, and the current of each line is equal to the sum of the currents of the lines that are in front of it.

$$
\begin{bmatrix} J_{ia} \\ J_{ib} \\ J_{ic} \\ J_{in} \\ J_{ig} \end{bmatrix}^{(K)}
= -\begin{bmatrix} I_{ia} \\ I_{ib} \\ I_{ic} \\ I_{in} \\ I_{ig} \end{bmatrix}^{(K)}
+ \sum_{m \neq M} \begin{bmatrix} J_{ma} \\ J_{mb} \\ J_{mc} \\ J_{mn} \\ J_{mg} \end{bmatrix}
\qquad (7)
$$

J_{ib}, J_{ia}, J_{in}: Current in the ith line

M: The number of lines in front of the J-th busbar

Step 3: Calculation of the busbars voltage

$$
\begin{bmatrix} V_a \\ V_b \\ V_c \\ V_n \\ V_g \end{bmatrix}^{(K)}
= \begin{bmatrix} V_a \\ V_b \\ V_c \\ V_n \\ V_g \end{bmatrix}^{(K)}
- \begin{bmatrix} Z_{aa} & Z_{ab} & Z_{ac} & Z_{an} & Z_{ag} \\ Z_{ab} & Z_{bb} & Z_{cb} & Z_{nb} & Z_{bg} \\ Z_{ca} & Z_{cb} & Z_{cc} & Z_{cn} & Z_{cg} \\ Z_{an} & Z_{nb} & Z_{nc} & Z_{nn} & Z_{ng} \\ Z_{ag} & Z_{gb} & Z_{gc} & Z_{gn} & Z_{gg} \end{bmatrix}
\begin{bmatrix} J_{ia} \\ J_{ib} \\ J_{ic} \\ J_{in} \\ J_{ig} \end{bmatrix} .(K)
\qquad (8)
$$

Where,

Z_{aa}, Z_{bb}, Z_{cc}, and Z_{nn}: The lines impedance of the phases and the neutral conductor.

Voltage correction

Voltage correction should be done in busbars with earthed neutral and downstream busbars. Voltage in busbars with earthed neutral for k[th] repetition is defined as follows:

$$V_{in}^k = Z_{gn} j_{lg}^{(k)}, i \in \{Grounded\ nodes\} \qquad (9)$$

The above steps continue until the error value specified for the power is less than a value defined by us.

Optimization using Particle Swarm Optimization (PSO) algorithm
History of the PSO algorithm:

Particles swarm optimization by birds algorithm is an optimization technique based on collective intelligence and acts according to the initial answers. This technique was first developed by Eberhart and Kennedy in 1995 based on the social behavior of flocks of birds and fishes.

Optimization using the PSO algorithm

In many cases, this technique acts similar to evolutionary computational techniques like Genetic Algorithms (GA). In this algorithm, the system starts to run with some initial answers and tries to find the optimal answer by moving or dislocating these answers during successive repetitions. Unlike genetic algorithms, the PSO algorithms do not include evolutionary operators such as mutations or crossover (recombination). The problem answers in the PSO (particles) are the search space to find the optimal results for a system. The PSO algorithm acts based on the social behavior of a flock of birds. To better understand this technique, the following scenario is considered: "A flock of birds randomly search for food in a certain area. There is only one piece of food in this area, while the birds do not know the location of the food, but they know their distance from the food location at each moment." In this condition, a proper strategy to find the exact location of the food is to follow the bird that is closer to the food than other birds. The PSO algorithm is inspired by such a scenario and offers a solution for the optimization of the problems. In the PSO algorithms, each bird acts as a solution to a problem. All available answers have a competency value that is obtained from the function defined for the problem. The fundamental of this technique is to find the location with the best competency in the problem space. This value has a direct impact on the speed of movement of these birds from problem answers to the location (optimal answer).

Introducing the PSO method

The basis of this method is to find the optimal solution using the particle swarm. Each particle is a candidate and represents a solution to the problem. Some of the interesting features of the PSO method are (i) simplicity, and (ii) high speed compared to other evolutionary methods such as a genetic algorithm. In the PSO algorithm, there is a swarm of "m" particles, in which each particle "i" with a mass of mi has a location of Xi(t) and speed of Vi(t) in a D-dimensions search space.

$$Pop(t) = (x_1(t), x_2(t), \dots, x_n(t)\} \qquad (10)$$
$$V_i = (v_{i1}, v_{i2}, \dots, v_{lN}\} \qquad (11)$$
$$X_i = (x_{i1}, x_{i2}, \dots, x_{lN}\} \qquad (12)$$
$$Pbest_i = [Pbest_{i1}, \dots, Pbest_{1N}] \qquad (13)$$
$$Gbest_i = [Gbest_{g1}, \dots, Gbest_{gN}] \qquad (14)$$
$$V_i^{l+1} = W.V_i^l + C_1.Rand(0.1).(Pbest_i - X_i^l) + C_2.Rand(0.1).(Pbest_g - X_i^l) \qquad (15)$$
$$V_i^{l+1} = X_i^l + +V_i^{l+1} \qquad (16)$$

(a) Particle swarm (pop (t)): "m" particles that are initially randomly located and lead the function to the optimal answer.

(b) P_best: This parameter indicates the best location that each particle has gained during the algorithm execution.

(c) **G$_{best}$**: This variable indicates the best location that all the particles have gained during the algorithm execution.

(d) **Personal recognition (C$_1$)**: This coefficient causes the particle to move due to Pser to the best location which it has ever gained.

(e) **Global recognition parameter (C$_2$)**: This coefficient causes the particle to move towards GBest, the best location that all the particles have ever gained.

(f) **Inertia coefficient/mass coefficient (W)**: This coefficient leads to the balance in local and global searching in the algorithm.

(g) **Speed (V)**: This parameter shows the change in location of the particle in the search space. The path of the particle movement is shown in Fig. 3. As can be seen in Fig.3, the location of the particle at the next moment is determined using the two parameters "Pies" and "Guest". The third effective factor in the determination of the future location of the particle is the previous speed of the particle. These three factors together determine the future location of the particle. In other words:

$$V_i^{l+1} = X_i^l + + V_i^{l+1} \qquad (16)$$
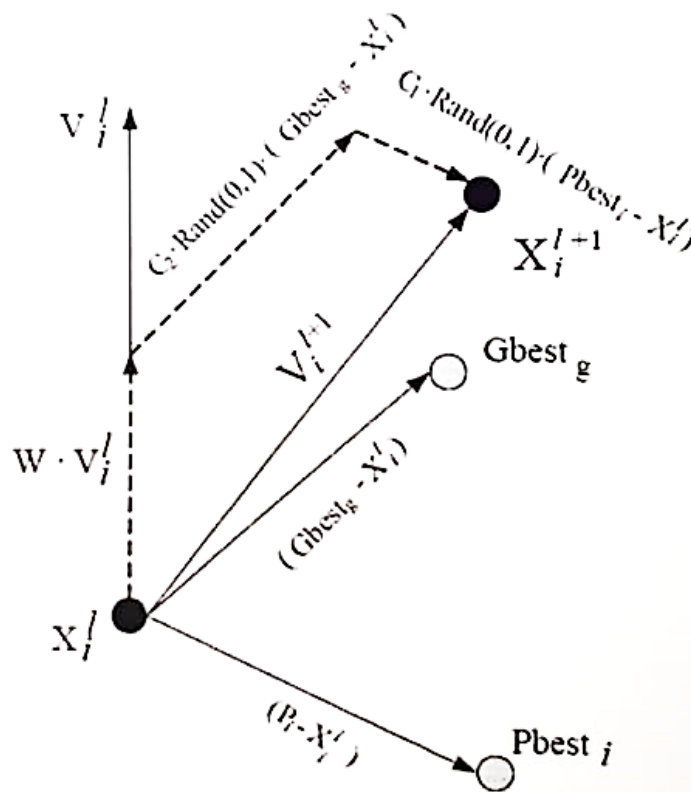
Figure 4 – Mechanism of the PSO algorithm

Hence, if C2≫C1, the particles tend to Gbest (global-best positions). Whereas, if C1≫C2, particles tend to Pbest (personal-best positions). In this case, to have an average state, it must be C1 = C2. In this case, the tendency to reach Pbest and Gbest will be equal. If C1 and C2 are large values, the speed of reaching the optimal points will increase, whereas the accuracy of calculating the optimal point will decrease and the probability of fluctuation in the calculation of optimal points in this algorithm will increase. On the other hand, if the values of C1 and C2 are small, the accuracy of calculating the optimal point will increase, whereas the speed of reaching optimal points will decrease. In general, the condition C1+C2 ≥ 4 is established for C1 and C2. Normally, C1 = C2 = 2/05 is considered to meet these two conditions (speed and accuracy). The inertia coefficient or mass "W" leads to reaching the optimal point. The small values of W cause slow move-

ment (displacement) of points, and so, the search space becomes small. On the other hand, the large values of W, result in a large range of movements, and so, search space becomes large. If W = 0, the particle swarm reaches the endpoint with a highly accurate. If W = 1, the particle swarm reaches the endpoint, slowly. Thus, when running the algorithm, small values of W lead to rapid convergence in an optimal local location while large values of W prevent convergence. Normally, in the running the PSO algorithm, the value of W must be adjusted during the training and reduced linearly from 1 to near 0. The following equation is used to set W.

$$\omega = \omega_{max} - \frac{\omega_{max} - \omega_{min}}{Iter_{max}} \times Iter \qquad (17)$$

$Iter_{max}$: The maximum number of repetitions

$Iter$: The current repetition number

ω_{max} : The maximum value of the inertia coefficient

ω_{min} : The minimum value of the inertia coefficient

The problem of optimal planning and formulation for home appliances

In this section, the planning of appliances performance is formulated and presented using linear planning mixed with integers and binary variables. The proposed solution is represented below.

Problem specifications

For planning, a set of appliances is specified with a number of "N" and their specifications are determined based on "i" (from 1 to N). The amount of power of the appliances is different and its amount is specified in section "k".

Determinant variables

The unit of P_{ij}^k is kWh. By multiplying it by a factor (15/60=0.25), it can be represented in a unit of kW. P_{ij}^k is the actual (or active) value of the load. In addition to P_{ij}^k, an auxiliary binary variable is needed to determine the load processing. The binary determinant variables are shown as $X_k^{ij} \in \{0,1\} X_k^{ij} = 1$. For example, appliance "i" with a phase of load "j" is processed at the time of part "k", otherwise $X_k^{ij} = 0$. Similarly, we can show other binary auxiliary variables with $S_k^{ij} = 0$ that the processing for appliance "i" with a phase of load "j" is performed at time "k". This shows that X_k^{ij} and S_k^{ij} are complementary, and the binary variables are $X_k^{ij} = 1$ and $S_k^{ij} = 1$, for example:

$$X_k^{ij} + S_k^{ij} = 1 \quad \forall I_{i,j,k}$$
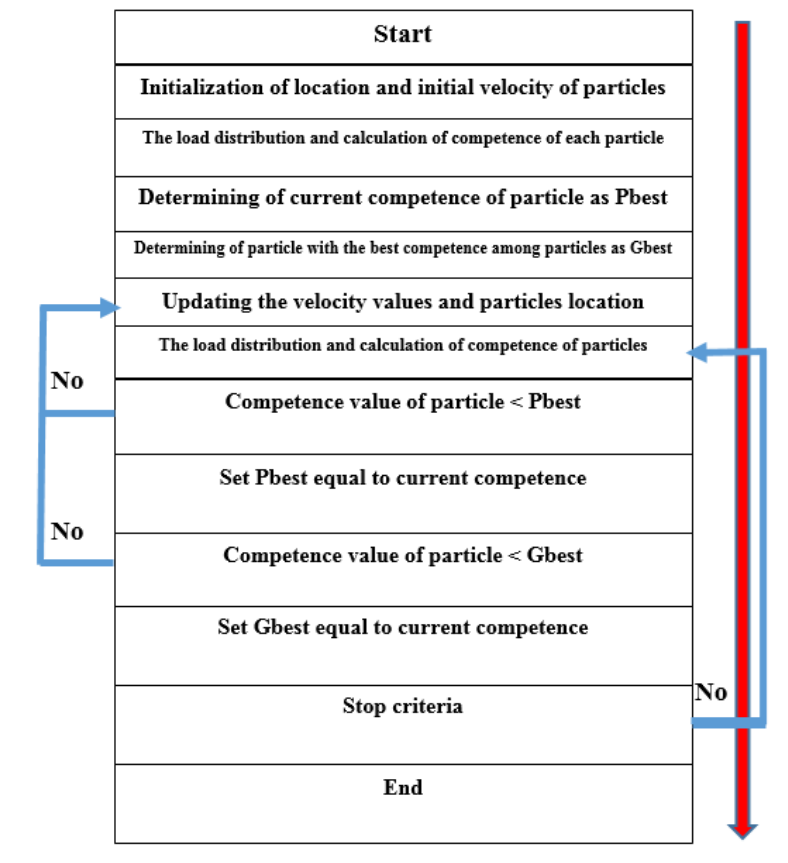
Figure 5 – The proposed flowchart for the PSO algorithm

Results

The test network used in the present investigation was a low-voltage network located in Mosian city (south of Ilam province). This city has 26 bases and its single-line diagram is shown in Fig. 6. Table 1 shows the values of the PSO parameters. Before running the algorithm, the load balancing was performed in the test network, and the loads were divided equally between the different phases. The optimization results are listed in Table 2. According to Table 2, bases of 4, 9, 13, 17, 30, and 42 were diagnosed to be suitable for installing the earthing system. Finally, it was founded that the loss rate has been reduced from 2579 W to 1922 W.
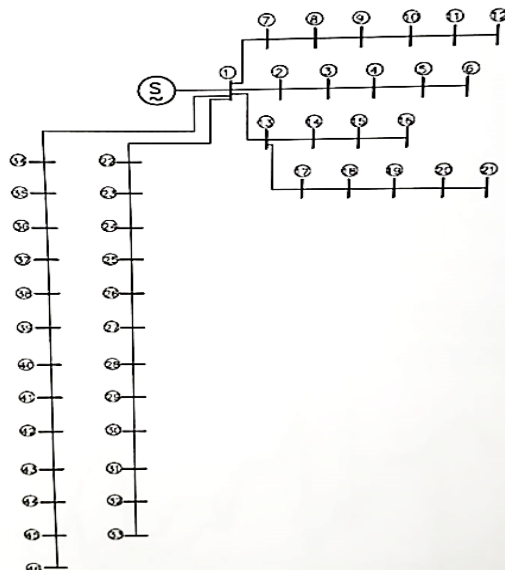
Figure 6 – Network

Table 1

Parameters of the PSO setting

Parameter	Value
Number of sub-swarm	46
Number of particles	0
Maximum coefficient value	0.9
Minimum coefficient value	0.2
C_2 وC_1	2
The number of repetitions	50
Every initial speed of every generation	30

Table 2

Results of optimal selection of earthing system location

Voltage balance index	Losses	Location of bases
0.119	1922	4,9,13,17,30,42

The voltage diagram of the neutral conductor at the foundations (bases), before/after installing the earthing system is shown in Fig. 7. As shown, the neutral voltage has decreased after installing the earthing system.
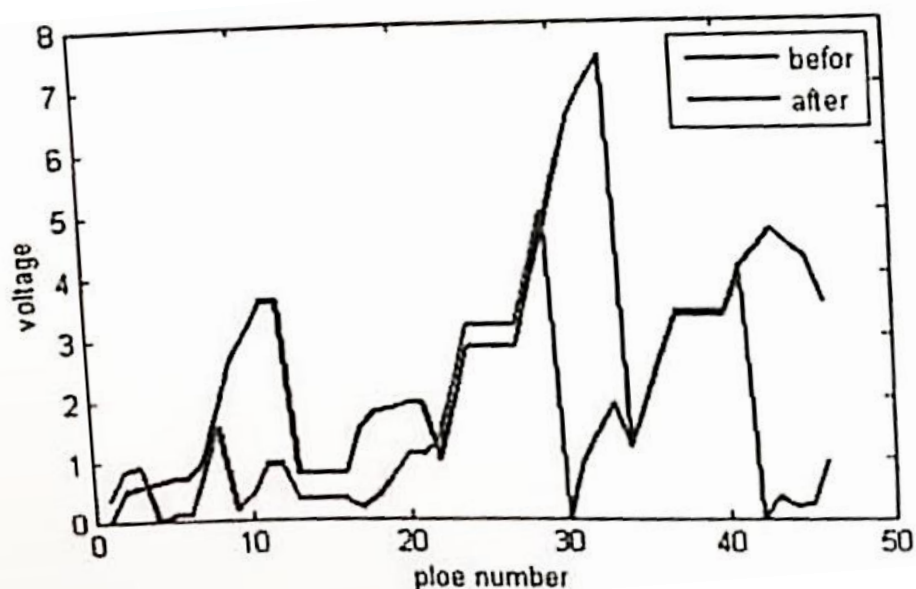
Figure 7 – The neutral voltage before/after installation of the earthing system

The imbalance index for the foundations (bases) before and after the installation of the earthing system is shown in Fig. 8. According to Fig. 8, the amount of imbalance has decreased after the installation of the earthing system. The total imbalance index before the installation of the earthing system was equal to 0.1235, which decreased to 0.119 after the installation of the earthing system.
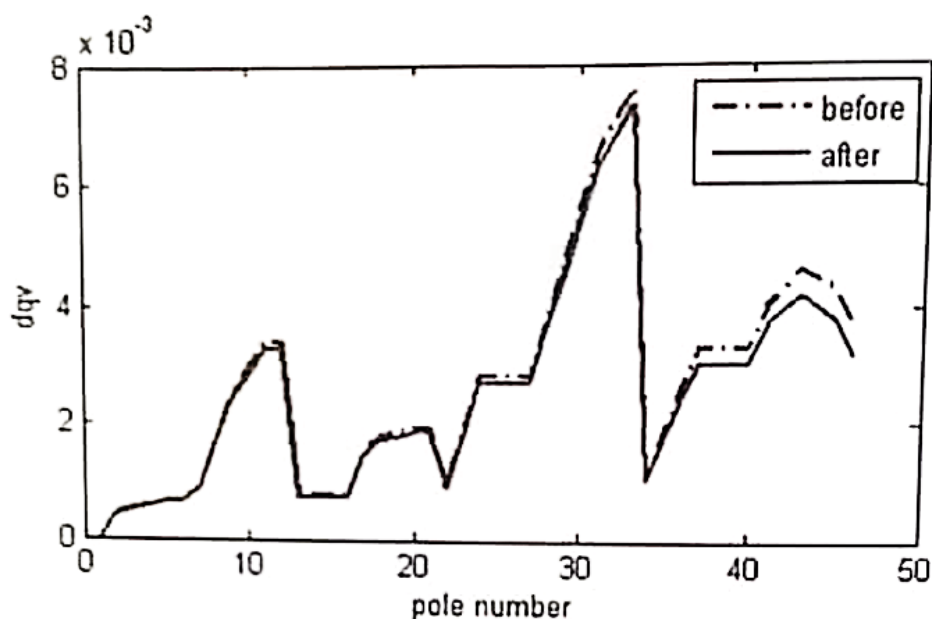
Figure 8 – Voltage imbalance index before/after installation of the earthing system

Conclusions

Since reducing losses and balancing network voltage is one of the main aims of electric power distribution companies, so locating an electrical erarthing system for this purpose can lead to useful results. Hence, it is suggested that by practical implementation of results of simulation and calculations of losses and voltage balance in similar networks, this method can provide high-quality and reliable electricity to all subscribers.

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SPEECH IDENTITY RECOGNITION USING ARTIFICIAL NEURAL NETWORK AND SUPPORT VECTOR MACHINE ALGORITHMS

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ABSTRACT

This study sought to recognize the identity of individuals from their sounds using artificial neural network (ANN) and support vector machine (SVM) algorithms. The speaker recognition was text-independent, which is an exceedingly complex task. Typically, attempts at speech recognition are narrower than other areas of speech processing. As the research innovation, speech recognition was accomplished using multiple features extracted from the acoustic signals. The classification was based on the ANN algorithm and the SVM classifier. Notably, the whole process was evaluated using grid data. In this study, a new text-independent speech recognizing system was proposed. The features selected included Mel-Frequency Cepstral Coefficients (MFCC), energy, and first- and second-order derivative features. The proposed system worked based on the Perceptron neural network and the SVM. At the best state, the system's recognition accuracy for 15 speakers (10 males and five females) was 99.2%.

Keywords: speaker recognition; MFCC; artificial neural network (ANN); speech processing; support vector machine (SVM).

Introduction

Humans are differentiable by the discrepancies in their voices. The majority of distinction between the speeches of individuals arises from the shape and size of the sound-producing organs, and the remaining portion is due to diverse diction. Besides anatomical features, properties such as dialect and accent, vocabulary, speech speed, and other personal habits (e.g., emotions) contribute to speech variety. Speech voice can be quickly recorded by various devices or transmitted over telecommunication channels. Other technologies and capabilities such as Skype, Google Talk, and Google voice search have further attracted researchers' attention to speech processing.

Speaker recognition is among the most popular and crucial speech processing applications. It helps isolate sound-producing sources, recognizes speakers in meetings, and is helpful in employee attendance systems. These applications are usually multi-user. In multi-user places such as the Internet and cases of an extensive archive of speeches of many individuals, a powerful search engine to find certain speeches is crucial for speech recognition systems.

Speaker recognition is an identity recognition technique based on biometric properties, recognizing and monitoring humans from their speech signals. These methods suffer from problems, including channel and microphone variety and unstable speaker's health, speech, and physical conditions. Therefore, compensating for these problems leads to a mismatch between training and testing results (Kenny et al., 2007a; Vogt & Sridharan, 2008). Several recently proposed techniques are available to solve these problems when designing speaker recognition systems, which can largely contribute to fixing issues in this area (Mokgonyane et al., 2019; Singh et al., 2020). Speaker recognition covers two main domains, text-dependent, where the text is similarly voiced in both training and testing phases, and text-independent, in which the speaker can speak any word or sentence. Interestingly, the restrictions on text-dependent systems have promoted

their accuracy. In addition, text-independent speaker recognition is more challenging to implement.

Speech signal identity recognition has many advantages. There is no need for the individual in person. For instance, the system can recognize the person's voice in monitoring applications even when an obstacle exists between the person and the sensor (microphone). Or, for online banking affairs using smartphones, the user's identity is verified only from the received voice. This task does not require special equipment and needs standard microphones mounted on various devices such as mobile phones and laptops. Models utilized to show the speakers are available in pattern-based and probability-based categories. Pattern-based models are more straightforward, such as the dynamic time-wrapping (DTW) method (Kim et al., 2018) and vector quantization (VQ) (Todkar et al., 2018). Statistics-based models include the Gaussian mixture model (Chakroun & Frikha, 2020) and the hidden Markov model (HMM) (Li et al., 2019).

Speaker recognition encounters multiple challenges, including environmental noise, channel noise, emotions during speaking, and sound recording systems with different qualities, diminishing the recognition systems' accuracy.

Noise is among the factors that significantly reduce the efficiency of speaker recognition systems. It reduces system performance at both aligned and non-aligned modes. Therefore, speech recognition has explicitly addressed the noise problem (Ming et al., 2007). Thus, achieving a proper solution to fix these obstacles and provide measurable results even in the presence of these problems has persistently been a subject of interest.

This study deals with text-independent speaker recognition with associated critical conditions and complexity. Typically, works on speech recognition are more limited than other areas of speech processing. As the research innovation, speech recognition was accomplished using multiple features extracted from the acoustic signals. The classification was based on the ANN algorithm and the SVM classifier. Notably, the whole process was evaluated using grid data.

Evaluation of the proposed algorithm
1. Database

The database utilized in this study has been designed by scholars at the University of Sheffield in the UK. This database is freely released, known as Grid, and is among the limited accessible databases available to researchers. Grid is a multi-purpose database designed to collect and provide data to develop speech recognition systems through individual speechreading. The database contains 1000 short one-second sentences from 34 speakers (18 males and 16 females). Grid enables implementing other scenarios such as gender recognition or speaker recognition. This study employed 15 speakers to evaluate the system (five females and ten males). The speaker recognition systems were designed using 6 to 12 seconds speeches, while speaker recognition was carried out using one-second sentences. The designed database was a high-quality signal, having a 24-bit rate and a sampling frequency of 25 kHz. In creating the speaker recognition system, 700 sentences were used to teach the system, and 300 one-second sentences were utilized to evaluate the system.

2. Evaluation criteria

Word recognition rate (WRR) is a criterion utilized in many speech recognition systems. In a multi-class categorizing system, each output denotes one of the categories $i \in \{1, ..., K\}$. The ith output rate indicates the probability of $P(i \mid o)$, implying that the test vector O belongs to the ith category. The accuracy and efficiency of speaker recognition systems are based on the WRR criterion, indicating the ratio of the system's correct diagnoses to all diagnoses, as follows:

$$WRR = \frac{\text{Accurately diagnosed expressions}}{\text{All the test expressions}}$$

3. Feature extraction

Mel-Frequency Cepstral Coefficients (MFCC) feature extraction is a popular method in speech recognition systems. MFCC enables extracting signal push information, which is critical in speech processing. The signal, which refers to the human speech, is first split into 25 ms frames. These frames are extracted in 10 ms steps to avoid omitting any information from the audio signal by overlapping. Besides these features, using the energy feature and the transient signal information obtained by the first and second derivatives is helpful.

The other feature utilized in this study is the energy of each frame, which is obtained based on the amount of each sample in the frame. Accordingly, besides 12 MFCC features, one energy feature is extracted for each frame, implying the extraction of 13 stationary features from each frame.

4. Proposed MFCC based system

The block diagram of the speaker recognition system is illustrated in Figure (1).
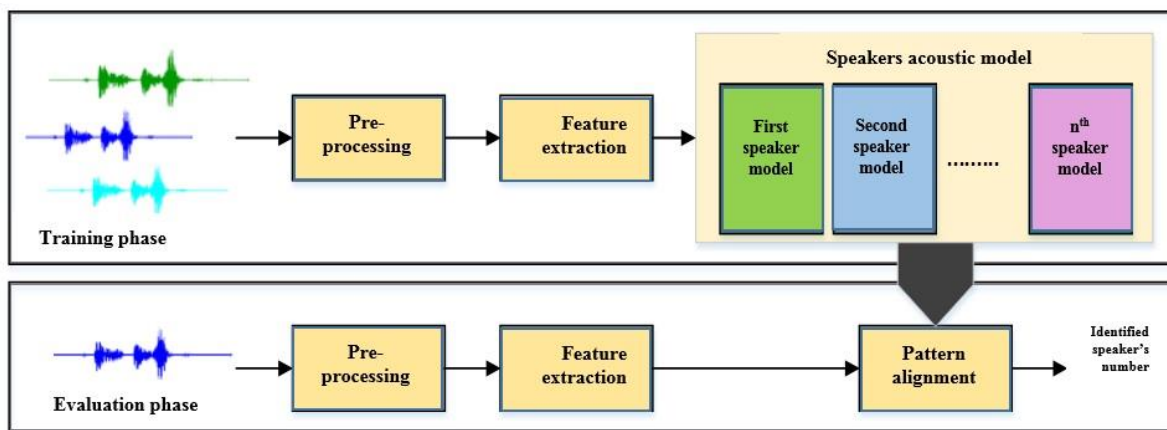
Figure 1 – Block diagram of the speaker recognition system

In this method, each speaker is trained by a separate model using the ANN in the training phase. Following constructing the acoustic model of each speaker, the desired features are extracted for each acoustic file in the evaluation stage and are aligned to the acoustic models of each speaker. The model having the highest output score is identified and selected as the recognized speaker. The ANN employed contains neurons in its output layer equal to the number of speakers, where displaying each neuron indicates recognition by the system. According to studies, selecting three consecutive frames in the ANN input layer achieves the best performance. Thereby, the number of input neurons is three times the number of features extracted from each frame. The middle or hidden layer is the system's central processing unit, where each category is learned and modeled. According to investigations, 1000 hidden neurons best compromise performance, accuracy, and computational complexity.

The first proposed system was designed using MFCC features and the ANN algorithm. This feature was extracted in two forms, i.e., extracting 39 and 12 features from each frame separately. The Block diagram of the proposed system is shown in Figure (2).
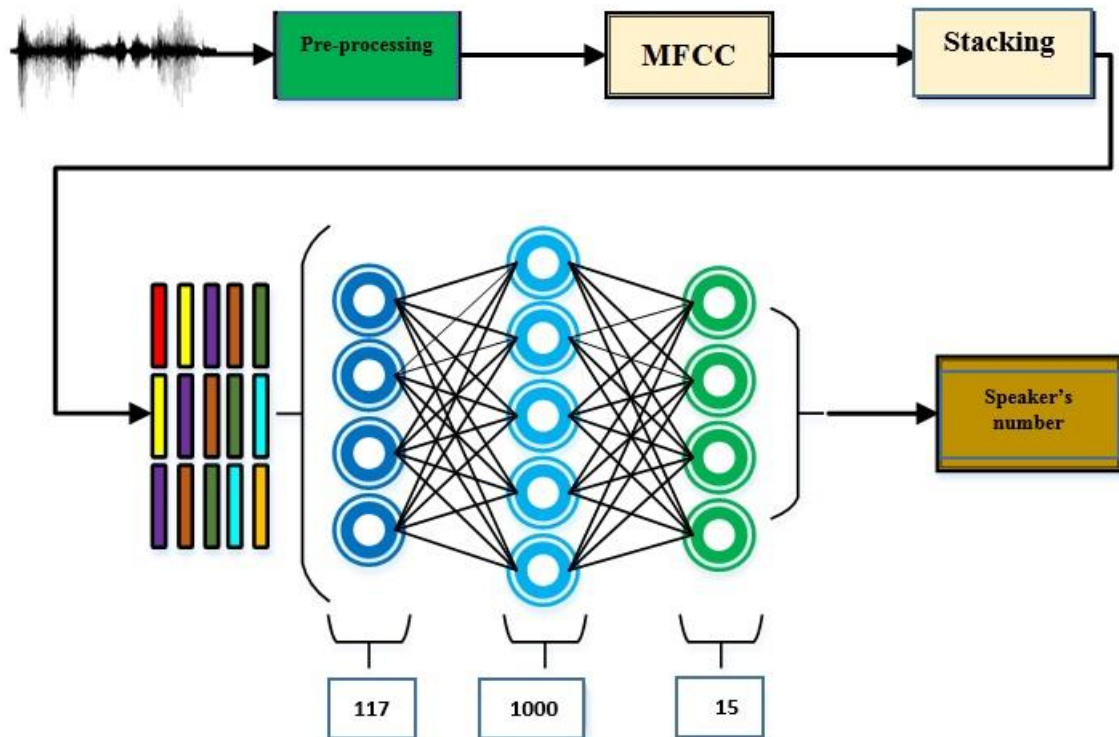
Figure 2 – Block diagram of the MFCC-based system

Table 1 gives the results relevant to the MFCC-based system.

Table 1

Recognition rate (%) for each speaker in the MFCC-based system

Speaker's no.	MFCC 12	MFCC 39
1	100	100
2	89.3	100
3	74	98.8
4	100	100
5	95	98.6
6	100	100
7	100	100
8	95	97.3
9	92.6	100
10	100	100
11	93.3	99.6
12	95.6	100
13	94.6	98.6
14	90.6	97
15	91	97.6
Mean	94.1	99.2

According to the results, the proposed system had many errors in some categories, reducing system efficiency. Thus, the system's overall recognition accuracy was 99.2%. A decrease in system accuracy is due to its non-optimal features. Table 2 summarizes the system results.

5. The proposed SVM-based system

The SVM-based system parameters are the same as the previous, but the system is delivered to an SVM for categorizing after extracting the MFCC features and stacking. This study employed Gaussian and binary functions as the backup vector kernels. The proposed system is shown in Figure (3).
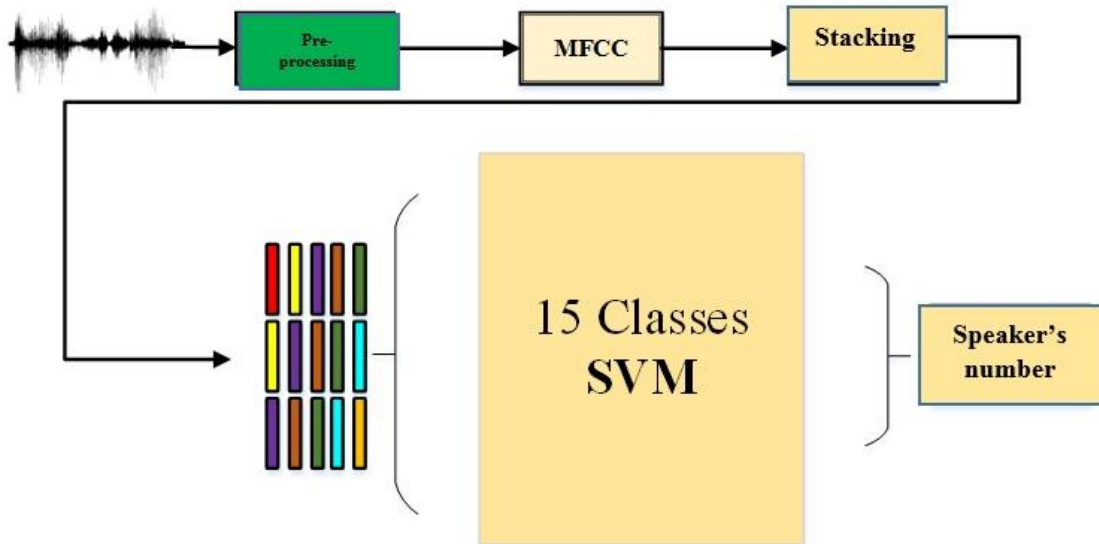
Figure 3 – The use of SVM in the proposed system

Table 2 presents the results of the proposed systems. As given in Table 2, the proposed system, having a Gaussian kernel function, possesses a better performance with its recognition accuracy of 95.73%, indicating that using the Gaussian function can better model the behavior of features.

In the first scenario, 39 features had the best performance. The SVM-based system only employed 39 features. The system performance was improved significantly when using the ANN algorithm with 39 features, with an accuracy of 99.2%, which is acceptable among speaker recognition systems.

Table 2

Speaker recognition (%) in the SVM-based recognition system

Speaker's no.	Gaussian kernel	Binary kernel
1	100	100
2	96.9	91.6
3	92.3	90.4
4	100	96.6
5	90.9	86.6
6	92.4	89.3
7	93.7	87.3
8	96.4	91.6
9	100	99.3
10	99.3	95.3
11	88.3	86.9
12	100	100
13	89.6	86.4
14	96.6	92.6
15	99.6	96.3
Mean	95.73	92.8
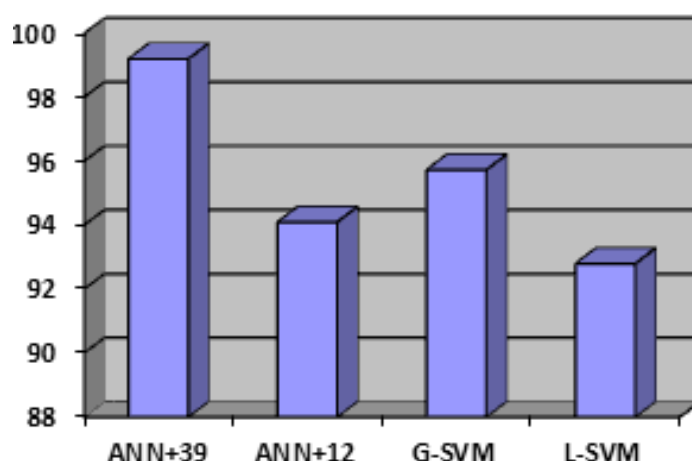
Figure 4 – Comparison of the proposed systems

Table 3

Computation duration of the speaker recognition system for 15 speakers

	MFCC ANN 12	**MFCC ANN 39**	**Gaussian SVM**	**Logical SVM**
Processing duration (s)	10.62	12.17	6.2	6.7

6. Computation duration

The simulations were carried out in a system powered by a core i7 processor and 8GB of RAM. The computational duration for each system was obtained by averaging the processing durations in each case. Table 3 gives the computational period in seconds, i.e., the course takes for the system to process all 300 files. When using the ANN algorithm, the system needs more time to process.

7. Comparison

Table 4 compares the results of the proposed method with those reported in other studies. The proposed system has achieved better results using more appropriate and efficient features and more robust categorization.

Table 2

Comparison of the proposed method with those reported in other studies

Methods	**Features**	**Number of speakers**	**Recognition (%)**
GMM-based method (Barker et al., 2010)	MFCC	12	98.2
Decision-making threshold (DMT) based method (Hollien et al., 2016)	Based frequency Transient feature vowel letters spectrum	10	98.5
Deep learning based method (Damirchi et al., 2021)	MFCC	15	99.8
The proposed method	MFCC + ANN	15	99.2

Conclusion

Concerning previous research, this study proposed a system to recognize the speaker where the number of speakers has increased to 15. A system was first proposed based on the ANN algorithm and MFCC features. It was restricted to deciding on the speaker's speech signal within 1 s, which is a short evaluation period. Designed for 15 speakers, the system was trained using a fragment of the Grid database. First, the developed system was evaluated using MFCC features and the ANN algorithm, achieving a recognition accuracy of 99.2%. It was then assessed using MFCC features and an SVM as a classifier, achieving a recognition accuracy of 95.73% at best. By comparison, the best computational duration was achieved when using the SVM-based recognition system.

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SIMULATING THE CURRENT-VOLTAGE OF SOLAR CELLS AND INVESTIGATING THE EFFECT OF THICKNESS AND ELECTRON AFFINITY OF SILICON CARBIDE NANOCRYSTALS ON THE EFFICIENCY OF SOLAR CELLS

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ABSTRACT

Over the past few years, silicon solar cells have become one of the most widely used solar cells, due to the desired efficiency and simplicity employed in their design and construction. The objective of this study was to simulate the current-voltage of solar cells and evaluate the effect of thickness and electron affinity of silicon carbide nanocrystals on the efficiency of solar cells. Finally, it was concluded that the use of silicon carbide nanocrystals as a window layer leads to an increase in dark conductivity and band gap, which in turn can improve the efficiency of solar cells. To be more specific, the effect of fabrication parameters and electronic parameters, i.e. layers thickness and doping on the selected model NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) was evaluated. Finally, efficiency (η) = 21.01%, fill factor (FF) = 83.12%, short circuit current density (Jsc) = 38.5mA / cm2, open-circuit voltage (Voc) = 663.1 mv, and quantum efficiency in 400 to 1000 nm range were obtained, which are significantly superior to previous introduced structures. In light of the above, it was found that the use of NC-SiC: H (n-type) as an emitter layer leads to increased efficiency.

Keywords: solar cells; silicon carbide nanocrystal; quantum efficiency; thickness; electron affinity.

Introduction

The first silicon solar cell based on direct light was designed by Calvin Fuller, Gerald Pearson, and Daryl Chaplin in 1954 with an efficiency of about 6% and used in applications related to space satellites. Some references have attributed the invention of the first silicon solar cell with an efficiency of less than 1% to Rasel (1941) [1, 2]. In 1996, IMT began engineering research in this field and accelerated the study of silicon nanocrystalline as an excellent material for the fabrication of transistors and photovoltaics [3]. Basically, the absorption coefficient plays a vital role in the structures of solar cells. According to the experimental results, the absorption coefficient of silicon nanocrystals is more than twice that of silicon crystals [4].

In 2009, Garoufalis and Zdetsis calculated the optical band gap and the absorption spectrum of nanoparticles very accurately. They proved that the details of absorption and diffusion properties of nanoparticles can be described by considering the surface regeneration effect. At the same time, they investigated the effect of oxygen pollution on improving the absorption and diffusion properties of nanoparticles [5]. In 2011, Hamashita et al. introduced a new structure based on silicon carbide nanocrystals. In this structure, the p-type NC-SiC layer was deposited on the silicon crystal layer by a very high-frequency plasma enhanced chemical vapor deposition (VHF-PECVD) method by inserting an amorphous silicon layer to prevent the destruction of the silicon crystal layer [6]. In 2012, Hamashita et al. proposed a new structure using a p-type silicon carbide nanocrystal layer by reducing the thickness of the buffer layer with a better fill factor than the previous structure [7].

Silicon carbide nanocrystals absorb light easily at room temperature due to the effects of quantum confinement. The development of solar cells with optimal temperature and efficiency is possible by optimizing the size of silicon carbide nanocrystals. This study considers NC-SiC as an emitter layer. Because p-type needs further optimization, n-type NC-SiC is used as an emitter layer instead of p-type NC-SiC in the designed structure to increase the efficiency of the solar

cell. One-dimensional software called Automation for Simulation (AFORS) has been selected to run the simulation process. It should be said that this software developed specifically for simulating silicon solar cells, has a high simulation speed and a set of ready-made models.

Most researches in the field of efficiency improving third generation or nanocrystalline cells have used the p-type NC-SiC layer as an emitter layer but have failed to realize the desired efficiency. The use of n-type NC-SiC as the emitter layer in this study has led to an increase in overall efficiency and amplification of quantum efficiency at short wavelengths. In light of the above, the objective of the present study is to simulate the current-voltage of solar cells and evaluate the effect of thickness and electron affinity of silicon carbide nanocrystals on the efficiency of solar cells.

Model selection

The studied structures in this research are the p-type and n-type silicon carbide nanocrystals, which are fully efficient and cost-effective. Data were extracted using the Afors-Het simulator. Critical parameters and plots of the cell including energy spectrum, open-circuit voltage, short-circuit current density, fill factor, general efficiency, and quantum efficiency in standard radiation state are compared with an established model and finally, the desired model is selected.

In the structure of the first model, the P-Type NC-Sic: H with boron doping and N-Type silicon crystal are used in the emitter and the body, respectively. Accordingly, this model is named Al / Ag / ITO / NC-SiC: H (p) / a-SiC (p) / C-Si (n) / Al [8]. In the structure of the second model, n-type NC-SiC: H with phosphorus doping in meters and p-type silicon crystal with boron doping in the body are used. Due to the formed structure, this model is named Al / ITO / NC-SiC: H (n) / a-SiC (p) / C-Si (p) / Al. Before conducting experiments on the studied structures, a separate evaluation of each layer seems necessary. Each solar cell structure requires a set of metal contacts embedded at the top and bottom of the structure to transfer the electrons produced in the PN bond to the load. In these structures, Al metal is used to transfer the generated current to the load. Al deposition steps are often performed using the sputtering method. Although the Al generates a Schottky bond with silicon and in turn reduces efficiency, it can create a better bond to N-type and P-type semiconductors and is more cost-effective. In these structures, the ITO layer is used as a transparent conductor that allows light to pass through the PN bond. Figure (1) reflects this model as a set of hierarchical layers.
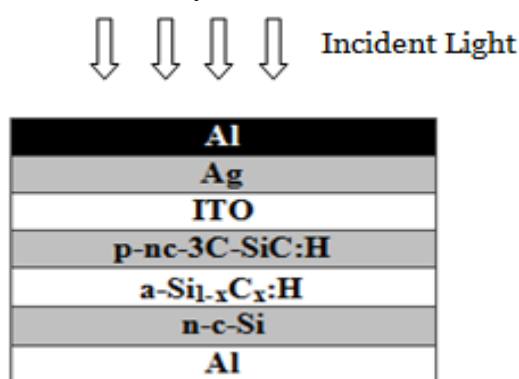
Figure 1 – Model 1: Al / Ag / ITO / NC-SiC: H (p) / a-SiC (p) / C-Si (n) / Al, structure intended to compare with the proposed structure in this research regarding efficiency improvement [8]

It should be said that in some structures Ag is also used as a conductor. The current-voltage plot for both structures is represented in Figure 2.
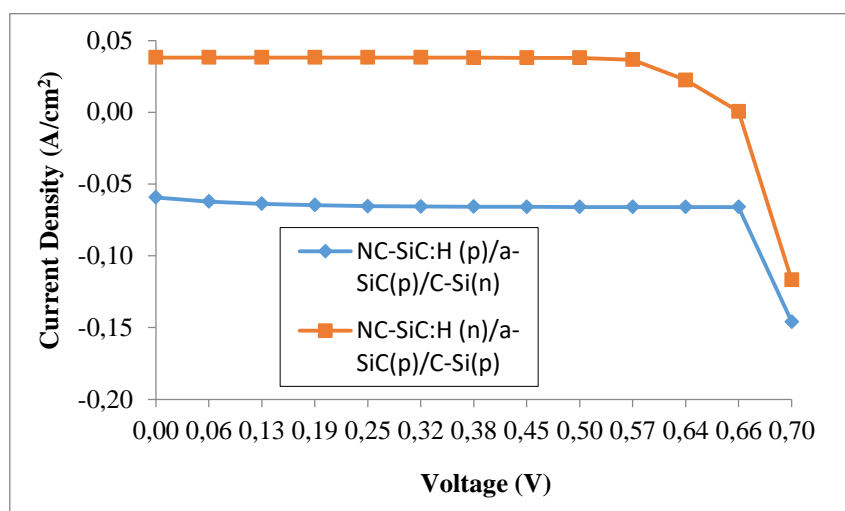
Figure 2 – Current-voltage plot for Al / Ag / ITO / NC-SiC: H (p) / a-SiC (p) / C-Si (n) / Al and Al / ITO / NC-SiC: H (n) / a-SiC (p) / C-Si (p) / Al structures

As a result, it is possible to cause effective damage due to the etching of hydrogen atoms on the surface of silicon crystals. To prevent damage, the $a - Si_{1-x}C_x$: H layer can be used as a passivation layer. In recent years, NC-SiC: H has attracted the attention of the industry due to its excellent electrical properties and better stability. Basically, it can be described as a biphasic material consisting of buried SiC crystals in an amorphous matrix with chain boundaries and void micro parts. At the same time, the excellent properties of microstructures such as high electrical conductivity, high stability, and good band gap have improved the performance of this material compared to other materials.

The carbon atoms in silicon carbide provide a greater degree of freedom to control the properties of the material. Increasing the carbon concentration widens the energy band gap between the conductivity and the capacitance and increases the efficiency of the solar cell. Also, the electronic properties of semiconductors are affected by the perturbation of the atomic lattice caused by the increase in carbon concentration. So solar cells with a layer of silicon carbide on the back of the cell have more flexibility than silicon. As a matter of fact, in the dark state, the short-circuit current density of the cell is almost zero due to the lack of electron-hole pair production. Under short-circuit conditions, the power delivered to the load is zero due to zero open-circuit voltage, even if the short-circuit current density is non-zero. At medium wavelengths, the absorption coefficient is smaller, and most carriers are produced in areas with a higher probability of absorption. This leads to increased quantum efficiency. Due to the long wavelength, only a small portion of the light is absorbed in the active region of a cell, reducing quantum efficiency. When photons do not have enough energy to produce an electron-hole pair the quantum efficiency drops to zero. The back surface field (BSF) increases the likelihood of absorbing generated carriers close to the surface of the back connection, which in turn increases the sensitivity to long wavelengths. The back connection of the cell can be designed as a reflector to provide conditions for absorbing longer wavelengths. Today, silicon crystalline cells have a passivation layer preventing recombination on surfaces. Also, the serrated surface and anti-reflection coating (ARC) in them help to absorb light.

The energy band plots of the two models of solar cells are shown in Figure 3. Energy band plots include conductivity band energy, capacitance band energy, Fermi energy level of electrons, and Fermi energy level of holes. Fermi energy levels are not shown in the figure due to a large number of levels. At the intersection of the two layers p and n, the layer curvature and the

empty area phenomenon are formed due to the high differences of the layers doping. Indices 1 and 2 in the figure represent the first and second models, respectively. As shown in the figure, at 1.83E-3 cm thickness, the curvature phenomenon of the bands is significant. The second model has more conductivity and capacitance band energy than the first model.
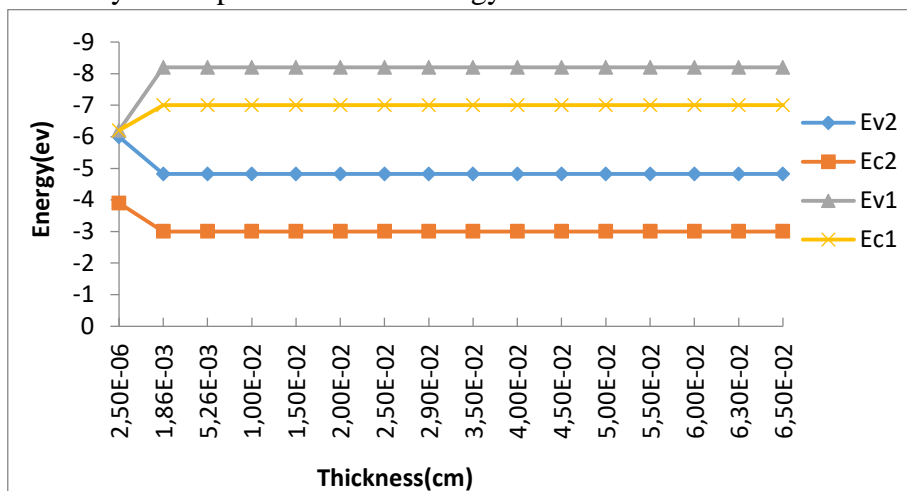
Figure 3 – Bands energy plots resulting from two introduced structures: (1) Al / Ag / ITO / NC-SiC: H (p) / a-SiC (p) / C-Si (n) / Al and (2) Al / ITO / NC-SiC: H (n) / a-SiC (p) / C-Si (p) / Al

Figure (4) shows plots of the external quantitative efficiency (EQE), internal quantitative efficiency (IQE) and internal modified quantitative efficiency (IQE1) of the two structures under study. The simulation results show that although the quantum efficiency of the first model cell is better than the second model, the performance of the second model regarding cell parameters is better than the performance of the first model. Both models have a high efficiency in the wavelength range of 3500 to 1050 nm.
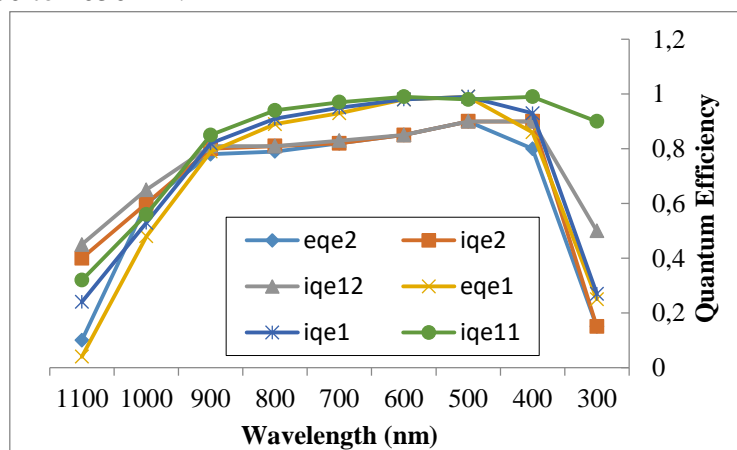
Figure 4 – Plots of external quantum efficiency (EQE), internal quantum efficiency (IQE) and modified internal quantum efficiency (IQE1) resulting from two structures Al / Ag / ITO / NC-SiC: H (p) / a-SiC (p) / C-Si (n) / Al and Al / ITO / NC-SiC: H (n) / a-SiC (p) / C-Si (p) / Al

As shown in Figure (4), the quantum efficiency in the wavelength range of 350 to 1050 nm is very significant in both models. This is one of the important advantages of silicon carbide nanocrystalline structures.

Another method to prevent C-Si corrosion is to reduce the deposition time of NC-SiC: H layer. The simulation parameters of the two models such as open-circuit voltage, short-circuit current density, fill factor and efficiency are compared in Table (1).

Parameters obtained from simulation of two structures Al / Ag / ITO / NC-SiC: H (p) / a-SiC (p) / C-Si (n) / Al and Al / ITO / NC-SiC: H (n) / a-SiC (p) / C-Si (p) / Al

Model	(mV) V_{OC}	J_{SC} (mA/cm²)	FF (%)	(%)η
1 - Al/Ag/ITO/p-nc-3C SiC:H/a-Si$_{1-x}$Cx H/n-c Si/Al	648	35.9	73	17
2- Al/ITO/ NC-SiC:H (n-type)/a-SiC(p-type)/C-Si(p-type)/Al	663.1	38.5	83.12	21.01

According to the results of the table, the structure of the second model has led to a more acceptable efficiency of 21.01% due to the amplification in the short-circuit current density, fill factor, and open-circuit voltage compared to the first structure. Therefore, Al / ITO / NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) / Al cell can be selected as the preferred cell.

Results

Current-voltage simulation of solar cell designed NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) under standard radiation conditions

Figure (5) shows the current-voltage simulation of a solar cell designed under standard radiation conditions (radiation spectrum of 1.5 AM, temperature of 27 ° C and radiation of one kilowatt per square meter). If the light is emitted to the structure a slight increase in voltage leads to a significant increase in current. After this sudden jump, the voltage rise leads to a slight increase in current.
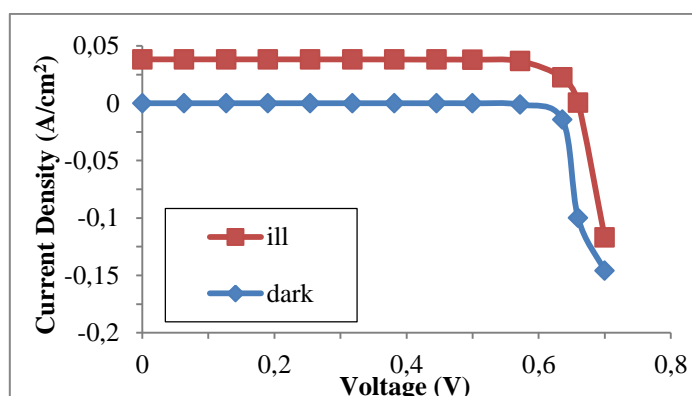
Figure 5 – Plot obtained from current- voltage simulation of solar cell NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) in the dark environment and under the radiation

Figure (6) shows the power plot of desired solar cell under the radiation. The maximum power point in standard working conditions is equal to 0.6 V. At the highest point of this figure, the maximum output power is obtained. The greater the distance from this point, the lower the output power, so that at voltages of 0 and 0.663 volts it goes to zero. In fact, there is only one special resistor extracting the most power from the solar cell. In other conditions, the output power does not reach its maximum value.
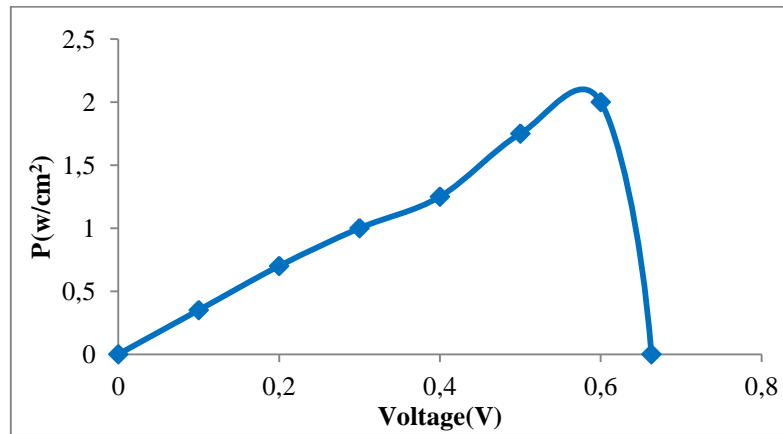
Figure 6 – Power plot of NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) structure under light

Effect of different layers' thickness on the efficiency of the desired solar cell model

Figure (7) shows the efficiency of the solar cell in terms of the thickness of the NC-SiC: H (n-type) layer. As shown in the figure, a thickness of 2 nm has led to the highest efficiency in the cell.
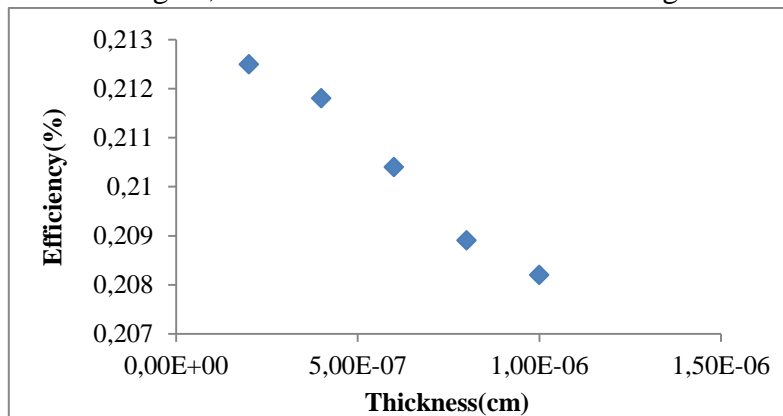
Figure 7 – Efficiency of the NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) structure against the thickness of the NC-SiC: H (n-type) layer

Figure (8) shows the efficiency of the cell against the thickness of the a-SiC (p-type) layer. As shown in the figure, a thickness of 5 nm has led to the highest efficiency in the cell.
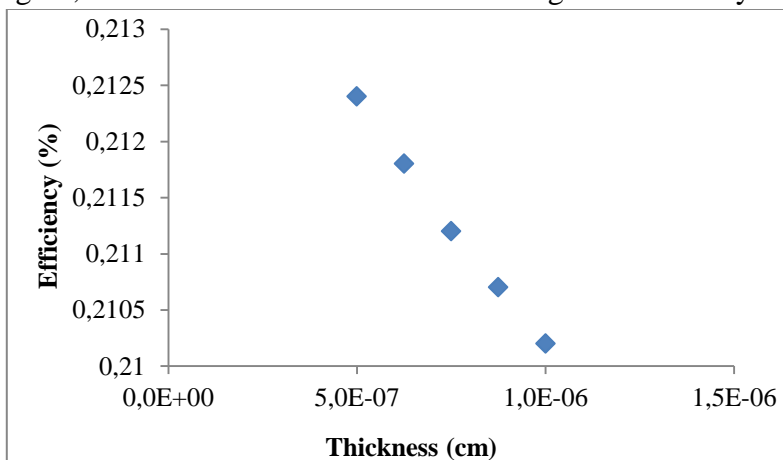
Figure 8 – Efficiency of the NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) structure against the thickness of the a-SiC (p-type) layer

Finally, Figure (9) shows the efficiency of the cell under study against the thickness of the C-Si (p-type) layer. As shown in the figure, increasing the thickness has improved the efficiency of the cell.
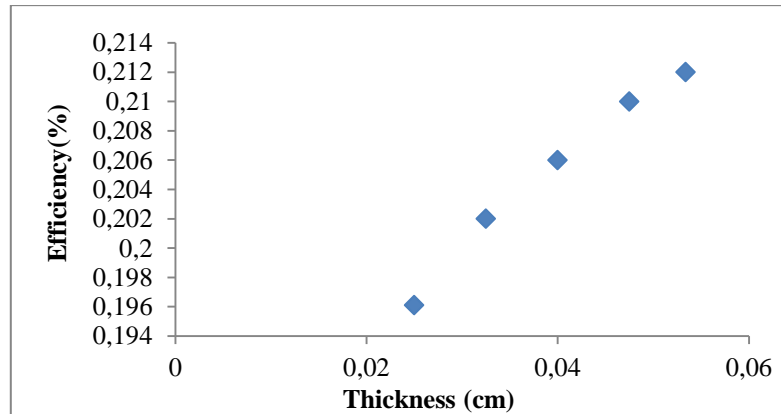
Figure 9 – Efficiency of the NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) structure against thickness of the C-Si (p-type) layer

The effect of the NC-SiC: H electron affinity on structure performance

Figure (10) shows the effect of the NC-SiC: H electron affinity on open-circuit voltage. According to the topics discussed in the previous sections, electron affinity remains at a constant value after a certain threshold.
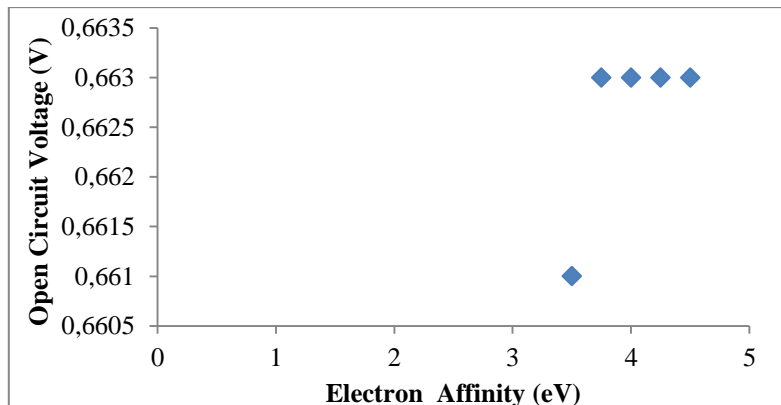
Figure 10 – Effect of NC-SiC: H electron affinity on the open-circuit voltage of the NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) structure

Figure (11) shows the effect of NC-SiC: H electron affinity on short-circuit current density.
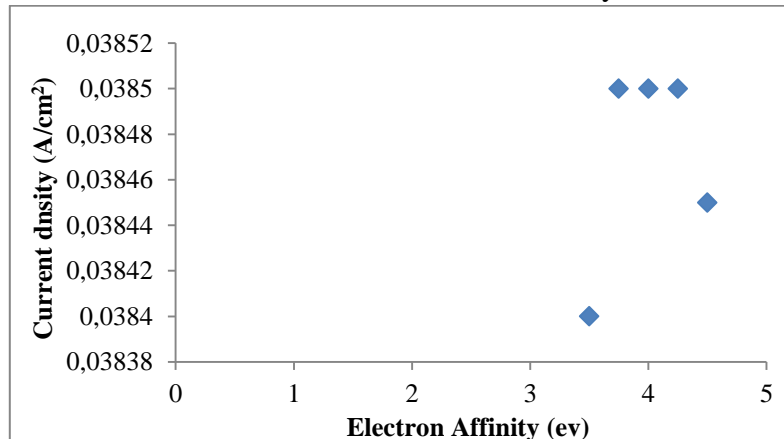
Figure 11 – Effect of electron affinity of NC-SiC: H on the short-circuit current density of the NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) structure

Figure (12) shows the effect of NC-SiC: H electron affinity on the fill factor. As stated in the previous sections, the fill factor remains constant after a certain amount of electron affinity.
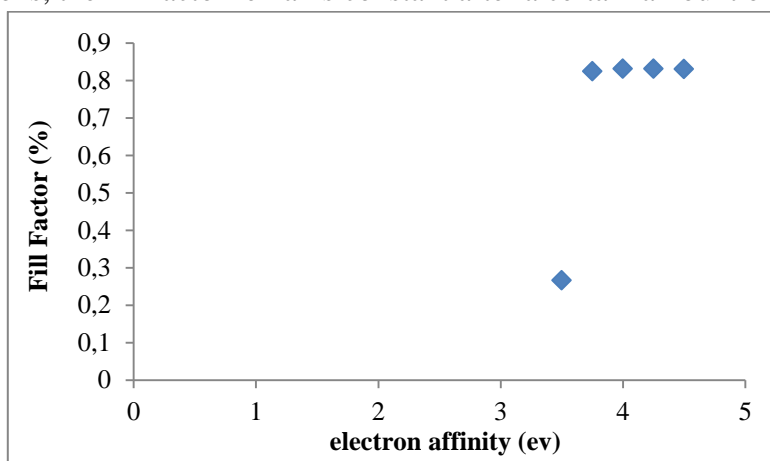
Figure 12 – Effect of the electron affinity of the NC-SiC: H on the fill factor of the NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) structure

Finally, Figure 13 shows the effect of NC-SiC: H electron affinity on the efficiency of NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) structure.
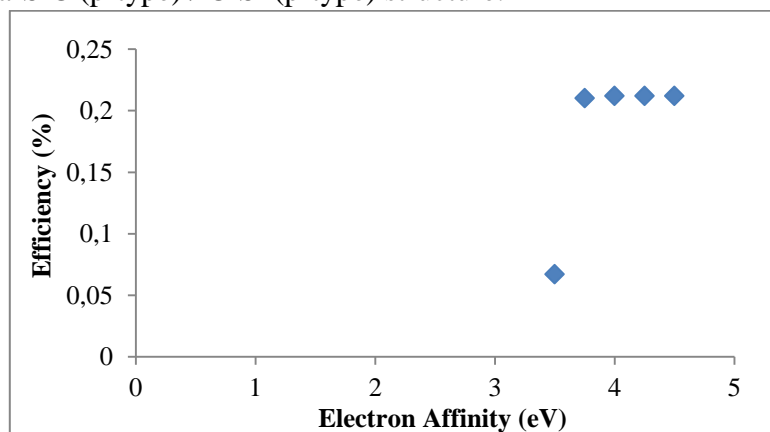
Figure 13 – Effect of electron affinity of NC-SiC: H on the efficiency of NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) structure

Conclusion

In this study, the effect of fabrication parameters and electronic parameters, i.e. layers thickness and doping on the selected model NC-SiC: H (n-type) / a-SiC (p-type) / C-Si (p-type) was evaluated. Finally, efficiency (η) = 21.01%, fill factor (FF) = 83.12%, short circuit current density (Jsc) = 38.5mA / cm2, open-circuit voltage (Voc) = 663.1 mv and quantum efficiency in 400 to 1000 nm range were obtained, which are significantly superior to previous introduced structures. In light of the above, it was found that the use of NC-SiC: H (n-type) as an emitter layer leads to increased efficiency.

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OPTIMIZATION OF MACHINING PARAMETERS IN MILLING OF AISI4140 STEEL TO OBTAIN THE BEST SURFACE QUALITY USING EVOLUTIONARY OPTIMIZATION ALGORITHMS

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ABSTRACT

Today, end milling technique is one of the most common methods available for the production of industrial parts. Basically, in this method, the rotation of a high-speed cylindrical steel with sharp edges on its floor and around leads to the removal of material from the work piece. Adjustable parameters in this process include tool rotation speed, the linear speed of work piece, tool load depth, chipping direction (agree, disagree), and tool diameter. The main objective of this technique is to obtain the highest material removal rate and the best surface quality. The main objective of optimization methods in this field is to provide suitable conditions for optimizing both outputs. Over the past few years, the variety of evolutionary algorithms has increased their application in various researches. AISI 4140 steel is one of the most widely used alloy steels in the industry. This study investigates the optimal conditions for end milling of AISI 4140 steel by different evolutionary algorithms. Surface quality and cutting rate are the optimal outputs of a machining process, and reducing the cutting rate leads to increased surface quality. Improving the surface quality and increasing the chipping rate simultaneously is the focal result of this study.

Keywords: milling; optimization; surface quality; taguchi method.

Introduction

Milling is considered to be one of the most common processing and machining operations on manufactured parts. A milling machine is used to create complex shapes in metal pieces or other solids. The moveable work piece is placed on a table, and the rotation of the cutting tool leads to the removal of the load from the piece. Milling machines can create a wide range of chipping geometries such as flat surfaces, angled surfaces, cogwheels, and grooves. This process requires a variety of equipment such as milling machines, work pieces, fixtures, and cutting tools. At the same time, the work piece is connected to a fixture embedded into the machine. In the milling process, each edge of the milling cutter periodically chips during its rotation and ro-

tates freely for cooling until the next turn. As a result, the edges are not under constant pressure like turning grates. Chipping is also done faster by the cutter. Milling machines are divided into two classes include horizontal and vertical, depending on whether the main axis of the milling cutter is horizontal or vertical.

The rotational motion of the end mill is called the main motion or cutting. To make the chip thicker, the work piece has a straight-line movement called load motion. Both the main motion and the load motion are done by the milling machine. In rotary milling, as a rule, the load motion cutter is adjusted against the direction of the milling cutter. Of course, it is possible to adjust the direction of load motion with the direction of cutter motion. In the first method, when the direction of cutter motion and the work piece is not the same, the chip is removed from the thinner point. Also, before the milling cutter edges penetrate into the work piece, the cutter slides on the work surface and leads to the production of a lot of friction. In this position, the cutting force tries to pull the work piece upwards.

The massive application of AISI 4140 steel in the industry, as well as the widespread use of end milling in the final stages of parts manufacturing, motivate us to focus on them. The number of parameters involved in this process is very large and access to the desired results depends on accurate knowledge of their impact as well as the creation of accurate models. As a result, after conducting sufficient studies and reviewing the principles of end milling, we identified the effective parameters for performing practical tests and collected the required data.

End milling is one of the final manufacturing processes of parts and affects the quality of the surface obtained, which in turn affects the important characteristics of the product such as fatigue resistance, light reflection, heat transfer, and so on. For this reason, to achieve the desired surface quality, we must minimize the surface roughness of the part. As a result, the surface roughness obtained from the end milling process was selected as the output of the process. In light of the above, the objective of the present study is to optimize the machining parameters in the milling of AISI4140 steel to obtain the best surface quality based on evolutionary optimization algorithms.

Materials and methods

The work piece is a cubic block with the dimensions reflected in Figure (1). The material selected for the work piece is Mo40 or 1.7225 or AISI 4140 or 42CrMo4 steel, which are known as the most important and widely used steels in the class of heat-treatment operational steels in the industry.
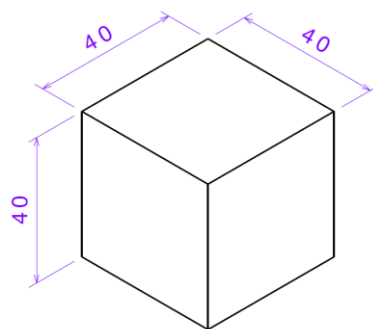
Figure 1 – An example of a work piece and its dimensions

A hand-held milling machine equipped with a digital ruler is used to prepare the work piece. Three types of movement strategies namely spiral, zigzag and one-way have been extracted from Katia software.

Taylor Habson's roughness meter is used to measure surface roughness. Also, for milling test parts, the end mill of high-speed steel of TEKNIK Company has been used. Complete characteristics and view of the milling cutter are presented in Table (1) and Figure (2), respectively.

Table 1

Characteristics of the milling cutter

Number of edges	Tool length	Tool diameter	Tool material	Manufacturer	Tool type
4	60 mm	10 mm	HSS high speed Steel	TEKNIK	end mill

Figure 2 – End mill cutter

Input variables and preliminary tests

The input parameters in surface roughness detection tests along with their level of variation are listed in Table (2).

Table 2

Input values range of milling parameters

	Parameters	Variation range			Unit of measurement
		1	2	3	
Cutting Speed	V	110	130	150	m/min
feed rate	F	500	700	900	mm/min
Depth of load	a_p	0.1	0.2	0.3	mm
Tool path distance	Step over	4	5	6	mm
Motion strategy	Strategy	One-way	Zigzag	Spiral	-

We have to do 243 tests in full mode. The number of experiments based on the Taguchi method and Table L27 has decreased. The use of this type of table depends on the number of variables considered in the test design software.

Evolutionary optimization

A genetic algorithm is a search technique to find approximate solutions to optimization problems. Genetic algorithms are a special type of evolutionary algorithms based on evolutionary techniques such as inheritance and mutation.

Genetic algorithms use Darwin's natural selection principles to find the optimal formula for predicting or matching patterns. Genetic algorithms are a good option for implementing regression-based prediction techniques. Problem inputs are turned into solutions in a process inspired

by genetic evolution. Such solutions are evaluated as candidates by the evaluator function. The execution of the algorithm ends as soon as the condition for termination of the problem is met. A genetic algorithm is generally an iteration-based algorithm whose components are often selected in a random process.

Table 3

Preliminary tests performed according to Table of Taguchi L27

No.	Input variables					Output variable (Ra)
	V	F	a_p	Step over		
1	110	500	0.1	4	oneway	0.91
2	110	500	0.1	4	zigzag	0.925
3	110	500	0.1	4	spiral	0.945
4	110	700	0.2	5	oneway	1.535
5	110	700	0.2	5	zigzag	1.455
6	110	700	0.2	5	spiral	1.76
7	110	900	0.3	6	oneway	1.66
8	110	900	0.3	6	zigzag	1.775
9	110	900	0.3	6	spiral	1.635
10	130	500	0.2	6	oneway	1.395
11	130	500	0.2	6	zigzag	1.605
12	130	500	0.2	6	spiral	1.52
13	130	700	0.3	4	oneway	1.1
14	130	700	0.3	4	zigzag	0.855
15	130	700	0.3	4	spiral	1.045
16	130	900	0.1	5	oneway	1.135
17	130	900	0.1	5	zigzag	1.375
18	130	900	0.1	5	spiral	1.235
19	150	500	0.3	5	oneway	1.075
20	150	500	0.3	5	zigzag	0.94
21	150	500	0.3	5	spiral	1.205
22	150	700	0.1	6	oneway	1.085
23	150	700	0.1	6	zigzag	1.305
24	150	700	0.1	6	spiral	1.475
25	150	900	0.2	4	oneway	1.757
26	150	900	0.2	4	zigzag	1.965
27	150	900	0.2	4	spiral	2.125

Many parameters affect the final surface roughness of the part in the end milling process. In this research, five parameters including cutting speed, feed rate, depth of cut, step over, and tool path strategy have been selected. The L27 Taguchi has also been used to design experiments. After the experiments, the surface roughness of each work piece was measured four times in a row and the average values obtained were recorded. Subsequently, a suitable model using regression was extracted for the relationship between surface quality and input parameters.
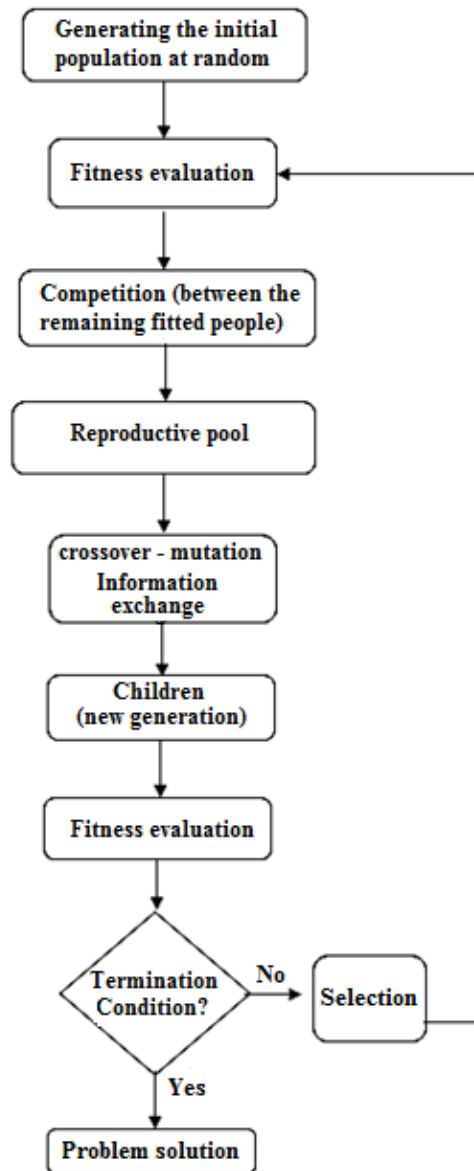
Figure 3 – Genetic algorithm

The obtained model is used as the objective function or the basis of the optimization work. Our objective in this section is to determine the levels of the parameters in order to achieve the desired output. This process is performed using an intelligent genetic algorithm. In addition to rapid convergence towards the final solution, this algorithm has good computational accuracy. Subsequently, the Taguchi prediction method was used to determine the optimal levels. The results of the Taguchi method were almost close to the results obtained from the genetic algorithm. Only a significant difference was observed in the tool path strategy. In this research, MINITAB 16.2 software has been used to implement the Taguchi method. This software calculates all the

calculations related to the Taguchi method including the signal-to-noise ratio, and plots the obtained results.

Results

1- Problem optimization of the end milling process

The purpose of end milling optimization is to find the values of the parameters affecting the process and to achieve the minimum roughness at the surface of the part. In this section, an artificial neural network model and a meta-heuristic algorithm called genetic algorithm are used to optimize the process output. To implement this algorithm, the Genetic Toolbox is used in Matlab2011 software.

2- Input parameters and definition of optimization relationships

In this study, five parameters have been investigated as input variables of the milling process. There are four parameters of the continuous type. Also, there is only one discrete parameter called tool path strategy includes three levels one-way, zigzag and spiral. For this reason, optimization operations for each level of the strategy parameter are performed separately (in three separate steps). Because artificial neural network models have strong interpolation and weak extrapolation capabilities, the upper and the lower bounds for each of the input parameters are considered.

Table 4

Variation range of input parameters

V (m/min)	F (mm/min)	a_p (mm)	Step over (mm)
110-150	500-900	0.1-0.3	4-6

In optimizing the surface roughness of the one-way strategy, we consider the fifth parameter, i.e. the path strategy parameter on the first level, and the first four parameters are set according to Table (4). Then the genetic algorithm is executed. The parameters of the genetic algorithm producing the best solution are reflected in Table (5).

Table 5

Initialization parameters of genetic algorithm

Population size	Crossover method	Probability of mutation	Selection operator	Termination condition
50	Two point	0.21	roulette wheel	600 iterations

After adjusting the above parameters and running the genetic algorithm several times, the results of the five operations with the lowest surface roughness are presented in Table (6).

Table 6

Obtained results of genetic algorithm for input parameters

No.	Proposed values of genetic algorithm for input parameters					Output
	V (m/min)	F (mm)	a_p (mm)	Step over (mm)	strategy	Ra (μm)
1	149.99	577.20	0.1	4	oneway	0.867
2	144.55	587.80	0.101	4	oneway	0.868
3	144.96	585.43	0.1	4.002	oneway	0.868
4	143.98	585.59	0.1	4.005	oneway	0.868
5	144.431	587.431	0.101	4.002	oneway	.0868

Based on the results in the table above, the genetic algorithm for obtaining the minimum surface roughness in the one-way strategy offers a cutting speed of 144 m / min, which is close to the third level of this parameter, i.e. 150 m / min. In fact, the genetic algorithm for maximizing surface roughness suggests the use of maximum cutting speed. Also, this algorithm proposes the following parameters to achieve the minimum surface roughness: feed rate equal to 585 mm/min, depth of cut equal to 0.1 mm and step over equal to 4 mm, i.e. the minimum value of all three parameters leads to the best final result.

Table 7

Proposed values of the genetic algorithm in the zigzag strategy

| No. | Proposed values of genetic algorithm for input parameters | | | | | Output |
	V (m/min)	F (mm)	a_p (mm)	Step over (mm)	strategy	Ra (µm)
1	149.960	502.00	0.1	4.665	Back&Front	0.860
2	149.885	500.79	0.1	4.662	Back&Front	0.860
3	149.976	500.42	0.1	4.659	Back&Front	0.860
4	149.000	500.00	0.1	4.644	Back&Front	0.866
5	149.998	501.092	0.1	4.666	Back&Front	0.866

According to Table (7), GA has suggested the highest value for cutting speed, the lowest value for feed rate, the lowest value for depth of cut and also the value of 4.66 mm for step over (close to the minimum value).

Table 8

Proposed values of genetic algorithm in spiral strategy

| No. | Proposed values of genetic algorithm for input parameters | | | | | Output |
	V (m/min)	F (mm)	a_p (mm)	Step over (mm)	strategy	Ra (µm)
1	149.960	502.00	0.1	4.665	Back&Front	0.860
2	149.885	500.79	0.1	4.662	Back&Front	0.860
3	149.976	500.42	0.1	4.659	Back&Front	0.860
4	149.000	500.00	0.1	4.644	Back&Front	0.866
5	149.998	501.092	0.1	4.666	Back&Front	0.866

The results of the third stage optimization for the spiral strategy on the three parameters i.e. feed rate, depth of cut, and step over are the same as the other two strategies, but the value of 124 m/min is proposed for the cutting speed parameter in the spiral strategy, which is close to the second level.

3. Conclusion

The overall results show that to achieve the minimum surface roughness in the end milling, we have to set the cutting speed at the highest level (third level), the feed rate at the lowest value, the depth of cut at the lowest value, and the step over at 4 mm. The results for the strategy parameter show that the zigzag strategy produces less surface roughness. The difference in surface roughness in the three strategies is about 0.01 µm, which can be ignored.

4. Analysis of end milling process test results by Taguchi method

The quality variable in this study is the amount of surface roughness obtained in the end milling process. Because the minimum value of the variable is desirable for us, the objective of the study is to minimize surface roughness (Ra).

Table 9

Signal to noise values for end milling process parameters

Level	V	Feed	a_p	Step over	Sterategy
1	-2.618	-1.151	-1.123	-1.686	-2.040
2	-1.799	-2.015	-4.426	-2.144	-2.302
3	-2.824	-4.074	-1.691	-3.410	-2.898
Delta	1.026	2.923	3.303	1.724	0.859
Rank	4	2	1	3	5

In the Taguchi method, the signal-to-noise ratio level must be maximized to achieve the lowest roughness. As you can see, the second column of the second level of the cutting speed parameter has the highest value of signal-to-noise ratio, i.e. Taguchi introduces the second level of cutting speed of 130 meters per minute as the optimal value, which leads to the lowest roughness.

The maximum value of the signal-to-noise ratio for the feed rate parameter is observed in the first level, i.e. Taguchi introduces the first level of feed rate equal to 500 mm/min as the optimal value, which leads to the lowest roughness. The maximum signal-to-noise ratio for the depth of cut parameter is observed in the first level, which is equal to 0.1 mm. This means that the minimum value for depth of cut results in the lowest surface roughness.

The signal-to-noise ratio for the step over parameter in the first level is equal to the maximum value. This means that the lower the step over value, the lower the surface roughness. Finally, for the fifth parameter i.e. the tool path strategy, the signal-to-noise ratio at the first level (one-way strategy) has a maximum value, meaning that the one-way strategy produces less surface roughness than the other strategies.

The results showed that the depth of cut is the most effective parameter on the final surface roughness of the piece and then the parameters of feed rate, step over, cutting speed, and path strategy have the greatest impact on the final surface roughness of the piece, respectively.

Conclusion

In this research, different stages of modeling and optimization of the end milling process on AISI 4140 steel have been investigated. The results showed that to achieve the minimum surface roughness at the end milling, the parameters of cutting speed, feed rate, depth of cut and step over should be set to the highest level (third level), the minimum value, the minimum value and 4 mm, respectively. The results for the path strategy parameter show that the spiral strategy produces less surface roughness. At the same time, the difference in surface roughness between the three strategies is about 0.01 μm, which can be ignored.

In the Taguchi method, to achieve the lowest roughness, the signal-to-noise ratio level must be the maximum value. In fact, the Taguchi method introduces the second level of cutting speed of 130 meters per minute as the optimal value for the lowest roughness.

The genetic algorithm in the one way strategy proposes 144 m/min, 585 mm, 0.1 mm, and 4 mm for the parameters of cutting speed, feed rate, depth of cut, and for step over, respectively.

The genetic algorithm in the zigzag strategy proposes maximum, minimum, minimum, and 4.66 mm values for cutting speed, feed rate, depth of cut parameters, and for step over, respectively.

The results of process optimization for the spiral path strategy in the three parameters feed rate, depth of cut, and step over are the same as the two strategies. However, the proposed cutting speed parameter for the spiral strategy is 124 m/min.

The depth of cut parameter has the greatest effect on the final roughness of the piece. Then, the parameters of feed rate, step over cutting speed, and cutting path strategy have the greatest impact on the final surface roughness of the part, respectively.

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NEW MATERIALS AND THE EFFECT OF ADDED FIBER MATERIAL ON THE STRENGTH OF CONCRETE FOR RUNWAYS AND HELICOPTER PADS (NEW COMPOSITE CONCRETES)

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ABSTRACT

Concrete is one of the most widely used materials in the construction industry, so in recent years, the approach of construction industry experts has been focused on improving the quality of this product. One of the technical characteristics of concrete that has been considered by researchers in research is its compressive and tensile strength. To achieve this goal, in recent years, the use of less water to cement ratio with the help of superplasticizers, as well as the use of natural or synthetic pozzolans, as well as the use of fibers of different

materials and specifications, in Concrete composition is common. Identifying the properties of concrete as one of the most widely used building materials has always been studied by many researchers. Compressive strength of concrete has been one of the characteristics that many experts have studied. Due to the current popularity of airport runways and helicopter pads, the need for final concrete coatings with the ability to accept heavy flights and wide-body aircraft using materials that have acceptable compressive and tensile strength has increased, in this way The use of composite concretes can be one way to meet this need. Our aim in this study is to investigate the effects of adding fibers of different materials on the strength properties of concrete.

Keywords: high strength concrete; steel fibers; polypropylene fibers; glass fibers; runway; flight pad.
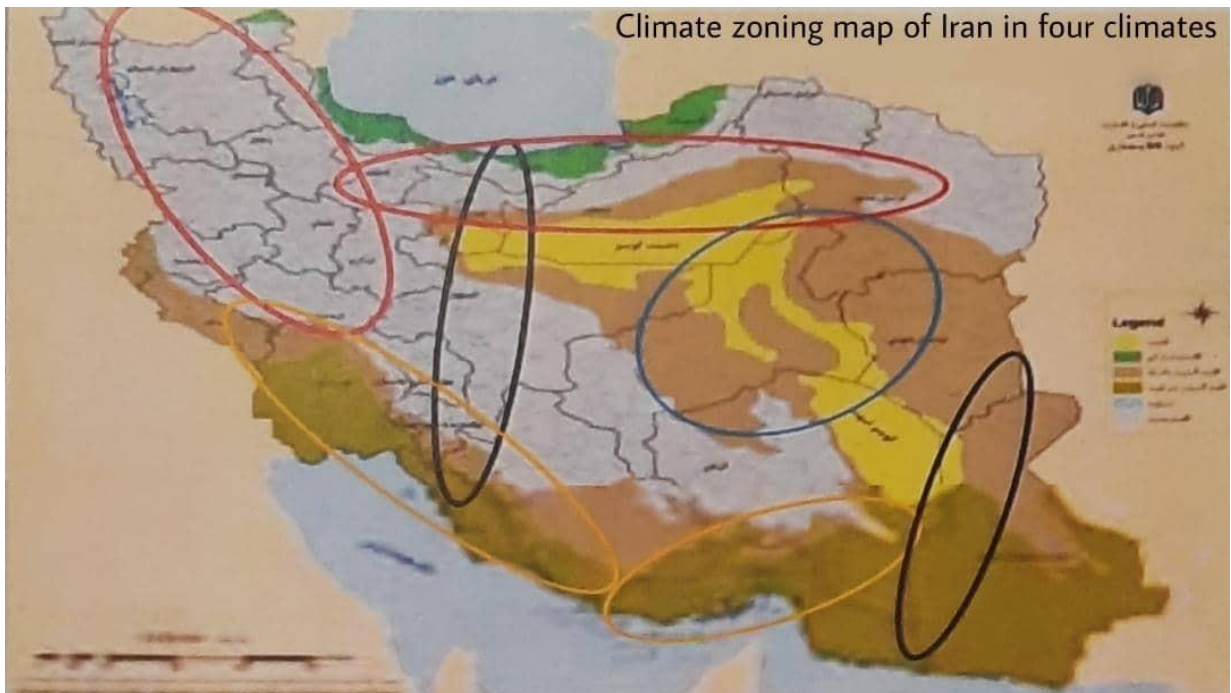
Potential of concrete application according to Iran's climate www.cement review 1111-1.
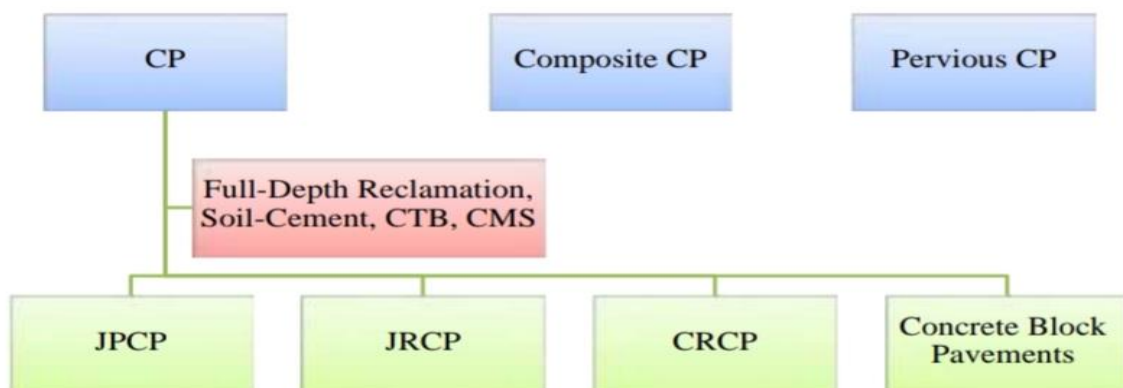
Types of concrete procedures and pavements

Mehrabad airport 29 runway improvement project

* Executive operations in a 4,000-meter-long runway with a width of 60 meters (45meters main width in 9 lines of 5 meters with 15 meters of shoulder) and with 16 taxi ways perpendicular to the runway

* The initial condition of the pavement was all flexible pavement of asphalt concrete.

* Following the selection of the Road, Housing and Urban Development Research Center by the parent company of the country's airports as the supreme supervisor of the project, the center was responsible for accepting all executive operations of the project as follows;

* Asphalt laying of the main runway and creep runways (taxi way) in the amount of 180,000 cubic meters (in a runway with a length of 4000 meters and a width of 60 meters and 16 taxi ways perpendicular to the runway)

* Execution of project bed construction operations in required locations Approximately 150,000 square meters

* Execution of cement stabilization layer (FDR) operation in the amount of 70,000 cubic meters

* Execution of concrete surface operations with paver in the amount of 110,000 cubic meters

* Execution of soil strip operation in the amount of 350,000 square meters * Execution of underground drains and absorption trenches in each strip

* Asphalt run over runway in the amount of 180,000 square meters

Concrete pavement of Mehrabad airport in Tehran www.imen rah.com 1010-01

Concrete pavement of Mehrabad airport in Tehran www.imenrah 1010-09

1200-ft-long post-tensioning tendons ready for con crete from the bridge deck paver in the distance.

Airport prestressed concrete pavement design project www.imenrah.com 1010-05
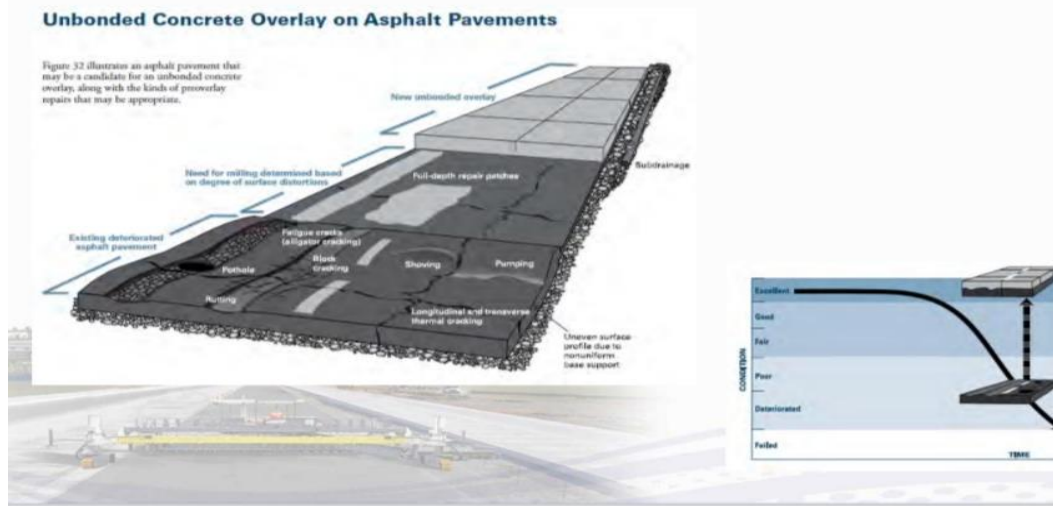
Concrete cover

Brighter colors and colder

concrete surfaces reflect light. This feature reduces the energy required to light the road overnight. Lighting lights are important elements of urban highway facilities that directly improve traffic safety by enhancing night vision. Asphalt pavements require more lights per unit length to achieve illumination than concrete pavements. Studies show the results of cost savings of up to 31% in primary energy and lighting maintenance costs of concrete pavement versus asphalt pavement. Sunlight energy that is not reflected from the pavement is converted into thermal energy that raises the pavement temperature. Concrete pavement reflects more sunlight than asphalt pavement and is colder. Higher temperatures increase the formation of thick fog. Cooling a city only 5 degrees Celsius can have a dramatic effect on the concentration of fog. The use of lighter concrete pavements can have a good effect in this regard.

Ratio of total lifetime costs of asphalt to concrete pavement	Ratio of total costs Total costs equivalent to longevity	Equivalent cost of renovation in year zero with discount rate of 5 (Rials)	Equivalent cost of maintenance in year zero with 5% discount plan (Rials)	Cost and initial construction (Rials)	Type of pavement	Bed support	Road category
1.59	1297123171	385419190	67223781	844480200	Concrete		Low traffic highway
	2063622889	803293125	380294265	880035500	Asphalt	Low	
1.54	1227035904	363455623	67223781	796356500	Concrete		
	1887927712	719450477	380294265	788182970	Asphalt	medium	
1.70	1368993506	407941525	67223781	893828200	Concrete		Highway with medium traffic
	2322336485	926752590	380294265	1015289630	Asphalt	Low	
1.66	1280938655	380347374	67223781	833367500	Concrete		
	2130669019	833287884	380294285	919088870	Asphalt	medium	
1.80	1458811425	436094444	67223781	955513200	Concrete		Highway with high traffic
	2631894577	1074136708	380294265	1376813000	Asphalt	Low	
1.76	1370776574	408500291	67223781	895051900	Concrete		
	2434627796	970794481	380294265	1063539050	Asphalt	medium	

Comparison of lifetime costs of asphalt and concrete pavements one kilometer of the desired road

A study was conducted in the Iowa area on three areas to evaluate concrete and asphalt pavements from 1954 to 1994.

Zone A has concrete pavements, Zone B has asphalt pavements, and Zone C has almost equal pavements and asphalt pavements. The results presented here focus on areas A and B. This figure shows the results for regions A and B. As can be seen, area A (concrete pavement) has lower construction and maintenance costs. In terms of performance, both systems performed well. Zone A (concrete pavement) has a pavement status index (PCI) of 97 (excellent) and zone B (asphalt pavement) has a pavement status index (PCI) of 84 (very good)
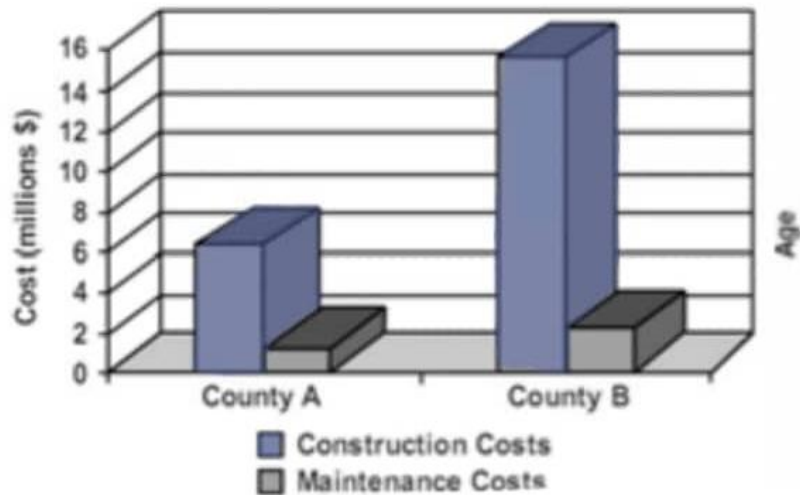
Comparison of service life
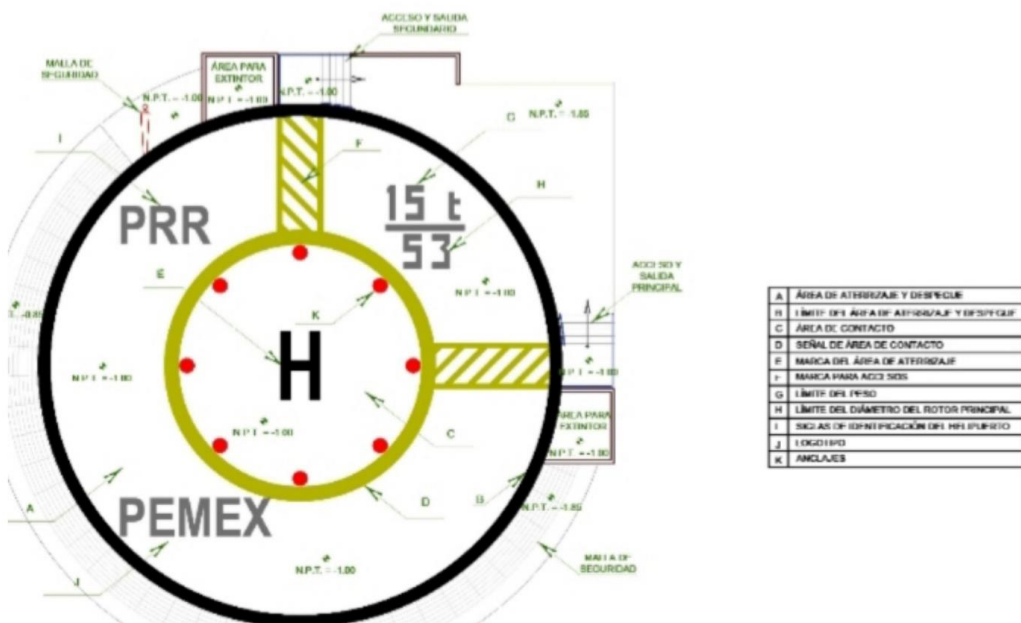
Helicopter pad standard specifications

Introduction

At present, the reconstruction of the main runway of Shahid Madani Airport in Tabriz has been designed and executed using the 15-meter-wide and 4200-meter-wide Fenisher concrete method, which is capable of accepting wide-body flights up to B747 category. Traditional asphalt was applied with its final surface concrete, which in addition to greater compressive strength, will also be more resistant to the changing climate of the region. Similar to this plan, the construction of Ramsar airport runway and 29 right runway of Mehrabad airport has been approved by the pilots of this airport and according to related tests, the life of concrete pavement is between 40 to 45 years, while the life of traditional asphalt pavement is maximum 15 years.

Concrete is a combination of two components of aggregates with a matrix of cementitious materials whose cementitious materials can include natural or synthetic pozzolans. Therefore, it can be said that the ductility and strength properties of concrete made depend on the transition zone between the two (Brentson et al., 1990). With the use of most natural aggregates and controlled values of water to cement ratio, as well as the use of appropriate additives can be found in high-strength concretes (Mehta and Aitsin, 1990). However, today with the growth of concrete technology and the use of advanced types of new chemical additives, it is possible to achieve concretes with higher strength than conventional concrete. Concretes that were measured as high strength concretes fifty years ago are now known as low strength concretes. For example, in the 1950s, concrete with a strength of 30 MPa and above was called high strength concrete, and this amount increased to about 40 to 50 MPa in the 1960s. In the 1970s, concretes with a strength of 60 MPa and above became known as high strength concretes, and in the 1980s, the strength of high strength concrete increased to 100 MPa and above. With the rapid development of concrete technology in recent years, in most parts of the world, concrete with a compressive strength of more than about 40 and 60 MPa is still known as high-strength concrete. In the American Concrete Institute standard, concrete with a compressive strength of cylindrical specimens over 40 MPa at the age of 28 days is defined as high-strength concrete (Committee 318 of the American Concrete Institute, 1999) and in some other standards this amount It is more than 60 MPa. Adding pozzolans to the concrete composition, in addition to reducing cement consumption and reducing environmental pollution, improves the performance and strength properties of concrete.

Other materials that improve the durability and strength properties of concretes and have been used in the composition of man-made mortars for a long time, are fibers of different materials and with different shapes. Fibers in concrete reduce the growth of primary fine cracks due to shrinkage and drying of concrete and with high elastic properties and tensile strength, improve the strength properties of concrete. Also, adding fibers in the concrete composition controls water absorption and reduces permeability in concrete. (Rama et al., 2010).

Destruction and deterioration of concrete is strongly dependent on the formation of cracks and microcracks due to loading or environmental influences. Heat and moisture changes in the cement paste cause fine cracks, and such fine cracks are concentrated on the surface of the coarse grains. With the greater impact of loading as well as other environmental issues, microcracks join together and form cracks, and finally these cracks spread in the concrete body [1]. The use of different fibers in concrete and the fabrication of fibrous concrete (FRC) is considered as an effective step in preventing the spread of microcracks and cracks and compensating for the weak tensile strength of concrete.

The most important characteristics of fiber concrete are its energy absorption, flexibility and impact resistance; For this reason, today, this concrete has played a very serious role in the development of concrete technology and is considered as a new and economical material in con-

struction issues [2]. The energy absorption and strength properties of concrete can significantly reduce the risk of failure of concrete structures, especially in areas subject to repeated loads and seismic loads. The energy absorption properties of fibrous concrete are usually measured by a tensile test. In this test, the strength index "according to ASTM C1018 standard as the surface below the load curve - deformation of a standard beam with dimensions of 30 × 10 × 10 cm to a specific deformation (eg 3.5 times the deformation at the moment of the first crack), to the following level The same curve is defined until the deformation corresponding to the first crack, although the standard [544-ACI 4] provides a different definition from the previous definition for measuring the strength of fibrous concrete.

To clarify the ductility of fibrous concrete, note that the fracture strain of a brittle matrix (such as Portland cement) is far less than the fracture strain of a solid fiber (such as steel, glass, polypropylene, collar, etc.). As a result, when the fiber-reinforced cement is loaded, the matrix will crack much sooner than the fiber breaks. With matrix cracking, one of the following three types of failures may occur for a composite body: A. The composite body may break immediately after the matrix cracks, as in the case of low volume polymer fibers. B. The composite body may continue to withstand loads and deformations under lower loads, as in the case of low to medium volume steel fibers. In this case, the resistance after cracking is first provided by pulling the fibers out of the crack surface and then continues by deforming them. C. Even after the matrix cracks, the composite body may withstand more tensile stresses and deformations, such as when medium to high carbon fibers are used. Note that this only happens if the adhesion resistance of the filament at the moment of the first crack is greater than the load at the moment of the first crack, because at the moment of cracking the entire load is suddenly transferred to the fiber. Now, as the load on the composite body increases, the fiber transfers the extra stress to the matrix through adhesion. It is clear that among the above three cases, fiber concrete in position (a) has no ductility and the highest ductility is obtained for fiber concrete in conditions (c).

Fiber concrete is made with different fibers including steel, glass, carbon, aramid (Kevlar), polypropylene (PP), hemp and asbestos. Today, steel fibers are most commonly used in fibrous concrete, although other fibers may be used for specific reasons.

Concrete strength is usually the most important criterion used to evaluate the quality of concrete. Increasing the resistance over time is based on the continuity of cement dewatering and reducing the percentage of porosity and empty space between the components in the adhesion stage. The microsilica in concrete, which is a pozzolanic material, combines with the calcium hydroxide due to the hydration of the cement to form a gel-like composition. This compound is the main factor in increasing the strength and reducing the porosity of the particles that make up concrete. Large crystals of calcium hydroxide in the aggregate-paste joint prevent the increase in strength, which microsilica under pozzolanic reaction with calcium hydroxide converts into resistant components called hydrated calcium silicate, thus increasing the compressive strength of concrete.

In this research, after producing ordinary concrete and high-strength concrete, the effect of fibers of steel, glass and propylene on their performance and compressive and tensile strengths at 7 and 28 days of age has been investigated.

Background review

In a 1981 study of concrete reinforced with polypropylene fibers, Kobayashi and Chou showed that fiber reinforcement clearly increases strength, and that post-cracking behavior is strongly influenced by loading speed because it is a function of viscoelastic properties. It is a polypropylene fiber. In 1999 in the United States, the characteristics of microsilica concrete re-

inforced with polypropylene fibers were examined by HesamTo Tanji and it was found that the use of 5% microsilica with a volume ratio of 0.3% for restoration work from a perspective Resistance is the optimal mixing scheme. In 2002, Hanizam and Nordin studied the effect of alkali-resistant glass fibers on the compressive strength of lightweight concretes and concluded that there was a relationship between the amount of fibers used and the amount of compressive strength of fibrous concrete. By increasing the consumption of fibers in the composition of concretes from 0.2 to 0.6 by volume, they were able to increase the strength of concrete produced. In 2005, Noss and Fernandez increased the compressive strength by about 77 percent and the tensile strength by about 55 percent by using steel fibers in the composition of concretes containing superplasticizers as well as fly ash. In 2010, Chandramoli et al. Studied the strength properties of concretes containing glass fibers in different strength classes and found that consuming 0.03% by volume of glass fibers increased the compressive, tensile and flexural strength of concretes. Rama and Sudarsana in 2010 in a study entitled The effect of glass fibers on concretes containing fly ash were able to use fly ash and glass fibers to increase the compressive strength of concrete by about 20% at the age of 56 days. In 2012, Dashmukh et al. Studied the effect of glass fibers on concretes made using Portland cement and were able to consume 0.1% by volume of glass fibers in the composition of concrete, about 23% in compressive strength and 42%. Increase in tensile strength and 14% in flexural strength. In 2012, Kavita et al. Studied the behavior of glass and steel fibers on concrete and found that the compressive strength of fiberglass concretes made of steel or glass fibers had the same strength at 7 and 28 days of age. In 2012, Shend et al. Used steel fibers with different length to diameter ratios and concluded that by increasing this ratio from 50 to 67, the compressive and tensile strengths of the prepared specimens were reduced. Using the optimal amount of 3% by weight of steel fibers, they succeeded in improving the compressive and tensile strength properties of the concretes produced in their research. Tajan and Bahandari in a study in 2014 studied the effect of glass fibers on ordinary concrete and were able to consume 0.45% by volume of glass fibers in concrete at the age of 28 days, about 14% in compressive strength and 71% in strength Increase the tensile strength of concrete.

Javadi and Pourbaba have studied the effect of quartz powder on the compressive strength of high strength concrete using Azarshahr materials and the results show that the optimal ratio of microsilica and quartz powder is about 10 and 11% by weight of cement, respectively. In another study, Akbari et al. Obtained the optimal ratio of microsilica in increasing the compressive strength of concrete by 15%. Maleki and Ismaili studied the effect of microsilica products on the properties of hardened concrete and concluded that the use of microsilica products such as microsilica powder and gel has a compressive strength of 37 and. Increases by 5 and 56% [5]. Farrokhzad and Mehr Pouya have studied the use of microsilica and nanosilica to improve the mechanical properties and durability of self-compacting concrete containing aggregates obtained from concrete recycling and the results show that concrete samples with 15% microsilica have the highest average compressive strength and the lowest Are control examples. Ahmad Ardakani et al. Investigated the effect of microsilica on the compressive strength of concrete after fire and the research findings show that the best percentage of microsilica for concrete with the highest strength at 25 ° C is 8.7%, while with increasing The temperature of this percentage decreased and finally at a temperature of 1000 ° C to 5. It reaches 8%.

Materials and methods
Materials

Cement: The cement used to produce concrete in this study was type 2 cement. Microsilica: As part of the cementitious materials in the mixing design, microsilica gel containing 92%

silica was used. Mixture of aggregates used: The aggregates used in the production of concrete in this study were made of lime and broken and their granulation diagram is in accordance with the diagram of Figure 3-1.
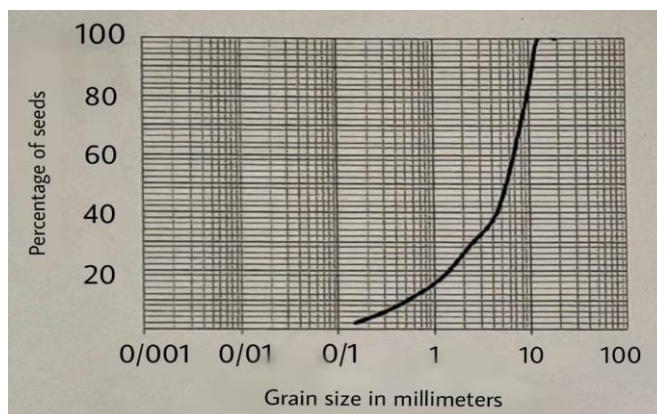
The results of mechanical tests performed on aggregate materials are given in Tables 1-3 and 2-3.

Unit weight of mass (gr/cm3)		Water absorption (%)	Needle aggre-gate (%)	Flaky aggregate (%)	model
Non condensing	compact				
1/39	1/53	0/83	12	9	sand

The results of mechanical tests on aggregate coarse . (1-3)

Unit weight of mass (gr/cm3)		Absorption of water (%)	Sand equivalent (%)	Fineness modulus	model
Non condensing	compact				
1/72	1/86	1/04	75	3/51	sand

The results of mechanical tests on aggregate fine. (2-3)

Consumable superplasticizer:

Consumed superplasticizer is one of the basic superplasticizers based on polycarboxylate ether, which according to its instructions, is 0.8% by weight of cement used. Steel fibers: The length of these fibers is 50 mm and its diameter is 1 mm, so the ratio of length to diameter of these fibers is 50. Glass fibers: Glass fibers are used in combination with aluminoborosilicate in which the percentage of alkalis is 2%. According to the manufacturer of these fibers, their length is 20 mm and their diameter is 17 to 20 microns, and also the percentage of water absorption of these fibers is zero and their color is white. Polypropylene fibers: According to the manufacturer, the polypropylene fibers used are hydrophobic and have a zero water absorption percentage and are 25 mm long and 20 to 25 microns in diameter. The color of these fibers is also white.

Method of mixing materials and sampling

Mixing materials was combined and performed in several stages with the help of an electric mixer. The method of mixing is that first, the aggregates are mixed in the mixer for two

minutes and dry, then the fibers and some water are added gradually and during mixing, and in the next step, cement and microsilica are left with water and The superplasticizer was poured into the mixer at the same time and the materials were mixed for another 10 minutes. Mixing of materials in the manufacture of fiber-free concretes, as in the case of fiber-reinforced concrete, is done with the difference that there is no fiber in the mixing.

After mixing, the molding was done in standard cylindrical molds and the samples were vibrated, both internally using rods and hand hammers and externally with the help of electric vibrating table. The molded samples were removed from the molds after 24 hours and immersed in a pool of water and processed under standard conditions.

Mixing designs

Fiberless concrete mixing design

To investigate the effect of different fibers, three modes were considered, the first mode is ordinary concrete and the second mode is the same concrete using superplasticizer and the ratio of water to cement is lower, which will be examined, and finally the third mode is the same made concrete It is in the second case, with the difference that microsilica is also used in its composition. Mixing designs of concretes made without the presence of fibers are in accordance with Table 3-3.

Table 3-3

Concrete designs made without the presence of fibers

Plan	Water to cement ratio	Cement (Kg/m³)	water (Kg/m³)	Microsilica (Kg/m³)	Coarse-grained aggregate (Kg/m³)	Fine-grained aggregate (Kg/m³)	Super lubricant (Kg/m³)	Fiber (Kg/m³)
C1	0/5	540	270	0	1050	800	0	0
C2	0/3	540	162	0	1050	800	4/32	0
C3	0/3	540	162	54	1050	800	4/32	0

Fiber concrete concreting designs in high strength concrete, using three steel fibers and polypropylene and glass, with different amounts of consumption are given in Tables 3-4, 3-5 and 3-6.

Table 3-4

Mixing designs of high strength concretes containing steel fibers

Plan	Water to cement ratio	Cement (Kg/m³)	Water (Kg/m³)	Microsilica (Kg/m³)	Coarse-grained aggregate (Kg/m³)	Fine-grained aggregate (Kg/m³)	Super lubricant (Kg/m³)	Steel fibers (Kg/m³)
C3-S1	0/3	540	162	54	1050	800	4/32	15
C3-S2	0/3	540	162	54	1050	800	4/32	20
C3-S3	0/3	540	162	54	1050	800	4/32	25
C3-S4	0/3	540	162	54	1050	800	4/32	30

Mixing designs of high strength concretes containing polypropylene fibers.

Plan	Water to cement ratio	Cement (Kg/m³)	water (Kg/m³)	Microsilica (Kg/m³)	Coarse-grained aggregate (Kg/m³)	Fine-grained aggregate (Kg/m³)	Super lubricant (Kg/m³)	Glass fiber (Kg/m³)
C3-P1	0/3	540	162	54	1050	800	4/32	3
C3-P2	0/3	540	162	54	1050	800	4/32	4
C3-P3	0/3	540	162	54	1050	800	4/32	6
C3-P4	0/3	540	162	54	1050	800	4/32	8

Mixing designs of high strength concretes containing glass fibers

Plan	Water to cement ratio	Cement (Kg/m³)	water (Kg/m³)	Microsilica (Kg/m³)	Coarse-grained aggregate (Kg/m³)	Fine-grained aggregate (Kg/m³)	Super lubricant (Kg/m³)	Glass fiber (Kg/m³)
C3-G1	0/3	540	162	54	1050	800	4/32	2/70
C3-G2	0/3	540	162	54	1050	800	4/32	4/05
C3-G3	0/3	540	162	54	1050	800	4/32	5/40
C3-G4	0/3	540	162	54	1050	800	4/32	10/80
C3-G5	0/3	540	162	54	1050	800	4/32	16/20

Optimal fiber mixing schemes in high strength concretes

After performing the compressive and tensile strength tests on the samples obtained from high strength fiber concretes, from the results obtained which are mentioned below), the optimal amount of fiber consumption was determined according to Table 3.7 is.

Plan	Water to cement ratio	Cement (Kg/m³)	water (Kg/m³)	Microsilica (Kg/m³)	Coarse-grained aggregate (Kg/m³)	Fine-grained aggregate (Kg/m³)	Super lubricant (Kg/m³)	Glass fiber (Kg/m³)
C3-P1	0/3	540	162	54	1050	800	4/32	25
C3-P2	0/3	540	162	54	1050	800	4/32	5/4
C3-P3	0/3	540	162	54	1050	800	4/32	6

Mixing plan of ordinary concrete and ordinary concrete containing super plasticizer

The mixing plan of ordinary concretes containing super plasticizers and the optimal amount of different fibers can be seen in Table 3-8 and the mixing plan of ordinary concretes containing the optimal amount of different fibers can be seen in Table 3-9.

Table 3-8

Mixing designs of ordinary concretes containing superplasticizers and different fibers.

Plan	Water to cement ratio	Cement (Kg/m³)	water (Kg/m³)	Coarse-grained aggregate (Kg/m³)	Fine-grained aggregate (Kg/m³)	Super lubricant (Kg/m³)	fiber (Kg/m³)	Type of fibers
C2-S	0/3	540	162	1050	800	4/32	25	Steel
C2-G	0/3	540	162	1050	800	4/32	5/4	Glass
C2-P	0/3	540	162	1050	800	4/32	6	Polypropylene

Table 3-9

Mixing designs of ordinary concretes containing different fibers

Plan	Water to cement ratio	Cement (Kg/m³)	water (Kg/m³)	Coarse-grained aggregate (Kg/m³)	Fine-grained aggregate (Kg/m³)	fiber (Kg/m³)	Type of fibers
C1-S	0/5	540	270	1050	800	25	Steel
C1-G	0/5	540	270	1050	800	5/4	Glass
C1-P	0/5	540	270	1050	800	6	Polypropylene

Results

The samples obtained from the concretes were broken after processing under standard conditions at the ages of 7 and 28 days in compressive strength and tensile strength tests. Tests to determine the strength of the samples were performed using a fully automatic digital hydraulic loading device that loaded at a constant speed of 0.24 MPa per second.

Results of slump tests and compressive and tensile strength of fiber-free concretes In Table 4-1, we see the results obtained from the slump tests and the compressive strength and tensile strength of concrete specimens made without fibers at the age of 7 days and 28 days.

Table 4-1

Results of slump tests and compressive and tensile strength of fiber-free concretes.

Plan	Description	Islamp (Cm)	7 days		28 days	
			Pushing resistance MPa	Tensile strength MPa	Pushing resistance MPa	Tensile strength MPa
C1	Free of microsilica and super-lubricant	7	37	3/5	45	4/27
C2	No microsilica and has super lubricant	12	43	4/12	65	6/83
C3	Contains microsilica and superplasticizer	14/5	52/5	5/15	75	8/56

2- 4- The results of slump tests and compressive and tensile strength of high strength fiber concretes (to determine the optimal amount of fiber consumption)

The results of slip tests and compressive and tensile strength of high strength concretes containing steel fibers, at the ages of 7 and 28 days, are shown in Table 4-2.

Results of slump tests and strength of high strength concretes containing different amounts of steel fibers

Plan	Islamp (Cm)	7 days		28 days	
		Pushing resistance MPa	Tensile strength MPa	Pushing resistance MPa	Tensile strength MPa
C3-S1	12	53	5/47	76	9/14
C3-S2	11	54	5/6	78	9/36
C3-S3	10/5	54/6	5/65	78/7	9/6
C3-S4	9/5	53/5	5/55	76/8	9/29

The results of slip tests and compressive and tensile strength of high strength concretes containing polypropylene fibers, at the ages of 7 and 28 days, are shown in Table 3-4.

Results of slump tests and strength of high strength concretes containing different amounts of polypropylene fibers

Plan	Islamp (Cm)	7 days		28 days	
		Pushing resistance MPa	Tensile strength MPa	Pushing resistance MPa	Tensile strength MPa
C3-S1	11/5	53/1	5/9	77/6	10/09
C3-S2	11	54/4	6/1	80	10/8
C3-S3	9/5	56	6/56	86	12/04
C3-S4	9/5	53/5	6/25	83/5	11/69

The results of slip tests and compressive and tensile strength of high strength concretes containing glass fibers, at the ages of 7 and 28 days, are shown in Table 4-4.

Results of slump tests and strength of high strength concretes containing different amounts of glass fibers

Plan	Islamp (Cm)	7 days		28 days	
		Pushing resistance MPa	Tensile strength MPa	Pushing resistance MPa	Tensile strength MPa
C3-G1	14	53/8	6/1	76/1	9/6
C3-G2	12/5	56/5	6/55	79/6	10/3
C3-G3	11/5	58	7/16	80/5	10/87
C3-G4	10	55/8	6/33	78/5	9/8
C3-G5	8/5	54/6	6/17	77/3	9/6

3-4 Results of slip tests and compressive and tensile strength of fibrous concrete in the optimal state of fiber consumption

The results of slip tests and compressive and tensile strength of high strength fiber concretes at the ages of 7 and 28 days are shown in Table 4-5.

Table 4-5

Results of slump tests and strength of high strength fiber concretes.

Plan	Type of fibers	Islamp (Cm)	7 days		28 days	
			Pushing resistance MPa	Tensile strength MPa	Pushing resistance MPa	Tensile strength MPa
C3-S3	steel	10/5	54/6	5/65	78/7	9/6
C3-P3	Polypropylene	9/5	56	6/56	86	12/04
C3-G3	Glass	11/5	58	7/16	80/5	10/87

The results of slip tests and compressive and tensile strength of conventional fiber-reinforced concrete with superplasticizer at the ages of 7 and 28 days can be seen in Table 4-6.

Table 4-6

Results of slump tests and resistance of conventional fibrous concrete containing super plasticizer

Plan	Type of fibers	Islamp (Cm)	7 days		28 days	
			Pushing resistance MPa	Tensile strength MPa	Pushing resistance MPa	Tensile strength MPa
C2-S	steel	10/5	45/5	4/55	69	7/68
C2-P	Polypropylene	8	46/8	5/42	75	9/77
C2-G	Glass	10	48/5	5/9	70/5	8/9

The results of slip tests and compressive and tensile strength of ordinary fibrous concretes at the ages of 7 and 28 days are shown in Table 4-7.

Table 4-7

Results of slump tests and strength of conventional fibrous concrete

Plan	Type of fibers	Islamp (Cm)	7 days		28 days	
			Pushing resistance MPa	Tensile strength MPa	Pushing resistance MPa	Tensile strength MPa
C2-S	steel	6	39/5	3/9	48/1	4/85
C2-P	Polypropylene	5	40/8	4/7	52/5	6/3
C2-G	Glass	7	42/5	5/18	49	5/8

4-4- Compressive and tensile strength diagrams of concretes

Diagrams of compressive and tensile strength of fiber-free concretes can be seen in the diagrams of Figures 4-1 and 4-2.
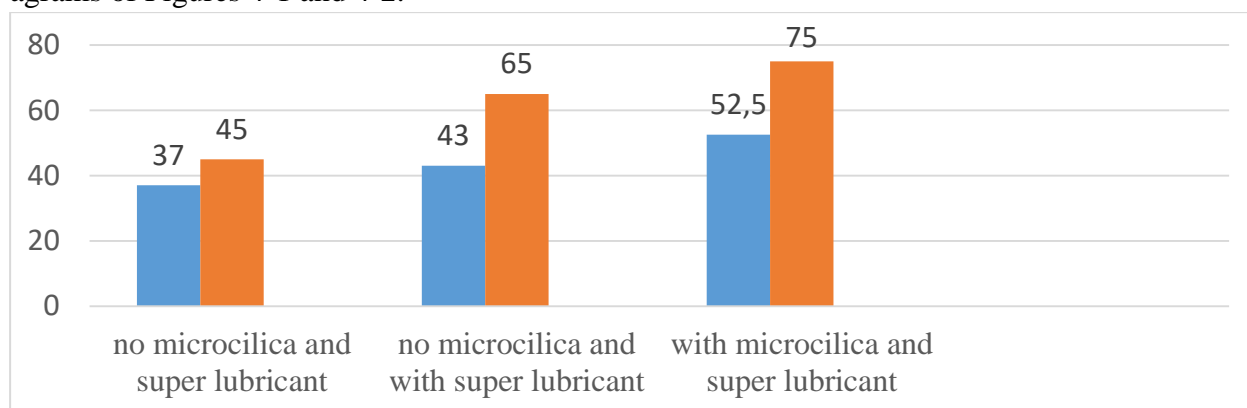
Figure 4-1 – Compressive strength diagram of fiberless concretes at the ages of 7 and 28 days.
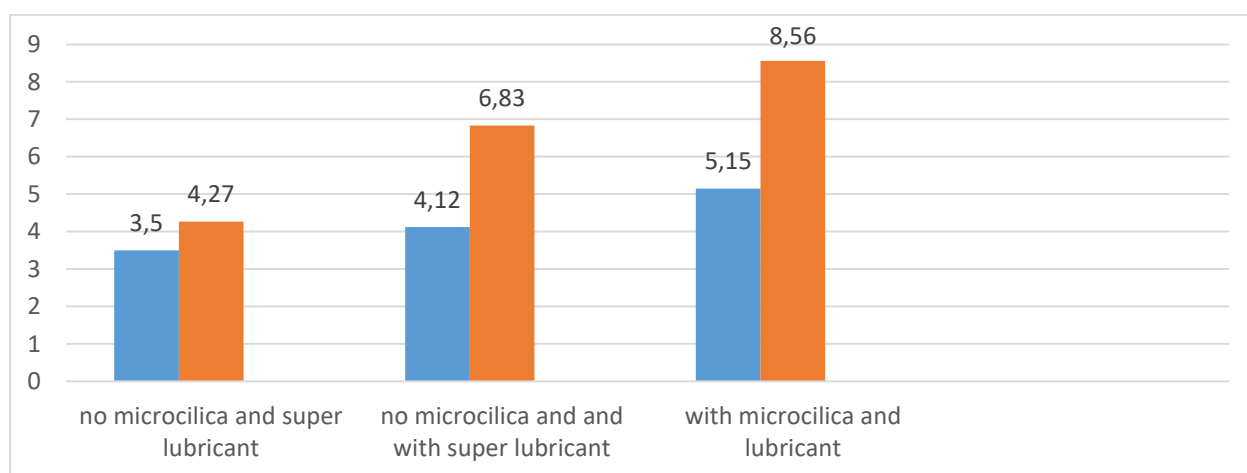
Figure 2-4 – Tensile strength diagram of fiberless concretes at the ages of 7 and 28 days

Compressive and tensile strength diagrams of high strength fiber concrete are shown in Figure 3-4.
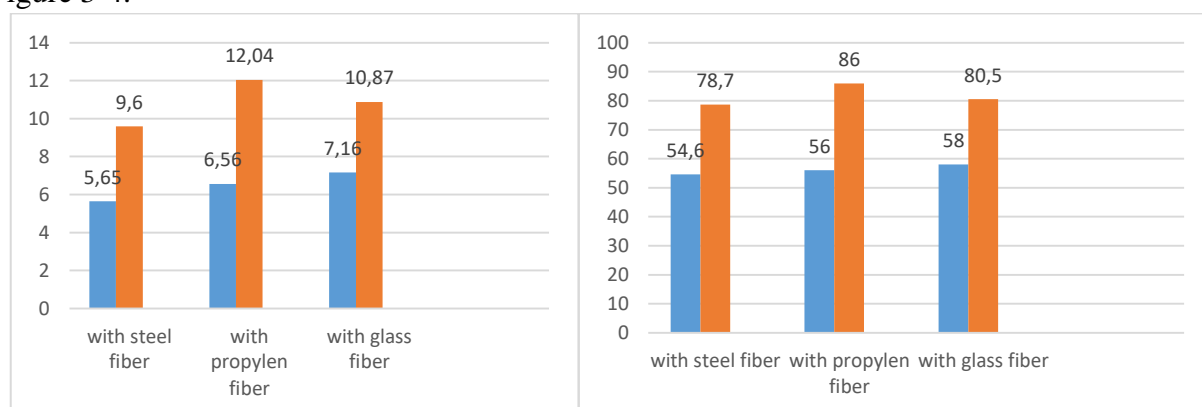
Tensile strength 7and 28 days (mega pascal)　　　　Compressive strength 7and 28 days (mega pascal)

Figure 3-4 – Compressive and tensile strength diagram of high strength fiber concrete at 7 and 28 days of age.

Compressive and tensile strength diagrams of conventional fibrous concrete containing super plasticizer can be seen in the diagrams in Figure 4-4.
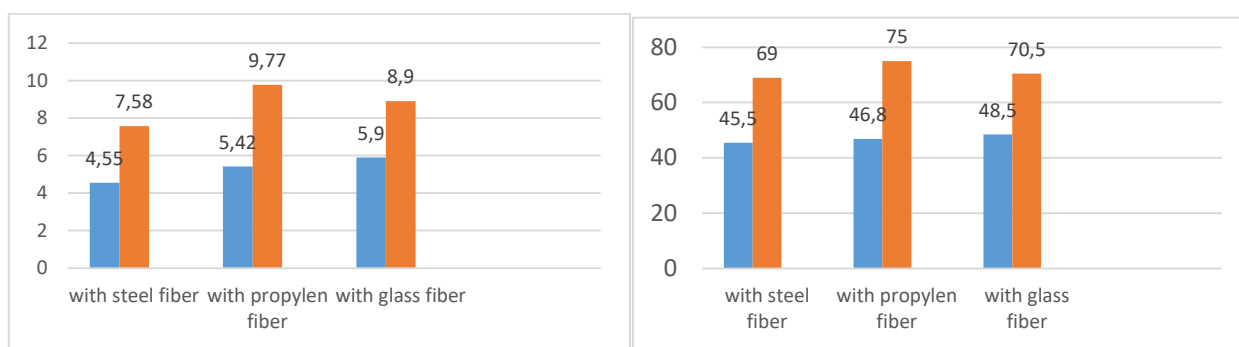
Tensile strength 7 and 28 days (mega pascal)   Compressive strength 7 and 28 day (mega pascal)

Figure 4-4 – Compressive and tensile strength diagram of ordinary fibrous concrete containing super plasticizer at the ages of 7 and 28 days
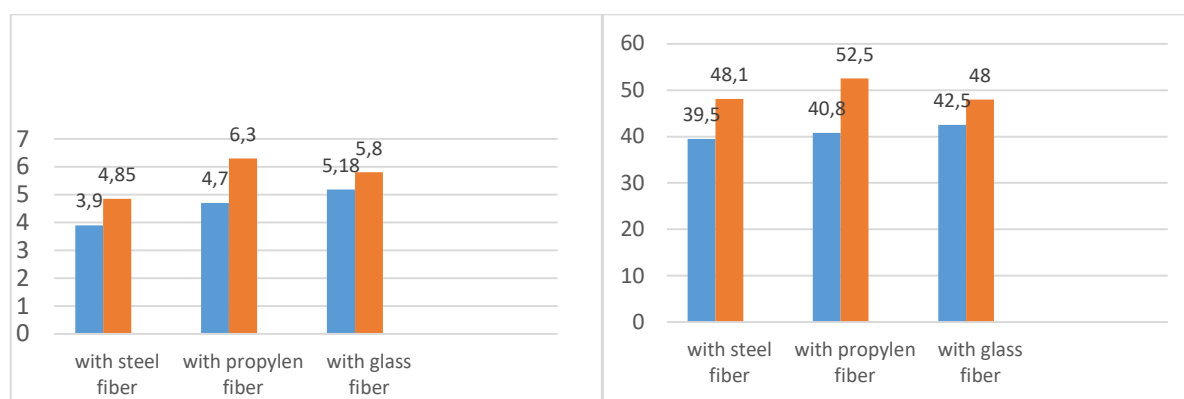
Tensile strength 7 and 28 days (mega pascal)   Compressive strength 7 and 28 day(mega pascal)

Compressive and tensile strength diagrams of conventional fibrous concrete can be seen in the diagrams in Figure 4-5.

Conclusion

In this study, by reducing the ratio of water to cement in ordinary concrete, the water consumption is close to the amount of water required for cement hydration reactions and the cavities formed in concrete are reduced, resulting in increased concrete strength. It is noteworthy that super lubricant has been used to control the performance of concrete.

By adding microsilica in the composition of lime concrete produced in the process of hydration of cement, it reacts with the silica in microsilica and stabilizes the production of hydrated calcium silicate and increases the strength of concrete, while microsilica particles fill the space between aggregates and prevent them from locking. And thus the efficiency of concrete has increased. By adding fibers to concrete, the cohesion of concrete has increased and the efficiency of concrete has decreased. Also, by adding fibers in the composition of concretes, their compressive and tensile strength has been increased. It was related to polypropylene fibers and the lowest amount was related to steel fibers.

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EVALUATING THE QUANTITATIVE AND QUALITATIVE CHARACTERISTICS OF FRUITS ON THE SMART FARMS USING THE INTERNET OF THINGS

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ABSTRACT

The Internet of Things is a huge network of interrelated objects and people connected to the Internet. Over the past few years, IoT science has gained great influence and importance in the agricultural sector. One

of the important sub-fields of this science is monitoring and control of greenhouses, farms, and fisheries. To be more specific, the monitoring process in agriculture observes the proper operation of systems and the realization of agricultural production. In this study, a monitoring system based on wireless sensor network (WSNs) technology has been developed to monitor the environmental conditions of the greenhouse using the NRF24L01 + module and the Arduino board. The connection between the sensor node and the base station is established by the NRF24L01 + module, and subsequently, the information collected by the sensor node is transferred to the base station. The collected data is transferred from the base station to an Internet database and stored. The user can access the desired information using a mobile phone or browsing web pages through a browser. Comparing the qualitative and quantitative characteristics of the products produced in the proposed system compared to the traditional greenhouse proves the improvement of the performance of the proposed system.

Keywords: IoT; smart farm; quantitative and qualitative characteristics of fruit; the sensor node.

Introduction

The core of the Internet of Things is data. To optimize farming processes, embedded IoT devices must collect and process data in a repetitive cycle so that farmers can respond quickly to emerging issues and changing environmental conditions. Precision agriculture is a new concept for IoT-based approaches with more precise control over farming processes. In simplest terms, plants and animals receive the treatment they need well enough. The biggest difference with traditional approaches is that in precision agriculture, separate decisions are made per square meter or even per plant/animal (rather than a farm). By accurately measuring changes in a field, farmers can increase the effectiveness of pesticides and chemical fertilizers and use them selectively and optimally.

Wireless sensor networks have a variety of applications in smart farms, such as measuring and monitoring soil properties, including soil moisture, soil temperature, soil pH level, and properties such as temperature, wind speed, and rainfall. The information generated by the sensors can be sent to farmers in the form of packets via the Internet, and necessary measures such as irrigation or fertilization can be done (Kodali et al., 2014).

Over the past few years, much research has been done on IoT applications in agriculture. Creating the right environmental conditions is critical for the ideal growth of plants, crop growth, and the optimal use of water and other resources. For example, using Arduino Mega, Sambasivam et al. (2018) analyzed atmospheric conditions such as soil moisture, humidity, and temperature in an indoor environment. By using greenhouse automation, productivity can be increased to some extent. Also, Tanmay Baranwal et al. (2016) designed an IoT-based device that analyzes sensed information and sends it to the user. This device can be monitored remotely and used in agricultural fields and refrigerators for security purposes.

In Chaudhary et al. (2011), the use of a programmable system on chip (PSoC) technology as part of a wireless sensor network (WSN) to monitor and control various greenhouse parameters has been proposed. Aung et al. (2019) introduced the smart greenhouse system as a convenient way to extract information from the greenhouse. IoT provides a report of all work done and updated information and the current state of the greenhouse from anywhere and anytime. The information the greenhouse owner receives is limited, but accessing such information is immediate. In (Jorda et al., 2019), an experimental prototype of an IoT-based micro-farm is designed using a wick system as a planting method. The results of this study allow urban farmers to remotely monitor their farms.

Manishkumar et al. (2018) discuss using the cloud-based Internet of Things in agriculture. Precision agriculture promptly provides adequate resources, including water, light, pesticides, etc.

Based on a more accurate and cost-effective resource approach, smart agriculture has the potential to provide better and more sustainable agricultural products. The new farms are fulfilling the eternal dream of mankind and feeding our growing population, estimated to reach 9.6 billion

by 2050. Accordingly, this study aims to evaluate the quantitative and qualitative characteristics of fruits in the smart farm using the Internet of Things platform.

Proposed method

The proposed method has been experimentally implemented in a designed greenhouse with a length of 3 meters and a width of 2 meters. The sensor node and base station start working simultaneously in this method. A radio network is then established using the RF24L01 + module, and the base station is connected to a wireless Internet modem. In the next step, the data request is sent to the sensor node because the base station does not yet have the sensor information. After receiving the request from the base station, the sensor node sends the information to the base station. At the same time, the sensor compares the information with the threshold and, if necessary, controls the relevant relays. Immediately after receiving the data, the base station creates an HTML page, displays the information, and sends the information to the database.
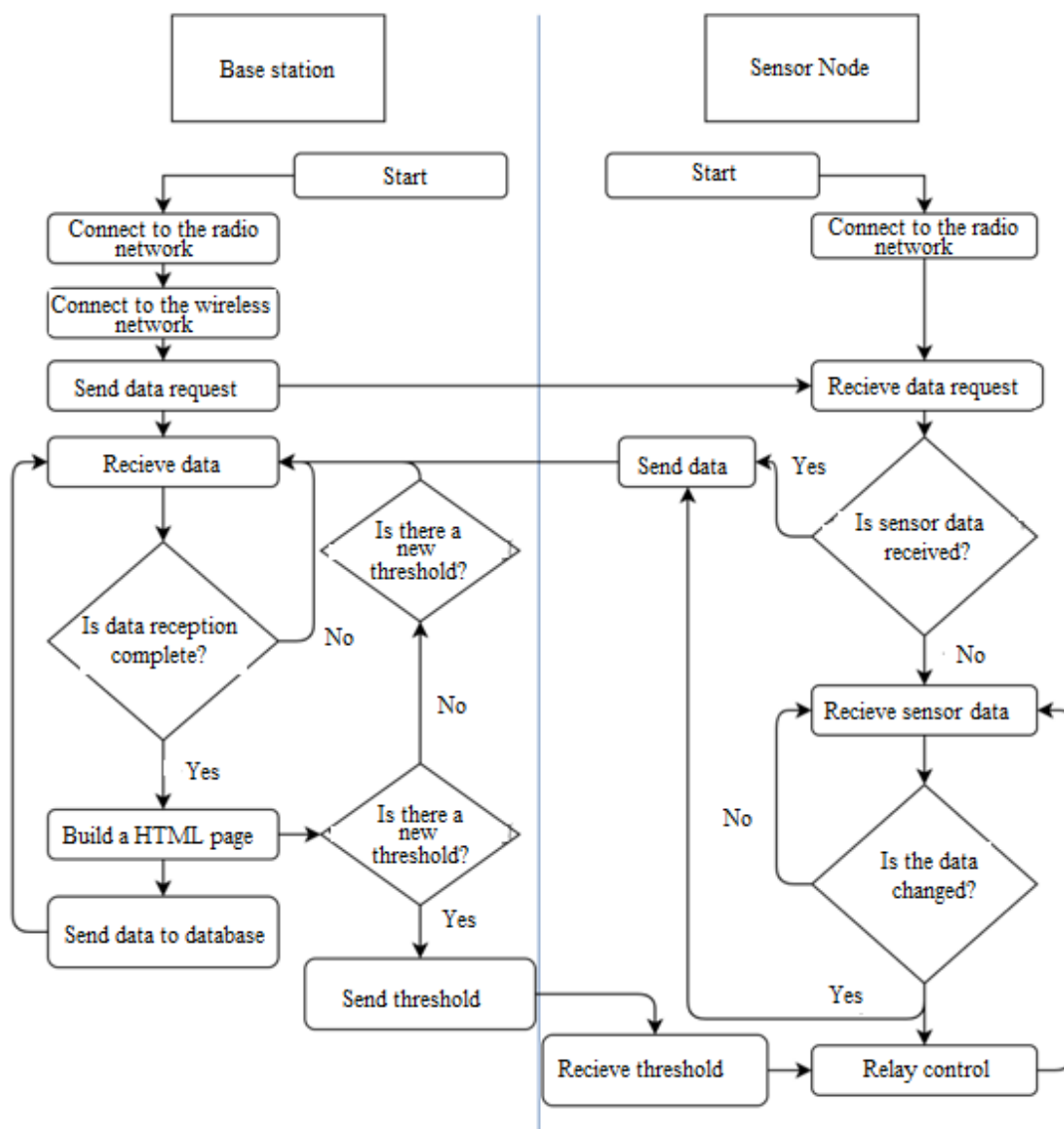
Figure 1 – Flowchart of the proposed method
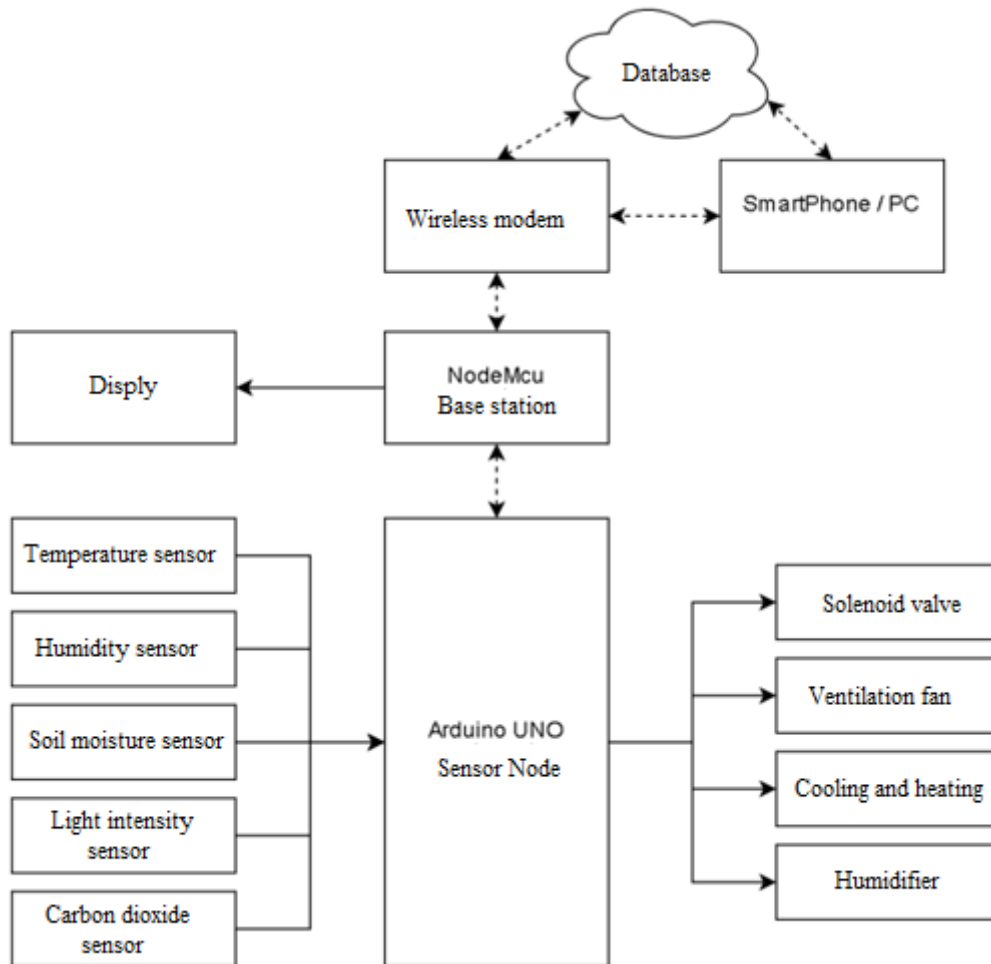
Figure 2 – Proposed system components

1. Sensor node hardware

Arduino Uno is one of the most well-known and popular microcontroller boards developed by Arduino. The Arduino Uno allows most communication methods with different modules and carries a reasonable number of pins. Its board also provides enough processing speed and memory to perform many simple calculations. In the figure below, you can see the Arduino Uno board. As shown in the figure, the Arduino Uno board communicates wirelessly between the sensors and the base station. The sensors and a wireless transmission module are connected to the Arduino. A wireless transmission module is also connected to the base station. Putting results together, the sensors and the base station communicate wirelessly and exchange data.

Figure 3 – Arduino UNO board

The NodeMCU module is a development board specifically used in the Internet of Things. This module has an open-source, programmable FIRMWARE running on the ESP8266 WiFi chip used to control objects.

Figure 4 – NodeMcu module in combination with CH340G chip

The DHT11 temperature and humidity sensor are low-cost for measuring air temperature and humidity. The small size of this sensor, low power consumption, and signal transmission over a distance of more than 20 meters has made it one of the best options for use in various projects.
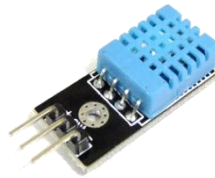
Figure 5 – DHT11 temperature and humidity sensor module

Measuring soil moisture is critical in agricultural applications. We need a soil moisture sensor to supply water in a timely and correct manner leading to the production of quality products.
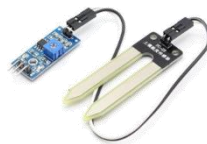
Figure 6 – YL-69 soil moisture sensor module

The TSL2561 light sensor is a sophisticated sensor capable of detecting a wide range of visible light.

Figure 7 – TSL2561 light sensor module

The MQ-135 sensor is an air quality sensor that detects smoke, alcohol, gasoline, and carbon dioxide in the air. The heater of this sensor uses voltage V5.

Figure 8 – MQ135 air quality sensor module

The NRF24L01 + module utilizes 2.4 GHz radio waves to communicate with various devices up to a maximum distance of 100 meters.

Figure 9 – NRF24L01 + wireless transmitter and receiver module

This project uses the NRF24L01 + module to communicate wirelessly between nodes and the base station. The NRF24L01 + modules are connected separately to the base station (NodeMcu) and the Arduino board. The two modules then exchange data.

Figure 10 – Dual channel relay module

This project uses a two-channel relay to control the water pump, humidifier, air conditioner, and ventilation.

One of the important features of LCD monitors is the number of characters that can be displayed. For example, the 2×16 model means the LCD screen has four columns and four rows.

Figure 11 – Character LCD with dimensions of 16×2

This display is used to display base station information.
In this project, the following parts have been used to set up the base station:
- NodeMcu control board - CH340G
- Character LCD with dimensions of 16×2
- Transmitter and receiver module + NRF24L01
- Micro USB cable
- Adapter 5V 1A
- Jump wire
The above parts are connected as follows.
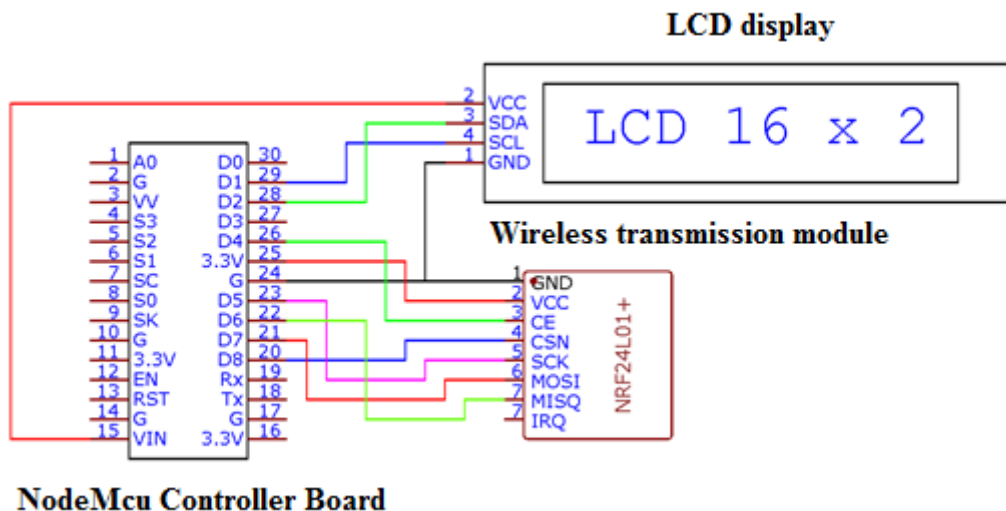
Figure 12 – Base station (master) circuit schematic

After communicating between the NodeMcu board, the NRF24L01 + transfer module, and the LCD, a Google Sheet must be created over the Internet to store the data received from the sensors. After creating the desired file, we load the script code using the Google Script Editor tool. These codes load the data sent from the base station into the file. This system also can display stored data in the form of plots.

Smart greenhouse scenarios

One of the definable scenarios for environmental parameters is as follows: "The temperature or humidity of the greenhouse environment is high or low." By installing temperature and humidity sensors in different parts of the greenhouse, it is possible to control the heating, cooling, and air conditioning equipment in proportion to the ambient temperature and humidity. Also, in critical situations, the necessary warnings are sent to the farmer to reduce the quality loss or even the loss of crops. Another scenario is reduced soil moisture and thirsty plants. Soil moisture sensors located in different parts of the greenhouse monitor the irrigation conditions of plants. If the farmer does not have access to the greenhouse, using the remote control scenario, the conditions for controlling the greenhouse equipment and remote monitoring are provided for the farmer. Also, using wireless modules, sensor information can be stored on the Internet, and changes in environmental parameters can be observed on plots.

Localization of sensors in the greenhouse

The location of the sensors in the greenhouse is determined based on the scenarios defined in the previous section. Figure (3-15) shows the proposed greenhouse map as well as the location of the sensors with a focus on facilitating agriculture and implementing various scenarios.

The length, width, and height of the proposed greenhouse are 3, 2, and 2.5 meters, respectively. The sensors are located in specific sections according to their application. The temperature and humidity sensor is placed at the height of 2 meters in the center of the greenhouse to sense the temperature and humidity of the greenhouse. The soil moisture sensor is located at the farthest point from the central irrigation system to record the lowest amount of soil moisture. The following figure shows the implementation circuit of these sensors.
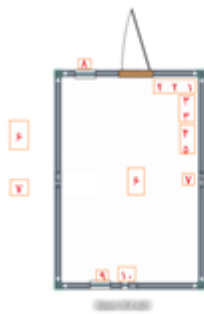
1. Arduino
2. Relay
3. Solenoid valve
4. Light sensor
5. Carbon dioxide sensor
6. Temperature and humidity sensor
7. Soil moisture sensor
8. Ventilation fan (input)
9. Ventilation fan (output)
10. Cooling and heating equipment

Figure 13 – Proposed map of the greenhouse and location of the sensors
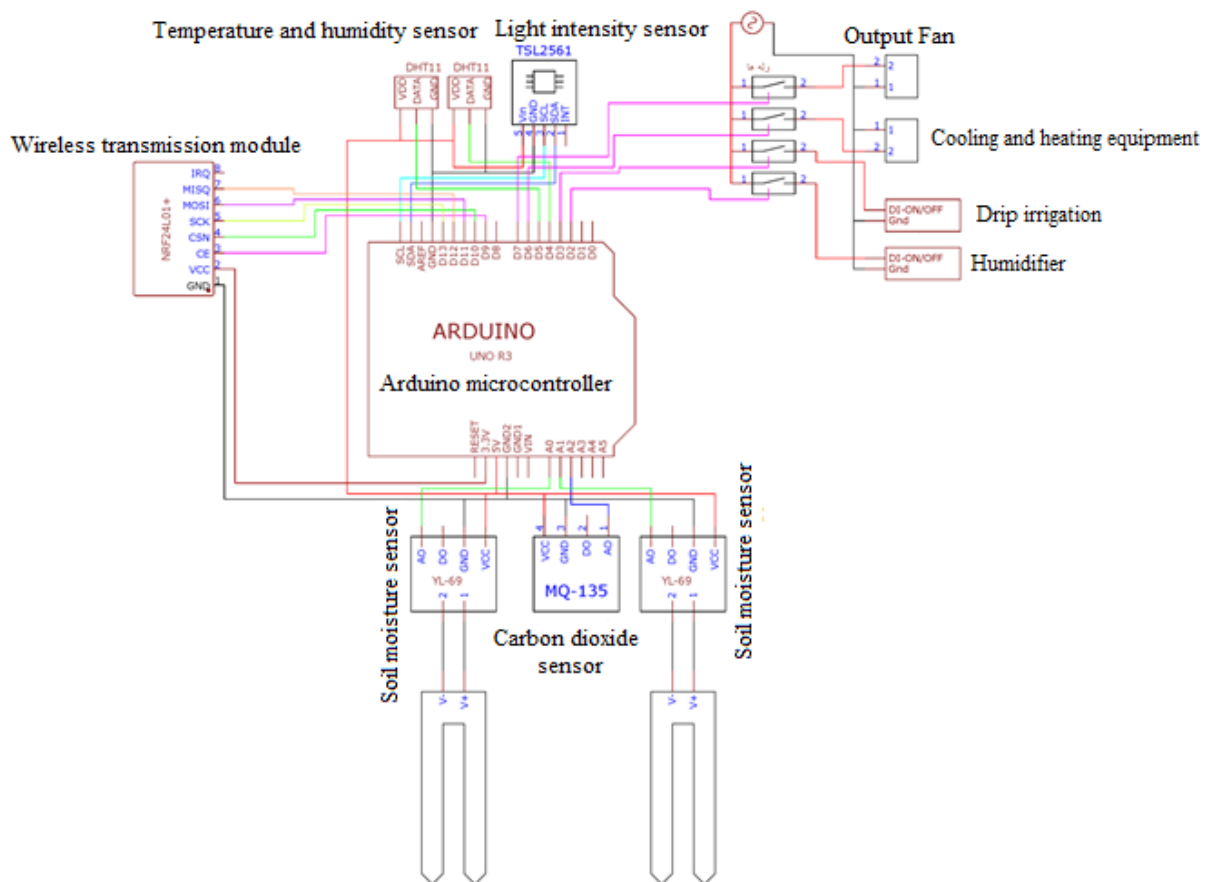
Figure 14 – Sensor node (slave) circuit schematic

Software implementation

Designing and implementing an HTML application interface for displaying data stored in Google Sheets is desirable. This user interface interacts directly with the base station. The interface is designed using HTML and displays sensor update information on web pages. The information plots stored in Google Sheets are also displayed as 24-hour charts.

1. Real-time display of sensor information. This part displays the information of temperature and humidity sensors, soil moisture, carbon dioxide, and light intensity in an instant and is updated automatically.

2. Defining the threshold of the parameters. This part defines the desired limitations, such as maximum temperature, air humidity, and soil moisture. Clicking the "Submit" button sends the information to the sensor station through the base station.

3. Greenhouse 24-hour plots. The sensor information is sent to the Google Sheets platform every 1 hour. Using the plot tool, we show the sensor information diagrammatically.

4. Outside the greenhouse, 24-hour plots.

5. The URL of the web page that is defined locally.

In this study, a string variable in the Arduino programming language is used to display the user interface, which contains the HTML file of the user interface. The GET method gets the settings, sending the desired parameters to the base station via URL.

The NodeMcu wireless controller board is used to create the server. This board is connected to the wireless modem using the ESP8266WiFi.h library and the definition of SSID and password, then displays the information received from the sensors through the ESP8266WebServer.h library using the class "send" (TEXT/HTML). It also receives the HTML file class as a parameter and sends it to the server.

Subsequently, to store information in the Google Sheets platform, we use the HTTPSRedirect.h library and the class "connect" (host, HTTPS Port) to connect to the above system and use the unique spreadsheet code created to access the data storage location and send the desired parameters via URL. Finally, the information is checked and stored using a script written for the file.

The Chart tool displays the sensor information plot on the Google Sheets platform, and the above plot is inserted into the HTML file with the <iframe> tag using the Publish Chart option.

Results

The table below shows a significant increase in the fruit mean length in EDU of the proposed method compared to the traditional method. The values obtained in Sweet million do not differ significantly. In other types, the fruit length in the traditional method is not significantly different from the proposed method, and no special trend is observed.

Table 1

Fruit mean length (mm) in five types of greenhouse tomatoes

Method	Guiza	EDU	M09	Golden cherry	Sweet million
Traditional	56	54	60	30	22
Smart	67	75	67	34	23

According to the values in the table below, the fruit mean diameter of all types (except EDU) has not increased significantly. The diameter of the fruit is not affected by different methods.

Table 2

Fruit mean diameter (mm) in five types of greenhouse tomatoes

Method	Guiza	EDU	M09	Golden cherry	Sweet million
Traditional	52	50	51	20	24
Smart	52	54	51	20	24

According to the table below, the mean weight of fruit in EDU produced based on the proposed method compared to the traditional method shows a significant increase. In Guiza, the amount obtained from the proposed method compared to the traditional greenhouse method shows a significant increase. In other types, there is no significant difference between the methods.

Table 3

Fruit mean weight (g) in five types of greenhouse tomatoes

Method	Guiza	EDU	M09	Golden cherry	Sweet million
Traditional	119	97	141	8	7
Smart	156	148	148	10	9

According to the results in the table below, the mean plant yield (total harvest from the first five clusters) in Sweet million and Guiza is not significantly different. In Golden cherry, the performance of the proposed method has improved 1.7 times. Also, the results of the proposed method in M09 and EDU show a significant increase of 1.8 and 1.3 times compared to the traditional method.

Table 4

Mean plant yield (kg) in five types of greenhouse tomatoes

Method	Guiza	EDU	M09	Golden cherry	Sweet million
Traditional	13.23	11.24	7.49	4.93	3.38
Smart	13.39	14.69	13.98	8.55	3.72

Conclusion

Understanding environmental factors and using smart tools can effectively create an ideal environment for growing plants and agriculture. Given the growing population of the world, it is vital to provide solutions to address food shortages. The proposed solutions should help farmers minimize the manpower and resources needed and increase the quality of products. One of the ways to increase the quality and quantity of products is the optimal use of water and fertilizer resources. This study assessed the needs and problems of farmers and used special hardware and software to implement smart greenhouses and meet the relevant needs.

The results showed that the proposed system could grow five types of tomatoes. Regarding qualitative parameters, the fruit length of EDU in the proposed method has increased 1.38 times compared to the traditional method. No significant difference was observed in the fruit diameter parameter in the cultivated varieties. The fruit weight of EDU in the proposed method has increased 1.52 times compared to the traditional method. Also, the weight of Guiza in the proposed method has increased 1.31 times compared to the traditional method. The mean total plant yield in M09, EDU, and Golden cherry types increased 1.8, 1.3, and 1.7 times, respectively.

We recommend using a servo motor and moving canopy on sunny days for better temperature control. Using a gas solenoid valve to control the temperature in winter is also desirable instead of heating equipment. On the other hand, pH sensors can measure the salinity of the soil as well as the number of elements needed. Finally, the farmer is informed about the current condition of the greenhouse by sending short messages and emails.

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EVALUATING DATA FROM SENSORS IN SMART FARMLANDS USING INTERNET OF THINGS (IOT)

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ABSTRACT

This research has created a monitoring system by employing wireless sensor networks technology to monitor environmental conditions of greenhouses using the NRF24L01+ module with an Arduino board. In this system, the connection between the sensor node and base station is established by the NRF24L01+ module, and the data gathered is transferred by the sensor node to a base station. Gathered data, having been transferred to the base station, will be transferred to an Internet database to be stored so that the user can utilize the data through his/her mobile phone or by visiting web pages. This research examines the sensors used in a greenhouse environment and calculates some evaluating parameters, such as reliability, average packet transfer delay, power consumed and data transfer rate. Consistent with these evaluations, the proposed system's reliability at the 10-meter distance from the base station was 92.25%, being acceptable for this application. The average delay of the packet transfer was 206 milliseconds in one hour, being insignificant. This indicates that the sent packets were transferred to the base station in a very short time. The total energy consumption of 36 Watts per day suggests that the module had a low energy consumption. The wireless transfer module used in this project was also compared to other wireless transfer modules. It was determined that this module was more effective than other modules regarding the coverage rate and data transfer.

Keywords: smart greenhouse; precision farming; IoT; smart farmland; data evaluation.

Introduction

Smart farming also called the third Green Revolution, is an emerging concept that refers to a set of farmland management techniques using information and communication technologies that can radically transform the agriculture industry, producing more high-quality products in large numbers. One of the manners in which the quantity and quality of agricultural products can be increased is to use new up-to-date technologies. Thus, we can make our farmlands smart and

connect those farmlands by using "precision farming" or "smart farming" and use the data received to improve products and lands. In this connection, IoT is believed to play a major part in farming, forest products, and all farming regions.

IoT refers to a system involving computation equipment, digital and mechanical machines, objects, animals and humans with a unique ID capable of data transfer on the network without human interaction and intervention. Today, IoT applications are widely used in most industries, including agriculture, construction management, medicine, energy and transportation. This certainly involves a direct relationship with the ever-increasing coordination between electronic engineers and software developers who work on IoT products and systems.

Precision farming techniques have been introduced in recent decades. Meanwhile, they were utilized by some innovative farmers, as the smart use of farming data is still limited (Aubert et al. 2012). IoT has expanded the concept of precision farming into smart farming, in which the farmland converts into an interacting smart web of farming objects (Wolfert et al. 2010). The whole farming management perspective that concerns the unified integration of measurement and monitoring in real-time, smart analysis, smart control and smart planning of all farming processes is a critical subject. Other subjects include improved ease of use, viability and simplification of existing solutions, engagement of the main farmers' community, and initial adopters (Kruize et al., 2013).

Tanmay Baranwal et al. (2016) designed an IoT-based device that analyzed the sensor-based data and then transferred them to the users. This device could be remotely monitored and implemented for farmlands and cold storage security objectives. This article aimed to solve such problems as identifying rodents, threats against agriculture products and providing immediate warnings using data analysis and processing without human intervention.

Mehmet et al. (2018) provided an IoT-based communication architecture and a basic measurement technology, together with communication mechanisms. Moreover, in addition to recent theoretical developments, underground wireless communication applications were reported.

Terteil et al. (2018) did research to create a monitoring system for precision farming with low costs and less energy consumption that would produce low greenhouse gas emissions; also, they established a user-friendly interface to get farmers to monitor the changing farming parameters (e.g., climate status, soil, water, detection of pests, detection of permeation and fire detection) using their smartphones in a cyclic period at every point and at any time.

Manishkumar et al. (2018) also proposed to use the cloud-based IoT in farming. Precision farming is, in fact, a concept that seeks to appropriately provide suitable sources on accurate timing. These sources can include water, light, pesticides, etc.

In IoT-based smart farming, a system is in place for monitoring farmlands. This system provides us with integrated data using sensors (light, air humidity, temperature, etc.) and helps automate land irrigation. Using this system, farmers can monitor their lands wherever they are. IoT-based farming systems are not only applicable in traditional farming methods but are also usable in small domestic, organic and modern farmlands.

The proposed system gathers the data from sensors and wirelessly transfers it to the base station, where the data are received and stored on the Google Sheets, which will be displayed in the local HTML network. The proposed smart system, together with the user interface, greatly contributes to the farmer increasing the quality of the farming products. This system can also send warnings and provide daily reports to the farmer in case a crisis unfolds so that the farmer and the experts can take precautionary measures.

Proposed Method

This technique was experimentally designed in a greenhouse which measures three meters long and two meters wide. The sensor node and base station begin operating simultaneously in this technique. Then, a radio network using the RF24L01+ module is established, connecting the base station to the wireless IoT modem. Later, because the base station still does not have the sensor-based data, it applies to the data sent by the sensor node. The sensor node, having received data from the base station, examines the sensor data and then sends them to the base station, simultaneously comparing the data with the threshold limit and controlling the related relays if necessary. The base station also receives data to create an HTML page, displays the data and sends the data to the database simultaneously.
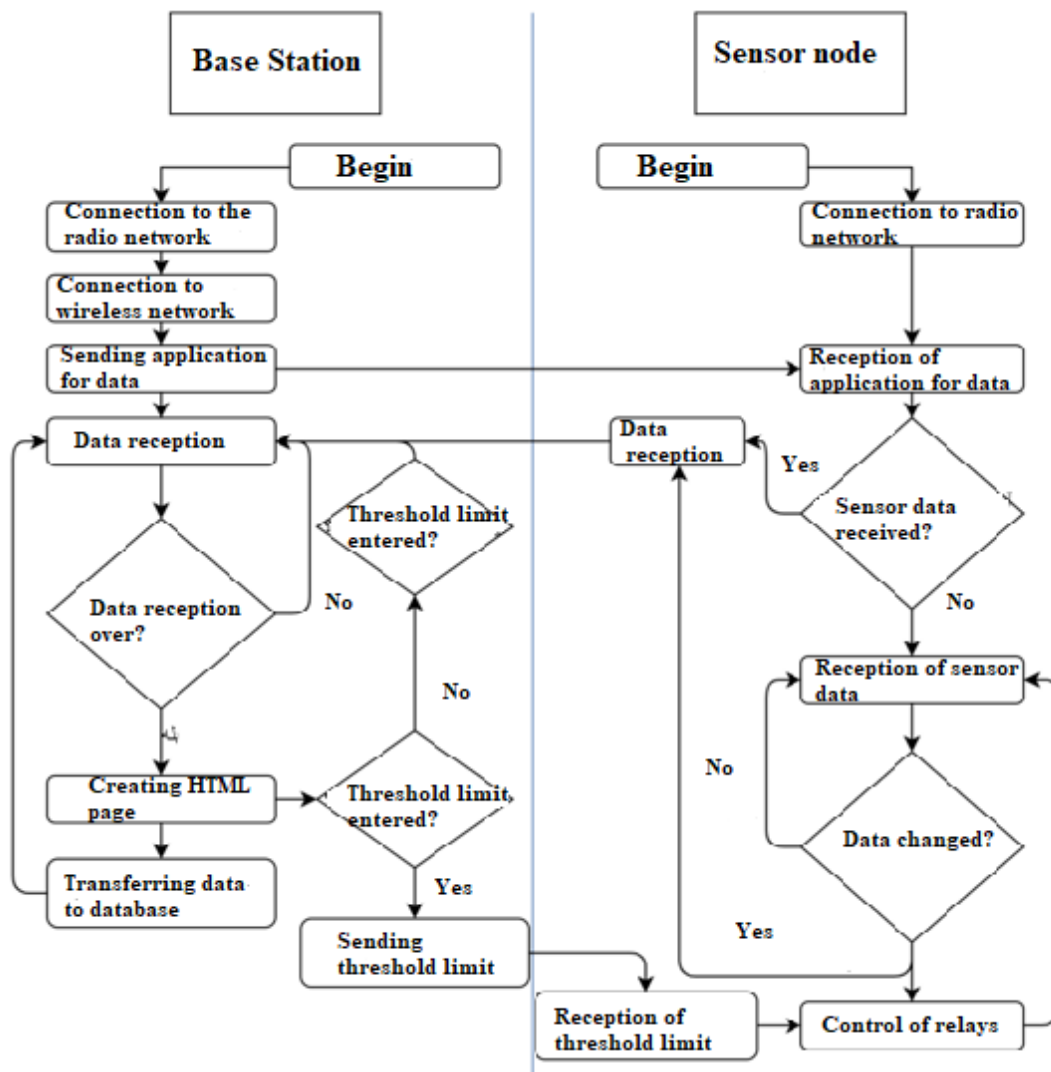
Figure 1 – Proposed technique flowchart
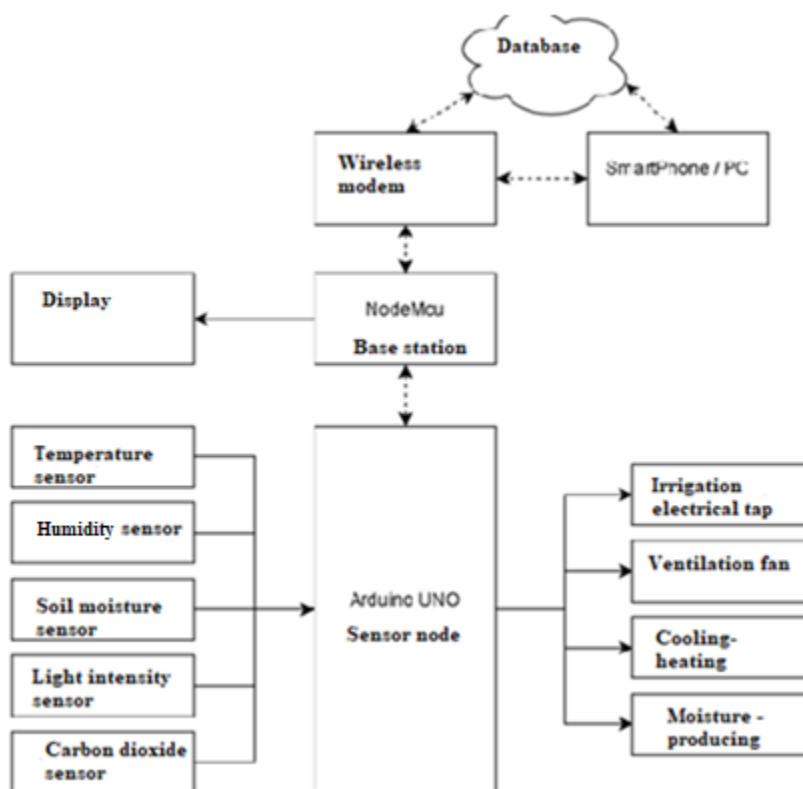
Figure 2 – Components of the proposed system

Sensor Node Hardware

UNO Arduino is the most famous and applicable type of Arduino. UNO Arduino establishes the connection between communication techniques and various modules. A rational number of PINs on them enjoy appropriate processing speed and sufficient memory for many tasks. The image below illustrates the UNO Arduino board, which establishes wireless communication between sensors and the base station. This procedure follows: the sensors and a wireless transfer module are connected to an Arduino board. A wireless transfer module must also be connected to the base station. This way, sensors and the base station are connected wirelessly and exchange data.

Figure 3 – UNO Arduino board

NodeMCU module is a development board specifically used in the IoT. This module has a firmware installed on a ESP8266 WiFi chip and used to control objects in open text form, and is programable.

Figure 4 – NodeMcu module together with a CH340G chip

DHT11 temperature and humidity sensor is low-cost to measure temperature and air humidity. The small size of this sensor, as well as its low energy consumption and capability of transferring the signal to a distance of over 20 meters, make it one of the best choices to be used in various projects.
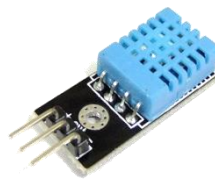
Figure 5 – DHT11 humidity and temperature sensor module

Today, it is imperative to measure soil moisture in farming usages. To have a high-quality product, you need to timely and correctly irrigate its land, and it is here that you will need a soil moisture sensor.
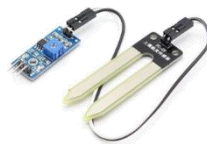
Figure 6 – YL-69 Soil moisture sensor module

TSL2561 light sensor is a complicated sensor capable of detecting a large spectrum of visible lights.

Figure 7 – TSL2561 light intensity sensor module

MQ-135 sensor is a device to detect air quality. This sensor can detect smoke, alcohol, gas, and carbon dioxide in the air. The heater of this sensor uses 5V voltage.

Figure 8 – MQ-135 air-quality detection sensor module

NRF2401+ module uses radio waves of 2.4GHz frequencies to communicate with various devices from a maximum of 100 meters.

Figure 9 – NRF24L01+ wireless sender and receiver module

This project used this module to establish wireless communication between the nodes and the base station, as the NRF24L01+ module is connected to the NodeMcu base station, and a NRF24L01+ module is also connected to the Arduino board, connected to the intended sensors. These two modules will then exchange data together.

Figure 10 – Two-channel relay module

This project uses a relay to control the water pump, moisture-producing device, cooler and ventilation fan. LCDs are determined by the number of characters they show; for example, the 2*16 model suggests the LCD has 16 columns and two rows.

Figure 11 – LCD with 2*16 characters

This display is used to show the base station's data.
This project also uses the following parts to set up the base station:

- NodeMcu - CH340G control board
- 2*16-character LCD
- NRF24L01+ receiver and sender module
- Micro USB cable
- 5V 1 Amp Adaptor
- Jumper wire

The above parts, having been completed, are connected as follows:
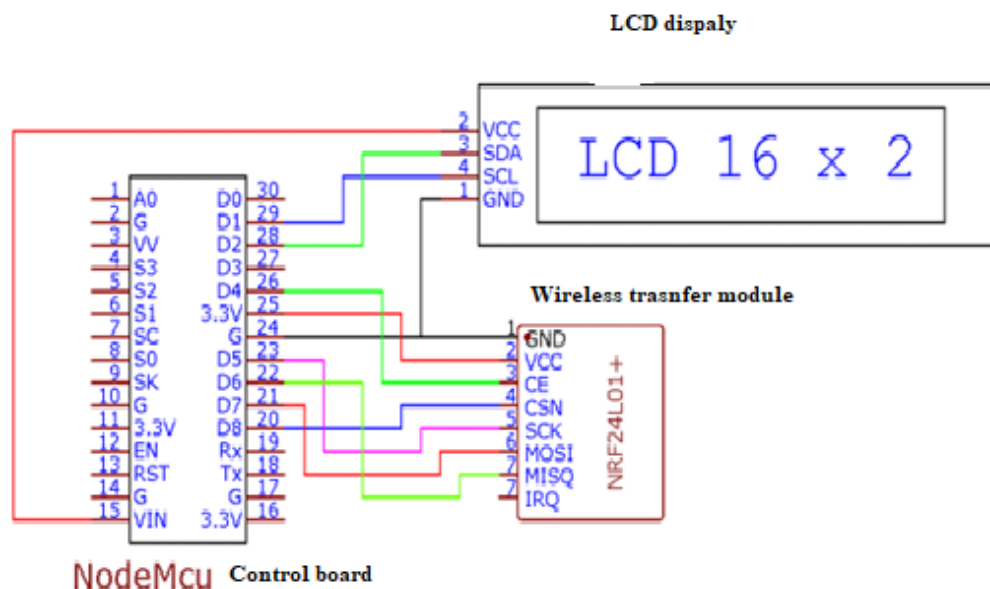
Figure 12 – Circuit schematic of the base station (Master)

After communication between the NodeMcu board and NRF2401+ transfer module and the display, Google Sheets must be created on the Internet platform to store the data received from the sensors in the file. After the intended file was created, the Google Script Editor was used to load the script codes, which load the data sent from the base station in the file. This system also displays the data stored in a diagram.

Smart Greenhouse Scenarios

One of the scenarios about environmental parameters is as follows: the temperature or humidity of the greenhouse environment is either high or low. Using temperature and humidity sensors installed at different points of the greenhouse, cooling, heating and air ventilation equipment can be controlled in proportion to the temperature and humidity situation. Under critical conditions, necessary warnings can be given to farmers to reduce the likelihood of quality drops or loss of the products. Another scenario occurs when soil moisture is low, and the plant faces thirst. Using soil moisture sensors installed at different greenhouse points, plant irrigation can be monitored and regulated. The farmer may not have access to the greenhouse, as a remote-control scenario allows him to control the greenhouse equipment and monitor the situation remotely. Using wireless modules, sensor data can be stored on the Internet and be informed of the changing environmental parameters via diagrams.

Placement of the Sensors at the Greenhouse

The place sensors are deployed to the greenhouse is determined based on the scenarios defined in the previous section. Figure 15-3 illustrates the proposed greenhouse map, as well as the

deployment of the sensors, taking into account the facilitation of agricultural affairs and administration of various scenarios.
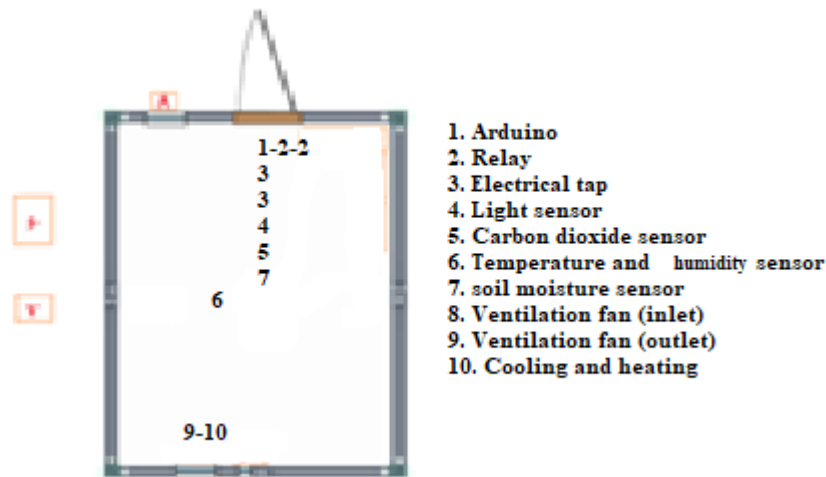
Figure 13 – Proposed greenhouse map and placement of the sensors

The proposed greenhouse is 3 meters long, 2 meters wide, and 2.5 meters high, with each of the sensors placed in specified sections given their supplications. Temperature and humidity sensors are deployed at the height of 2 meters in the central part of the greenhouse to obtain the temperature and relative humidity of the greenhouse. The soil moisture sensor is deployed at the farthest point from the irrigation system to yield the least soil moisture value. The figure below indicates the circuit of the sensors' installment.
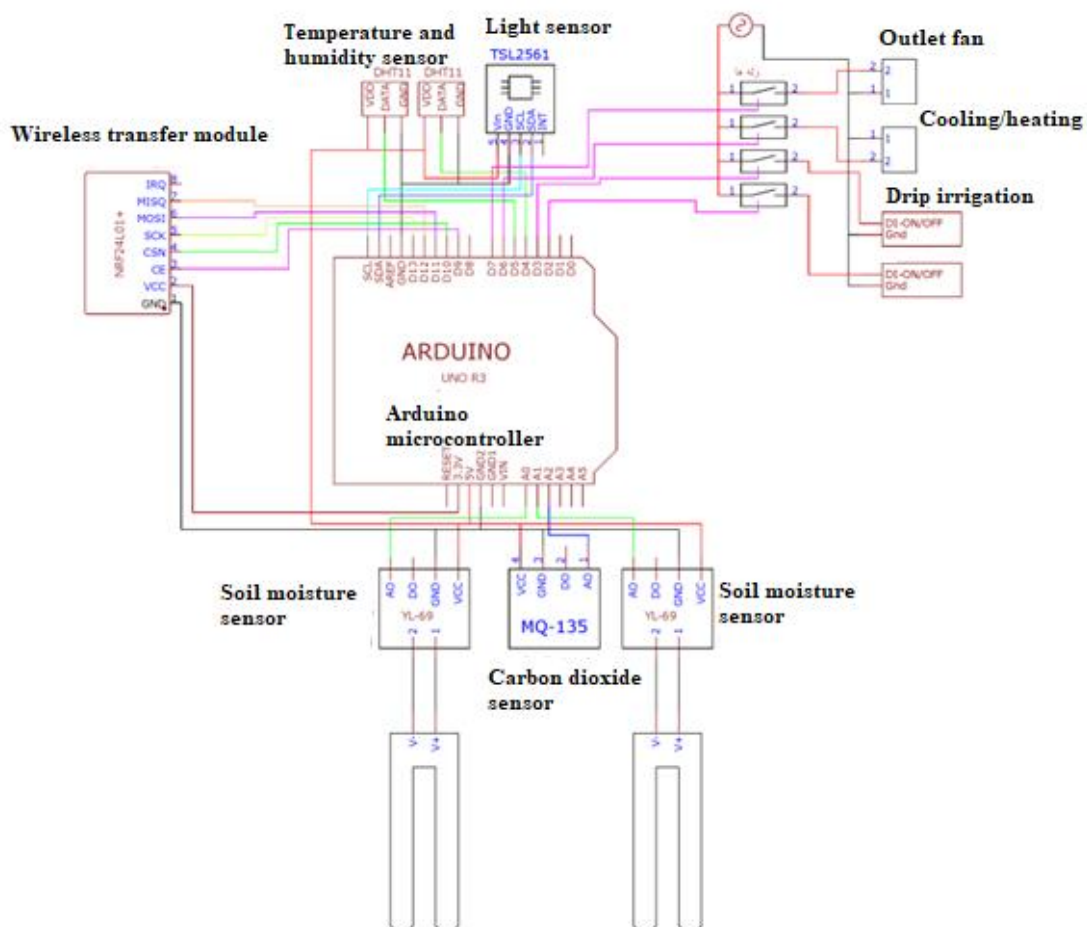
Figure 14 – Circuit schematic of the sensor node (slave)

Setting up the Software

Designing and implementing the HTML user interface is appropriate for displaying the data stored in the Google Sheets System. This user interface is in direct interaction with the base station. Using the HTML language, an interface was designed to display the updated sensor data on a webpage and a diagram of data stored on the Google Sheets in a 24-hour diagram.

1. Momentarily display of the sensor data: This section displays the data of temperature and humidity, soil moisture, carbon dioxide, and light intensity sensors momentarily and updates them automatically.

2. Definition of the parameters' threshold: This section defines intended limitations, including maximum temperature and humidity, soil moisture, and sending the data by clicking the button Submit through the base station to the sensor station.

3. The 24-hour diagram of the greenhouse: Data from sensors are sent every one hour to the Google Sheets platform to be stored. Using a diagram, sensor data are seen in the form of a diagram.

4. 24-hour diagram outside of the greenhouse

5. Webpage address section, locally defined.

In this research, a field variable in the Arduino programing language was used to display the user interface containing the HTML user interface file. In this interface, the GET method received the settings, with the intended parameters sent to the base station through the URL.

NodeMcu wireless control board was also used to create a server connected to the wireless modem using the ESP8266WiFi.h library and the definition of SSID and the password. Then, data from sensors were displayed in the form of text/HTML through the ESP8266WebServer.h library and use of the Send class. This class receives the HTML file and sends it to the server.

Also, to store data in the Google Sheets platform, the HTTPSRedirect.h library and the connect (host, httpsPort) are used to connect to the above system; then, the created unique spreadsheet code is used to access the place where data are stored, and the intended parameters are sent through the URL. In the end, the script written for the file is used to examine and store the file.

The Chart tool was used to display the diagram of sensor data on the Google Sheet platform, as the Publish Chart option is used to replace the above diagram with the <iframe> tag in the HTML file.

Findings

Assessing Sensor Data

Sensors were placed in different parts of the greenhouse. Considering the wireless communication of the sensors with the base station, the sensors must be connected to the Arduino microcontroller and NRF240L01+ wireless transfer module to be used for wireless communications; thus, the above sensors were brought together in a group to save cost and energy. After the sensors were installed, the data they sent were received in the base station, which, having been stored on the Google Sheets platform, were displayed by an explorer on a computer or mobile phone through the HTML user interface. To assess the efficiency and tolerance of the wireless sensor network, some parameters, including reliability, average packet transfer delay and consumed energy, were calculated, which will be later discussed.

Reliability

In the network, every node may break down or fail due to environmental factors such as fire, water leakage, impact or depletion of power source. Reliability denotes that if a node breaks down, the network's performance is not affected. This project's premise is to use unreliable components to create a reliable network. The reliability of the network and relevant protocols is a

major debate in the wireless sensor network. This project aimed to create a system to manage and control a smart greenhouse that should enjoy higher reliability and coefficient of tolerance so that it can send data gathered from sensors to the base station and rely on the sent results, which would help the farmer take appropriate measures. To measure reliability, it should be investigated how many nodes sent from the node to the base station will reach safely at the destination. In this project, the number of 3600 data packets sent from the node to the base station were stored in a file. The reliability of the node was calculated by dividing the number of data that reached safely at the base station by the number of data sent from the node.

Table 1

Node's reliability at different distances

Distance from the vase station (m)	Number of packets sent	Number of received (safe) packets	Reliability
2	3600	3474	96.5
10	3600	3321	92.25
15	3600	3194	88.72

As noted by the table, as the distance of the sensor node increases from the base station, the system's reliability decreases, indicating that the wireless transfer module faces problems with the communications as it distances from the station, with the number of lost packets also increasing. To send data from each sensor, a unique key was used to detect the relevant data. The following image illustrates the file stored in the node and the base station.
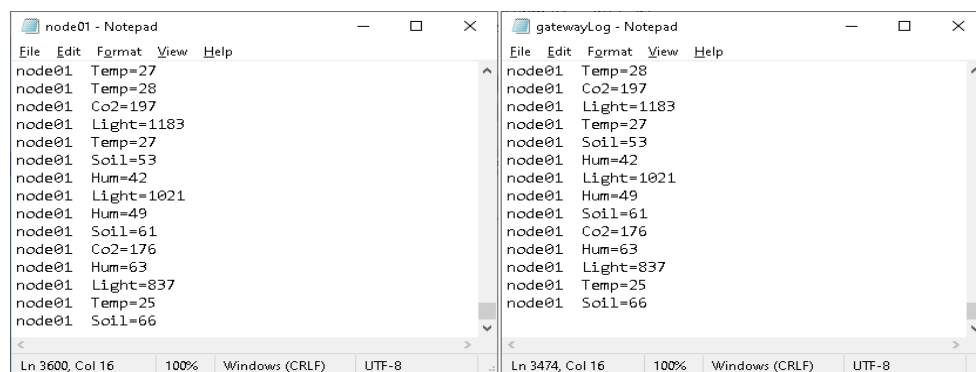
Figure 15 – Log file stored

As the image shows, the node01 file contains data of 3600 packets sent from the node to the base station, as the gatewayLog file contains data received from the base station. The file includes two columns; the first one pertains to the key of the node, while the second column pertains to the sensor data where Light, Co2, Soil, Hum, and Temp indicate light, carbon dioxide, soil moisture, humidity and temperature.

Average packet transfer delay

The second parameter of assessment is the average packet transfer delay. The table below gives the average delay rates of node packets is calculated within one hour, assuming a packet transfer of every second.

In a monitoring system, receiving the packets sent from the sensors with some delay is very important. Otherwise, the system does not give necessary warnings to the farmers on time

or implement the necessary commands. As the table shows, within an hour and assuming the transfer of data from the sensors every second to the base station, the average delay was calculated to be 206 milliseconds which was very desirable.

Table 2

Average delay of packet transfer

Time (second)	Total delay	Average delay of packet transfer (milliseconds)
3600	741676	206

Power Consumed by the Nodes
To calculate the current and voltage, the following circuit is used.
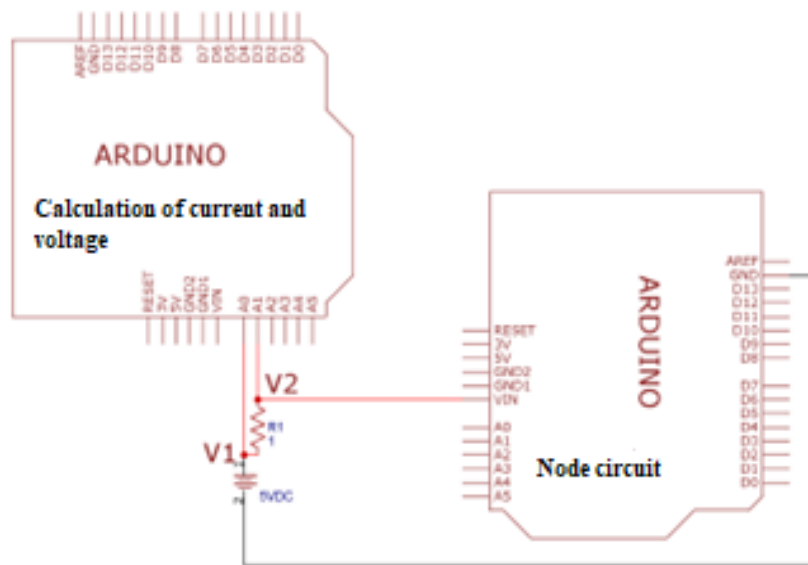
Figure 16 – Circuit to calculate the power consumed by the node and base station

Because the consumed power is constantly changing, the voltage and current must be continuously measured to determine the average power consumption. To do so, an Arduino microcontroller was used, which continuously measured the voltage and the current at a time interval and multiplied them by each other. At last, the average values were calculated and displayed. The momentarily current consumed by the circuit was equal to the current passing through the resistor. Resistance current was also calculated by measuring the voltage of the two-sided resistors. The following formula measures the circuit current.

$$V_1 - V_2 = R.I_{R1} \xrightarrow{I_{R1}=I_S} I_S = \frac{V_1 - V_2}{R}$$

The resistance used in this circuit must be very small to prevent the circuit from voltage drop. For this, 2.2. ohm resistance in the circuit was used. As a result, the circuit current is calculated from the following formula.

$$I_S = \frac{V_1 - V_2}{2.2}$$

The circuit voltage is V_2 which is measured as current is then multiplied by its voltage to calculate the circuit's power value.

Average power consumed by the sensor node and base station

Circuit	V₁	V₂	Iₛ	The average power consumed (W)
Sensor node	4.80 V	4.32V	0.22A	0.95W
Base station	4.90V	4.64V	0.12A	0.55W

As noted in the table, the sum of the average power of the entire system was 1.5 Watts. The following formula yields the total power consumed, which is 300 mAh.

$$P = V.I$$

Rate of Data Transfer
The table below gives the data transfer rate of three applicable wireless transfer modules and their coverage.

Table 3

Comparison of transfer rate and coverage

Module	Rate of data transfer	Coverage (m)
NRF240L01	1-2Mbps	10-100
ZigBee	20-250Kbps	10-100
Bluetooth	1-3Mbps	2-10

As noted, the transfer rate of the NRF240L01 module used in this project was greater than the ZigBee module but less than the Bluetooth, though its coverage was greater than that of the Bluetooth.

Examining Data Stored
To test the proposed system, stored data were displayed by the Google Sheets platform chart. The following figures illustrate the diagram of the data stored for the last 48 hours.
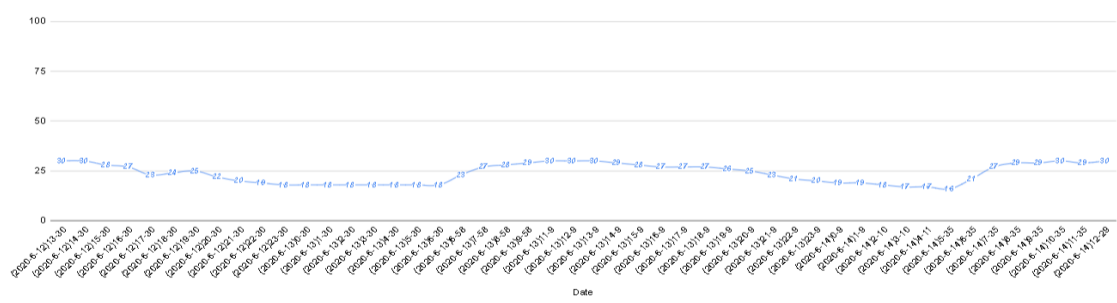
Figure 17 – Temperature changes in the last 48 hours
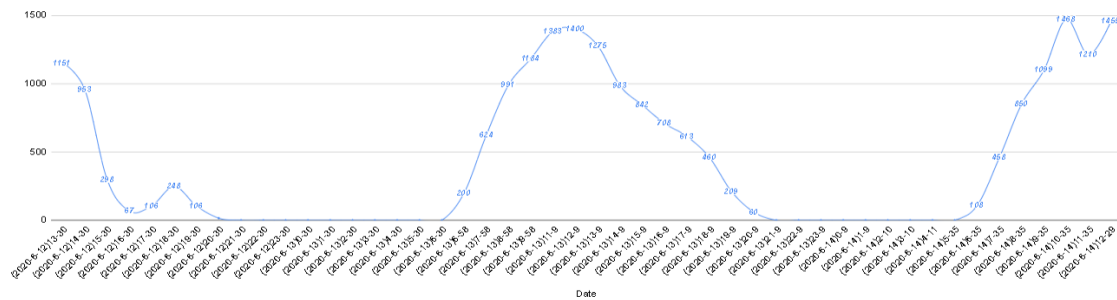
Figure 18 – Light intensity changes in the last 48 hours
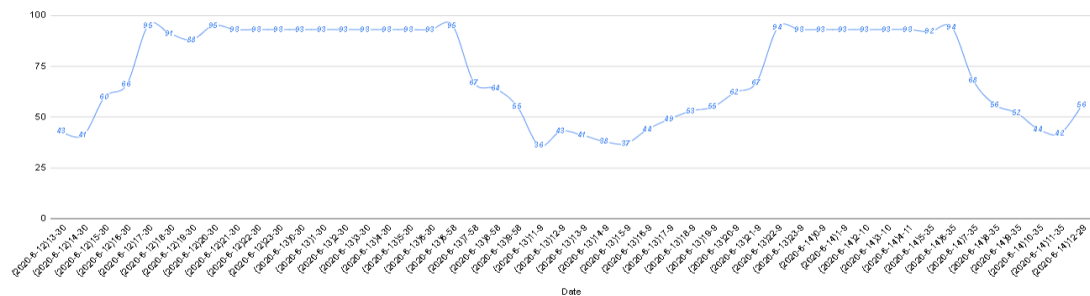
Figure 19 – Air humidity changes in the last 48 hours
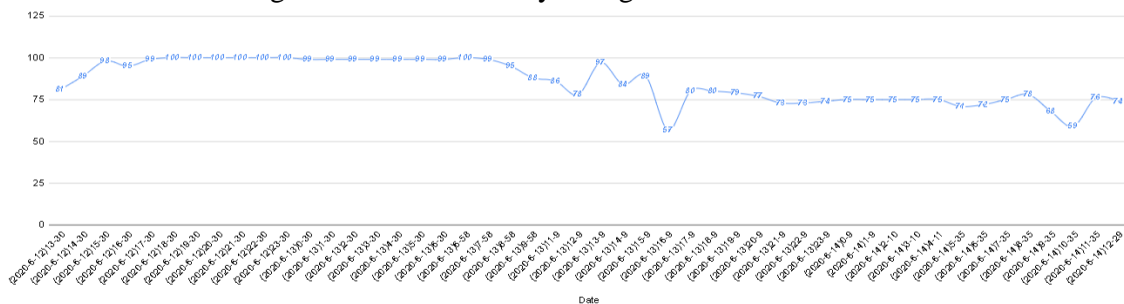
Figure 20 – Soil moisture changes in the last 48 hours
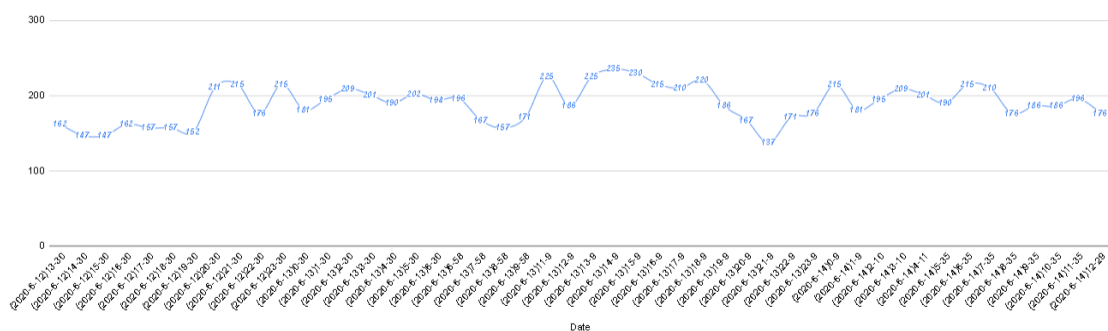
Figure 21 – Carbon dioxide changes in the last 48 hours

As noted in Figures 17 and 18 of temperature and light intensity diagrams, as the light intensity increases, the temperature gradually increases. When it reaches the defined default threshold of 30 °C, it will activate the cooling and air ventilation system by sending a command to the relay, thus preventing the excessive temperature increase in the greenhouse environment. Figure 19 shows that the air moisture diagram is reversely related to the temperature and light intensity diagram, as increased light intensity and temperature reduce the air moisture in the environment.

Conclusion

This research designed and implemented a smart greenhouse considering the farming needs and the problems that may arise for the farmers. A smart greenhouse system is characterized by having different sensors, various warnings at critical times, providing a simple user environment for remote control, economic design and implementation, etc. Also, an HTML user interface was designed to display the sensor data and warnings. This research examined the sensors used in the greenhouse environment. Also, some evaluation parameters, including reliability, average packet transfer delay, consumed power and data transfer rate, were calculated. Data from the past 48 hours were also reviewed. After the sensors were installed in the greenhouse, some evaluation parameters, including reliability, average packet transfer delay, consumed power and data transfer rate, were examined. It was noted that the reliability of the proposed system at the 10-meter distance from the base station was 92.25%, indicating higher reliability. The average packet transfer delay was 206 milliseconds within an hour, which was insignificant. The total energy consumption of 36 watts per day indicated low energy consumption. The total current consumed by the system was 300 mAh, which was very low compared to other projects, though acceptable. It is recommended that future climatic data are provided in direct contact with the base station and meteorology organization.

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COMMODITY RECOMMENDATION SYSTEMS IN ONLINE STORES USING ENSEMBLE LEARNING AND ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

This paper introduces a method based on ensemble learning and artificial neural networks to recommend links in online stores. In this method, the link recommendation problem is initially converted into a classification problem using users' purchase history. Afterward, training datasets are split into smaller subsets. Each subset is assigned to a neural network. After training, majority voting among neural networks is employed to recommend links for each commodity to each customer. The results indicate the proposed

approach has outperformed other basic approaches such as SVM, KNN, NB, and ensemble learning methods such as Bagging and Boosting, in terms of accuracy, precision, and recall, and by testing the Amazon Commerce dataset. The proposed approach finally managed to accurately recommend commodities with an accuracy of 99.3%.

Keywords: link recommendation; classification; machine learning; ensemble learning; artificial neural network; online store.

Introduction

Nowadays, the majority of electronic commerce (e-commerce) websites are equipped with recommender systems. Recommender systems help customers not only reduce the time spent on finding the desired product and increase the quality of the product they found, but they also help merchandising companies increase their profitability. Among the outcomes of recommender systems is to personalize websites based on customer preferences.

The primary task of a recommender system is to explore customer interests and needs. Recommender systems let e-commerce provide customers with personalized items and services by drawing on information history and user data and identifying their preferences (Gavalas and Kenteris, 2011).

This paper introduces a method based on ensemble learning with a baseline classifier of perceptron artificial neural networks.

Related Work

Elahi et al. (2009) proposed a website personalization technique based on the developed association rules.

Mahdavi Adi et al. (2007) utilized clustering for consistent automatic fuzzy concept networks and search engine results for personalization.

Fahimi (2001) developed a hybrid algorithm utilizing a weighing criterion and then user navigation data and page links to generate recommendations for the user.

Moradi et al. (2011) presented a method that tries to personalize responses by adding a new variable to the personalization system in the end-to-end information retrieval system through re-ranking.

Karimi et al. (2009) provided a framework to detect user behavior patterns using application-based web mining techniques.

Karimi Alavijeh et al. (2015) proposed a method that generates user indexes in two steps.

Mosabebian et al. (2012) attempted to model website users' behavior by employing web mining-based methods to personalize the website.

Iwata et al. (2008) applied two criteria, namely the frequency and the time the user spends on a given page.

Montaner et al. (2003) added a similarity criterion to the clustering algorithm using the Dempster-Shafer theory. The simulation results demonstrate that this similarity criterion yields much better results than the previous clustering criteria.

In their research, Min and Han (2014) initially studied and compared four hybrid methods and then proposed some techniques to improve the previous methods.

Proposed Method

In the proposed recommender system problem, it must be initially predicted whether two groups in a given network are interconnected in case they are aware of each other's presence. Indeed, the objective is to recommend links more interested in interconnection and accept all recommendations made by the recommender system that are preferred by the user. In this paper, "node" refers to users of online stores and marketable commodities.

Feature Extraction

To apply machine learning algorithms, we have a fixed-length feature vector for each user. Accordingly, the purchase history of each user or customer can be extracted as follows:

- First, a graph of online store information (commodities and customers) is established.
- Links or graph edges between the nodes are determined using store background.
- Any user-related node of the graph is considered as a sample for classification. Every sample must possess several features (previous connections).
- The artificial neural network (ANN) needs to determine the set of recommended links. (The commodity corresponding to index 1 should be recommended to the user.)
- It should be noted that several outputs can become 1 at the same time (multi-label).

Utilized neural network

This paper uses the most basic form of a network, i.e., perceptron, as the baseline classifier. The output of a perceptron j is calculated as follows:

$$y_j = H\left(\sum_{i=1}^{N} p_i w_{ij} + b_j\right) \ , \ j = 1, 2, \dots, M \ (1)$$

where N is the number of the features of the vector, p is the input, and M is the number of outputs. Weights w_i and bias b are the unknown parameters of the perceptron, which are set using training data and an optimization algorithm. Besides, H is a hardlim function that can be calculated as follows:

$$H(x) = \begin{cases} 1 & , & x > 0 \\ 0 & , & x \le 0 \end{cases} (2)$$

Fig. 2 illustrates the architecture of the perceptron neural network for M labels, whose length of the feature vector is N.

As shown, this neural network consists of a single layer with M neurons. The number of neural network inputs equals N, which denotes the overall length of the graph. It determines which commodities out of N available commodities in a given online store have already been purchased by an input sample. The purchased commodities are denoted by 1, and unpurchased commodities are denoted by 0.

The number of outputs in neural network architecture is M. As shown in this figure, there are M new commodities to recommend. The neural network output determines which commodities out of these M items should be recommended to the input sample. The output of this network is a vector of length M comprised of 0's and 1's.

Ensemble Learning

The proposed process of using ensemble learning in perceptron neural networks generally consists of the following steps:

- Splitting training data into several smaller subsets
- Training a series of perceptron neural networks with any of the subsets in the previous step
- Developing as many trained neural networks as the number of determined subsets
- Introducing new samples into all the trained networks
- Voting among the outputs of all networks and determining the final label based on the majority vote

Fig. 3 depicts the flowchart of ensemble learning for four subsets.

Evaluation Criteria

To evaluate the performance of the proposed method, the 10-fold cross-validation mechanism is applied. Here, in the database, 10% of the samples as the testing data and the rest 90% as the training data are fed to the algorithm. The precision of the 10% testing data is measured.
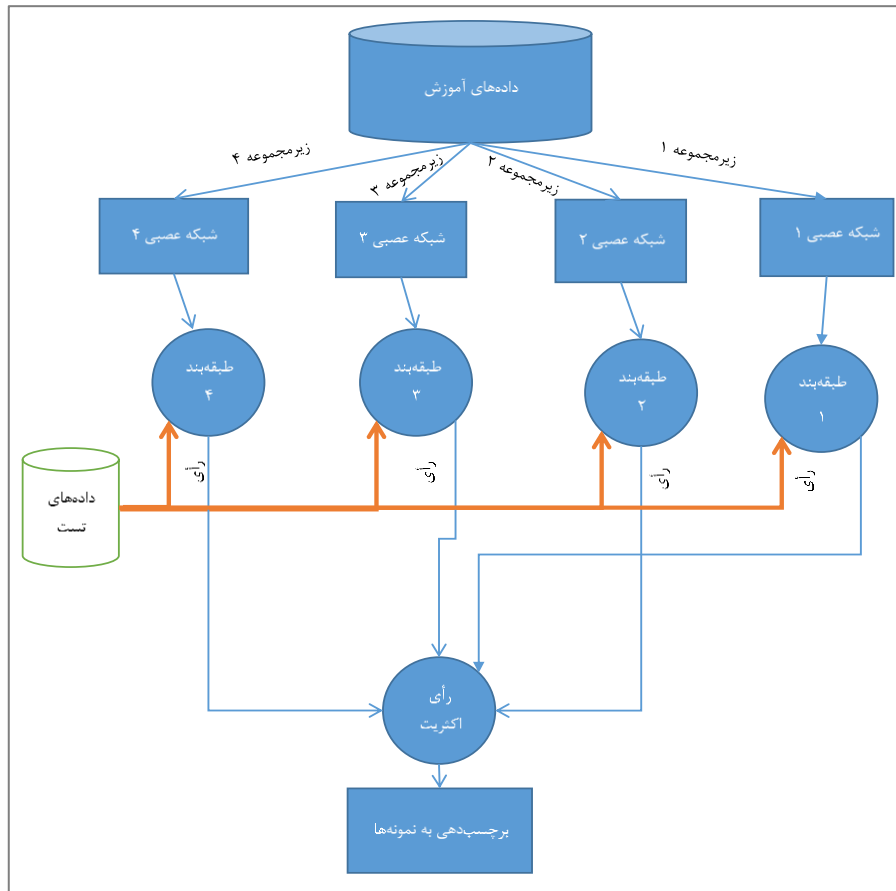
Figure 3 – Flowchart of the proposed ensemble learning

Then, the other 10% of the samples are selected, and the remaining 90% are considered as testing data. The operation is repeated ten times until all the samples are considered both as testing and training. The precisions obtained in each epoch are averaged and introduced as the precision of the algorithm.

The following evaluation criteria are taken into account:

$$\text{Accuracy} = \frac{TP+TN}{TP+FP+FN+TN} = \frac{N_T}{N} \qquad (3)$$

$$\text{Precision} = \frac{TP}{TP+FP} \qquad (4)$$

$$\text{Recall} = \frac{TP}{TP+FN} \qquad (5)$$

Obviously, the higher the values of the overall accuracy, precision, and recall, the more improved the classification.

Results

The proposed method is applied in the MATLAB 2018b programming environment, running on a system with an Intel® Core™ i7-7700HQ Processor. The proposed method is tested using the Amazon Commerce dataset from the Amazon online store available at the UCI data-

base (https://archives.ics.uci.edu/ml/datasets/), which will be described in detail in the next section. Other default settings for the algorithms are as follows:

– From the available datasets, 3000 nodes are selected for the feature vector and 27 nodes for labeling. In addition, the sample size is assumed to be 3000, split into training and testing data in accordance with the 10-fold cross-validation mechanism.

– To build a link recommendation model of a perceptron neural network with 3000 inputs, 27 neurons in the first layer and 27 outputs are considered. Indeed, it can be said that a perceptron is taken into consideration for each of the 27 labels, and the set is connected in parallel.

– The number of the learning epochs of the neural network is assumed to be 10.

– The number of data subsets for ensemble learning voters is set to be 10. In each epoch, a subset with 100-2000 samples is selected randomly.

– In each epoch, due to increased speed and higher precision, the initial weights of the current neural network are equal to the final weights of the neural network in the previous epoch.

Utilized dataset

The utilized dataset is extracted from the information available on the Amazon website. This dataset includes the purchase history of 10,000 users who have been associated with 3000 different products. Due to reduced computational load and execution time, only 3000 out of 10,000 samples are employed. On the other hand, there are 27 new products considered as labels.

Results

We initially address the execution [time] of a perceptron neural network without using ensemble learning. Fig. 4 demonstrates the process of learning and error reduction in a perceptron neural network.
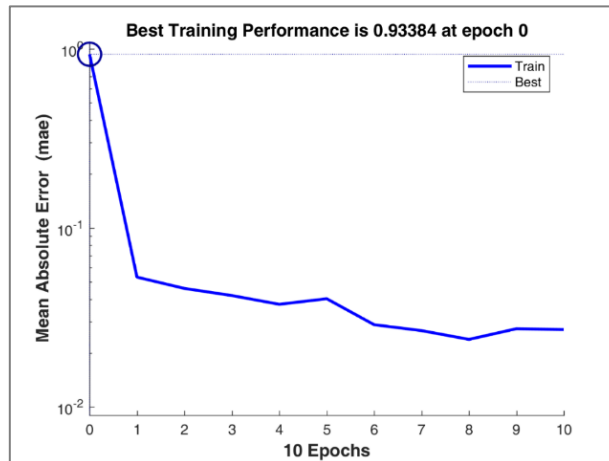
Figure 4 – Process of learning and error reduction in a perceptron neural network

As can be seen, an error has experienced a downward trend during learning, reaching below 0.03 after ten epochs. The error criterion during execution is the mean absolute error (MAE), which can be calculated as follows:

$$MAE = \frac{1}{n}\sum_{i=1}^{n}\left|y_i^{perceptron} - y_i^{actual}\right| \quad (6)$$

where n represents the number of training samples.

The following diagram shows the average accuracy of each neural network for the training data.
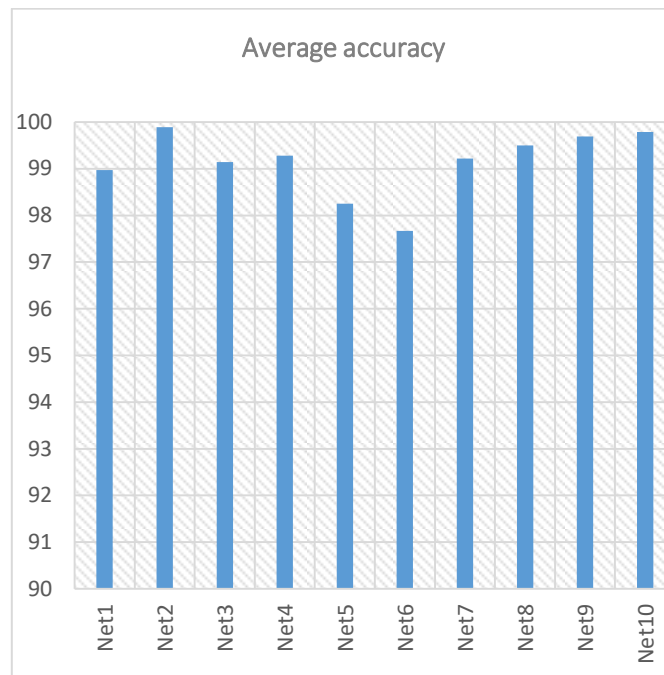
Figure 4.3 – Average accuracy obtained for each of the ten ensemble learning networks

As shown, the average accuracy is above 97% for all of the networks and has experienced an upward trend for the last four networks. This can be attributed to the unmodified weights of the neural network. For each network, initial weights are equal to the final weights of the previous network. For example, for network #10, initial weights are not randomly determined but are the same weights obtained for network #9. Accordingly, the neural network is trained much faster and is more likely to have higher precision. The majority voting rule is now implemented for the testing data among these ten networks, and the label is selected based on the majority vote.

Table 1 compares a baseline perceptron neural network and the proposed ensemble learning algorithm.

Table 1

A comparison between ensemble learning and the perceptron neural network

Algorithm	Average accuracy	Precision	Recall
Perceptron	95.39	32.36	22.57
Ensemble learning	99.31	72.57	58.59

Table 1 clearly shows improvements made by ensemble learning.

Comparison

This section compares the proposed method with two categories of classification algorithms. In the first step, the proposed method is compared with baseline classification algorithms such as support vector machine (SVM), k-nearest neighbors (KNN), Naïve Bayes (NB). Second, it will be compared with the most common ensemble learning methods such as Bagging, Boosting, and Random Subspace.

Table 2 makes a comparison between the proposed method and the other methods.

Table 2

A comparison of the results

Algorithm	Average accuracy	Precision	Recall
Proposed	99.31	72.57	58.59
KNN	96.24	27.55	14.58
NB	22.31	5.72	69.38
SVM	94.88	3.95	5.17
Bagging	97.29	32.50	14.37
Boosting	95.52	62.27	12.34
Random Subspace	92.29	28.15	3.70

Conclusions

In this paper, a link recommendation method was proposed for online stores in e-commerce. The proposed method is based on an ensemble learning algorithm, whose baseline classifier is a single-layer perceptron neural network. Applying the proposed method on a dataset from a real-world online store demonstrated that ensemble learning could significantly increase the precision of poor-performance baseline algorithms. Furthermore, the proposed method seemed to have higher precision than the other machine learning methods (e.g., SVM, KNN, and NB). It was also established that the proposed algorithm outperformed the most common ensemble learning methods (e.g., Bagging and Boosting). This is because these algorithms mainly use decision trees or KNN classifiers as the baseline classifier, which perform weaker than neural networks in this context. This indicates that choosing a single-layer perceptron as the baseline classifier in ensemble learning algorithms is more effective than other baseline classifiers.

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AN INVESTIGATION ON DAMAGES TO FOREST REGENERATION AND SOIL IN TWO LONG AND SHORT LOGGING SYSTEMS (A CASE STUDY: SIAHKAL SHENROOD FORESTS)

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ABSTRACT

Awareness of the extent of logging damages to the forest stands is of great significance in forest management. Minimizing forest soil and regeneration damages is a major requirement during the logging operation. This study was conducted in Siahkal Shenrood forests (parcels 754 and 755) using a single selection management method and ground-based skidding system (Timberjack 450C rubber-tired skidder). For this purpose, four slope classes (-10-0%, 0-10%, 10-20%, and 20-30%) and three areas (under the wheel, under the log, and control) were used. The results of the long log skidding system showed that the mean bulk density first decreased by increasing the slope class from -10-0% to 0-10%, then remained constant by increasing the slope class to 10-20%, and finally increased again by reaching the slope class to 20-30%. The results also showed that the bulk density in the long log skidding system had the highest values in the slope classes of -10-0% and 20-30% under the wheel and log. Meanwhile, in the short log skidding system, it had the highest values in the slope class of -10-0% under the wheel and the slope class of 20-30% under the log. The bulk density values were approximately the same in the two slope classes of -10-0% and 20-30% in the control group.

Keywords: short and long logging system; regeneration; Siahkal Shenrood forests.

Introduction

Having accurate information about the amount of damage to the soil and regeneration can help manage and choose the right method of forest exploitation.

This research is to estimate the amount of damage to the soil and forest regeneration during skipping operations in two systems, long and short.

Regeneration guarantees the future of the forest, with soil being its capital. Forest trees are susceptible to the physical properties of the soil (Mossadegh, 1996). The capacity of the forest for regeneration and survival depends on the location of the forest in terms of ecological components, logging techniques, logging intensity, and the extent of logging damages. In this regard, logging is one of the most important forestry behaviors (Sist, 2000). The three main sources of power in forest logging are human and animal power, machine power, and the use of gravitational force (Bulger, 2004). The use of each of the above powers in different logging systems has different impacts on the forest ecosystem. Due to having high organic matter, forest soils have low bulk density, high porosity, high permeability, and low resistance. As a result, they are susceptible to compaction and shear stress (Froehlich et al., 1985) (McNabb, 1984). The effects of skidding operations on forest soils can be divided into three main groups, including soil disturbance, soil compaction, and soil puddling and rutting (Rad, 1996).

Among the logging components, tree felling is very important as the beginning of the logging operation chain and has a great impact on the next stages. Tree felling includes subcomponents of cutting and felling, trimming, logging, and crown thinning. In the past, cutting, trimming, and conversion in natural forests were mostly done with axes, pit saws, and handsaws. However, today, chain saws have replaced hand tools for cutting and trimming operations in northern Iran. In the mountainous forests of northern Iran, due to having relatively steep slopes and thick broad-leaved trees, the use of selective methods, advanced mechanization, and multi-functional cutting and conversion machines is not common (Sarikhani, 2008). Logging is an operation during which a felled tree is cut into smaller pieces; in other words, logging involves the conversion of trees into logs with acceptable size for final use, making them ready for the next step, i.e., skidding or transport (Sessions et al., 2007; Dykstra et al., 1996).

The aim of this study was to estimate the effects of short and long logs on the soil and forest regeneration.

Materials and Methods
The area of study

This study was conducted in Siahkal Shenrood forests, Shenrood Series 7 (parcels 754 and 755) at an altitude of 750 to 2100 meters above sea level. Although the series mentioned has different altitudes, slopes, geographical directions, low and high ridges, and numerous valleys topographically, it does not have much diversity in terms of typology. Such a low diversity can be due to the same climatic, ecological, and edaphic conditions throughout the series. This series is considered as one of the middle-land and summer forests in terms of altitude, where there is not much variety of plant types and the beech species is often found in it.

Assessment of damages to regeneration and soil groups due to log transport using a skidder wheeled skidder Timberjack 450C

To assess the extent of damages to regeneration groups due to log transport using a skidder, a 100% survey The skidding operation took about 3 months, and then was carried out along the skid trails (6 * 1000 m) before and after the skidding operation and type of cutting was thining in two parcels of 754 (short log skidding system and type of cutting was thining) and 755 (long log skidding system). Both methods are in an area with a topographic condition and soil moisture and material Reproduction groups were classified into three categories: seedlings (with a height of less than 0.5 m), small saplings (with a height of 0.5 to 2 m), and saplings (with a height of 2 to 6-8 m). Regeneration groups were divided into two groups: intact and damaged. Damaged regeneration groups included four categories: completely crushed (fallen to the ground or cut down), injured (shedding of leaves completely or partially), and broken and harvested. To

measure the degree of soil compaction along the log skid trails, soil sampling was carried out before and after log skidding at the rate of 1600 cm3 in three areas In general, two skidding paths with approximately equal volumes and the same length of path were considered for the two long and short skidding systems.
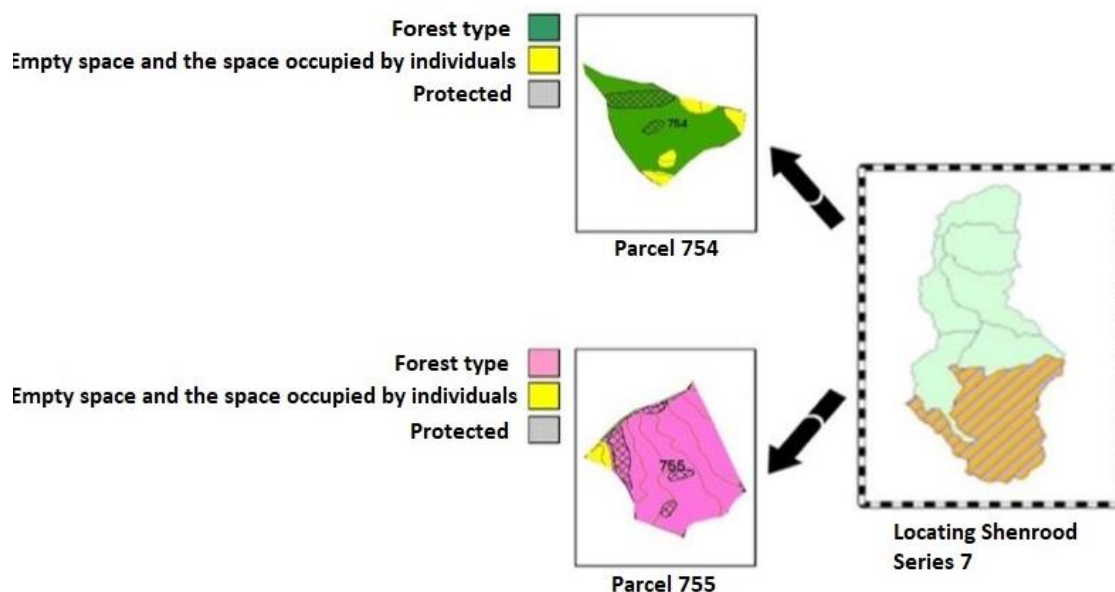
Figure 1 – Gilan vegetation regions in northern watersheds, watershed 25

In the short logging system, the logs with a length of less than 2.5 meters and in the long logging system, the logs with a length of more than 2.5 meters, which in the sum of the volume of skidding in each system are equal and approximately 2500 cubic meters (under the wheel, under the log, and control area) and four slope classes (-10-0%, 0-10%, 10-20%, and 20-30%). These slopes were selected according to the topographic conditions and the usual type of exploitation of forests in northern Iranin each parcel. A total of 120 soil samples were taken from a depth of 25 to 30 cm and sent to the soil laboratory to measure the bulk density and the moisture content. Data collection was performed in the form of a factorial experiment based on a completely randomized block design. To analyze the data, the Kolmogorov-Smirnov test was applied to examine the normality of data.

The two-way analysis of variance (ANOVA) was then used to investigate the effect of skidding traffic frequency and skid trail slope on bulk density, and the one-way ANOVA was applied to determine the maximum soil compaction in each of the slope classes. If the effect of each factor in one-way and two-way ANOVAs was significant, Duncan's Multiple Range Test (MRT) was used for grouping.

Results

Comparison of bulk densities in long log skidding system

According to the results obtained from data analysis, the effect of the slope factor on the bulk density was significant in the long log skidding system at the significance level of 0.01 (F = 12.90, α = 0.01). The effect of the compaction factor on the bulk density was significant in the long log skidding system at the significance level of 0.01 (F = 29.78, α = 0.01). The slope and area factors simultaneously had a significant effect on the bulk density in the long log skidding system at the significance level of 0.05 (F = 2.82, α = 0.05). The results of variance analysis are shown in Tables 1 and 2 and Charts 1 and 2.

Results of variance analysis of bulk densities in the long log skidding system

Source of variance	D_f	SS	MS	F	s.g
Slope	3	0.665	0.222	12.899	0.000**
Area	2	1.024	0.512	29.777	0.000**
Slope × area	6	0.291	0.049	2.822	0.02*
Error	48	0.825	0.17		
Total	59	2.805			

* and ** represent statistical significance at significance levels of α= 5% and α=1%, respectively.

Duncan's Multiple Range Test for identifying treatment groups for the slope factor in the long log skidding system

Types of slopes	Treatment group
(-10)%-0	1.6713 b
0-10%	1.4153 a
10%-20%	1.4727 a
20%-30%	1.6247 b

(Treatment groups marked with a letter do not differ significantly from each other at a significance level of 0.05).
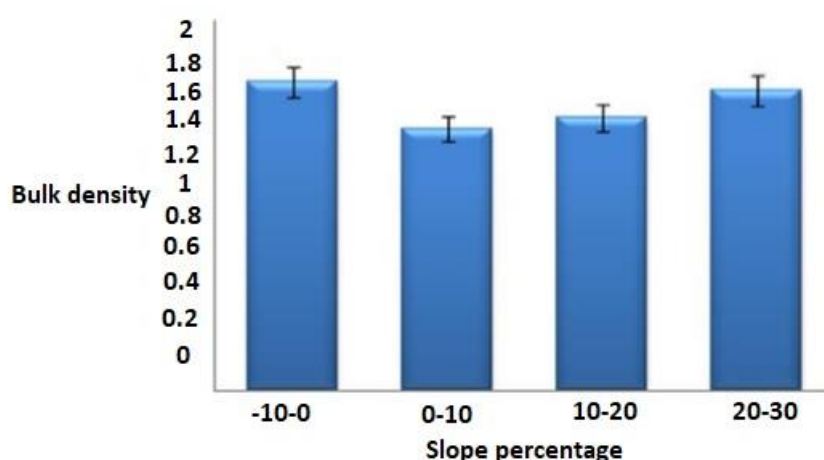
Chart 1 – Comparison of mean bulk densities in different slopes in the long log skidding system

In the long log skidding system, the mean bulk density first decreases by increasing the slope from -10-0% to 0-10%, then remains constant by increasing the slope to 10-20%, and finally increases again by reaching the slope to 20-30%. According to the analysis conducted, it was found that the bulk density has the highest value in the long log skidding system at slopes of -10-0% and 20-30%, as well as in areas under the wheel and log. Chart 2 shows a comparison of bulk densities in different areas and slopes.
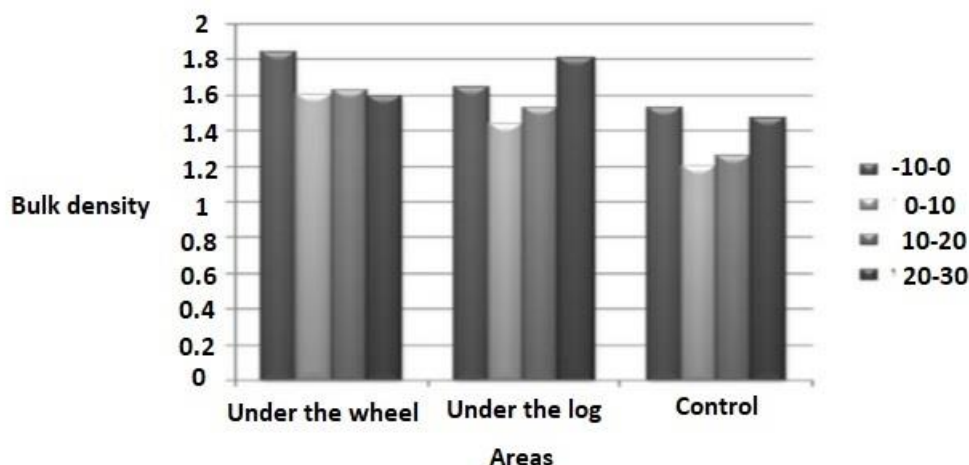
Chart 2 – Comparison of mean bulk densities in different areas and slopes in the long log skidding system

As can be seen in Chart 2, the bulk density has the highest value in the area under the wheel at the slope of -10-0%, while in the area under the log, the highest bulk density occurs at the slope of 20-30%. In the control group, mean bulk densities are approximately equal at two slopes of -10-0% and 20-30%. Due to skidder traffic, the bulk density is higher under the wheel. Except for the control area, the area under the log at the slope of 0-10% causes the least damage to the soil.

Comparison of bulk densities in short log skidding system

According to the results obtained from variance analysis, the slope factor has no significant effect on the bulk density in the short log skidding system at the significance level of 0.01 (F = 2.167, α = 0.01). The area factor has a significant effect on the bulk density in the short log skidding system at the significance level of 0.01 (F = 52.64, α = 0.01). The slope and area factors simultaneously have a significant effect on the bulk density in the long log skidding system at the significance level of 0.05 (F = 2.361, α = 0.05). The results of variance analysis are shown in Tables 3 and 4 and Charts 3, 4, and 5.

Table 3

Results of variance analysis of bulk densities in the short log skidding system

Source of variance	D_f	SS	MS	F	s.g
Slope	3	0.112	0.037	2.167	0.104**
Area	2	1.813	0.906	52.645	0.000**
Slope × area	6	0.244	0.041	2.361	0.044*
Error	48	0.827	0.017		
Total	59	2.995			

* and ** represent statistically significant at significance levels of α= 5% and α=1%, respectively

Table 4

Duncan's Multiple Range Test for identifying treatment groups for the area factor in the short log skidding system

Areas	Treatment group
Under the wheel	1.7285b
Under the log	1.6700b
Control	1.3340a

(Treatment groups marked with a letter do not differ significantly from each other at a significance level of 0.05).
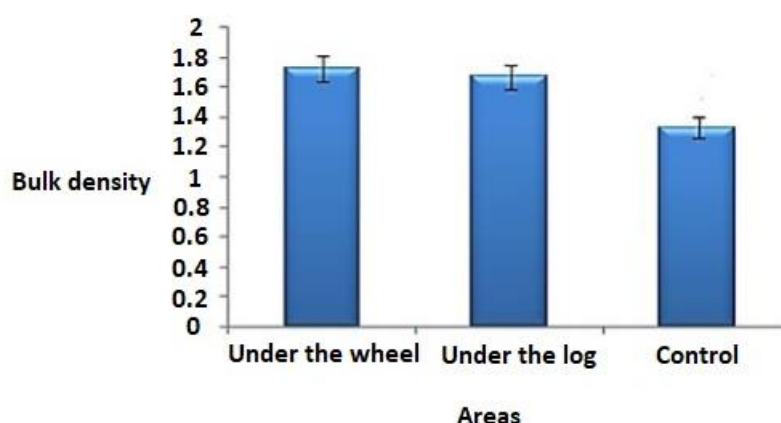
Chart 3 – Comparison of mean bulk densities in different areas in the short log skidding system
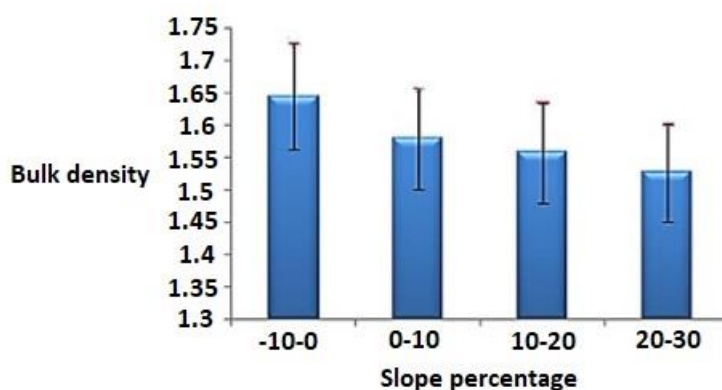
Chart 4 – Comparison of mean bulk densities in different slopes in the short log skidding system

According to Chart 4, the mean bulk density decreases with an increase in the slope in the short log skidding system. However, based on the results of the analysis of variance, this decrease is not significant at the level of 0.05. According to the analysis conducted, the bulk density has its highest value in the short log skidding system at the slope of -10-0%, as well as in areas under the wheel and log.

As can be seen in Chart 5, the bulk density has the highest value in the area under the wheel at the slope of 20-30%, while in the area under the log, the highest bulk density exists at the slope of -10-0%. In the control group, the mean bulk density has its highest value at the slope of -10-0%. According to the results, a slope of 0-10% causes the least damage to the soil.
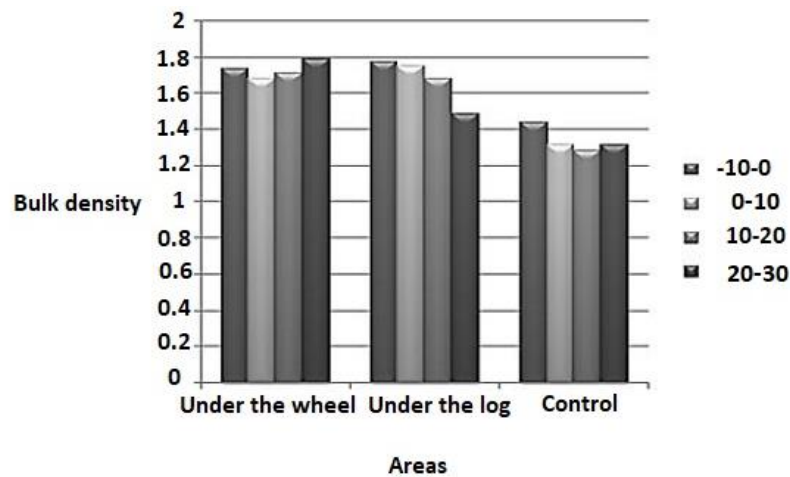
Chart 5 – Comparison of mean bulk densities in different areas under the influence of the slope in the short log skidding system

Damages to regeneration groups

Damages to regeneration were divided into 5 categories of completely crushed (fallen to the ground or cut down), injured (shedding of leaves completely or partially), broken, harvested, and intact. According to the following charts, the comparison of skidding damages to regeneration groups in short and long log skidding systems revealed that 100% of regeneration in the skid trail (with a width of 3 m) was destroyed after skidding operation.
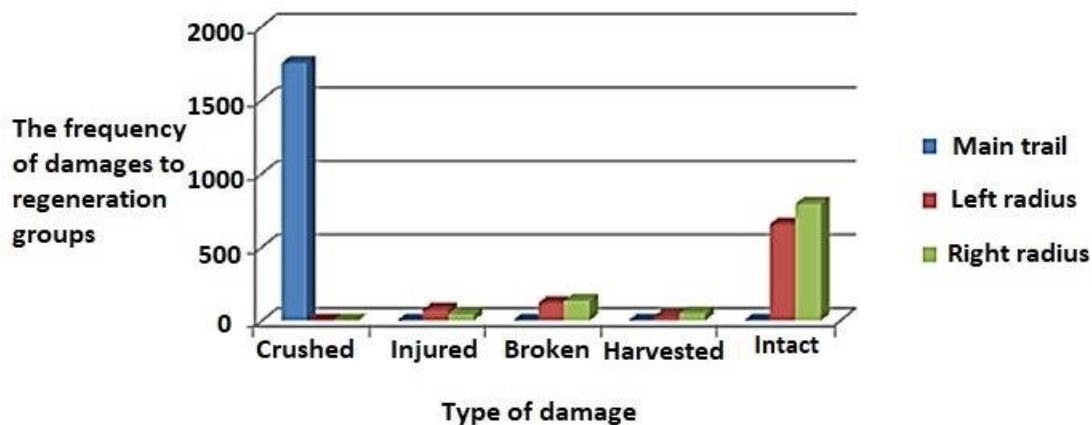
Chart 6 – The frequency of seedlings along the skid trail in the short logging system
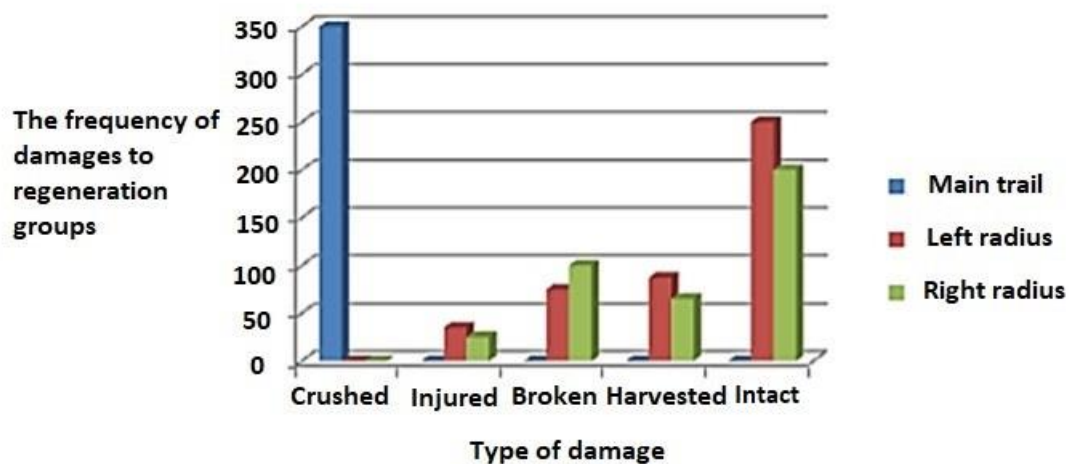
Chart 7 – The frequency of small saplings along the skid trail in the short logging system
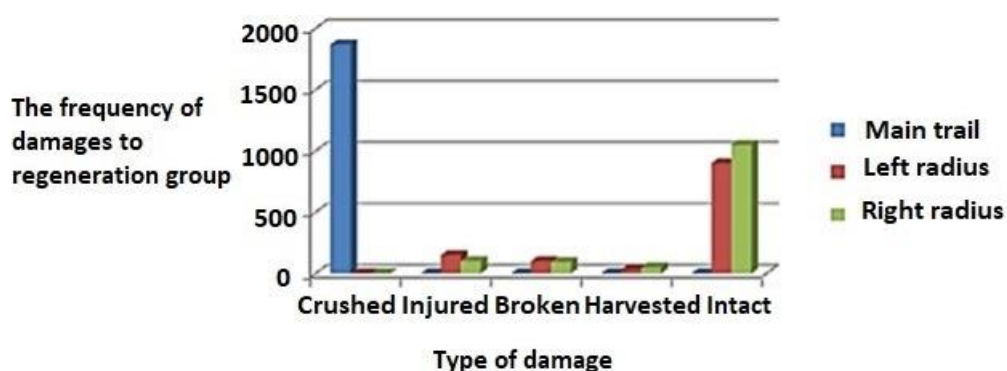
Chart 8 – The frequency of seedlings along the skid trail in the long logging system
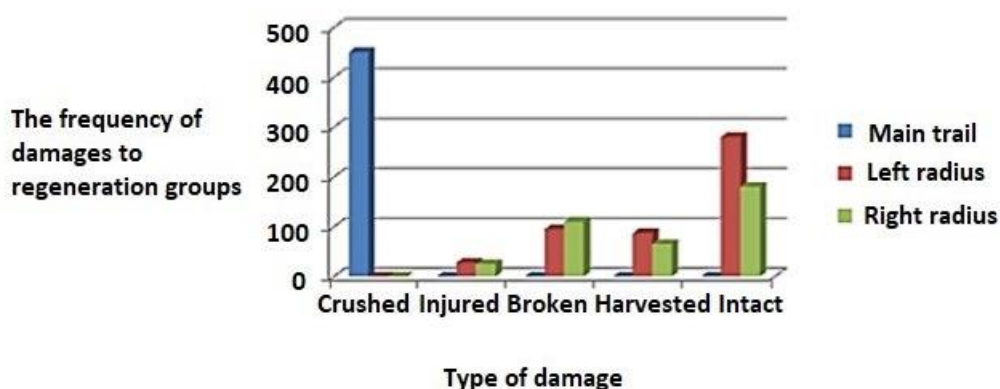
Chart 9 – The frequency of small saplings along the skid trail in the long logging system
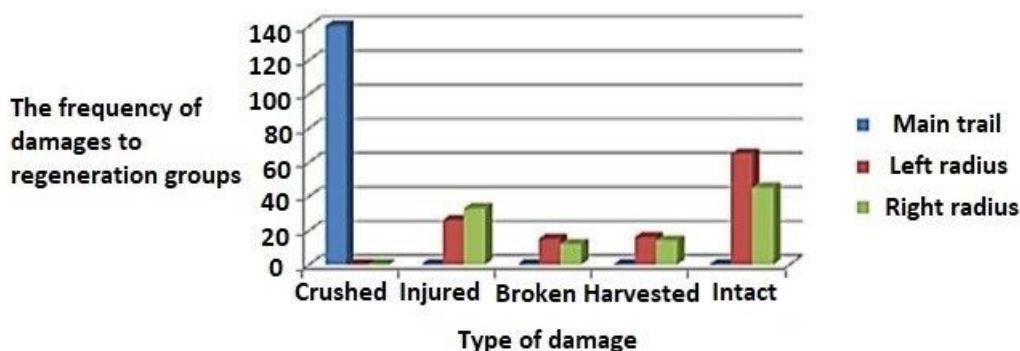
Chart 10 – The frequency of saplings along the skid trail in the long logging system

Discussion and Conclusion

The results of the study showed that the slope and the compaction area both affect the bulk density in the long logging system. In the long logging system, the mean bulk density first decreased by increasing the slope from -10-0% to 0-10%, then remained constant by increasing the slope to 10-20%, and finally increased again by reaching the slope to 20-30%. The bulk density had the highest values in the slope classes of -10-0% and 20-30% under the wheel and log. In the short logging system, the bulk density had the highest values in the slope class of -10-0% under the wheel and the slope class of 20-30% under the log. The bulk density values were approximately the same in the two slope classes of -10-0% and 20-30% in the control group. Based on the ANOVA results, the compaction area factor affects the bulk density in the short logging system. In the short logging system, the mean bulk density decreased with increasing the slope. However, the ANOVA results show that this decrease was not significant at the level of 0.05. The bulk density had the highest value at a slope of 20-30% in the area under the wheel, while in the area under the log, the bulk density had the highest value at a slope of -10-0%. In the control

group, the mean bulk density had the highest value at a slope of -10-0%. According to the results, the least damage to the soil occurred in the slope class of 0-10%. Skidder traffic causes damages to the forest soil as compaction, rutting, failure of drainage structures, removal of organic matter from the soil surface, and soil erosion. The soil compaction occurs the first time that vehicles pass over the skid trails. Proper design of skid trails, the use of sprocket-wheel vehicles and tire pressure monitoring, avoiding unnecessary traffic, observing instructions and shape restrictions, and performing compaction correction operations can be useful to reduce the extent of damages to the forest soil (Yazerloo et al., 2015).

In the short logging system, of 3500 regenerative trees along the skid trails (3×1000 meters), 2240 were destroyed. Of the remaining 898 seedlings in the 1.5-m margin on the left side of the skid trail, 72.93% were intact, 8.25% were injured. Of the remaining 852 seedlings in the 1.5-m margin on the right side of the skid trail, 93.3% were intact and 5.28% were injured. Of the 480 small saplings, 53.1% were intact on the left side of the trail and 7.3% were injured. Of the 475 small saplings on the right side of the trail, 51.3% were intact and 6.4% were injured. Of 122 saplings, 63.41% were intact on the left side of the trail and 18.3% were injured. Of the 118 saplings on the right side of the trail, 55.1% were intact and 27.9% were injured. Divsalar (2012) investigated damages caused by felling, conversion, and extraction of tree trunks to regeneration in Gulband forests. This author reported that of 8648 regenerative rootstocks, 791 were damaged, which is about 7% of the total rootstocks. The highest degree of damage occurred in the sapling stage and related to the beech species.

In the long logging system, of 3500 regenerative trees along the skid trails (3×1000 m), 2460 were destroyed, and of the remaining 856 seedlings in the 1.5-m margin on the left side of the skid trail, 41.7% were intact, 12.7% were injured, and of the remaining 860 seedlings on the right side of the skid trail, 81.1% were intact and 7.7% were injured. Of the 590 small saplings, 64.4% were intact on the left side of the trail and 5.5% were injured. Of the 380 small saplings on the right side of the trail, 47.4% were intact and 6.6% were injured. Of the remaining 122 saplings, 57.3% were intact on the left radius of the trail and 21.3% were injured. Of the 105 saplings on the right radius of the trail, 57.2% were intact and 31.4% were injured. Naqdi et al. (2007) conducted a study to assess the extent of damages to forest stands (trees and regeneration) using the logging method in Shafarud, Gilan, and showed that the extent of damages to seedlings was less than other regeneration groups (i.e., small saplings and saplings).

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OPTIMIZATION OF GRID-CONNECTED MICROGRID DEMAND CONSIDERING DEMAND RESPONSE

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ABSTRACT

Electricity grid is a product of urbanization expansion and rapid development of various infrastructures worldwide and over the past centuries. Although power companies are located in diverse regions, they typically use the same technologies to generate and distribute electricity. Proper implementation of the demand response (DR) program should be provided with some equipment to make subscribers aware of electricity price at any time and accordingly provide a proper response to the grid to reduce costs. This, in turn, reduces demand during peak hours. The intelligent grid, using the two-way communication network and the transmission of information to subscribers, and an advanced metering network provide a good structure for fully implementing DR programs. The present study applies a demand response economic model to implement DRs. The model uses price elasticity of demand, which provides subscribers a more precise consumption behavior regarding the factors influencing demand (e.g., electricity prices, bonuses, and fines). Applying the model to the microgrid, the operating cost significantly decreases in both operating modes.

Keywords: energy management; demand response; energy consumption pattern.

Introduction

Today, there are numerous problems ahead of electricity companies around the world. Some of the problems are as follow: currently, only one-third of the fuel energy is converted into electrical energy, and the heat lost is not recovered; 8% of power plants output is lost during the transfer to the consumption load; 20% of the power plant capacity is used only for peak hours (the peak period is 5% of the total time), and there are energy shortages and environmental pollutants.

The current power grid is inherently one-way. In addition, due to the hierarchical structure, the existing electrical network suffers from Domino-Effect. The current power grid cannot eliminate the problems (1).

Energy management (EM) changes customers' pattern of electricity consumption in order to achieve the desired consumption pattern. It reduces consumption, and thus not only an appropriate load curve is provided, and operation and planning costs are diminished. The purpose of the Energy Management Network (EMS) is to decide on the best use of generators to produce power and heat in the microgrid, the best schedule of the storage network, proper demand management, and accurate purchase and sale of electrical networks [2].

The combination of several renewable energies such as wind power and solar energy was investigated to produce and store DC energy in a battery to supply AC energy. The simulation was analyzed via Matlab / Simulink [3]. Their results are used in this paper for sizing with the lowest cost.

A method was proposed for optimal sizing of PV array, diesel generator, and battery storage installed in an integrated building network [4]. Optimization was done to offer a network with minimum cost and maximum reliability. To this end, variables such as solar energy, temperature, wind speed, and direction were applied. They reported the optimal ratio of size (daily energy produced by the source to energy demand per day) as 0.737, 0.46, 0.22, and 0.17, respectively, for PV array, diesel generator, and battery for a network in the Oman desert. A case study was presented by a network consisting of a diesel generator with 30 PV arrays (36%), five kVA (9%), and DR of 200 kWh / day. According to the findings, PV array, wind farm, and diesel generator respectively produced 36%, 55%, and 9% of the energy, costing 0.17 USD / kWh.

The optimal size of the distribution network, including the combined microgrid, was discussed [5]. The microgrid was provided with photovoltaic (PV), batteries, fuel cell (FC) technology, and electric vehicles connectable to grids. Particle Swarm Optimization (PSO) algorithm was used to minimize microgrid costs of distribution by size generation model. Analysis models and impacts of electric vehicles on the desired size of both microgrid distributions as well as reliability of the intended microgrid were also examined.

Sizing was performed assuming that the battery charge cycle was constant. A gradual change in the number of wind generators was also used to complete sizing. The number of solar cells was determined, assuming the constancy of the battery charge cycle [6.7]. However, the current study is to size the microgrid by assuming variability of battery charge cycle based on the demand and using a meta-heuristic algorithm.

Price elasticity of demand (PED)
The concept of elasticity, or demand elasticity, refers to the sensitivity of a variable to changes in other agents. Demand elasticity is not an absolute elasticity but the relative sensitivity of the quantity demanded to changes in the price, fine, or bonus of the commodity.

When demand is perfectly inelastic, it is called zero elasticity, and if it is perfectly elastic, it is called infinite elasticity. Perfectly inelastic or elastic demand indicate the status of the demand curve.

In the model proposed for this study, the demand increasing over periods is assumed as the consumption load during 24 hours, and time intervals are assumed to be one hour. Thus, the dimension of power and energy are the same. The elasticity matrix can be written as follows:

$$E = \begin{bmatrix} E(1,1) & E(1,2) & \dots & \dots & E(1,24) \\ E(2,1) & E(2,2) & \dots & \dots & \dots \\ \dots & & \dots & E(i,i) & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots \\ E(24,1) & \dots & E(24,j) & \dots & E(24,24) \end{bmatrix} \quad (1)$$

The diagonal elements represent inner elasticity, and non-diagonal elements represent cross elasticity. The following relations explain inner-cross relationships:

$$(i,i) = \frac{p(i)}{D(i)} \times \frac{\partial D(i)}{\partial p(i)} \quad (2)$$

$$(i,j) = \frac{p(j)}{D(i)} \times \frac{\partial D(i)}{\partial p(j)} \quad (3)$$

Final modeling of the problem
Grid-connected operation
Objective function

$$min \quad \sum_{t=1}^{T}\sum_{i=1}^{n}[b_{it}.x_{it} + c_{it}.y_{it}] + \sum_{t=1}^{T}[PB_t.B_t - PS_t.S_t] + C_{DR} \quad (4)$$

The grid understudies
To evaluate the performance of the proposed model, it is implemented with two CDGs and three RDGs as well as various cost factors and capacities. Table 1 presents costs, startup, minimum and maximum capacities of CDGs; production costs of each CDG unit are assumed to be

consonant at intervals. Since RDGs are supposed to work at no extra cost, they only have the maximum capacity.

Cost, start-up cost, and DGs capacity

DGs	Cost (Rial)		) KW(Capacity	
	variable	Startup	Minimum	Maximum
CDG1	70	100	0.6	45
CDG2	50	130	0.3	45
RDG1	0	0	0	15
RDG2	0	0	0	3
RDG3	0	0	0	2.5

Table (2) shows the purchase and sale prices of energy of the national grid. The selling price is generally lower than the purchase price. For experiments, prices are set to fluctuate significantly.

Purchase and sale prices of energy from the national electric grid

		Time(t=1,2,…,6)					
		1	2	3	4	5	6
PB_t	Rial	15	25	35	55	65	75
PS_t	Rial	5	15	25	45	55	65

The output of RDG units is predicted in Table 3. As an inherent feature, renewable sources are uncertain in the production of power. The presence of resources in power networks makes operation uncertain. For this reason, in this study, the predicted output is used to eliminate the impact of renewable sources. According to Table 3, the renewable sources of this study don't generate electricity in the early hours of the day, and the maximum production occurs during the peak hours.

Predicted output of renewable sources

	Time(t=1,2,…,6)					
	1	2	3	4	5	6
RDG1(KW)	0	0	5	8	12	15
RDG2(KW)	0	0	2	3	3	3
RDG3(KW)	0	0	2	2.5	2.5	2.5

Table 4 presents the base demand curve of the grid. The curve is divided into three periods of low demand (1, 2, and 3 o'clock), medium demand (4 and 5 o'clock), and peak demand (6

o'clock). Electricity price is unsteady, i.e., 150 Iranian Rial per kWh. In this study, the price of grid-connected electricity is assumed to be 150 Rials. Under CAP and I / C program contracts, customers are required to reduce their demand by up to 20% of the original demands.

Table 4

Base consumption load curve

Time	Load(kwh)
1	5
2	10
3	15
4	25
5	30
6	40

Demand price elasticity is presented in Table 5.

Table 5

Inner and cross elasticity

	Peak	Off-Peak	Low Load
Peak	-0.1	0.016	0.012
Off-Peak	0.016	-0.1	0.01
Low Load	0.012	0.01	-0.1

In order to implement DR programs, different scenarios with bonuses and fines are presented in Table 6.

Table 6

Scenarios

Scenario	A(t) Rial	Pen(t) /Rial
1	0	0
2	100	0
3	100	100

Results
Implementation of DR programmes
Grid-connected microgrid exchanges power with the original network. The operator's goal is to minimize the final operating costs resulting from the exchange.

Table 6 is used to apply DRs (I / C and CAP), which include bonuses and fines. The table presents three scenarios with striking differences in the amounts of bonuses and fines. Using " bonus and fine " and elastic demand in Table 5, the amount of demand was obtained for each scenario. Simulation results and the effect of DRs for different scenarios are stated below:

Scenario 1 is the baseline scenario with the initial load curve where no DR program is implemented.

Scenario 2 assumes a bonus of 100 Rials / kWh and a fine of 0 Rial / kWh. In other words, ISO provides rewards to customers for reduced consumption without penalty. By applying the final model to the initial load curve, the amount of demand is reduced to 0.86 kW at the peak (Figure 1).

Scenario 3 assumes a doubled sum of the bonus and fine compared to Scenario 2; the amount of the reward is 100 Rial / kWh, and the fine is 100 Rial / kWh (200 Rial / kWh totally). Figure 2 shows that the peak consumption is reduced by 1.7 kW (twice more than Scenario 2). Therefore, by increasing the number of rewards and penalties, ISO encourages more consumers' participation in DRs. Rewards and fines have a similar impact on the reduction of the consumption load; the sum value determines the final demand.
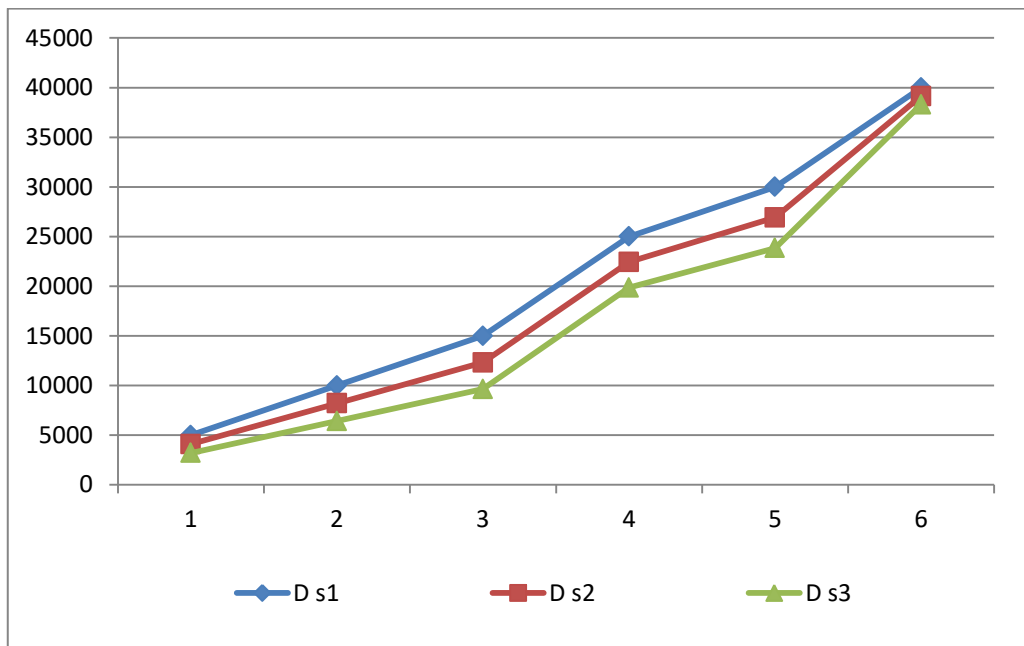
Figure 1 – The effect of DRs on the base load curve

According to Table 7, the peak load decreases by 2.15% in Scenario 2 compared to the base load (Scenario 1) by rewarding the consumer. In Scenario 3, the network operator reduces peak load consumption by 4.3% as the result of imposing fines and rewards on the subscribers, which is twice more than Scenario 2.

Table 7

Demand senarios

	scenario		Time(t=1,2,…,6)					
			1	2	3	4	5	6
d_t	1		5000	10000	15000	25000	30000	40000
	2		4106	8213	12320	22433	26920	39140
	3		3213	6426	9640	19866	23840	38293

Optimal grid-connected microgrid simulation

Grid-connected microgrid is capable of receiving and sending power to the global network, i.e., it can buy power from and sell it to the global network. The operator seeks to reduce the final operating costs as much as possible.

According to the table 10, Purchase and sale prices are 55 and 45 Rials at 4 o'clock. However, since the unit production costs 50 Rials, the purchase and sale of energy will not be cost-effective. Therefore, the network operator decides to generate power at this time. The rate of production will vary depending on the type of scenario. According to the table, the production rate of Scenario 3 is the lowest. As the price of selling power to the national network (55 and 65 Rials) is higher than the production cost (50 Rials) and since income is earned from power generation during 5 and 6 o'clock, the operator decides to produce at maximum unit capacity in order to sell the surplus of production to the global network. Table 11 presents to purchase and sale amounts.

Table 10

CDG production rate in grid-connected operation

	1	2	3	4	5	6
X s1	0	0	0	11500	45000	45000
X s2	0	0	0	8933	45000	45000
X s3	0	0	0	6366	45000	45000

Table 11

Power purchase/sale amount

	1	2	3	4	5	6
B s1	5000	10000	6000	0	0	0
B s2	4106	8213	3320	0	0	0
B s3	3213	6426	640	0	0	0
S s1	0	0	0	0	32500	25500
S s2	0	0	0	0	35580	26353
S s3	0	0	0	0	38660	27206

Moreover, with the application of scenarios, the amount of energy purchase in Scenario 3 is less than in other scenarios, but the amount of power sale to the network is more. By a reasonable bonus and fine, power generation and energy purchase from the grid decreases; though, the sale amount increases.

Table 12

Final costs in grid-connected operation

Scenario 1 cost	$10^6 \times 2.16$
Scenario 2 cost	$10^6 \times 1.66$
Scenario 3 cost	$10^6 \times 1.02$

According to the table, using Scenario 3, the operator can optimize power exchange in order to reduce costs. Improper rewards and fines to implement DRs impede the minimization of

operating costs. Further, DRs with non-optimal bonuses and fines may increase operating costs.

Conclusion

Increasing demand for electricity is associated with deficiency and backlog of investment in electricity infrastructure and reduced stability of the generation and distribution grid. Any unforeseen increase in demand or deviation in power distribution networks may lead to equipment failure, consequent global blackouts, and severe economic losses. However, demand for high-quality electricity, as well as electricity consumption, is expanding. Microgrids are a flexible solution for the problems caused by grids distributed generation. The MicroGrid Central Controller (MGCC) is responsible for minimization of island operating costs and optimization of power exchange with the global grid to reduce grid-connected operating costs. The present study applied a kind of decentralized control to manage energy. In decentralized control, each microgrid is controlled by a controller. It is a possible solution for the elimination of microgrids control and EM problems. The use of multi-function systems is a good candidate for decentralized control of power microgrids. Each factor of a multifunction system uses its intelligence to determine the leading activities and make decisions independently of other factors.

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EVALUATION OF MAGNETIC FIELD CHANGES IN KARANJ OIL FIELD WITH UPWARD CONTINUATION MAPS

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ABSTRACT

KARANJ anticline with the northwest-southeast trend is a part of the Zagros orogeny belt located in the southwest of Iran. In the provincial divisions, this anticline is located 130 km to the southeast of Ahvaz. The

Fars Group Formations are the major stratigraphic units of this surface anticline. According to documents, this oil field was discovered in 1963. The source rock of this field is Gurpi formation, and its reservoir rock is Asmari formation with Oligocene-Miocene. Iran is one of the oil-rich countries in the world, which has planned its economy based on oil and gas exchanges. Therefore, it constantly needs oil exploration. Reducing costs and duration of the exploration process are significant challenges in the oil exploration process. Using magnetometer based-methods can greatly meet our needs. In this regard, by examining the magnetic field and its changes in the KARANJ oil field as a case study and eliminating other interfering factors to the effect of this field, we will examine the possibility of providing a magnetic model for other oil fields. In this design, we use the desired distance with a magnetometer device in profiles with a north-south trend. The results of this study reflect that the reservoir rock of this oil field has northwest to southeast extension, and consequently, there is a possibility of corrosion fault along the northeast to southwest in this reservoir. We believe that this fault has probably caused the discontinuity in the reservoir. Subsequently, the gas injection increased the pressure and thus reduced the withdrawal from the field.

Keywords: KARANJ; magnetometer; upward maps.

Introduction

The utilization of geological and magnetometer based-data is an important part of early exploration studies of oil fields. Over the past few years, the advancement of knowledge has greatly contributed to the exploration of oil and gas [1]. Reducing costs in oil exploration processes is one of the most important purposes in petroleum geology. In addition, reducing the duration of the exploration process or increasing exploration speed is an influential factor in this field. So the key question is, can a cheaper and faster method be invented? We believe that the use of magnetometer based-methods can greatly meet our needs. The magnetometer based-technique is one of the methods for determining anomalies in geology [2]. Often, oil fields affect the earth's magnetic field and cause changes in the earth locally. Because oil and gas fields effectively create magnetic anomalies, we use geological and magnetometer based-data in this study to evaluate the hidden and overt structures of the region. Subsequently, by examining the magnetic field and its changes in the KARANJ oil field as a case study and eliminating other interfering factors concerning the effect of this field, we will examine the possibility of providing a magnetic model for other oil fields.

Geological location of KARANJ oil field

KARANJ anticline with the northwest-southeast trend is a part of the Zagros orogeny belt, located in the southwest of Iran. In the provincial divisions, this anticline is located 130 km southeast of Ahvaz. The Fars Group Formations are the major stratigraphic units of this surface anticline. This field is located in Falcon (1961) and Faver (1975) and Motiei (1374) divisions in the folded belt, Dezful embayment, and the folded belt, respectively. Also, in terms of geographical features, it is between latitude $49°38'$N to $31°16'$N and longitude $49°39'$E to $49°45'$E. The source rock of this field is Gurpi formation, and its reservoir rock is Asmari formation with Oligocene-Miocene [3]. Figure (2) reflects a three-dimensional image of the KARANJ oil field relative to other fields in southwestern Iran.

The magnetometer used in this study is the Proton Transformable Magnetometer TGSM 19 model, which contains a complete system for measuring the total intensity of the Earth's magnetic field. The system is a proton-based magnetometer with rotation, tilt, and VLF measurement capabilities. Network design and magnetometric operations: After collecting initial information, the area of the KARANJ oil field was selected to perform magnetometric operations. This operation was performed on profiles with a north-south trend with distances of 20 meters. Reading distances were set to 20 meters on each profile. Subsequently, seven profiles with a distance of 20 meters and a length of 1100 meters were gauged to cover the entire study area to the east and Reservoir No. 21. Also, the survey network was compiled as a square with reading distances of 20×20 meters. A total of 7 north-south profiles (the distance of each magnetometric station on

these profiles is constantly 50 meters) were designed, and finally, the measurements of 154 stations on the ground were read. Colored markers and a locator determined the exact location of each station. The locator used in this process was Garmin, and its location error was less than three meters. Coordinates were determined in the WGS-84 elliptical UTM system. Magnetic field strength measurements were repeated three times at each point, and then the average of all repetitions with UTM coordinates was recorded. Also, in a fixed station (base station), the magnetic field strength was measured and recorded at fixed intervals of 10 minutes. The repetition of the readings started before the beginning of the survey and continued until the end of the survey every day (two working days in total).
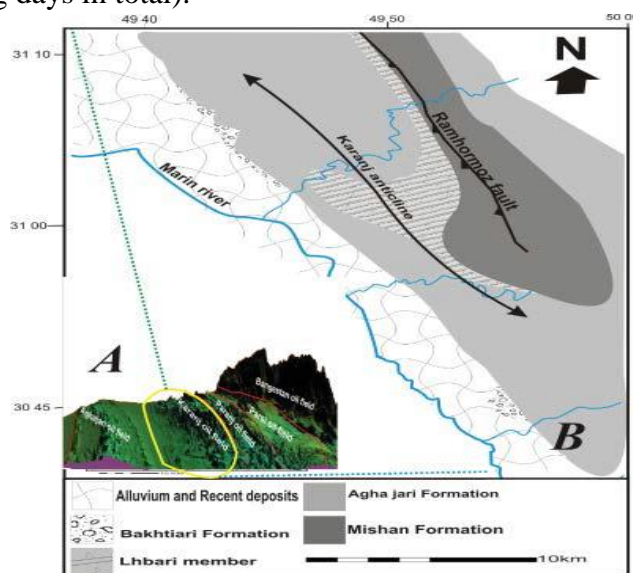
Figure 1 – A three-dimensional image of the KARANJ oil field relative to other fields in southwestern Iran (A) Geological map of KARANJ oil field (B)

Results

One of the goals of processing magnetic data is to prepare continuation maps upward. In the upward continuation map, superficial anomalies or attenuated noises and serious anomalies are easily visible. Upward continuation is used to reduce surface noise and determine the shape of the mass and, consequently, the effect of deep anomalies. In this method, mathematical equations map magnetic data from a base level to higher level surfaces. In other words, in this process based on mathematical relations and integration, we seek to answer this question: If the distance between the sensor of the magnetometer and the earth, for example, is 20 meters, how much does the shape of the total field intensity map change? This process converts the potential field measured at one level to another that can be measured at another level away from all sources. This conversion process attenuates the anomaly concerning its wavelengths. The shorter the wavelength, the greater the attenuation, and the longer the wavelength, the less attenuation. In other words, this filter is inversely related to the wavelength. The upward continuation process degrades the measured data. This conversion highlights the anomalies produced by deep sources compared to the anomalies produced by surface sources and consequently attenuates high-frequency surface noise and anomalies. In the maps of Figure 4, the application of the upward continuation method for 10, 20, 50, 100, 200, 300 meters, respectively, is shown (Figure 4). There are not many changes in this map compared to the trend. In other words, due to the effect of surface anomalies, not much change is observed compared to the trend, but a magnetic polarization with a northwest-southeast trend is visible.

Figure (1b) reflects an upward continuation map at the height of 20 meters. Changes in this map compared to the 10-meter map indicate weak changes in trend. Also, the local anomaly related to the main trend has affected the shape of the map to some extent. Figure (1D) reflects an upward continuation map at the height of 50 meters. In this map, the effect of surface anomaly is weakened, and the expansion of the magnetic polarization of the northwest-southeast trend is shown with more intensity. The presence of a fracture in the center of the map probably reflects the fault in the lower parts of the map. Figure (1D) reflects upward continuation at the height of 100 meters. Changes and superficial anomalies have been severely weakened, and local anomalies are evident in the mainstream. As it is known, in the northwest-southeast trend, there is a possibility of more severe faults. Also, the width of the created anomaly is quite evident in this figure. In Figure (1E), local changes do not affect this map, and this map reflects well the changes in the magnetic field at an altitude of 200 meters.
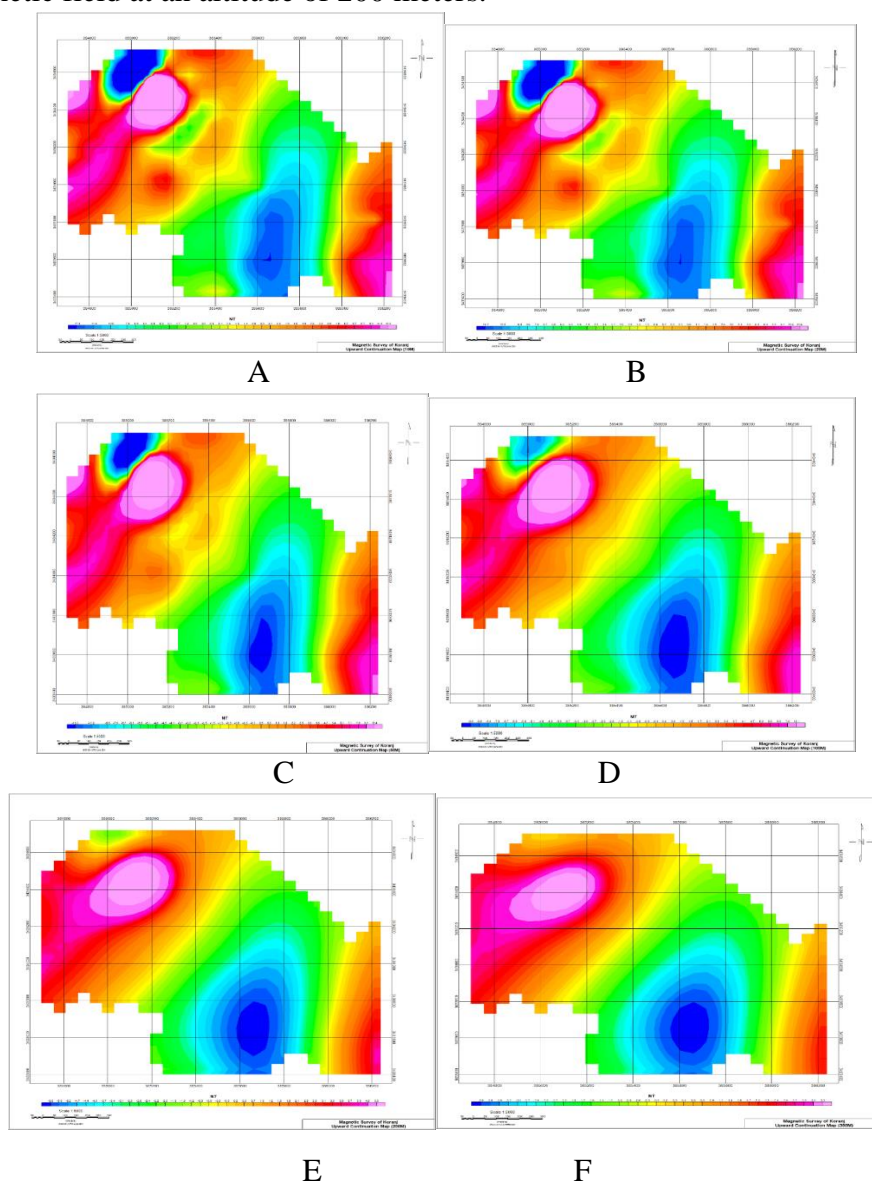
Figure 4 – A) u10 B) u20 C) u50 D) u100 E) u200 F) u300

As it is known, there are two anomalies along the northwest-southeast direction. Subsequently, the elongation of this dipole indicates the width of the anomaly. Figure (1C) reflects the magnetic changes in the upward continuation map at the height of 300 m. The field extension extends to the southwest, and the general trend of the field is in the northwest-southeast direc-

tion. As altitude increases, areas with high magnetic intensities (positive and negative) lose their density and subsequently expand. This result indicates the superficial origin of this data.

Conclusion

The main purpose of this study was to measure the changes in the magnetic field in the KARANJ oil field based on upward methods. As altitude increases, areas with high magnetic intensities (positive and negative) lose their density and subsequently expand. This result indicates the superficial origin of this data. The results of this study reflect that the reservoir rock of this oil field has northwest to southeast extension, and consequently, there is a possibility of corrosion fault along the northeast to southwest in this reservoir. We believe that this fault has probably caused the discontinuity in the reservoir. Subsequently, the gas injection increased the pressure and thus reduced the withdrawal from the field.

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INVESTIGATING THE RELATIONSHIP BETWEEN IT RESOURCES, KNOWLEDGE MANAGEMENT CAPACITY AND COMPETITIVE ADVANTAGE

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ABSTRACT

Despite the existing documents on the relationship between IT resources and knowledge management, limited information is available on the different types of IT resources that describe this relationship. The present study integrates two emerging research streams in knowledge management and expands the resources of the IT management knowledge link by investigating the role of resource commitment in using potential resource perspectives. Data of 168 organizations in China provide empirical evidence that three types of IT resources, including IT infrastructure, human reporce IT and IT relationships positively affect knowledge management capacity (KMC), which is in favor of competitive competition. Also, the present study identifies two positive mediating effects of resource commitment on the relationship between IT-resource relationship and KMC. Resource commitment directly and positively reinforces the KMC and the impact of IT and ICT communication resources on the KMC. We discuss the theoretical and practical implications of the results.

Keywords: IT resources; knowledge management capacity; Resource commitment; Resource-based perspective; Knowledge-based perspective; Potential resource perspective.

1-Introduction

Nowadays, changing environments are increasingly creating the emergence of knowledge management capability (KMC) as a key capability for organizations to increase individual performance, innovation, organizational capabilities, and competitive advantage. KMC can be de-

fined as the ability of an organization's process to mobilize and expand knowledge-based resources to gain a competitive advantage. The advent and depth of using information technology, especially communication networks and the Internet, has brought a fast, secure and convenient way to acquire, share and store knowledge by increasing cooperation and reducing costs (Mohamed, Stankosky, Murray, 2006). Information technology may enhance knowledge management for competitive advantage.

Based on Knowledge Management Priorities Report in 2015, 93% of organizations have dedicated funds for knowledge management and 61% respond positively to knowledge management programs (APQC, 2015). This report also suggests that the processes that manage investment in knowledge management technology are less obvious, so further investigation on the relationship between information technology and knowledge management is needed. Therefore, the process that the organization uses to apply different sources of information technology to manage knowledge and competitive advantage is crucial. The present study aims to review the present studies conducted on the implementation of the competitive advantage of IT knowledge management by considering the effects of different types of IT resources. Considering the effects of KMC on the long-term relationship of IT relationship and organizational performance, the present study aims to fill this gap by examining whether KMC mediates the impact of three types of IT resources (including IT infrastructure or ITI, Human Information Technology or HIT and Information Technology Relationship or ITR) on Competitive Advantage.

3- Research model
Figure 1 presents the research model and hypotheses.
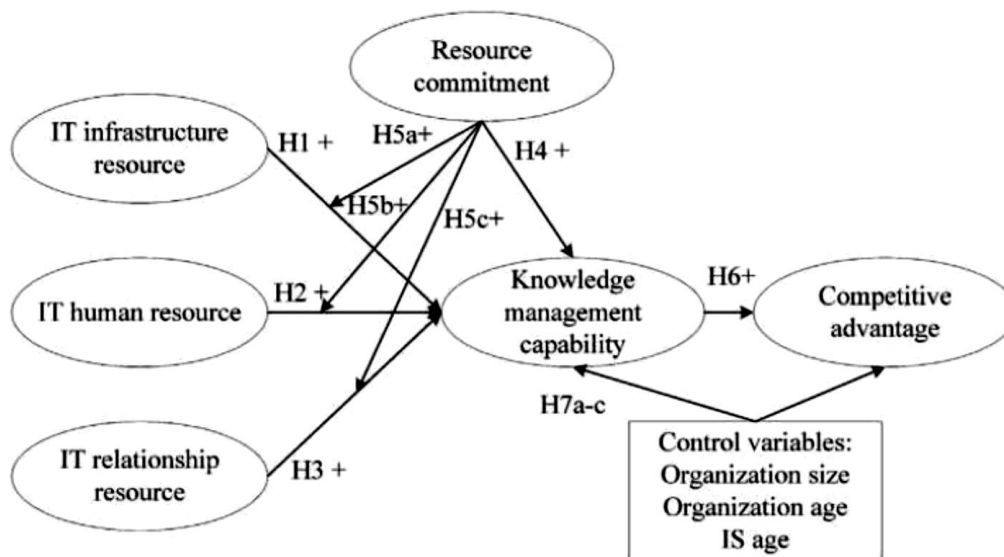
Figure 1 – Research model

4-Research method
4-1-Measurements
Measurement items for all structures were approved from existing studies where the instrument was tested (Table 1). In previous studies, we used a 7-point Likert scale to measure cases. ITI Resource, ITH Resource, ITR Resource, KMC, and Resource Commitment scale ranges from "strongly disagree" to "strongly agree." For competitive advantage, a scale ranging from "dissatisfied" to "satisfactory" was used. Each structure includes at least three pre-tests conducted among 11 business and IT managers to ensure the quality of the questionnaire. Small changes were made in this regard.

4-2- Data collection

A total number of 192 organizations were selected from different industries in central and western China from the contact list at Wuhan Information Management Research Center to test our models and hypotheses. In December 2012, we received 168 usable questionnaires from senior managers in these organizations with an experience of IT that 44 of them were in charge of there IS departments. Respondents had an average of 5.13 years of work experience in their current position. Senior managers were asked to provide information about the information technology and information practices of their organizations, including their activities. Our samples covered a wide range of industry sectors, including electricity, information technology, finance and manufacturing. In our sample, 48.8% of large companies had more than 1000 employees and 62.5% of them were doing business for more than 10 years. Several companies also had subsidiaries in eastern China. Table 2 presents the characteristics of the research sample. With the help of the Wuhan Information Management Research Center, we used a variety of approaches to ensure an acceptable response rate of 87.5%.

To determine the difference between the key variables between the late and early responses, a wave test was performed for lack of non-reactive bias. Respondents responded to the second wave of the questionnaire, which was sent one month after the initial examination of them. T test in ITI resources ($p = 0.29$), ITH resource ($p = 0.57$), ITR resource ($p = 0.85$), KMC ($p = 0.18$), resource commitment ($p = 0.56$) and competitive advantage ($p = 0.69$) showed no difference between the early or late respondents. This result suggests that our study is non-reactive probability. We proposed the Harman single-factor test proposed by Podsakoff et al. (2003) to confirm the threat of the common method. The results showed that the maximum variance by a single factor is less than 18%. Therefore, the common method in our sample is an insignificant threat.

Table 1

Structures and actions

Structure	Item	Measurement
IT infrastructure resource (ITI)	ITI1	Data management and architecture services are sufficient in my organization.
	ITI2	Network communication with good connectivity, reliability and availability is sufficient.
	ITI3	The quality of IT applications and services (such as ERP and ASP) can meet organizational needs.
	ITI4	IT management services can coordinate physical infrastructure and manage its relationship with business units effectively and efficiently.
IT human resource (ITH)	ITH1	My organization has a sufficient skill base.
	ITH2	My organization has skilled technical support staff.
	ITH3	The employees at my organization know how to solve IT problems.
	ITH4	IT teams are aware of business strategies for IT planning.
	ITH5	My organization employees can evaluate and control IT projects.

IT relationship (ITR)	ITR1	My organization has technology-based relationship with customers.
	ITR2	My organization has technology-based relationship with suppliers.
	ITR3	We have a good management line to support IT initiatives.
	ITR4	My organization has a good relationship between line management and IT service providers.
Resource commitment (RC)	RC1	My organization is working hard to improve information systems.
	RC2	My organization is working hard to improve information technology and its application in business operations.
	RC3	My organization is working hard to improve the IT skills of its employees through training.
Knowledge management capacity (KMC)	KMC1	My organization has knowledge acquisition processes in our suppliers, customers and partners.
	KMC2	My organization can produce new knowledge from existing knowledge.
	KMC3	My organization has the necessary processes to distribute knowledge throughout the organization.
	KMC4	My organizations hold periodic meetings to keep employees informed of the latest innovations.
	KMC5	My organization has formal processes for sharing best practices among different areas of activity.
	KMC6	In my organization, knowledge is accessible to those who need it.
	KMC7	My organization has processes for using knowledge to develop new products or services.
Competitive advantage (CA)	CA1	Customer retention
	CA2	Sales growth
	CA3	Profitability
	CA4	Return on investment

5-Results
5-1- Measurement model
Internal consistency and convergent validity of the structures were examined. The results of the exploratory factor analysis have been predicted. The six-factor structure is done with all predefined indicators. All indicators are loaded high on the relevant structures (0.55< and 0.55<), but low in other structures (0.4>). The minimum cross-loading of all cases is 0.792, which is higher than 0.707 (Lee, 2016). The maximum loading is related to other structures with 0.66. The difference between loading an item with its original structure and item to other structures is more than 0.1 (Jifan and Straub, 2005). Appendix C shows the statistical explanation, correlation and reliability. Cronbach's alpha and composite reliability of each structure is higher than 0.7. The average variance extracted (AVE) is 0.70, which is higher than 0.5, and the square

root of AVE is greater than the correlation variable (Hair, Anderson, Tatham, and William 1998). These values provide reliable evidence for good discriminant validity and convergence validity of the study. Polygonality was also tested by calculating variance inflation factors. These values are less than 3, which indicate that is no polygonality. These results show good measurement characteristics of the model.

Table 2

Sample characteristics

Characteristic	Range	Frequency	Percentage
Industry sector	Power	19	11.3%
	Information technology	20	11.9%
	Public sector	15	8.9%
	Education	17	10.1%
	Finance	31	18.5%
	Manufacturing	52	31%
	Others[a]	14	8.3%
	Total	168	100%
Ownership	State-owned	77	45.8%
	Private	53	31.6%
	Joint venture	20	11.9%
	Foreign	18	10.7%
	Total	168	100%
Organization age	<5 years	18	10.71%
	6-10 years	45	26.79%
	11-20 years	45	26.79%
	21-50 years	41	24.4%
	>50 years	19	11.31%
	Total	168	100%
Organization size (Number of employees)	<50	12	7.1%
	50-100	10	6%
	101-200	23	13.7%
	201-500	22	13.1%
	501-1000	19	11.3%
	>1000	82	48.8%
	Total	168	100%

[a] Other industries include agriculture, retail industry, and hotel/restaurant.

5-2-Testing the hypotheses

Table 3 presents the results of regression analysis, including standard path coefficients, variance by independent variables (R^2), incremental changes in R2 (AR^2), goodness of fit (GOF), and size effect (F^2). In Model 1, age has a positive and significant effect on KMC (P = 0.301, p <0.01), but age and organization size generally affect KMC. The results show that organizations can easily establish KMC and competitive advantage with an older IS division. In Model 2, all three types of IT resources have a significant impact on KMC (ITI resource | 3 = 0.161, p <0.05; ITH resources P = 0.492; p <0.01; ITR resources P = 0.182; p <0.01). The variance explained in KMC is 0.549. Also, the value is 0.686, which is higher than the proposed threshold of 0.36. Therefore H1, H2 and H3 are supported.

Model 3 with direct effects explained 56.7% of variance. ./- C The direct effect of resource commitment in KMC is positive and Tl is significant (P = 0.196, p <0.01), so H4 is supported. In Model 4, two terms of interaction with positive and significant coefficient $I1^2$ (with ITH sources

P = 0.128, P <0.05 and with ITR sources P = 0.102, p <0.05) show significant effects on KMC. However, the effect of the interaction between ITI resources and resource commitment (P = -0.061, P> 0.05) is inefficient in KMC. The GoF value of models 3 and 4 in Table 3 is higher than 0.36, which indicates acceptability of the PLS model. The F values of models 3 and 4 indicate that the change in the explanation of knowledge management variance is significant. Therefore, H5b and H5c are supported, while H5a is not supported. In models 5-7, we performed a regression analysis to test the mediating effect. Model 5 shows that age positively affects competitive advantage (P = 0.220, p <0.05).

In Model 6, ITI resources (P = 0.180, p <0.05) and ITH resources (P = 0.297, p <0.01) have positive and significant effects on competitive advantage, but the effect of ITR resources (P = 0.006, p> 0.05) is negligible. However, in Model 7, the effects of ITI resources (P = 0.117, p> 0.05) and ITH resources (P> 0.056, p> 0.05) on competitive advantage is positive and negligible, but the effect of KMC is positive and significant (P = 0.388, p <0.01). Therefore, KMC mediates the relationship between ITI resources, ITH resources and competitive advantage. GoF values in models 4 and 5 are also higher than 0.36, so H6, H7a, and H7b are supported, but H7c is not supported.

Table 4 summarizes the results of testing the hypothesis. H1, H2, H3, H4, H5b, H5c, H6, H7a and H7b are supported and H5a and H7c are not supported.

6- Discussion and Conclusion
6-1-Theoretical implications

The present study examines KMC results through an experimental study. The potential perspective is the source for integrating technical and socio-managerial perspectives in enhancing KMC in the IS disciplinary field. From a technical perspective, we examine how the three sources of information technology can help manage knowledge. In the socio-management perspective, resource commitment is introduced as a semi-modern relationship between IT resources and KMC. Also, we examine the mediating role of KMC in the relationship between different sources of information technology and competitive advantage. Several theoretical suggestions can be concluded.

Table 3

Results of regression analysis

	Knowledge management capability (KMC)				Competitive advantage		
	M1	M2	M3	M4	M5	M6	M7
Control variable							
Organizational size	0.050	0.028	0.048	0.062	-0.035	-0.065	-0.074
Organizational age	-0.045	0.034	-0.001	-0.022	0.039	0.087	0.072
IS age	**0.301****	-0.040	-0.017	-0.025	**0.220·**	0.032	0.046
Independent variable							
IT infrastructure (ITI) resource		**0.161***	**0.122***	0.088		**0.180***	0.117
IT human (ITH) resource		**0.492****	**0.423··**	**0.445··**		**0.297··**	0.106
IT relationship (ITR) resource		**0.182****	**0.128***	**0.139·**		0.006	-0.062
KMC							**0.388··**
Resource commitment			**0.196··**	**0.193··**			
Interaction							
Resource commitment x ITI resource				-0.061			
Resource commitment x ITH resource				**0.128·**			
Resource commitment x ITR resource				**0.102·**			
R²	0.090	0.549	0.567	0.589	0.054	0.223	0.292
AR²		0.459	0.018	0.022		0.169	0.069
₂2		0.504	0.040	0.051		0.179	0.089
F		**81.208··**	**6.386·**	**7.977****		**28.762··**	**14.208··**
GoF		**0.686**	**0.653**	**0.767**		**0.440**	**0.497**

* p<0.05.
** p<0.01.

Table 4

Results of hypothesis tesing

Hypothesis	Results
H1: IT infrastructure (ITI) resource ^ Knowledge management capability (KMC)	Supported
H2: IT human (ITH) resource ^ KMC	Supported
H3: IT relationship (ITR) resource ^ KMC	Supported
H4: Resource commitment ^ KMC	Supported
H5a: Resource commitment x ITI resource ^ KMC	Unsupported
H5b: Resource commitment x ITH resource ^ KMC	Supported
H5c: Resource commitment x ITR resource ^ KMC	Supported
H6: KMC ^Competitive advantage	Supported
H7a: Mediating effect of KMC on the relationship between ITI resource and competitive	Supported
H7b: Mediating effect of KMC on the relationship between ITH resource and competitive advantage	Supported
H7c: Mediating effect of KMC on the relationship between ITR resource and competitive advantage	Unsupported

7-Conclusion

The present study provides theoretical implications by integrating the RBV and KBV, and dependent resources perspective by presenting an integrated analysis of knowledge empowerers in management technical and social perspectives in the disciplinary field. It was observed that resource commitment is a semi-modern relationship between resource knowledge management and information technology. This result fills the gap in information technology management knowledge and provides explanations for conflicting results in literature. Resource commitment acts as a prejudgment to KMC and shows positive and direct effect. Also, positive resource allocation moderates the relationship between ITH and ITR resources, highlighting the importance of coordination between IT and human resource resources and resource commitment. This study examined the dimensions of internal resources and determines that three types of IT resources have a significant positive impact on KMC that can lead to a competitive advantage. KMC can mediate the relationship between ITI resources, ITH resources and competitive advantage. These results enrich the studies conducted on IT relationship resource management resources.

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THE USE OF HOMOTOPY REGULARIZATION METHOD FOR LINERE AND NONLINNER FREDHOLM INTEGRAL EQUATIONS OF THE FIRST KIND

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ABSTRACT

Recently,Wazwaz has studied the regularization method to the one-dimensional linear Fredholm integral equations of the first kind in [5]. In this work, we develop this method to the linear and nonlinear two-dimensional Fred-holm integral equations of the first kind. Indeed, the regularization method is used for linear integral equations directly. But nonlinear integral equations of the first kind are transformed to linearintegral equations of the first kind by a change of variable, then The Regularization-Homotopy Method is applied.The combination of the regularization method and the homotopy perturbation method, or shortly, the regularization- homotopy method is used to find a solution to the equation. Some examples will be used to highlight the reliablity of the generalized The Regularization-Homotopy Method.

Keywords: Fredholm integral equations; Regularization-homotopy method; Ill-posed problem.

Introduction

Integral equations of the first kind in one-dimensional case have been studied in many papers (see [8-14]). But although,this equations in two-dimensional case have many interesting applications in Mechanical engineering, Physical sciences and other applied sciences see [5,8], only a few papers have been written about them (see [1 - 13]).In this paper, we consider general form of the two-dimensional Fredholm integral equations of the first kind

$$f(x,y) = \lambda \int_a^b \int_c^d k(x,y,s,t) ds dt \qquad (1)$$

where f and K are continuous functions and is a constant. Also,F is a continuous function which has continuous inverse and finally u is the unknown function of the equation (1) to be find. Obviously, if G is linear then the Eq. (1) wil be linear. As mentioned above, we develop the regularization method of [1] to linear case directly and in nonlinear case, we first set $u(x,t) = F(h(x,t))$ to convert (1) to linear form, then the

1.1 The homotopy perturbation method

The homotopy perturbation method was introduced and developed by Ji- Huan He in and was used recently in the literature for solving linear and nonlinear problems. The homotopy perturbation method couples a homotopy technique of topology and a perturbation technique. A homotopy with an embedding parameterp[0,1] is constructed, and the impeding parameter p is considered a small parameter. The method was derived and illustrated in [14], and several differential equations were examined. The coupling of the perturbation method and the homotopy method has eliminated the limitations of the traditional perturbation technique [14]. In what follows we illustrate the homotopy perturbation method to handle Fredholm integral equations of the second kind and the first kind.

$$u_\alpha(x,y) = \frac{1}{\alpha}f(x,y) - \frac{\lambda}{\alpha}\int_a^b \int_c^d k(x,y,s,t)u_\alpha(s,t)dsdt \qquad (2)$$

obtained above in (2). The homotopy is now constructed

$$u_\alpha(x,y) = p\left(\frac{1}{\alpha}f(x,y) - \frac{\lambda}{\alpha}\int_a^b \int_c^d k(x,y,s,t)u_\alpha(,t)dsdt\right) \qquad (3)$$

where the embedding parameter p monotonically increases from 0 to 1. The homotopy perturbation method permits the use of the expansion

$$u(x,y) = \sum_{n=0}^\infty \sum_{m=0}^\infty p_n^n(x,y) \qquad (4)$$

and consequently

$$u(x,y) = \lim_{p\to 1}\sum_{n=0}^\infty \sum_{m=0}^\infty p_n^n(x,y) \qquad (5)$$

Substituting (4) into both sides of (3), and equating the terms with the same powers of the embedding parameter p the recurrence relation is obtained

$$p^0: u_0(x,y) = 0$$
$$p^1: u_1(x,y) = \frac{1}{\alpha}(x,y), \qquad (6)$$
$$p^{N+1}: u_{n+1}(x,y) = -\frac{1}{\alpha}\int_a^b \int_c^d k(x,y,s,t)dsdt,$$

Having determined the components $u_i(x,y), i \geq 0$, we then use

$$u(x,y) = \lim_{p\to 1}\sum_{n=0}^\infty \sum_{m=0}^\infty p_n^n(x,y). \qquad (7)$$

The series (7) converges to the exact solution if such a solution exists. It is important to note that if the kernel is separable, i.e. $K(x,y,s,t) = g(x,y)h(s,t)$, then the following condition

$$\left|1 - \int_a^b \int_c^d k(x,y,s,t)dsdt\right| \qquad (8)$$

Note that the nonlinear Fredholm integral equations of the first kind can be handled by the regularization-homotopy method in a parallel manner to the analysis presented earlier for the linear case. The non-linear Fredholm integral equations of the first kind are first converted the nonlinear Fred Holm integral equations of the first kind are first converted

$$f(x,y) = \int_a^b \int_c^d k(x,y,s,t)F(u(s,t)dsdt) \qquad (9)$$

to a linear Fredholm integral equations of the first kind of the form

$$f(x,y) = \int_a^b \int_c^d k(x,y,s,t)v(s,t)dsdt), (x,y) \in D = [0,1][0,1] \qquad (10)$$

using the transformation

$$v(x,y) = F(x,y) \qquad (11)$$

Assuming that F(u(x)) is invertible, then we can wirte

$$u(x,y) = F^{-1}(v(x,y)). \qquad (12)$$

The non-linear Fredholm integral equations of the first kind is often considered as an ill-posed problem and this may lead to several difficulties. In this work, we will limit ourselves only to cases where $K(x,t) = g(x)h(t)$. We will now examine the illustrative linear and non-linear Fredholm integral equations of the first kind.

LinearTwo-dimensional Fredholm integral equation of the first kind

Now, we are going to apply the regularization-homotopy method to illustrate the earlier presented analysis, for the linear case. Significantly, a necessary condition to guarantee a solution is that, the data function $f(x)$ must contain components which match the corresponding x components of the kernel $k(x, y, s, t) = g(x, y)h(s, t)$.

Example 2.1 Use the regularization-homotopy method to solve the linear Fredholm integral equations of the first ki

$$\frac{7}{12}(x + t) = \int_0^1 \int_0^1 (x + t)su(s, t)dsdt. \tag{13}$$

Using the regularization method, Eq. (13) can be transformed to

$$u_\alpha(x, u) = p\left(\frac{7}{12\alpha}(x + t) - \frac{1}{\alpha}\int_0^1 \int_0^1 (x + t)su_\alpha(s, t)dsdt\right) \tag{14}$$

We next construct the homotopy

$$u_\alpha(x, t) = p\left(\frac{7}{12\alpha}(x + t) - \frac{1}{\alpha}\int_0^1 \int_0^1 (x + y)su_\alpha(s, t)dsdt\right). \tag{15}$$

Proceeding as before, we find the recurrence relation

$$p^0: u_0(x, y) = 0$$

$$p^1: u_1(x, y) = \frac{7}{12\alpha}(x + y),$$

$$p^2: u_2(x, y) = -\frac{1}{\alpha}\int_0^1 \int_0^1 (x + y)su_1(s, t)dsdt = -\frac{49}{144\alpha^2}(x + y).$$

$$p^3: u_3(x, y) = -\frac{1}{\alpha}\int_0^1 \int_0^1 (x + y)su_2(s, t)dsdt = \frac{343}{1728\alpha^3}(x + y) \tag{16}$$

$$p^4: u_4(x, y) = -\frac{1}{\alpha}\int_0^1 \int_0^1 (x + y)su_3(s, t)dsdt = -\frac{2401}{20736\alpha^3}(x + y)$$

and so on. Based on this, we obtain the approximate solution

$$u_\alpha(x, u) = \frac{7}{12\alpha}(x + y)\left(1 - \frac{7}{12\alpha} + \frac{49}{144\alpha^2} - \frac{343}{1728\alpha^3} + \ldots\right) \tag{17}$$

This in turn gives

$$u_\alpha(x, u) = \frac{7}{12\alpha + 1}(x + y) \tag{18}$$

obtained upon summing the in nite geometric series. The exact solution u(x) of (13) can be obtained by

$$u_\alpha(x, u) = \lim_{\alpha \to 0} u_\alpha(x, u) = x + y. \tag{19}$$

Example 2.2 Use the regularization-homotopy method to solve the Linear Two-dimensional Fredholm integral equation of the first kind

$$\frac{1}{9}xy = \int_0^1 \int_0^1 (xystu(s, t)dsdt. \tag{20}$$

by the using homotopy method the eq(20) converted to the second kind of equation

$$\alpha u_\alpha(x, y) = \frac{1}{9}xy - \int_0^1 \int_0^1 (xyst)\, u_\alpha(s, t)dsdt, \tag{21}$$

So that

$$u_\alpha(x, u) = \frac{1}{9\alpha}xy - \frac{1}{\alpha}\int_0^1 \int_0^1 (xyst)u_\alpha(s, t)dsdt, \tag{22}$$

Next, to construct the homotopy

$$u_\alpha(x,y) = p(\frac{1}{9\alpha}xy - \frac{1}{\alpha}\int_0^1\int_0^1 (xyst)u_\alpha(s,t)dsdt, \tag{23}$$

Proceeding as before, we find the recurrence relation

$$p^0 : u_0(x,y) = 0$$

$$p^1 : u_1(x,y) = \frac{1}{9\alpha}(x,y),$$

$$p^2 : u_2(x,y) = -\frac{1}{\alpha}\int_0^1\int_0^1 xystu_1(s,t)dsdt = -\frac{1}{81\alpha^2}xy.$$

$$p^3 : u_3(x,y) = -\frac{1}{\alpha}\int_0^1\int_0^1 xystu_2(s,t)dsdt = +\frac{1}{729\alpha^3}xy \tag{24}$$

$$p^4 : u_4(x,y) = -\frac{1}{\alpha}\int_0^1\int_0^1 xystu_3(s,t)dsdt = -\frac{1}{7461\alpha^4}xy$$

And so on. Based on this, we obtain the approximate solation

$$u_\alpha(x,y) = \frac{1}{9\alpha}xy\left(1 - \frac{1}{9\alpha} + \frac{1}{81\alpha^2} - \frac{1}{729\alpha^3} + \dots\right), \tag{25}$$

This in turn gives

$$u_\alpha(x,y) = \frac{xy}{1+9\alpha} \tag{26}$$

obtained upon summing the infinite geometric series

$$u(x,y) = \lim_{\alpha\to 0} u_\alpha(x,y) = xy. \tag{27}$$

Nonlinear Tow-dimensional Fredholm integral equation of the first kind

The regularization-homotopy method is applied to illustrate the analysis presented before for the non-linear case, as given bellow. However, our focus will be limited to the separable kernel $k(xyst) = g(xy)h(st)$.

Example 3.1 Consider the following two-dimensional nonlinear Fredholm integral equation of the first kin

$$xy = 2\int_0^1\int_0^1 (xyst)u^4(x,t)dsdt \tag{28}$$

We first set

$$u(x,y) = \pm\sqrt[4]{u(x,y)} \tag{29}$$

to carry out the non-linear equation (28) to the linear Fredholm integral equation

$$xy = 2\int_0^1\int_0^1 (xyst)\,v(x,t)dsdt, \tag{30}$$

The regularization method carries Eq. (30) to

$$u_\alpha(x,y) = \frac{1}{\alpha}xy - \frac{2}{\alpha}\int_0^1\int_0^1 (xyst)\,v_\alpha(s,t)dsdt, \tag{31}$$

We next construct the homotopy

$$v_\alpha(x,y) = (\frac{1}{\alpha}xy - \frac{2}{\alpha}\int_0^1\int_0^1 (xyst)\,v_\alpha(s,t)dsdt), \tag{32}$$

Proceeding as before, we find the recurrence relation

$$p^0 : v_0(x,y) = 0$$

$$p^1 : v_1(x,y) = \frac{1}{\alpha}xy$$

$$p^2: v_2(x,y) = -\frac{2}{\alpha}\int_0^1\int_0^1 xyst v_1(s,t)dsdt = -\frac{2}{9\alpha}xy \tag{33}$$

$$p^3: v_3(x,y) = -\frac{1}{\alpha^2}\int_0^1\int_0^1 xyst v_2(s,t)dsdt = +\frac{4}{81\alpha^3}xy$$

$$p^4: v_4(x,y) = -\frac{2}{\alpha}\int_0^1\int_0^1 xyst v_3(s,t)dsdt = -\frac{8}{729\alpha^4}xy.$$

and so on. Based on this, we obtain the approximate solution

$$v_\alpha(x,y) = \frac{1}{\alpha}xy\left(1 - \frac{2}{9\alpha} + \frac{4}{81\alpha^2} - \frac{8}{729\alpha^3} + \ldots\right) \tag{34}$$

This in turn gives

$$v_\alpha(x,y) = \frac{9xy}{9\alpha + 2} \tag{35}$$

obtained upon summing the infinite geometric series. The exact solution v(x) of (27) can be obtained by

$$v\ (x,y) = \lim_{\alpha\to 0} v_\alpha(x,y) = \frac{9}{2}xy \tag{36}$$

The exact solution u(x) of (28) can be obtained by

$$u(x,y) = \pm\sqrt[4]{\frac{9}{2}xy}. \tag{37}$$

Example 3.2 Consider the following nonlinear Fredholm integral equation of the first kind

$$\frac{x}{6(1+x)} = \int_0^1\int_0^1 \frac{x}{1+y}(1+s+t)u^2(s,t)dsdt. \tag{38}$$

We first transform the nonlinear Equation (38) to a linear equation by using the change of variable

$$v(s,t) = u^2(s,t) \tag{39}$$

So that Equation (38) becomes

$$\frac{x}{6(1+x)} = \int_0^1\int_0^1 \frac{x}{1+y}(1+s+t)v(s,t)dsdt. \tag{40}$$

We first set

$$u(s,t) = \pm\sqrt{v(s,t)} \tag{41}$$

The regularization method transform Equation (40) to

$$v_\alpha(x,y) = \frac{x}{6\alpha(1+x)} - \frac{1}{\alpha}\int_0^1\int_0^1 \frac{x}{1+y}(1+s+t)v_\alpha(s,t)dsdt. \tag{42}$$

Now, to construct homotopy we have

$$p^0: v_{\alpha,0}(x,y) = 0$$

$$p^1: v_{\alpha,1}(x,y) = \frac{x}{6\alpha(1+y)}$$

$$p^2: v_{\alpha,2}(x,y)$$

$$= -\frac{x}{6\alpha(1+y)}\int_0^1\int_0^1(1+s+t)v_{\alpha,1}(s,t)dsdt$$

$$= -\frac{x}{6\alpha^2(1+y)}\left(\frac{3+2\log(2)}{6}\right) \tag{44}$$

$$p^3: v_{\alpha,3}(x,y) = -\frac{x}{6\alpha(1+y)}\int_0^1\int_0^1 (1+s+t)v_{\alpha,2}(s,t)dsdt = \frac{x}{6\alpha^3(1+y)}\left(\frac{3+2\,log(2)}{6}\right)^2$$

$$p^4: v_4(x,y) = -\frac{x}{6\alpha(1+y)}\int_0^1\int_0^1 (1+s+t)v_{\alpha,3}(s,t)dsdt = \frac{x}{6\alpha^4(1+y)}\left(\frac{3+2\,log(2)}{6}\right)^3$$

Thus, the approximate solution becomes

$$v_\alpha(x,y) = \frac{x}{6\alpha(1+y)}\left(1 - \frac{1}{\alpha}\left(\frac{3+2\,log(2)}{6}\right)\frac{1}{\alpha^2}\left(\frac{3+2\,log(2)}{6}\right)^2 - \frac{1}{\alpha^3}\left(\frac{3+2\,log(2)}{6}\right)^3\right.$$
$$\left. + \cdots \right) \tag{45}$$

This in turn gives

$$v_\alpha(x,y) = \frac{x}{(1+y)(6\alpha+3+2\,log(2))} \tag{46}$$

Letting a ! 0, we obtain the exact solution as

$$v\ (x,y) = \lim_{\alpha\to 0} v_\alpha(x,y) = \frac{x}{(1+y)(3+2\,log(2))} \tag{47}$$

Since

$$v(x,y) = \pm\sqrt{v(x,y)}. \tag{48}$$

The exact solution u(x) of (38) can be obtained by

$$v\ (x,y) = \pm\sqrt{\frac{x}{(1+y)(3+2\,log(2))}} \tag{49}$$

Conclusion

In this work, a combination of the regularization method and the homotopy perturbation method was proposed as a reliable treatment of the Two-dimensional linear and non-linear Fredholm integral equations of the first kind. The proposed method showed reliability to handling these ill-posed problems. three examples, linear and non-linear, were examined to illustrate the analyses which were presented. The exact solutions were formally derived, if the exact solutions existed, as these equations were ill-posed. We pointed out that the corresponding analytical solutions are obtained using Mathematica

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PROPERTIES AND APPLICATIONS OF POLYMERIC SURFACTANTS

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ABSTRACT

Polymeric surfactants are polymers with a high molecular weight produced by adding hydrophobic groups to the soluble polymer chain. The added groups affect the properties of the water-oil surface, such as interfacial tension and wettability. Due to their high viscosity and surface activity, polymeric surfactants cause fluid mobility and oil emulsion. Furthermore, polymeric surfactants do not separate injection components, unlike surfactant-polymer injection.

Keywords: polymeric surfactants; oil emulsion; oil recovery.

Introduction

Chemical methods for the enhanced oil recovery (EOR) involve injecting a displacing fluid in oil reservoirs to mobilize the crude oil trapped in the porous rocks. The displacing fluid generally is a water solution containing various additives [1]. The term "polymeric surfactant" refers to every polymeric structure containing two hydrophilic and lipophilic parts, also known as "micellar polymer" or "hydrophobic modified water-soluble polymer." Polymeric surfactants are divided into two main categories, including polysoaps and macrosurfactants. The polymer is used to increase the viscosity of water, while the surfactant acts as an emulsifier. The scope of alkali (generally a hydroxide such as NaOH or a carbonate) is essentially the same as the surfactant. The base reacts with the organic acid components in acidic crude oils, forming surfactants in situ [2]. Also, besides generating the surfactants, alkali is added to reduce the adsorption of anionic surfactants on certain rocks. The polymeric systems traditionally employed for EOR have been

extensively reviewed recently. The recovery mechanism in surfactant flooding reduces the interfacial tension between two phases [3].

It should be noted that, in a way, polymeric surfactants have been used for a long time in EOR without really recognizing them as such [4]. The idea of introducing hydrophobic groups in a water-soluble polymer, which makes it a polymeric surfactant, has been applied in EOR. The extant study was conducted to examine the properties and applications of polymeric surfactants.

Literature Review
Properties of Polymeric Surfactants

When the polymeric surfactant is dissolved in water then decreases interfacial tensions based on the considered system. The issue mentioned above is usually attributed to the specific orientation of these copolymers in which hydrophobic block refers and orients towards the surface where air exists. However, the macromolecular nature of surfactants leaves direct effects on the nature of this behavior [5]. On the other hand, the surface activity of macrosurfactants is determinable only if the hydrophobic block is short enough (in sample 34, it is less than 20 units, for example). In general, it seems that the hydrophobicity of insoluble block must have a medium level for a clear and accurate presentation of the measurable surface activity [6].

The relationship between properties and applications of polymeric surfactants

There is expanding application of polymeric surfactants in gene and drug delivery. These applications and respective options are based on the hydrophilicity dependence of some samples on external parameters (e.g., temperature, pH, and ionic strength). This may lead to the formation or controlled disorder of micelles when polymeric coagulation experiences some changes in such parameters when facing a living system under specific conditions.

One of the main usages of polymeric surfactants is their application as stabilizers in emulsion polymerization. In this area, it is believed that these materials act as a stabilizer (possibly by a spatial repulsion mechanism) against interconnection and Ostwald ripening phenomenon [7].

Polymeric surfactants have active performance if adsorbed in a common border between water and non-polar medium. In this case, adsorption is affected by similar factors, such as pH, length and structure block, concentration, and topology.

Requirements of polymeric surfactants for EOR

Polymeric surfactants are macromolecules containing two hydrophilic and hydrophobic parts in their structure. Compared to traditional surfactants, the macromolecular nature of these systems allows a much larger variety of structures [8]. Polymeric surfactants usually present very interesting rheological and interfacial properties. Logically, most of these properties originate from their chemical structure. For example, polysoaps have good emulsification properties but weak solution viscosity, while macrosurfactants, especially those containing a polyelectrolyte block, have excellent gelation properties but low surface activity. Without discussing the details, these characteristics derive mostly from the mechanisms of aggregation in solution. The chemical composition is also very important in determining the final properties. These types of polymers are important building blocks for smart materials. However, depending on the considered application, some structures are more suitable than others are. Therefore, polymeric surfactants attracted much interest for actual or potential applications in several fields, including (mini)emulsion polymerizations, coatings, biotechnology, medicine, pharmacology, cosmetics, agriculture, water purification, electronic, optoelectronic, and enhanced oil recovery [9].

Polymeric surfactants for EOR

The idea of using polymeric surfactants for EOR, which can act as solution thickeners and surfactants, is not new. Indeed, most of the systems successfully employed or proposed as solu-

tion thickeners based on hydrophobically modified water-soluble polymers can also act as surfactants [10].

Several papers published in scientific journals propose various amphiphilic polymers as systems for EOR. Nevertheless, only a few studies cover experiments performed to prove the effectiveness of such systems for the claimed application. We could identify a few papers in which viscosity, surface properties, and salt effects are taken into account to evaluate a given polymeric surfactant in EOR performance.

Conclusion

Polymeric surfactants for chemical enhanced oil recovery could be a valid alternative to the common systems because they potentially combine considered rheological and interfacial properties, while generally, mixtures of different chemicals are required. This advantage avoids the separation and loss of some components during the flooding processes or unwanted interactions. The recent advent has confirmed this potential in the past literature of examples of polymeric surfactants for EOR. On the other hand, complex experimental procedures and expensive starting materials are required in most cases, which have limited this approach so far. To achieve real exploitation of the potential of polymeric surfactants for EOR, the advantages must overcome the increased costs. More efforts from the scientific community and the exploration of economically suitable sources and processes are required to face the problems caused by the decreased oil availability. In general, several directions of efforts are required to consider polymeric surfactants as potential and suitable systems for enhanced oil recovery.

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SERVICES PROVIDED BY THE FANS TO THE CLUB AND THE ACHIEVEMENTS OF PROFESSIONAL SOCCER CLUBS: EXAMINATION AND ANALYSIS - CASE STUDY OF SEPAHAN AND TRACTOR CLUBS

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ABSTRACT

The purpose of the current study was to examine the effect of the services provided by the fans to the club on the participation and success of Sepahan and Tractor professional clubs. The present research is an applied study that employs causal-comparative for its purposes. The required information was collected using field methods and questionnaires. The statistical population of this study includes all fans of Sepahan and Tractor clubs, the total number of which is deemed unlimited. According to the characteristics of the statistical population, the requirements of the volume-based stratified sampling, and the recommendations of the Morgan Table, a total of 384 fans from Sepahan and Tractor clubs were selected as the research sample (i.e., 247 questionnaires from Sepahan fans and 137 questionnaires from Tractor fans). Furthermore, a researcher-made questionnaire based on a literature review was used to measure the research variables. The Cronbach's alpha of above 0.7 indicated the internal consistency of the questionnaire. The distribution of variables was evaluated using Kolmogorov and Smirnov tests, all of which were abnormal. The data obtained from the questionnaires were analyzed using one-sample sign and Mann–Whitney U tests, the findings from which indicated that the fans of Sepahan and Tractor clubs provided a higher-than-expected level of services to their respective teams. Moreover, the results revealed a significant difference between the level of services provided by the fans of Sepahan and Tractor Clubs. The final position of the clubs in the four seasons of 2011/2012, 2012/2013, 2013/2014, and 2014/2015, in which both clubs enjoyed high-position finishes, indicates that the involvement and participation of passionate and loyal fans have improved the team (win in most games, exhibiting free-flowing game).

Keywords: services provided by fans; fan participation; sepahan club; tractor club.

Introduction

Customer satisfaction is a leading concept for active marketers and marketing researchers alike. Many perceive it as the very essence of prosperity in a highly competitive world. Therefore, the significance of customer satisfaction and retention for the current customer-oriented and market-oriented sporting clubs in strategy development cannot be overstated. The success of clubs and customer satisfaction are two interrelated notions. That is, one of the prerequisites to being a successful club is to have an established fan base. Changing expectations, needs and demands all point out the necessity of assessing customer satisfaction on a consistent basis. In a competitive service industry, providing superior services is of paramount importance for survival and success (Koozechian et al., 2009).

Sports clubs have found that the key to retaining sports customers and making a profit lies in continuous effort in successful partnerships. Comprehending the expectations of the customers and the commitments they feel the need to fulfill enables the club to gain a competitive advantage. The key to plotting and adjusting the fans expect to have a carefully-designed customer

satisfaction indicator since being able to evaluate customer satisfaction is of paramount importance to market performance and management-level decision-making processes, thus acting as a tool by which marketers can evaluate the integrity of their relationship with their customers, and only then can an organization realize how satisfied, or unsatisfied, are their customers with the current state of the organization's services and products (Koozechian et al., 2009).

Only loyal fans with a high team identity can support the teams in times of triumph and loss. Team identity refers to a person's involvement or participation as a sports fan in a team or a club and establishing a perceived relationship with that it, representing the need for personal commitment and emotional participation of individuals in matters related to that team or club. The relationship is thought to make their mental and behavioral aspects cohesive and unique. Team identity is one of the main factors influencing and justifying the attendance of fans in stadiums to support the team and will make them compare their sphere of support with that of other clubs. Fans are able to enhance the quality of production and service, support their team while at the exhibition, especially in home games, exert a positive influence on their team's revenue sources, encourage potential and existing sponsors, and earn a lot of revenue through audio and video media for the team. Team identity can even offset the impact of winning or losing by increasing or decreasing team support. For example, various world-famous clubs have not lost their fan bases despite enduring consecutive defeats (Shojaei, 2011).

Recent studies in this field have contributed significant findings to the literature, but most studies have only examined the limited number of factors affecting sports fans. Studies have mainly explored management factors in the five dimensions of organization, aesthetics, kinship, media and tradition (Chen 2007). Locke (2009) employed social identity theory to develop a model for fans of new football teams in which the three aspects of football itself, its origins and its opportunities were identified as the main factors involved in creating team identity. Cole (2004) found that people are attracted to teams and clubs whose names have a long history in sports or other areas such as industry. Funk (1998) considers the importance, knowledge and information about the team or club, the level of trust in friends and those perceived to be involved in the team and club, personal experience and the intensity of support as effective factors in attracting fans to teams and clubs.

These findings have significant implications for the executives of the teams and the authorities of the Iranian Football Premier League organization, who can help the sports teams by devising a proper strategy to increase the attendance of spectators and the ensuing revenue. As such, the relevant officials of the teams and the organization of the Iranian Football Premier League are advised to direct more effort and resources to enhance the positive experience of the sporting exhibition, in turn resulting in heightened fan satisfaction. Managers must relentlessly seek ways to understand, evaluate, and improve the team identity of their fans. Retaining the club's fan base is of paramount importance to the sustainable growth of sporting events, as their support can enhance their loyalty to their team.

This study advises professional sports managers to devise long-term strategies tailored to the specific needs of the fans (in terms of identity and team attachment), with the ultimate aim of enhancing satisfaction and positive behavioral intentions (Beaton et al., 2009). Since the literature on the effect of managerial factors on creating and maintaining fan identity is few and far between in the country, this study aimed to examine the effect of services provided by fans to the club on the participation and success of Sepahan and Tractor professional clubs.

Theoretical foundations of research
Sports marketing
The term sports marketing was first used in 1987 by American scholars. Researchers have formulated various definitions for sports marketing, some of which are mentioned (Mohammad

Kazemi, 2007). Louise and Openerler (1985) argue that sports marketing is the application to great effect of mixed marketing elements to align the interests of consumers of sports products and those of sports organizations. Jose (2001) defines sports marketing as predicting, managing and meeting the needs and demands of customers through the application and implementation of marketing principles (Fallahi, 2009).

The notion of promotion as it applies to sports marketing is defined as the process of shaping and influencing the relationship established between people and products of sports companies, the level of intervention and the image of companies when it comes to sporting matters. According to this definition, there are various departments and individuals that sporting organizations should pay close attention to (Pitts et al., 2002).

A sports organization promotes its products and services to end consumers, business customers, the whole community, the business communities and the media. In sports marketing, a large part of communication and promotion, especially in relation to new customers and audiences, is of a learned nature. It may be necessary for companies or sports organizations to teach audiences what sport benefits them, where and when they can be obtained, and how to participate in service processes. As mentioned earlier, communications can be provided through individuals such as salespeople, educators, or media such as television, radio, newspapers, magazines, billboards, brochures, and the Internet (Mohammad Kazemi, 2007).

Quality of service in sports

Sports organizations are facing a new era of global competition. Within this highly competitive market, the organization's success depends on the extent to which the organization can satisfy its customers through the quality of its service. The more management is dedicated to its customers and their level of satisfaction and loyalty, the more the significance of quality services to sports organizations. To satisfy customers and retain loyal members, sports marketers need to understand the needs and demands of customers and perform periodic evaluations for such (Zhao, 2008).

The number of health and fitness clubs is increasing due to the corresponding global trend. As such, managers and owners of clubs are responsible for complying with standards covering a plethora of issues such as having a healthy and clean environment, employing qualified and approved staff for offering novel training routines and adhering to regulations, good equipment in terms of performance quality, correct and honest performance evaluation and customer orientation, flexible working hours, appropriate facilities and equipment for men and women, fair subscription fees, providing information about the dangers of activities, adapting to social change, making programs accessible to all members of society, and ensuring the welfare of the client (Ramezani, 2004).

Fan and Membership Card

Over the past decade, sports management experts have promoted the concept of identity relationships between fans and sports teams. Hogg and Abrams (1988) argue that "supporting a team is more than a mere physical act as it is a part in the whole of expressing one's identity to the team through which it is presented" and therefore creates cohesion and unity among the fans of any given team. When watching a sporting event, those who support a particular sports team involved in that event feel more excited than those who do not have an identity. In addition, affiliating oneself with a particular sports team is associated with fans' feelings of self-worth, ambition, and aggression (Van and Branscomb 1993 and Vaslan 1989).

An individual's identity toward a team or sports club can vary depending on the individual's motivation. People with a low team identity tend to have rather passive communication with that team, and hence their attendance in competitions is more motivated by mere entertainment,

taking advantage of social opportunities or reducing stress. In contrast, fans with a high level of identity generally feel a strong sense of loyalty to that team, to the extent that their individual identity is tied to the team identity. Fans who have such a sense of team identity are likely to develop completely negative relationships with those of the opposing team (Branscombe and Van, 1994). Such fans are susceptible to severe changes in the emotions associated with the success or failure of their team. That is because the emotions of these individuals are closely linked to the performance of their favorite team; they repeatedly attribute their team's failures and successes to themselves (Hirt et al., 1992).

Identity can be used to assess the degree of consumerism among fans (Gladen and Funk, 2001; Trail et al., 2003 and 2005), as a tool to assess the psychological well-being of fans (Van, 2006) and to identify the emotional and aggressive behavior of fans (Van and et al., 2002). Team-fan identity is recognized as an indicator of attendance at sporting events and the sale of tickets and commercial goods (Van et al., 2004; Lowry & Arenette, 2000). Also, the positive relationship between financial support and playground advertising is the result of the influence of fan-team identity (Gwyner and Swanson 2003).

Identity of sports fans

Research has revealed that the more the level of identity within a group, the more people tend to declare their membership in that group (Coleman, 1961) and hence exhibit higher levels of individual identity and emotional participation in that group (Underwood et al. 2001). Moreover, fans with a higher perceived identity tend to display more supportive behaviors toward that group (Fisher & Wickfield, 1998). Several researchers have documented team identity as a personal commitment and emotional participation in a sports organization that comprises psychological and behavioral aspects (Branscombe & Van, 1991; Satin et al., 1997; and Fisher, 1998).

Like any other important social identity, fanhood implies a dependence on a sporting concept in which the value and importance stems from collective identity (Hirt et al., 1992). As such, sports fans do not see themselves only as mere spectators in matches, but as participants whose engagement is undisputable to the integrity of their team (Novak, 1976).

Research method

The present research is an applied study that employs causal-comparative for its purposes. The required information was collected using field methods and questionnaires. The statistical population of this study includes all fans of Sepahan and Tractor clubs, the total number of which is deemed unlimited. According to the characteristics of the statistical population, the requirements of the volume-based stratified sampling, and the recommendations of the Morgan Table, a total of 384 fans from Sepahan and Tractor clubs were selected as the research sample (i.e., 247 questionnaires from Sepahan fans and 137 questionnaires from Tractor fans). Furthermore, a researcher-made questionnaire based on a literature review was used to measure the research variables. The Cronbach's alpha of above 0.7 indicated the internal consistency of the questionnaire.

Descriptive and inferential statistical methods were used in this study to analyze the data. The descriptive section employed indicators such as frequency and percentages, means and standard deviation, while in the statistics, the Kolmogorov-Smirnov test was used to determine the normality of variables and comparative one-sample t-test and Mann-Whitney non-parametric tests were used to examine research hypotheses. SPSS/pc ++ was also used for calculations.

Table 1

Cronbach's alpha coefficients for research variables

	Subscale	Alpha coefficient	
		Sepahan	Tractor
1	Services of the club to the fans	0.9226	0.9319
2	Services of the fans to the club	0.8998	0.7054
3	Total	0.9451	0.8914

Findings

The results showed that 64.3% of respondents were fans of Sepahan Club, and 35.7% were Tractor fans. Among the fans of Sepahan, 10.9% were under 20 years old, 46.2% were between 20 to 30 years old, 23.9% were between 30 to 40 years old, 9.3% were between 40 to 50 years old, 5.7% were over 50 years old, and 4% did not disclose their age. Among the fans of Tractor, 0.7% were under 20 years, 29.2% were between 20 to 30 years, 43.1% were between 30 to 40 years old, and 11.7% were aged between 40 to 50 years, while 15.3% were over 50 years old.

20.6% of Sepahan fans had a below-diploma education level, 40.1% had a diploma, 8.9% had an associate degree, 15.8% had a bachelor's degree, 9.3% had a master's degree or higher educational level, while 5.3% did not disclose their educational level. Among the fans of the Tractor club, 15.3% had a below-diploma education level, 44.5% had a diploma, 21.2% had an associate degree, 10.9% had a bachelor's degree, and 8% had a master's degree or higher educational levels.

Finally, 46.2% of Sepahan Fans were single, 38.9% were married, while 15% did not disclose their marital status. Among Tractor fans, 35.8% were single, and 64.2% were married.

Two-way analysis of variance and a significance level of p<0.05 is considered for statistical comparisons of the research.

Hypothesis 1: The services provided by the fans to the club are not adequate.

Since the variable of services provided by the fans to the club for the case study clubs does not have a normal distribution, the non-parametric one-sample sign test is used to test and examine. As such, the variable M is defined as the actual median of the variable of services provided by the fans to the club in the study community.

Considering that the variable of services provided by the fans to the club can attribute a value between 1 and 5, values less than or equal to 3 are deemed as low levels of services, while values of more than three are considered as appropriate and higher-than-expected levels, that is:

$$\begin{cases} H_0: M \leq 3 \\ H_1: M > 3 \end{cases}$$

According to the results of Table 2 for the fans of the Sepahan Club, the mean of the variable of the level of services provided by fans to the club is 3.81, with a standard deviation of 0.54 and a median of 3.837. Also, the significance level of the sign test was calculated to be 0.0001; that is, the level of services provided by the fans to the club is higher than expected. Moreover, the mean of the variable of the level of the services provided by the Sepahan fans to their club was calculated to be 3.88 with a standard deviation of 0.31 and a median of 3.837. ultimately, the significance level of the sign test was determined to be 0.0001; that is, the level of services provided by the fans to the club is higher than expected.

Finally, the mean corresponding to the variable of the level of the services provided by the fans to the club is 3.83 with a standard deviation of 0.47 and a median of 3.837, while the significance level of the sign test was determined to be 0.0001, that is, the level of services provided by the fans to the club is higher than expected.

Table 2

Signs test results, level of services provided by fans to the club

Club	Mean	SD	Median	Number of responses lower than the median	Number of responses equal to the median	Number of responses higher than the median	Significance level
Sepahan	3.81	0.54	3.837	6	8	233	0.0001
Tractor	3.88	0.31	3.837	0	0	137	0.0001
Total	3.83	0.47	3.837	6	8	370	0.0001

Hypothesis 2: There is no significant difference between the services provided by the fans to the club in Sepahan and Tractor clubs.

Because the variables of the level of services provided by the fans to Sepahan and Tractor clubs have non-normal distribution, the Mann-Whitney non-parametric test was used to analyze variables.

Table 3

Mann-Whitney results on comparing the level of services provided by fans to Sepahan and Tractor clubs

Club	Descriptive statistics			U statistics	Z statistics	Sig. level
	Mean	SD	Average rank			
Sepahan	3.81	0.54	182.97	14566.5	-2.264	0.024
Tractor	3.88	0.31	209.68			

The findings from Table 3 show that the Mann-Whitney U statistic is 14566.5 and the Z statistic 2.264, and the significance level of the test is 0.024. That is, there is a significant difference between the level of services provided by fans to Sepahan and Tractor. As such, the fans of the Tractor club offer more services to the club compared to their rival.

Hypothesis 3: There is no significant relationship between the club's success, providing services to the fans, and receiving the fans' support.

According to the results obtained and considering the final standings of the Persian Gulf Pro League for seasons 2011/2012, 2012/2013, 2013/2014, and 2014/2015, in which both clubs enjoyed high-position finishes, both clubs were successful in providing services to fans and receiving support from their fans. That is, the null hypothesis is rejected, and hence there is a direct and significant relationship between the success of the club and providing services to the fans and receiving the support of the fans.

2013/2014 Persian Gulf Pro League table

Pos	Team	Pld	W	D	L	GF	GA	GD	Pts
1	Foolad (C)	30	16	9	5	36	24	+12	57
2	Persepolis	30	16	8	6	34	15	+19	55[a]
3	Naft Tehran	30	15	9	6	39	23	+16	54
4	Sepahan	30	14	12	4	36	20	+16	54
5	Esteghlal	30	15	9	6	34	25	+9	53[a]
6	Tractor Sazi	30	11	13	6	39	33	+6	45[a]
7	Malavan	30	13	6	11	40	33	+7	44[a]
8	Saipa	30	7	14	9	26	31	−5	35
9	Saba Qom	30	8	9	13	32	38	−6	33
10	Gostaresh	30	7	11	12	31	34	−3	32
11	Rah Ahan	30	7	10	13	25	34	−9	31
12	Est. Khuzestan	30	6	11	13	26	37	−11	29
13	Zob Ahan	30	6	11	13	24	36	−12	29
14	Fajr Sepasi (R)	30	6	11	13	20	34	−14	29
15	Damash (R)	30	5	12	13	30	40	−10	26[a]
16	Mes Kerman (R)	30	1	19	10	21	36	−15	22

2012/2013 Persian Gulf Pro League table

Pos	Team	Pld	W	D	L	GF	GA	GD	Pts
1	Esteghlal (C)	34	19	10	5	42	18	+24	67
2	Tractor Sazi	34	18	11	5	55	32	+23	65
3	Sepahan	34	19	7	8	60	33	+27	64
4	Foolad	34	14	14	6	52	35	+17	56
5	Naft Tehran	34	14	13	7	42	29	+13	55
6	Mes Kerman	34	13	14	7	33	22	+11	53
7	Persepolis	34	12	14	8	41	31	+10	50
8	Rah Ahan	34	12	10	12	32	35	−3	46
9	Saba Qom	34	10	15	9	37	33	+4	45
10	Saipa	34	11	12	11	37	33	+4	45
11	Damash	34	11	10	13	36	43	−7	43
12	Fajr Sepasi	34	10	12	12	42	38	+4	42
13	Malavan	34	9	13	12	34	39	−5	40
14	Zob Ahan (O)	34	9	11	14	36	40	−4	38
15	Aluminium Hormozgan (R)	34	7	14	13	26	40	−14	35
16	Sanat Naft (R)	34	4	13	17	31	60	−29	25
17	Paykan (R)	34	6	7	21	26	66	−40	25
18	Gahar Zagros (R)	34	3	10	21	24	59	−35	19

2011/2012 Persian Gulf Pro League table

Pos	Team	Pld	W	D	L	GF	GA	GD	Pts
1	Sepahan (C)	34	19	10	5	54	27	+27	67
2	Tractor Sazi	34	19	9	6	57	32	+25	66
3	Esteghlal	34	19	9	6	58	34	+24	66
4	Saba Qom	34	12	14	8	40	38	+2	50
5	Naft Tehran	34	13	10	11	36	38	−2	49
6	Zob Ahan	34	9	18	7	29	33	−4	45
7	Damash	34	11	11	12	34	38	−4	44
8	Saipa	34	10	13	11	50	39	+11	43
9	Mes Kerman	34	11	10	13	35	39	−4	43
10	Sanat Naft	34	11	10	13	49	57	−8	43
11	Rah Ahan	34	9	15	10	43	42	+1	42
12	Persepolis	34	10	12	12	50	54	−4	42
13	Fajr Sepasi	34	10	11	13	31	38	−7	41
14	Foolad	34	10	10	14	35	37	−2	40
15	Malavan	34	9	12	13	32	33	−1	39
16	Sh. Tabriz (R)	34	6	16	12	34	44	−10	34
17	Shahin Bushehr (R)	34	6	15	13	30	43	−13	33
18	Mes Sarcheshmeh (R)	34	5	9	20	23	54	−31	24

Conclusion

Clubs with loyal and organized fans hold are perceived to have an important key to generating revenue and attracting sponsors, as their support for the club is an important determinant of other sources of revenue, both directly (through ticket sales) and indirectly (through the sale of club-related goods, sponsors and even the sale of television broadcasting rights in some countries). The support of loyal fans puts sports clubs in a favorable competitive status compared to other commercial companies, and the sustained attendance of fans increases the sales of sports and even non-sports products. In addition, the most influential fans are those who support a particular team because they are the main source of income for the club. To retain and entice the fans, club managers seek various forms of incentives, such as issuing membership cards with premium benefits for the fans

The findings of the first hypothesis indicated that the level of services provided by both fans of Sepahan and Tractor clubs to their respective teams is higher than expected. The effect of the membership card on social status, free parking spots, participating in the club's charity, supporting the group and the club in any situation and doing positive publicity for the club, attending the stadium and encouraging the team are among the most notable services offered by either of the parties according to the respondents. Nevertheless, findings from previous studies have been somewhat inconclusive regarding certain findings. Gwyner and Swanson (2003) argue that personality and professional characteristics are highly effective in supporting and serving the club. Trail et al. (2003) also declared fanhood as the most important factor in the success of various clubs. Ku et al. (2009) have identified inner emotions and feelings as effective in supporting and promoting team morale. Saatchian (2013) believes that the terms fan, spectator and viewer

should be used for different scenarios. Although the terms might be used interchangeably by even the media, a fan is someone who is loyal to the team, no matter the spot conditions of that team. Loyal fans play an undeniable role in developing the economic and non-economic potential of sports teams and clubs. Therefore, paying attention to this strategic indicator can be the key to enhancing clubs' financial strength. The economic growth of the sports industry depends on the growing public interest therein; as Hogg (1995) argues, in the last decade, the academics of sports management have placed great emphasis on the correlation of identity between fans and sports teams. Supporting a sports team in a city is more than just a simple supporting function.

The findings from the second hypothesis indicate that is a significant difference between the level of services provided by fans to the club in the two clubs, Sepahan and Tractor. The mean values for the Tractor club show that fans are more dedicated to their club. As such, the results of this hypothesis show that the fans of the Tractor Club have been more successful in this regard than those of Sepahan. Previous research has produced no results, either in line or in contrast to this study's results. An important reason for such a difference is the strong ethnicity-orientation of Azeri-speaking people compared to Sepahan supporters. The warm-hearted people of Azerbaijan are very sensitive and love what they have, which has led to such a conclusion in this hypothesis.

Regarding the findings on the third hypothesis, the final standing table for the seasons 2011/2012, 2012/2013, 2013/2014, and 2014/2015 reveal that the two teams of Tractor and Sepahan club have always been at the top of the league table, which indicates that attendance of loyal fans promotes the quality of the teams (win in most games, exhibiting free-flowing game).

Based on the results of the first hypothesis, club-level executives are advised to adopt measures to mitigate the impact of hooligans on the atmosphere and team quality. Also, based on the results of the second hypothesis, fans are advised to support their team's sponsors, that is, buy their products and wear the uniforms, the ultimate purpose of which would be to moralize the team in putting on a better exhibition. Finally, the results of the third hypothesis imply that executives should note that employing top-class players and coaches to offer free-flowing football.

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INVESTIGATING THE FEASIBILITY OF IMPLEMENTING RSQS MODEL'S PROBLEM-SOLVING DIMENSIONS AND POLICIES IN TEHRAN'S ETTEKA CHAIN STORES

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ABSTRACT

Perhaps, offering quality services to the customers and setting the ground for the creation of the store's brand loyalty is the most key factor in creating competitive distinction and, in more exact terms, a fundamental element distinguishing the successful from the unsuccessful stores in the retailing industry. Therefore, the present study investigates the retailing problem-solving dimensions and policies based on the RSQS model for Tehran's Etteka chain stores. The study is applied research in terms of the objectives, and it is a descriptive research of the field observation type regarding the data gathering method. The study population included those of Tehran's Etteka Chain Stores customers who referred to these stores within the temporal span of the research. To determine the study sample's volume, random sampling was the method of choice. The study sample volume was estimated at 384 individuals using the Cochran formula and considering the study's nature. The study is based on structural equation modeling, and SPSS and R&PLUS software packages have been applied. Cronbach's alpha coefficient was calculated for a used questionnaire equal to 0.918. The study results are indicative of the idea that there is a significant relationship between the general quality of retailing services and problem-solving dimensions and policies.

Keywords: quality; services; retail; quality of retailing services; chain stores.

Introduction:

The retailing environment is changing notably in contrast to the past. The environment is depicted with the raid of the internal and external companies to achieve high and uncommon profits (Sellers, 1990; Smith, 1989). Retailing should distinguish itself from its rivals to succeed in a highly challenging environment. The distinction comes about when the retailer succeeds in meeting the customers' needs in a way that is superior to the rivals. The main retailing strategy for creating a sustainable advantage in this regard is offering services with the highest level of quality (Barry, 1986; Hammel and Savit, 1988 Ritchel and Sazer, 1990).

Based on the results obtained from the research on service marketing, it has been made clear that service organizations should expand their long-term relationships to acquire and preserve competitive advantages. Under the present time's circumstances, companies have concluded that the retention of current customers is a lot more profitable than absorption of new customers and, nowadays, it is witnessed that the companies are more willing to develop their relation-based marketing premises and design powerful strategies enabling the expansion of close and, in the meanwhile, long-term relationships with the most profitable customers (Pratten, 2004).

In the retailing context and, more specifically, in the retailing stores that offer a combination of goods and services as the primary foundation of their structures, the retailers can influence the quality of services more than that of the goods. Since retailers can bring such effects, the quality of services plays a strategic and critical role in giving the customers a special perception of the services' quality. With the formation and development of various forms of modern retailing in Iran based on the number and value of the stores, the perception of the quality of retailing services and the determination of the constituents of retailing services' quality have become strategic and important subjects. However, few studies have been conducted on the quality of retailing services in stores active in Iran's retailing industry.

With the increasing daily expansion in the number of the service-providing jobs along with the augmentation in the importance of such industries and their significance in the elevation of the communities' GDP, such a subject as the offering of flawless services with superior quality has drawn a lot of attention. Gradually, the share of the organizations and institutions that only get involved in offering customers would undergo a lot of increase more than ever in the global economy compared to the quotient of the manufacturing entities and firms. Nowadays, fewer companies are even found with service-providing, not as an important part of their customer satisfaction process. Researchers have figured out that "quality of services" is one of the most important factors influencing the customers' choice of stores in the competitive and highly challenging retailing market, especially in such areas as chain stores where the services are offered in combination with physical products. The quality of the services offered to the customers is of great importance in keeping them satisfied, and it greatly contributes to creating the stores' positive brand image in the customers' minds. In line with this, the present study uses the RSQS model to investigate the quality aspects of retailing services in Tehran's Etteka Chain Stores to figure out the variables' interrelationships and come up with the conditions and criteria enabling the better implementation of this model of services quality assessment.

Study's Theoretical Foundations:
Quality of Services:
Dr. Deming states that "the optimization of quality via creativity and efficiency enhancement and production process quality control brings about reductions in the finished price and augments production of goods and services" (Feqhi and Farahmand, 2002, pp.527-529). Anderson believes that when the customers become readily willing to leave the company and turn to the rival firms, they should be considered lost. Customers' complaints about the quality of the provided services are reflective of the low service-providing performance experienced versus expected by the customers (Anderson et al., 2008, p.99). Paramason et al. (1988) and Gronerose (1984) define the quality of services as the difference between the customers' perception of the expected services and their perception of the services received. These researchers assume service quality can be a reliable measure of a non-confirmation (between perceptions and expectations) (Wang, 2003, p.74).

In traditional attitudes, the quality of products is appraised in the light of their physical properties and attributes like solidarity and reliability. Still, today, many companies have reinvestigated the concept of quality. These companies have noted that the most optimum and successful product cannot be envisioned as ideal if it cannot meet the customers' wants, needs and expectations. The new definition of quality within the framework of these concepts is as follows: the degree to which a product matches the customers' expectations and the presented specifications (Rusta et al., 2008, p.222).

The tendency to offer high-quality services plays a significant role in such service industries as insurance, banking and so forth; that is because the quality of services is enumerated among vital signs of an organization's survival and profitability. Nowadays, customer satisfaction and service quality are vital signs in most service industries. This issue gains twice as much importance, particularly regarding the financial services wherein the services' distinction is generally problematic (Keymasi and Javadin, 2003). The benefits stemming from services' quality is per se another factor encouraging the organizations to offer increasingly higher qualities of services. One of the direct effects of offering high-quality services is the increase in the ability of an organization to offer efficient services to the customers following its discernment of its customers' wants and

needs. Thus, such an organization tries to reduce or eliminate unnecessary services. With the elevation of efficiency and effectiveness in the service-providing task, an organization's profitability can be enhanced. Furthermore, offering better services to the customers causes them to repeat purchases and expand the company products' sales through word of mouth.

Retailing Services Quality Scale (RSQS):

Retailing environment is changing at a notable speed in contrast to the past; such an environment is portrayed with the raid of the domestic and foreign companies to acquire higher and uncommon profits. Retailers should make themselves distinct from their competitors in this highly challenging environment to appear successful. The distinction occurs when the retailer succeeds in satisfying the customers' needs in a way more superior than its rivals. The primary strategy adopted by the retailing activities serves to create a sustainable advantage, thereby offering services with the highest possible quality. SERVQUAL is the most well-known scale for measuring service quality; it is a scale consisted of five dimensions, namely tangibles, reliability, responsibility, confidence and sympathy. Although the scale has been experimentally tested in many service-providing jobs, it does not perfectly match the retailing environment. Very few studies have been carried out in the retailing industry compared to the other fields. The retailing industry is composed of stores that offer a combination of goods and services to customers. Although the services' quality assessment shares some aspects in completely service-providing environments with retailing environments, the assessment of the retailing services' quality should also incorporate other aspects. Therefore, Dabholkar (1996) introduced the RSQS model or the retailing service quality scale to bring about more conformation between the models devised for assessing the services' quality and the retailing context. The model has been drawn on SERVQUAL, comprised of 28 scales, seventeen of which stem from the Seropov Model, with its eleven properties having been formed based on qualitative research. RSQS consists of five aspects, as explained below (Dabholkar, 1996):

Physical aspects: the physical aspects of retailing activity are facilities, equipment, and physical facilities offered by the retailer, and they further cover apparent shape and comfort.

Reliability: it includes fulfilling promises, offering proper services, availability of goods and commodities, and ease of performing sales and purchases transactions in an unflawed manner. Reliability can also be further divided into two secondary aspects: the fulfillment of the promises and the proper accomplishment of the tasks.

Personal interactions: it encompasses the knowledge of the retailing staff about how to respond to the customers' questions, induction of confidence, providing on-time services to the customers and polite treating of them. This aspect can be further divided into politeness/assistance and induction of confidence.

Problem-solving: the problem-solving aspect deals with the quality with which the transactions and returns are administrated, and complaints are taken care of. In general, the aspect embraces the retailer's tendency to administrate the transactions and returns; his or her cordial willingness to take care of the customers' complaints directly and immediately.

Policies: this aspect refers to the cases directly stemming from the retailers' policies and strategies. The aspect includes the quality of the provided products, availability of parking lots and extendable work hours, and acceptance of the credit cards.

Table (1) gives some of the studies performed in retailing services' quality assessment based on RSQS.

Some of the studies performed on retailing services quality assessment

Author(s)	Research year	Case study	Key findings
Bushov and Terblanch	1997	Hypermarkets and department stores in South Africa	RSQS is a credible and reliable instrument for assessing the quality of retailing services
Mahta, Lavani and Han	2000	Supermarkets and electronics retailers in Singapore	RSQS is a tool more efficient for assessing the quality of supermarkets' services than the quality of the electronics stores' services
Kim and Jin	2001	Discount stores in the US and South Korea	The five properties mentioned for the measurement of the policies seem to lack reliability in both of these countries; the two aspects of personal interactions and problem-solving have been combined into one dimension named personal care
Sive and Chiang	2001	Department stores in Hong Kong	Three properties were eliminated in the pretest. The five-dimensional structure of RSQS was found inappropriate. The research ends with six dimensions of service quality.
Sive and Chio	2004	Japanese supermarkets in Hong Kong	Five properties were omitted due to the low value of their Cronbach's alpha coefficient. The problem-solving aspect of RSQS was merged with the personal interactions with a new dimension named credibility added.
Kaul	2005	Clothing stores in India	RSQS dimensions are not credible in India, and a four-aspect structure was affirmed.

Retailing Industry:

Retailing refers to a set of commercial activities leading to adding value to the products and services offered to the final consumers for their personal and non-commercial use. Most individuals think that retailing is just the selling of products in stores, while retailers also get involved in selling services (Levy and Weitz, 2012).

Some of the retailers, as well, work in both retailing and wholesaling. They are retailers when they engage in the sales of the goods to the consumers, and they are wholesalers when they engage in sales to other businesses like restaurants. In some parts of the supply chain, the production, wholesaling and retailing activities are undertaken by independent companies (Levy and Weitz, 2012). Large retailers administrate their distribution centers and do activities of the same type as the wholesalers. They directly buy from the manufacturers; then transfer their bought goods to their stores to be distributed from them. Some retailers are also vastly active in the area

of vertical merging; they design the products that will be sold themselves; then, they enter contracts with manufacturers for their exclusive production (Zentes, 2007).

To reduce the transportation costs, the manufacturers and the wholesalers generally carry the goods in large packages to the retailers, who subsequently prepare the goods in smaller amounts to be used by themselves and their clients. This is of great importance for both the manufacturers and the consumers because it, on the one hand, enables the manufacturers to produce and carry goods in larger volumes and, on the other hand, enables the consumers to purchase the products in smaller and more useful amounts.

The value-adding activity performed by the retailers is termed inventory management. With such an activity, the consumers' access to their needed items of goods is constantly made possible. Therefore, consumers can buy a small number of their required products and keep them at home because the local retailers are nearby (Levy and Weitz, 2012).

Retailing stores feature different shapes and sizes, and new kinds of retailing emerge gradually over time. Retailing stores can be categorized based on one or several specifications. Amongst these factors, the level of the services offered by a store, type of goods offered for sale in a store, the relative level of sale prices, method of sale canals' control and method of compiling goods can be pointed out. Retailing stores can be divided based on their ways of selling canals' control into chain stores, retailing cooperatives, consumer cooperatives, concessional organizations and combined business firms (Cutler, 2007). The present study investigates problem-solving dimensions and policies of Etteka Chain Stores using RSQS.

Study Method:

The current study is applied research in terms of its objectives and descriptive survey research in terms of the methodology. The study population included all of the customers of Etteka Chain Stores in Tehran. The study used the Cochran formula to reach the volume of the study's sample, which was comprised of an unlimited number of individuals. Based on the formula above, the study sample's volume reached 384 individuals. Also, the two-stage cluster sampling method has been utilized with the first cluster being comprised of the weekdays and the second cluster comprising the stores' work hours. It is worth mentioning that simple random sampling has been the method of choice inside the clusters. The data examined herein have been randomly obtained from the customers of Etteka Chain Stores within two days (the weekdays were divided into two parts: the first days of the week, including Saturday to Wednesday, and the last days of the week, including Thursday and Friday. To consider the customers' scattering during the days with a low population of the customers visiting the stores and the days with a high population of customers visiting the stores, a day from the first weekdays and a day from the last weekdays were chosen for sampling and data collection; the data gathering lasted from 8:00 am to 10:00 pm. The sample eventually contained 226 males (56.6%) and 174 females (43.4%), of which 34.5% were single, and 65.5% were married.

To gather data, questionnaires were administered. To test the questionnaire's validity, content validity was the test of choice. The final questionnaire was confirmed by the supervising and advising professors. In the end, the questionnaire was found to a good validity. To test the questionnaire's reliability, Cronbach's alpha coefficient was computed. In this research, 30 questionnaires were administered within the format of a pretest. Cronbach's alpha coefficient was obtained equal to 0.918 in SPSS software. The amount was above the acceptable range; hence the questionnaire was affirmed with favorable reliability.

To analyze the demographic questions' responses provided by the customers, SPSS, version 16, was applied. After the extraction of the data frequency, the study sample was described

concerning its properties and characteristics. Furthermore, to test the study hypotheses and investigate the model's goodness of fit, R&PLUS software was utilized.

Findings:

The results indicated that the customers' age is 30.16, with a standard deviation of 8.13. 28.3% of the customers had diplomas and lower degrees; 22% had associate degrees; 26.9% had a BA, and 22.8% had MA and higher degrees. Nearly 31% of the studied individuals were among the constant customers of the store; 22.8% of them used to go to one of Etteka's chain stores for shopping most of the time, and 26.9% of them used to go shopping in Etteka's chain stores occasionally.

Hypothesis One: problem-solving dimension is significantly associated with the overall quality of the services.

To investigate the relationship between the problem-solving indices and the problem-solving itself, the following is the assumption tested herein:

Null Hypothesis (H_0): the indices are not associated with problem-solving.

Primary Hypothesis (H_1): the indices are associated with problem-solving.

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

To investigate this issue, the diagram is seminally delineated based on a standard method, and the coefficients are secondly estimated with a confidence level set at 5% ($\alpha=0.5$)
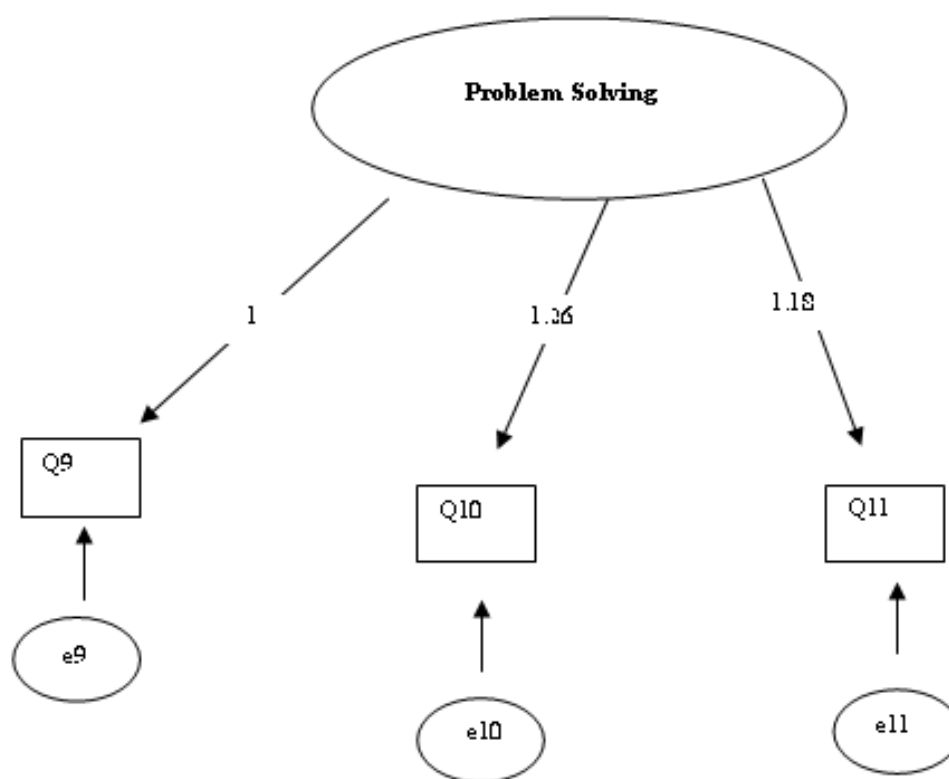
Figure 1 – Problem-solving model

When the customers are satisfied with the employees taking care of their problems in the stores, the highest amount of problem-solving index is reached. In the next ranks, the stores the

customers of which feel satisfied with the employees' taking care of their complaints and admitting the returned goods and their replacement with new ones are the stores said to have adopted appropriate problem-solving strategies.

Hypothesis Two: the policies constitute an aspect that is significantly correlated with the overall quality of services.

Table 2

Investigating the problem-solving scales

Index	Coefficient	p-value
Q_{21}	1	0
Q_{22}	1.26	0
Q_{23}	1.18	0

To investigate the relationship between the indices of policies and the policies themselves, the following are the presumptions examined herein:

Null Hypothesis (H$_0$): the indices are not associated with policies.
Primary Hypothesis (H$_1$): the indices are associated with policies.

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

To investigate this issue, the last diagram is seminally delineated based on a standard method, and the coefficients are secondly estimated with a confidence level set at 5% (α=0.5)
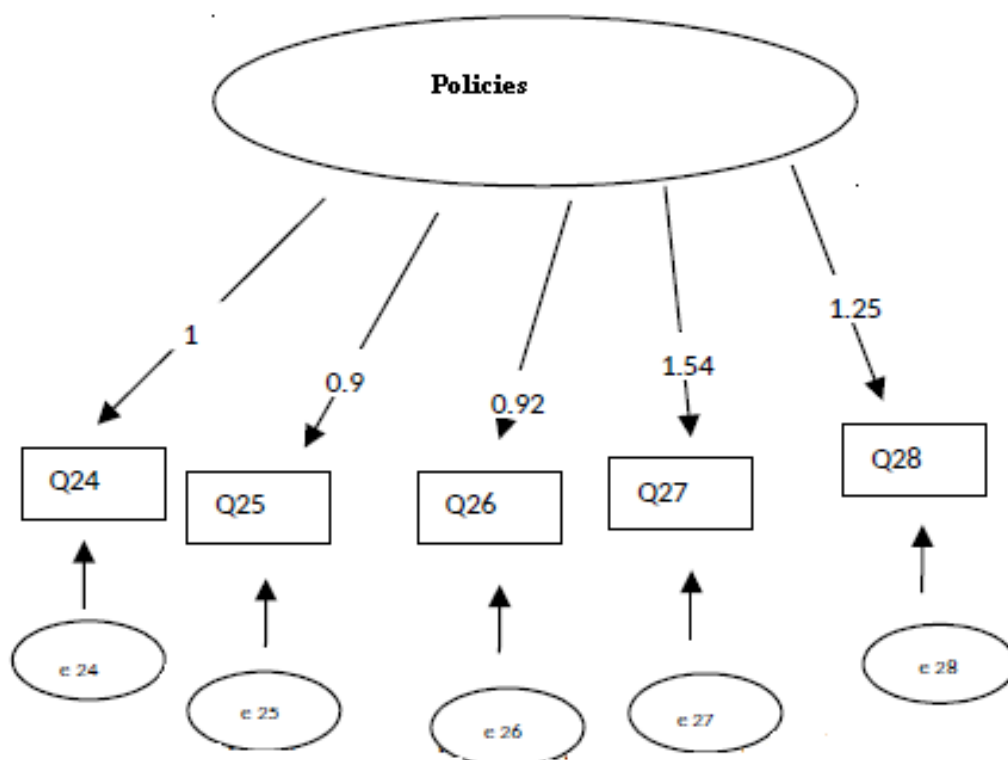

Figure 2 – Stores' policies model

Investigating the policies' indices

Index	Coefficient	p-value
Q_{24}	1	0
Q_{25}	0.90	0
Q_{26}	0.92	0
Q_{27}	1.54	0
Q_{28}	1.25	0

Conclusion:

The study findings indicated that the customers studied in the sample are an average age of 30.165 with a standard deviation of 8.13; the youngest customer was 19 years old, and the oldest one was 70 years old. Meanwhile, a high percentage of the customers was in the 20-40 age range. On the other hand, the study results indicated that 28.3% of the customers have a diploma and lower degrees; 22% have associate degrees; 26.9% have BA degrees, and 22.8% have MA and higher degrees. The demographic indices of the customers also signified that more than one-third of Etteka chain stores' customers are employees; almost one-third is housekeeper, university student, and freelancer; and the remaining one-third works in other types of jobs. In addition, it was made clear in this study that more than 50% of Etteka chain stores' customers have incomes in a range from 500000 TOMANs to 1000000 TOMANs; about 22.8% of them have incomes below 500000 TOMANs, and about 17.9% of them have incomes between 1000000 TOMANs and 1500000 TOMANs. Amongst the 400 customers studied herein, only 8.3% were found with revenues above 1500000 TOMANs. One of the other helpful cases is the number of customers' referring to the stores. This research indicated that almost 31% of the studied individuals are constant customers; 22.8% often visited the stores; 26.9% sometimes visited the stores, and about 19% rarely or very few times visited Etteka Chain Stores for shopping.

The results also expressed that the problem-solving aspect is significantly associated with the overall quality of services. The above-presented first hypothesis is confirmed by the amounts obtained as the significance coefficient (0.000 which is below 0.05). The stores the customers who are satisfied with how the employees take care of their problems in the course of their shopping, as well as how they welcome them and admit or replace the returned goods, are the stores that have adopted appropriate problem-solving strategies.

Besides, the results also indicated that the policies are significantly correlated with the overall quality of the services. Considering the amounts obtained for significance coefficient, i.e., 0.000, below 0.05, the abovementioned second hypothesis is affirmed.

Considering the significant relationship between the policies and the overall quality of services, it is suggested that the managers of Etteka Chain Stores should adopt proper strategies regarding offering high-quality goods along with proper prices as well as about the parking lots' statuses in qualitative and quantitative terms and also concerning the acceptance of credit cards and granting of special credit cards in every one of the chain stores. Moreover, considering the significant relationship between the problem-solving and the overall quality of the services, it is suggested that the managers of Etteka Chain Stores should be sensitive to cases like admitting and replacing the returned goods, taking care of the customers' problems and rapid providing of responses to the customers' complaints and plan accordingly to better take care of the cases above.

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BRAND ATTITUDE, CONSUMER AWARENESS, AND BRAND CERTIFICATION EFFECTS ON BRAND REPUTATION (CASE STUDY ON ANSAR BANK)

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ABSTRACT

In this research, we investigated the effect of brand certification on brand reputation with the mediating role of brand attitude and consumers' awareness in the bank. Accordingly, a conceptual model was offered, and considering its dimensions, a researcher-made questionnaire was prepared and distributed among the desired population. The research method was descriptive-analytical, and two types of libraries and the use of electronic and field sources were applied for data collection. The reliability ratio of the questionnaire was 0.872 indicating the desirable reliability, and structural equation methods and partial least squares analysis were performed, using PLS software for testing hypotheses. Finally, considering the research hypotheses investigation and analysis, the impact of each variable was determined. The results showed that all questions are significant with considerable impacts. According to the proposed model, brand certification affects all three main variables, and brand attitude, consumer awareness, and brand certification respectively have the highest impact on brand reputation as the dependent variable. Therefore, Ansar Bank should provide the context of customers' satisfaction through improving consumer attitude and awareness to improve its brand performance.

Keywords: brand reputation; brand attitude; consumer awareness; brand certification; Ansar Bank.

Introduction

Nowadays, achieving a competitive advantage is not obtained by relying on the functional characteristics of products and services, but, the brand is the distinguishing factor of a company from competitors. Consumer behavior can be affected by his attitude towards the desired subject (Foroudi, 2018). Awareness of people's attitudes provides the possibility of predicting and directing consumer behavior in the market (Eskandari, 2012). Generally, the more favorable is a person's attitude towards a brand, the more is the probability of choosing it (Ahmadi, 2014).

Regarding the importance of brand reputation in the banking industry and its promotion according to customers, it is necessary to identify the factor that promotes it. Therefore, influential factors include brand certification, attitude, and consumer awareness, the factors that promote the brand reputation of the bank. Nowadays, we witness changes in consumers' values and culture. In the bank branches, various factors can affect the consumer's purchase behavior and decision. Consumer behavior has a prominent role in providing banking services, selling, and marketing them. For the success of brand certification, it is necessary to investigate the factors affecting the evaluation of consumers' attitudes about brand reputation (Melewar et al., 2017). So far, no study has been performed with this title in Ansar Bank. Moreover, considering the role of consumers' awareness, brand attitude, and brand certification in using bank services, some studies can be performed and their impact on brand reputation can be measured by identifying relevant variables. In this respect, brand reputation and certification play an important role in creating a competitive advantage for the bank. Regarding the importance of the subject in the banking industry, in the present research, it has been tried to investigate the effective factors of brand certification on Ansar Bank brand reputation through the mediating variable of brand attitude and consumer awareness.

Research Theoretical Foundations:
Brand Reputation

The main elements of a brand are graphic design or logo, symbols, signs, characters, slogans, internet domains, resonance, celebrities, or packaging (Keller, 2003: 209). The strength and remaining power of a brand depending on the ratio of reputation that makes itself distinguished from competitors (Kapferer, 2006: 63).

Brand Attitude

Brand attitude is defined as a behavior that one shows when searching, purchasing, using, evaluating, and discarding products, services, and ideas that meet his requirements. Buyers' attitudes toward brands reflect their evaluations of the features and advantages of the brand, as well as their general evaluations of it, and thus creates the basis of buyers' evaluation and selection (Keller, 2003).

Brand Certification

Brand certification is an important part of the product or service the customers' purchase. Customers do not just buy the physical product or the principle of service, but the status, prestige, and advantages they receive through it, and this intangible quality is the same thing that can make them prefer to buy a product rather than similar products and increase that company's market share (Burmann et al., 2009). Images that have already been created make the product package be opened or closed and the brand is released by opening it. The brand certification image includes symbolic associations (brand personality) and functional associations (beliefs about the brand) (Divandari et al., 2009). In Figure 1, the research conceptual model is shown:
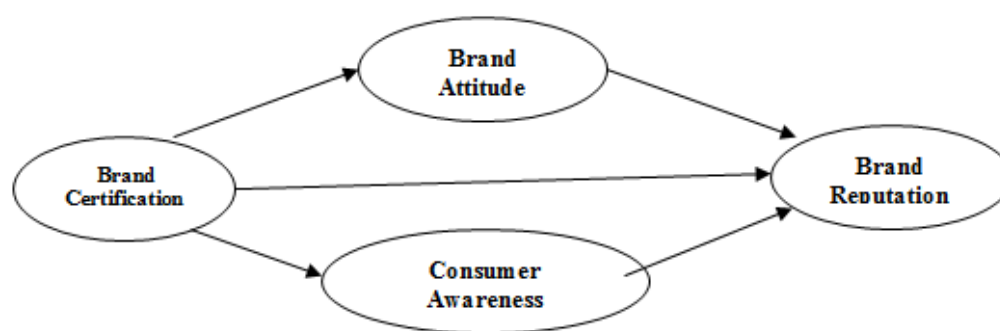
Figure 1 – Research Conceptual Model

To obtain the number of samples, considering that the number of customers of the bank is more than 10 thousand people, the Cochran method and formula with an unlimited population were used. Concerning this formula, the sample amount was obtained by 267 people.

To collect the necessary information, two library studies and field methods have been used. In the first stage of the research, a questionnaire including 40 closed-ended questions with the Likert's spectrum was used to investigate the effect of brand certification on brand reputation with the mediating role of brand attitude and consumers' awareness in Ansar Bank. The questionnaire consisted of two parts; the first part had four questions about the general characteristics of the respondents, and the second part included closed questions that were used to collect information. The Likert scale was used to rank the research data.

To investigate the validity of the questionnaire, 25 questionnaires were distributed among bank experts active in the field of brand management, and 23 questionnaires were collected. After receiving the questionnaire in the first stage, some questions with a coefficient of less than 0.7 were deleted and some others, on which that expert were given suggestions, were replaced with more appropriate ones. Moreover, several experts considered adding other questions to it and thereby modifying the model, which was finally confirmed after reviewing these suggestions and changes in the questionnaire and were added to the final questionnaire.

Considering the aforesaid, 400 questionnaires were prepared and distributed among the sample of the statistical population and 365 questionnaires were received and reviewed after investigating and analyzing them. To determine the reliability, Cronbach's alpha method was applied using SPSS software. Since the total reliability value for this factor was obtained equal to 0.872, and the rest of the factors were higher than 0.7, it can be said that the questionnaire had good reliability.

Finally, the research was conducted using a structural equation model to estimate the direct and indirect effects of PLS software.

Results
Statistical Description of Research Questions
According to the presented model, brand certification with the two mediating variables of brand attitude and consumer awareness with the brand reputation is investigated in Ansar Bank.

Inferential Statistics
Investigating Data Distribution
Hypothesis H_0: There is no significant difference between the distribution of variables and the normal distribution (The distribution of variables is normal).

Hypothesis H_1: There is a significant difference between the distribution of variables and the normal distribution (The distribution of variables is not normal).

Table 1

Testing Normal Distribution of Variables

Variables	Kolmogorov Value	Sig	Error Probability Level	Result
Brand Reputation	2.985	0.013	0.05	Non-Normal
Brand Certification	2.012	0.030	0.05	Non-Normal
Consumer Awareness	2.512	0.00	0.05	Non-Normal
Brand Attitude	3.419	0.01	0.05	Non-Normal

In Table 1 it can be inferred that there is a significant difference between the expected distribution (normal distribution) and the observed distribution for all variables and their distribution is not normal. Therefore, we use the partial least squares method and Smart PLS software.

Research Hypotheses Test

According to the research model, 7 hypotheses (2 main and 5 minor) are determined. The hypotheses and their testing results are presented below.

Investigating Research Minor Hypotheses

1: Brand certification affects the brand reputation of Ansar Bank.

2: Brand certification affects the brand attitude of Ansar Bank.

3: Brand certification affects the consumer awareness of Ansar Bank.

4: Brand attitude affects the brand reputation of Ansar Bank.

5: Consumer awareness affects the brand reputation of Ansar Bank.

According to the results of the calculations for the first, second, third, fourth, and fifth minor hypotheses, the brand reputation of Ansar bank is equal to 0.37, the brand attitude of the Bank is equal to 0.43, the brand certification on the consumer awareness of the Bank is equal to 0.46, the brand reputation of the Bank is equal to 0.51, and the brand reputation of the Bank is equal to 0.49, respectively. The test statistics value for these effects are equal to 2.79, 3.14, 2.23, 3.58, and 3.62, respectively. Considering that these values are higher than the threshold value of 1.96, the zero hypotheses is rejected with 95% confidence. Regarding that these coefficients are significant and positive, it can be concluded that the brand certification has a positive effect on the brand reputation, brand attitude, and consumer awareness; brand attitude has a positive effect on the brand reputation, and consumer awareness has a positive effect on the brand reputation of Ansar Bank. So, all research minor hypotheses are accepted.

Investigating the Research Main Hypotheses

1: Brand certification has an effect on brand reputation with the mediating role of brand attitude in Ansar Bank.

2: Brand certification has an effect on brand reputation with the mediating role of consumers' awareness in Ansar Bank.

Based on the results of the calculations for the first and second main hypotheses, the effect of brand certification on brand reputation with the mediating role of brand attitude and consumer awareness in Ansar Bank have been calculated equal to 0.28, and 0.32, respectively. Considering that the first value is lower and the second one is higher than the effective value (0.3), and the

test statistics of all variables in this path are higher than the threshold value of 1.96, therefore the impact ratios are lower and higher than the allowable limit, respectively, and the impact ratio in the second hypothesis is acceptable. Thus, it can be concluded that brand certification has a lower impact on brand reputation with the mediating role of brand attitude in Ansar Bank, and the first research hypothesis is not accepted; while, the brand certification has an effect on brand reputation with the mediating role of consumer awareness and the second research hypothesis is accepted.

Investigating the Brand Reputation, Brand Attitude, and Consumer Awareness Dimensions

The results of the investigation and analysis of the brand reputation, brand attitude, consumer awareness, and brand certification dimensions of the original model, indicate that the calculated factor load values for all indicators have been higher than the acceptable limit of 0.50. Moreover, the t-index for testing the values of factor loads is higher than the limit of 1.96, indicating the significance of the factor loads or the ratio of explaining the brand reputation structure, mental image structure, and consumer awareness dimension of the indicators.

According to the research findings, all test statistic values are higher than the threshold value of 1.96, so the relationships between the variables are significant and the proposed model has a good confidence level. Furthermore, the ratio of impact level of all research variables is higher than 0.3, so the ratio of impact level of the research main variables on the brand reputation variable is considerable, and among them, the impact of brand attitude on brand reputation with a score of 0.51, and brand certification on brand reputation with a score of 0.37 have the highest and the lowest impact, respectively.

Conclusion

In this research, the effect of brand certification on brand reputation with the mediating role of brand attitude and consumer awareness in Ansar Bank was investigated. Based on the aforesaid, the first main hypothesis is rejected, while the second main hypothesis is confirmed.

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MODELING TAIL DEPENDENCE USING COPULA IN FINANCE

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ABSTRACT

Identifying the structures of dependency between financial assets is one of the interest topics for researchers. However, there are challenges to this purpose. One of these challenges is the modeling of heavy tail distributions. Distributions of financial assets generally have heavier tails than other distributions and the dependence of financial assets in crashes is bigger than booms. To address there is a function called Copula. So, for modeling dependency structure between multivariate data without any assumptions on marginal distributions, copula is suggested. Also, tail dependency measures have analytical formulas in terms of copula. In general, copula connects the joint distribution functions to the marginal distribution of each variable. In this regard, I used a factor copula model that is useful for models where variables are based on latent factor structures. Finally, I have estimated the parameters of factor copula by Simulated method of Moment, Secant method and Robbins-Monroe algorithm.

Keywords: Heavy Tail; Factor Copula; Broyden; Robbins-Monro.

1. INTRODUCTION

The existence of risk has forced financial institutions to cover losses. This is done by insurance. By paying the premium, it reduces the risk and increases the borrower's credit. Rating scale is done by global rating agencies such as *Moody, Poor & Standard and Fitch.* Now, we had to calculate these risks.

In this research, I want to examine the dependence on high profits or losses by introducing appropriate measurement criteria. First, I will introduce the factor copula and its model. Then I fit the model on 470 stocks of the S&P500 index. I will use the closing price of each stock to obtain daily returns and sort them by date. I also explained time series models and estimate unknown parameters using the same model.

The reason why I used daily returns instead of stock prices is that time series analysis of returns is that we expect returns change linearly. Also, I obtain the number of latent factors in 470 stocks using random samples, and finally, by comparing 3 estimation methods, I obtain the optimal value of the factor copula parameters.

2. THE COPULA OF A LATENT FACTOR MODEL

Consider the model of section 3[1], based on a set of $N+K$ latent variables. The copula implied by equation 2[1] is not known in closed form. These simulated dependence measures can be used in the SMM estimation method of [2] Oh and Patton (2013), which is briefly described in 3.1. I used results from extreme value theory to obtain analytically results on the tail dependence implied by a given factor copula model. Recall the definition of tail dependence for two variables X_i, X_j with marginal distributions G_i, G_j in [2]. In this research, I used the Tau-Kendall rank dependency measurements to estimate the parameter 0. According to [2], I used the sample rank dependence measures for the pair (X_i, X_j) with C_{ij} as their copula. In propositions 1 and 2 [1], I can see lower and upper tail dependence measures using factor models for single factor and multi-factor copula models, as well as, according to proposition 3 [1], if we know the distribution of latent variables and errors, we can obtain constant values of the formulas for the tail dependencies stated in propositions 1 and 2 using factor models. According to [1], I am likely to estimate parameter θ in blow model:

$$X_i = \sum_{k=1}^{K} \beta_{ik} Z_k + \varepsilon_i \qquad i = 1, 2, \ldots, N$$

$$\varepsilon_i \sim N(\mu = 0. \sigma^2 = 1) \ (1)$$
$$Z_k \sim Skew\ t(\nu = \infty. \lambda) \quad Z_k \perp \varepsilon_i \quad \forall i. k$$
$$X \sim F_X = C(G_1(\theta),\dots, G_N(\theta); \theta)$$
$$\theta \equiv [vec(B)', \lambda]'$$

In this model, I considered the Normal distribution for errors and the latent variables had the Skew-t distribution with the degree of freedom infinity. According to the proposition 4[1], I estimated the number of latent factors in our model. I will sort the eigenvalues of matrix $\hat{R}_T^y$ and then consider the number of those whose values are greater than one, and if T tends to infinity, $\hat{K}_T$ will tend K in probability.

3. ESTIMATION OF FACTOR COPULA

According to [2], I used the Simulated Method of Moment which is suitable for models that have a large number of unknown dependent parameters or their density functions which are not closed-form. This can be estimated the marginal distributions using the EDF. Considering GARCH model (p = q = 15)[1] augmented with lagged market return information. I estimated the distribution of standardized residuals as the EDF using GARCH model and observations Y. I will estimate the factor copula parameters, $\theta_0 \square \in \Theta$, with vector of residuals, $\hat{\eta}_t$. Let $\tilde{m}_S(\theta)$ be a $N \times N$ matrix of dependence measures computed using S simulations from $F_X(\theta)$, and $\{Xs\}_{s=1}^S$ and let $\hat{m}_T$ be the corresponding vector of dependence measures computed using the standardized residuals $\{\eta_t\}_{t=1}^T$. I will explain 3 estimator methods that used in this paper to obtain the values of factor copula parameters.

3.1 Simulated Method of Moments

Define the difference between these as

$$g_{T.S}(\theta) = \hat{m}_T - \tilde{m}_S(\theta) \tag{2}$$

This SMM estimator is based on searching across $\theta \in \Theta$ to make 2 as small as possible. The estimator is defined as $Q_{t.s}(\theta)$ where

$$Q_{t.s}(\theta) = \acute{g}_{T.S}(\theta)\hat{W}tg_{T.S}(\theta) \tag{3}$$
so
$$\hat{\hat{\theta}}_{t.s} \equiv \operatorname{argmin}_{\theta \in \Theta} Q_{t.s}(\theta) \tag{4}$$

Weight matrix $\hat{W}t$ is a positive definite matrix, which may depend on the data. First, I obtained the residual variables using the GARCH model. We estimated their marginal distributions empirically and obtained Tau-Kendall rank dependency measures in the sample mood, it means $\hat{R}_T^r$. I set $\hat{m}_T$ as the vector of calculated dependency measurements of the standard residues $\{\eta_t\}_{t=1}^T$. According to proposition 4[1], let $\hat{m}_T = \hat{R}_T^r$, Which is a $N \times N$ matrix. Then the number of latent factors returns the kth-largest eigenvalue of the matrix $\hat{R}_T^r$ which is more than 1. I used data from S&P500. Our data, Y_i, is related to the price of 500 US stocks from 2013 to 2018, which is 1258 workable days. I sorted data of table and finally, the number of our stocks became equal to $N = 470$. The reason why I use returns instead of prices is that we expect return to change linearly. Also, the dependence between returns is not very interesting for us, and what is important for us is the dependence between residuals. The eigenvalue greater than 1 with N =470 is equal to 67.
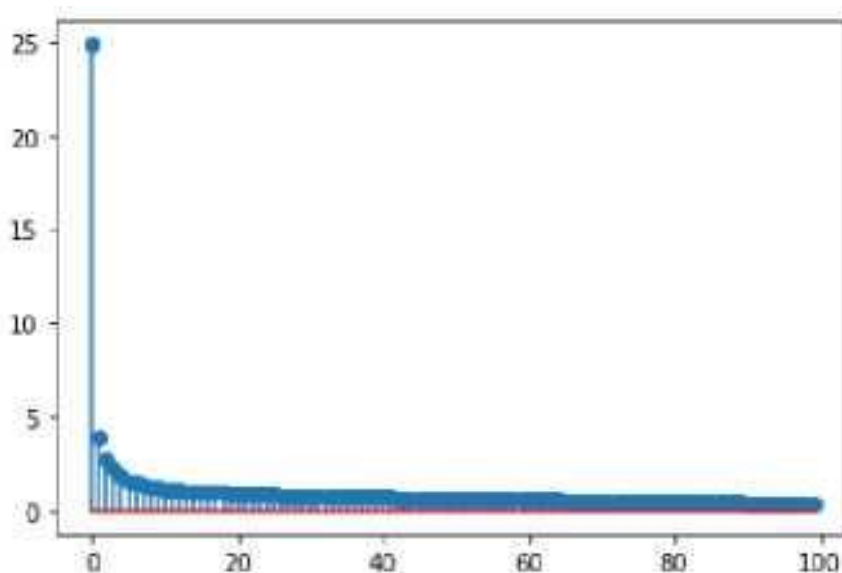
Figure 1 – Number of latent factors with 470 returns

According to the SMM, I obtain $\widetilde{m}_S(\theta)$. Matrix $\widetilde{m}_S(\theta)$ is the measure of dependence calculated from the 1000 simulations of $\mathbf{F}_X(\theta)$ and $\{X_s\}_{s=1}^S$. I calculate the Tau-Kendall dependency measure with the simulated latent variables, and let them, $\widetilde{m}_S(\theta)$. This vector is a function with the parameter which includes the skewdness λ and latent factor coefficients matrix Z, which means β_i, i={1,…,N}.

3.2. Broyden Method

Suppose we had a family of distributions, $p(x|\theta)$, and we wish to estimate the r-dimensional parameter vector θ by matching a m-dimensional vectors of moments, $\mu(\theta) = \mathbf{E}[\widetilde{m}_S(\mathbf{x})|\theta]$, to a fixed vector $\mu_0 = \hat{m}_T(\theta)$. If $\mathbf{E}[\widetilde{m}_S(\mathbf{x})|\theta]$ can be expressed analytically in closed form, we can obtain the moments estimate $\hat{\theta}$ using the Newton-Raphson method, as follows [3]. Start with a guessed value, θi. Then for $t = 1, 2, …$, update the guess to

$$\theta_{t+1} = \theta_t + [\mathrm{E}[\widetilde{m}_S(\mathrm{x})|\theta t]']^{-1} (\hat{m}_T(\theta)\text{-}\mathbf{E}[\widetilde{m}_S(\mathbf{x})|\theta t]) \qquad (5)$$

where $\mu'(\theta_t) = \mathrm{E}[\widetilde{m}_S(\mathrm{x})|\theta t]'$ is the matrix of derivatives of $\mu(\theta_t) = \mathbf{E}[\widetilde{m}_S(\mathbf{x})|\theta t]$ with respect to θ. Suppose now the problem is overdetermined, with more moments specified than parameters in the model, and we would like θ that gives the best least-squares fit, minimizing $\|\hat{m}_T(\theta)\text{-}\mathrm{E}[\widetilde{m}_S(\mathrm{x})|\theta t]\|^2$. The normal equations are $\mathbf{E}[\widetilde{m}_S(\mathbf{x})|\theta t]'(\hat{m}_T(\theta)\text{-}\mathrm{E}[\widetilde{m}_S(\mathrm{x})|\theta t]) = 0$, which we can again solve by Newton-Raphson, using iterative least squares. Starting out at a guess θ_1, for $t = 1, 2,..$ the updated guess is

$$\theta_{t+1} = \theta_t + [\text{least squares regression of } (\mu_0 — \mu(\theta_t)]) \text{ on the matrix } \mu'(\theta_t)] \quad (6)$$

After solving equation 6, $\theta t+1$ will equal with $\theta t + (\mu_T(\theta t) \mu(\theta t))^{-1} \mu'(t)T(\mu 0 — \mu(\theta t))$. [3] Obtaining $\mathbf{E}[\widetilde{m}_S(\mathrm{x})|\theta t]$ with closed-form which is random function, is impossible. Therefore, we cannot compute $\mathbf{E}[\widetilde{m}_S(\mathrm{x})|\theta t]'$. I used Secant method and as a result of Broyden method that because of matrix form. Secant method is a root-finding algorithm that uses a succession of roots of Secant lines to better approximate a root of function f. This can be thought of as a finite difference approximation of Newton method. Secant method is defined by the recurrence relation:

$$\theta_{t+1} = \theta_t + \left(\frac{\mu(\theta t) - \mu(\theta t - 1)}{\theta t - \theta t - 1}\right)^{-1} (\mu_0 - \mu(\theta t)) \qquad (7)$$

Broyden method is a generalization of the Secant method to more than one dimension. In numerical analysis, Broyden method is a quasi-Newton method for finding roots in r variables. Newton method for solving $\mu(\theta)=0$ uses the Jacobian matrix, J, at every iteration. However, computing this Jacobian is a difficult and expensive operation. The idea behind Broyden method is to compute the whole Jacobian only at the first iteration and to do rank-one updates at other iterations.[4, 5] I supposed $\mu(\theta_t) \to \mu_t$ and $\mu'(\theta_t) \to J_t$ which is $m \times r$ matrix (m = r). So

$$J_t = J_{t-1} + \frac{(\mu_t - \mu_{t-1}) - J_{t-1}(\theta_t - \theta_{t-1})}{||\theta_t - \theta_{t-1}||^2}(\theta_t - \theta_{t-1})^T \qquad (8)$$

And

$$\theta_{t+1} = \theta_t + J_t^{-1}(\mu_0 - \mu_t) \qquad (9)$$

If m > r, *we have equation 8 and*

$$\theta_{t+1} = \theta_t + (J_t^T J_t)^{-1} J_t^T (\mu_0 - \mu_t) \qquad (10)$$

3.3 Robbins-Monroe algorithm

Assume that we have a function $M(\theta)$, and a constant a, such that the equation $M(\theta) = a$ has a unique root at θ_0. It is assumed that while we cannot directly observe the function $M(\theta)$, we can instead obtain measurements of the random variable $N(\theta)$ where $E[N(\theta)] = M(\theta)$. The structure of the algorithm is to then generate iterates of the form:

$\theta_{n+1} = \theta_n - a_n(N(\theta_n) - a)$

Here, $a_1, a_2, \ldots$ is a sequence of positive step sizes. Robbins and Monro proved [6] that θ_n converges in L^2 to θ, and Blum [7] later proved the convergence is actually with probability one, provided that:

$N(\theta)$ is uniformly bounded,

$M(\theta)$ is nondecreasing,

$M'(\theta_0)$ exists and is positive, and

The sequence a_n satisfies the following requirements:

$$\sum_{n=1}^{\infty} a_n = \infty. \sum_{n=1}^{\infty} a_n^2 < \infty$$

In this algorithm using SMM method, I let:
1.   Moment of $\widetilde{m}_S(\theta)$ as a function with random parameter θ.
2.   A particular sequence of steps which satisfy these conditions, and was

suggested by Robbins-Monro, have the form: $a_n = \frac{1}{n}$, for $a > 0$. Other series are possible but in order to average out the noise in $N(\theta)$, the above condition must be met.
3.   Suppose I obtain $\widehat{m}_T$ empirically, which is equal to a. Our purpose is that $\widetilde{m}_S(\theta)$ equal to a as much as possible.
4.   For updating θ in each step, we have:

$$\theta_{n+1} = \theta_n - a_n(\widehat{m}_S(\theta) - \widehat{m}_T) \qquad (11)$$

5.   Also we simulated with 1000 samples to 1000 times.

To estimate the parameters of β, λ, I used two elements of moments [0,1] and [1,2]. Then, I update the parameters every times by 11.

5. NUMERICAL RESULT

In this chapter, I fit the model with the three methods described in Chapter 3 with S&P500 index data. For simplicity, I consider N=10 to have one latent factor and a state that latent factor coefficients are common, it means $\beta_1 = \cdots = \beta_{10} = \beta$. I assumed that the weight matrix $\widehat{W}_T$ in Equation 3 is Identity matrix, $\widehat{W}_T = I$. The results for simulated method of moment is:

Table 1

The result of parameters with Simulated Method of Moment

Parameter	Initial value	Optimal value
β	-0.6	-0.5999985
λ	-2	-1.9991886
MSE = 8.0508306e - 09		

I estimated the value of Q and that was 9.68755201. Although this method failed to reduce the value of objective function, it could be an optimal method to estimate the parameters of copula. I also fit the data with Broyden method and the results with $m = 3$, $r = 2$ is:

Table 2

The result of parameters with Broyden Method

Parameter	Initial value	Optimal value
β	-0.6	0.6158638421
λ	-2	-0.5999471132
MSE = 0.000924684		

The results of Robbins-Monro algorithm:

Table 3

The result of parameters with Robbins-Monro algorithm

Parameter	Initial value	Optimal value
β	-0.6	-0.55929763
λ	-2	-2.13245125
MSE = 0.05362494		

5. Conclusion

I found that although the simulated method of moment was performed with more time, the MSE value decreased and the optimal parameters values became closer to the initial parameters. Therefore, this method is more suitable than the other two methods (Table 1).

Also, despite the fact that Broyden method is faster to process, it cannot be a good method to estimate copula parameters because of calculating the values of parameters (Table 2). It should be noted that the Robbins-Monro algorithm is a good estimator. This method, the values

of optimal parameters is approximately close to initial parameters. Therefore, it can be an appropriate method to estimate the factor copula parameters (Table 3).

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EFFECT OF COMPETITIVENESS ON SERVICE QUALITY WITH AN EMPHASIS ON THE MEDIATING ROLE OF CUSTOMER LOYALTY

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ABSTRACT

Attention to the importance of competitiveness and improving the service quality creates a favorable image in the minds of customers, which increases customer loyalty to the organization. Service quality is a prominent competitive tool that market leaders try to use to attract customer loyalty. Service quality is the size of the discrepancy between the customer's perception of the service and his/her expectations

Materials and Methods: This study is a review. First, using specific keywords in search engines SID, Google Scholar, Comprehensive Portal of Humanities and Meg Iran, we extracted articles related to research in Iran and the world in both English and Persian.

Findings: A review of researches has shown that consumers place great credit on companies that focus on increasing quality in their activities, and with healthy competition in the market engage in activities and actions that improve customer service and increase their satisfaction; it ultimately leads to increased customer loyalty.

Keywords: competitiveness; quality of services; customer loyalty.

Introduction

In today's dynamic and competitive environment, the success of any organization to increase and maintain market share and improve the competitive situation depends on identifying the factors that create a competitive advantage. Gaining competitiveness in today's world has become one of the main challenges of various industries. Without competitiveness Companies cannot act in the best manner; in other words, companies that have been successful and are among the best have a competitive advantage (Sepahvand et al., 2016). Competitiveness is a key criterion for assessing the degree of success of countries, industries and enterprises in competitive political, economic and

trade fields. This means that any country, industry or enterprise that has a high competitive ability in competitive markets, has a higher competitiveness. This has led organizations to try for identifying the factors affecting competitiveness and strengthening them in order to improve their competitiveness. One of the most important issues that promote competitiveness is to increase the service quality (Mousavi et al., 2018).

Service Quality is a prominent competitive tool that market leaders try to use to attract customer loyalty. The service quality is the size of the discrepancy between the customer's perception of the service and his/her expectations (Karbasi Yazdi and Bishmi, 2018).

It is very important to pay attention to the service quality in a competitive organization. A loyal customer is also considered as a competitive asset for the organization (Cheng et al., 2014).

In fact, with increasing competition in the markets, organizations are aware of the importance of customer satisfaction and loyalty and that retaining the organization's current customers is far less costly than attracting new customers. For today's organizations, customer satisfaction alone is not enough, they must be sure that their satisfied customers are also loyal (Sajedifar et al., 2012).

In recent years, companies that produce different products and services in different societies have focused all their efforts on the quantity of offered products and services and the quality factor in the management value portfolio was of much lower priority (Bazazian and Saeidnia, 2016).

Procedure

This study is a descriptive study and a review in terms of the implementation method. Reviewing the past researches is done in different ways. One of the most well-known is systematic review, which is a kind of secondary study and analysis of previous studies. In other words, systematic review is a structured search that is performed based on predetermined rules and regulations. The statistical population of this study includes all research articles that were extracted from different research journals.

Search strategy: According to the definitions of competitiveness, service quality and customer loyalty and reviewing the research background, we selected the keywords competitiveness, service quality and customer loyalty. Accordingly, we reviewed ISI, Google Scholar, Meg Iran and the comprehensive portal of humanities and extracted the articles.

Selection Strategy: From among the search results in the mentioned databases, we used articles only and removed other documents, including chapter summaries and reviews of books, reports and news. At this stage, according to the mentioned keywords, we identified 45 documentaries; by eliminating additional items and focusing on competitiveness, we achieved 8 final articles.

Reviewing the research background

Numerous definitions of competitiveness have been proposed by different scientists, each looking at it from a different perspective. A definition can be this: When an organization earns a higher economic profit than the average profit of market competitors, that organization has a competitive advantage in that market. If an organization's production, pricing, and marketing decisions significantly affect the prices of other organizations, all of those organizations are in the same market. The amount of created value compared to competitors depends on the costs and revenues of one organization compared to competitors. Competitiveness is an attractive concept that is examined at various levels, including: organizational level, micro and macro level of industry, or the economic position of nations in comparison with each other. A research conducted by Ryan and Vahida Zaman showed that the concept of competitiveness includes various con-

cepts, such as competitive advantage, price competitiveness perspective, management and strategy perspective, and historical and socio-cultural perspective. Competitiveness can also be considered as a dependent, independent or intermediate variable (depending on the perspective). The diversity of existing levels and approaches reflects the wide application of this concept. Competitiveness, from any perspective, ultimately deals with the long-term performance compared to competitors. However, competitiveness also deals with the factors that lead to it and the way to achieve them.

Asset framework, process, performance improve the competition of companies. Competition is a combination of assets and processes. Assets may be substitutes for (natural resources) or creation of (infrastructure) and asset adjustment processes to achieve the economic benefits of selling to customers. Assets include human resources, infrastructure, technology, company structure, company culture, etc. (Cheng et al., 2014). A loyal customer is considered as a competitive asset for the organization. Customer loyalty has a tremendous impact on business profits for trade survival and development as well as it paves the way to achieve a competitive advantage for an organization (Kara and Demirsi, 2013). According to the indisputable belief in the field of marketing, customer attraction and customer orientation are the principles of dynamism and sustainability of an organization or economic enterprise. Therefore, today's market belongs to the customer (Asadi et al., 2017).

Researchers believe that service quality has a direct impact on customer loyalty and, in other words, is the primary key to customer loyalty. Service quality is defined as a measure of the difference between customers' perceptions and expectations of services. In another definition, service quality is defined based on its three distinct characteristics, which are: 1. Service Quality is consumed at the same time as it is produced, so the consumer understands all the shortcomings of service quality. It is a set of benefits; but it is often a gain of experience. 3. It is the quality of relationships between the providers of service and its consumers, which is one of the essential aspects of service quality (Mousavi et al., 2018).

In a research on the impact of service orientation on customer loyalty with the mediating role of service quality in the hotel industry, Karbasi Yazdi and Bishmi (2015) stated that service orientation has an impact on service quality and customer loyalty and the perception of service quality also affects positively and meaningfully customer loyalty.

Bahari et al. (2017) also studied the relationship between service quality and customer loyalty by considering the mediating role of customer satisfaction and concluded that service quality has a positive and significant effect on customer satisfaction and customer loyalty. Also, service quality has an indirect and significant effect on customer loyalty through the mediating role of customer satisfaction. Rezayan and Mousavi Bazar (2016) conducted a research on the gap in the quality of educational services in Mashhad Medical Faculty from the perspective of students using SERVQUAL. By selecting 216 students using random sampling method, they measured the service quality based on the criteria and sub-criteria of the SERVQUAL model; the results showed that the service model has a favorable situation in all criteria and sub-criteria.

Soltan and Wang (2018) also studied the impact of service quality on university brand performance and university brand image. The results of this research indicate that high service quality has a significant impact on improving the performance of the university brand and has a great impact on improving the image of the university brand from the perspective of students.

In their research, Lai and Hitchcock (2016) also examined the service quality in Macau hotels; they stated that there is a significant difference between different dimensions of service quality components in terms of importance and quality of performance. Jasinskas et al. (2017) also used the SERVQUAL model and concluded that the higher the quality of service, the higher the level of customer satisfaction and loyalty, and these two components have a positive and sig-

nificant relationship. Njovo and Makacha (2015) also stated that service quality has a positive and significant effect on organizational competitiveness.

Rahim et al. (2015) also examined the service quality in a Dubai airline and found that service quality, perceived value, and brand image have a significant positive effect on customer satisfaction, which in turn can lead to the brand loyalty. Rasheed and Abadi (2014) conducted a research on the impact of service quality, trust and perceived value on customer loyalty in Malaysian industrial services. The results show that there is a positive relationship between service quality and trust, service quality and perceived value, customer trust and loyalty and perceived value and customer loyalty. Kandampully et al. (2015) have measured the effect of the quality of hotel services on the image of customers as well as customer loyalty. After analyzing their data, they have come to the conclusion that the service quality and the customer's mental image of the hotel has a positive and direct effect on customer loyalty. Although the service quality alone does not have a direct impact on customer loyalty, and first this service quality creates a mental image, then this mental image along with the service quality affects customer loyalty.

Conclusion

What distinguishes today's world of companies and organizations from decades ago is the unstable and complex environment of competition, rapid changes, technological advances, the growing development of communications, and the rapid exchange of information. In recent years, maintaining and promoting competitive advantage in the field of business has been widely, inclusively and increasingly emphasized and has become the most important issue of economic development. The service quality is one of the most important factors that increase the internal ability of the company and increase its competitiveness. Marketing researchers have praised the benefits of service quality and cited them as indicators of an organization's competitive advantage. The superior service quality enables a company to differentiate itself from other competitors and gain a series of competitive advantages compared to them.

A review of various researches shows that competitiveness can affect the service quality of organizations and improve it. In fact, the service quality has a direct impact on customer loyalty and in other words, is the primary key to customer loyalty. In fact, service quality increases customer loyalty and will lead to their satisfaction, so we can say that competitiveness is associated have positively and significantly with service quality and the customer loyalty is affected by the relationship between the two.

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EXAMINING THE EFFECT OF EMPOWERMENT ON COMMITMENT-BUILDING WITH THE MEDIATING ROLE OF ORGANIZATIONAL TRUST (CASE STUDY: EMPLOYEES OF KHORASAN RAZAVI DEPARTMENT OF ENVIRONMENT)

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ABSTRACT

The purpose of the study was to examine the effect of empowerment on organizational commitment with the mediating role of organizational trust. The method was applied-descriptive with correlational design using structural equation modeling (SEM). The population of study was 120 employees of Khorasan Razavi Department of Environment. Using a convenience random sampling method, 102 people were selected as the study sample. A questionnaire was used to collect data. Its validity was confirmed by factor analysis and its reliability confirmed using Cronbach's alpha coefficient. Data were collected and analyzed in AMOS and SPSS statistical software. SEM results indicated that the direct effect of empowerment on organizational commitment (0.29) was positive and significant. The direct effect of empowerment on organizational trust (0.43) was positive and significant too and the effect of organizational trust on organizational commitment (0.77) was significant. The indirect effect of empowerment on organizational commitment with the mediation of organizational trust was positive and significant (0.365).

Keywords: empowerment; organizational commitment; organizational trust.

Introduction

Everything is changing drastically given the quick changes in human knowledge and information. The organizations interact with the environment as an open system and have to respond to environmental changes to survive. As human resources are the key element and the core of organizations, equipping and preparing these resources to face change is of great significance and all organizations with any mission have to devote the most capital, time and program to human development in different aspects as efficient work force is the top key index of any organization over other organizations. Thus, the existence of capable and committed work forces in the organization in any organization while reducing absenteeism, delays and relocation, significantly increases the performance of the organization. However, unluckily, their potential talents are not usually used in organizations. Therefore, empowerment is considered as the key challenge for managers in the present age. Because of these challenges, the managers have to create the conditions for organizations so that each person can become more empowered, as a committed and capable work force is one of the necessary conditions for effective performance in new organizations. Capable employees are expected to carry out more effectively and efficiently compared to non-capable employees. Organizational trust is one of the positive and constructive consequences in the organization. Trust is a predictor of consequences like organizational commitment and

employee loyalty. Organizational commitment is a kind of sense of dependence and belonging to the organization. Clearly, organizational commitment of employees will be valuable when it has a positive effect on organizational performance and promotes organizational productivity (Farhangi & Hoseinzadeh, 2006).

The main source of competitive advantage in this century will not be new technology, but initiative, creativity, support, participation and commitment of employees, which will be realized by empowerment (Bakinhham & Kelifton). Moreover, organizational trust has a key role in increasing participation in organizations and creates an opportunity for individuals and organizations to cooperate to increase their investment. Considering the significance of employee empowerment in modern organizations, and the need for organizational trust and commitment of employees towards the organization, the study tries to answer the following questions: Is there a relationship between empowerment and organizational commitment? Does organizational trust mediate the relationship between empowerment and organizational commitment?

Theoretical foundations
Organizational commitment

Pillay and Williams (2004) stated that organizational commitment means how employees are loyal to the organization according to their organization goals and recognizing and accepting value (Yeh, 2014, p.98). Organizational commitment is an attitude about employee loyalty towards the organization and an ongoing process that arises through the participation of individuals in organizational decisions, attention to people in the organization, position and well-being of the organization (Cepahvand & Shareatnegad, 2015, p.520). The superior position and status in the organization increases the organizational commitment of individuals as it promotes social identity (Fuller et al., 2003, p. 790). Organizational commitment is a situation where an employee is familiar with a particular organization and its goals and wants to be considered a member of that organization (Robbins, 2007, p.80). Wang (1989) has introduced the three concepts of loyalty, organizational identity, and recognition and readiness for commitment, and the common aspect of all definitions of commitment is that no success is guaranteed with not having commitment.

Empowerment

The pace of change every day adds to the ambiguity, uncertainty, and complexity of organizations, which fundamentally changes key competencies for effectiveness. Under such conditions, managers lack much opportunity to control employees and need to spend their time and energy identifying the internal and external environment of the organization and delegate other daily tasks to employees (Mogholee, Hasanpour & Hasanpour, p. 120). In these conditions, the employees of the organization are not just a tool for managerial success but the assets of the organization, and they have become the main drivers of the workflow and partners of the organization (Roy & Sheena, 2005, p.41). Thus, the employees and the knowledge in their minds are very valuable resources for the organization (Kordnaeh, Moshabaky, Fanee & Khanalizadeh, 2010, p.25). However, the studies have indicated that in most small businesses, human resource issues are of secondary significance after general management and organization (Naghave & Bahrololoum, 2010). One of the concepts in the development of human resources is employee empowerment (Rezaee dizgah & Farahbod, 2010, p.110). Hence, empowerment is stated to be one of the key challenges for present managers (Amirkhani et al., 2012, p. 132). As human resources are of the most important and valuable assets that any organization possesses, one of the most

effective approaches to gain competitive advantage and reach organizational goals is to make the organization more efficient (Amir Kabery & Fathee, 2010, p. 101).

Organizational trust

Trust is clearly a fundamental and complex aspect of human interaction (Weber & Malhotra & Murnighan, 2005). In the management literature, the presence or absence of trust in organizations has turned into one of the critical issues (Robbins, 2002, p. 336). Trust is required for organizations to perform efficiently (Ristig, 2009). Organizational trust is considered as a key component of successful organization (Tanner, 2007, p. 9). Lahan (1979) discusses trust functionally and refers to it as a mechanism for reducing social complexity (Mollering & Bachmann & Lee, 2004). He is the first to distinguish between trust in management and trust in the organization (Perry & Mankin, 2007). Many authors, mainly in sociology, psychology, social sciences, and economics, have proposed some definitions of trust (Ammeter, 2004). Trust is the tendency to be sensitive based on positive expectations of the other party's intentions or behavior (Celani & Salamon & Singh, 2008). Trust is an extremely abstract concept, a factor making the theoretical examination of trust difficult (Herreros, 2004, p.7). Trust is a multidimensional concept involving personal, inter-organizational, political, social trust, co-worker trust in the workplace, trust of supervisors and subordinates, and organizational trust (Joseph & Winston, 2004). Therefore, trust continues to be an unresolved concept (Burt, 2005, p.93).

Research hypotheses

According to the theoretical foundations and the studies carried out, the hypotheses are as follows:

1- Empowerment has a significant effect on the organizational commitment of the employees of Khorasan Razavi Department of Environment.

2- Empowerment has a significant effect on the organizational trust of the employees of Khorasan Razavi Department of Environment.

3- Organizational trust has a significant effect on the organizational commitment of the employees of Khorasan Razavi Department of Environment.

4- Empowerment has a significant effect on organizational commitment with the mediating role of organizational trust in Khorasan Razavi Department of Environment.

Methods

The study was descriptive-correlational in terms of data collection and applied in terms of purpose. The population was all the employees of Khorasan Razavi Department of Environment. The sampling method was simple random sampling method: all the members of the population had the same opportunity to be selected in the sample and were randomly selected according to the population members. At the time of the study, the number of employees was 120, where 102 people were randomly selected using Cochran sampling formula. Three questionnaires - Spritzer (1998) Empowerment Questionnaire by, Allen and Meyer (1991) Organizational Commitment Scale and Alonen et al. (2008) Organizational trust Scale - were used to collect research data. To this end, content validity was used to evaluate the validity of the questionnaire and Cronbach's alpha to evaluate the reliability after designing the questionnaire. At the start, 30 questionnaires were distributed among the sample. SEM was carried out to analyze the data. The software used in the study was Spss and Amos. According to Table 1, Cronbach's alpha of all three variables was higher than 0.70 and reliable.

Cronbach's alpha coefficient of the main variables

Variable	Cronbach's alpha
Organizational Commitment	0.74
Empowerment	0.84
Organizational Trust	0.87

Results

The study findings revealed that empowerment with the mediating role of organizational trust directly affects the organizational commitment of the employees of Khorasan Razavi Department of Environment. Based on the results, one can propose the following practical suggestions for managers:

1. Sharing information (decisions, strategies, and policies) directly affects organizational commitment through increasing trust, sense of worth and significance among the employees.

2. Managers can have a very effective role in enhancing the organizational commitment of employees by evaluating the performance of employees to create feedback, as the employees feel that the organization values their performance that increases the employee trust in the organization.

3. With confidence and timely appreciation of employee support and efforts and respectful behaviors, the managers help each employee increase trust in the organization and increase employee productivity.

4. The managers can raise the level of competence and trust of employees with the proper training program preparing them to assume more responsibilities in the future.

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INVESTIGATING THE ROLE OF VIRTUAL REALITY QUALITY IN THE BEHAVIORAL INTENTION OF TOURISTS IN VISITING THE DESTINATION

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ABSTRACT

The present study aimed to investigate the role of virtual reality quality in the behavioral intention of tourists in visiting the destination. The present study was a descriptive-analytical research and the method of data collection was field and survey (using a questionnaire) and hypothesis testing type. The presented model was tested using a sample of 384 tourists and using the structural equation method (Lisrel). The results revealed that the three factors of content quality, system quality and clarity have positive impacts on attitude and telepresence. Regarding the variables of tourists' attitude and their behavioral intention, the two mediating factors of clarity and content quality, respectively, have the greatest impact. It seems that their visit intention is more affected by attitude than feeling of presence.

Keywords: virtual reality quality; system quality; content quality; feeling of presence; tourist attitude; visit intention.

Introduction

Nowadays, advanced digital technology is changing the way tourists plan their travels and search for destination information. Tourists have no place or time limitations to experience their potential destination before the actual visit. Various types of information technologies, such as virtual reality, have changed the traditional ways of traveling and experiencing their future destination. Virtual reality through digitally compatible space allows tourists to experience places, services or places before purchasing (Tussyadiah, et al., 2018).

Studies have revealed that the presence of virtual reality can have a positive impact on consumer experience and enjoyment. Advanced technology of virtual reality has revolutionized the tourism industry by providing the opportunity to pre-experience the destination. Virtual reality is the representation of the real world in a three-dimensional computer simulator (Çakiroğlu and Gökoğlu, 2019). In other words, virtual reality is a computer simulation of a three-dimensional environment that reconstructs realities using special electronic devices such as a helmet equipped with a sensor and a screen (Lee, 2018). Although the tourism industry makes extensive use of virtual reality to attract customers and its marketing efforts, research on the virtual reality roles, quality assessment, and psychological acceptance of virtual reality users on hospitality and tourismv is still in its infancy. Accordingly, the present study was conducted to examine the role of content quality, system quality and virtual reality clarity on the behavioral responses of tourists in the area of destination marketing. Hence, the main question is what is the relationship between the quality of virtual reality and the behavioral intention of tourists in selecting a destination?

Research hypotheses

1- There is a significant relationship between the quality of virtual reality content and tourists' attitudes toward virtual reality.

2-There is a significant relationship between the quality of virtual reality content and the feeling of telepresence of tourists.

3- There is a significant relationship between the factor of quality of virtual reality system and the attitude of tourists towards virtual reality.

4- There is a significant relationship between the factor of quality of virtual reality system and feeling of telepresence of tourists.

5-There is a significant relationship between the factor of quality of virtual reality and tourists' attitudes toward virtual reality.

6- There is a significant relationship between the factor of clarity of virtual reality and the feeling of telepresence.

7-There is a significant relationship between tourists' attitudes toward virtual reality and their behavioral intention to visit the destination.

Methods

The present study is applied in terms of aim and survey in terms of approach. Given the aim of the study, the statistical population includes people who have not traveled to our selected cities (Yazd, Tabriz, Shiraz, Ramsar and Isfahan) to present virtual reality films. To examine the tourist's perception of virtual reality, the present study introduced one of the cities of Iran, where participant has not traveled there yet using one of the websites based on virtual reality services (such as https://iraninvr.com/ and https://www.visitiran.ir). Using this service, participants are able to experience a virtual tour and visit the interesting and historical attractions. With this pro-

gram, they can travel around the selected tourist destination city to plan a tour in advance. Then, the questionnaire was given to the statistical population.
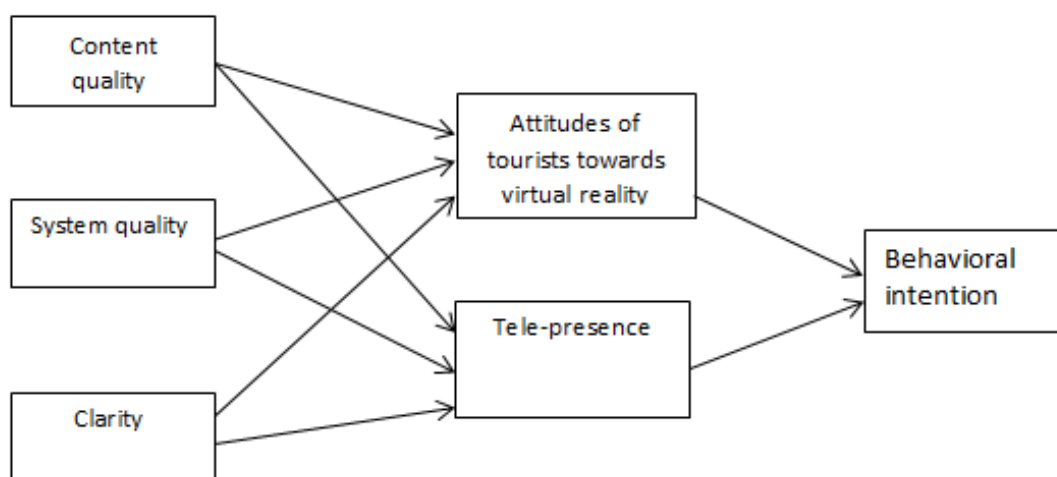

Figure 1 - Conceptual model of research adopted from from Lee et al. (2020)

Due to unlimited number of statistical population, based on Krejcie and Morgan table, 384 tourists were selected. A convenience random sampling method was used in this study. A questionnaire was used to operate the variables. The initial format was translated based on the questionnaire presented in the study of Lee et al. (2020) and then modified and finalized by conducting a survey of university professors who were experts in the field. This questionnaire was divided into 6 general dimensions and 21 design questions including the dimensions of behavioral intention, telepresence, attitude, content quality, system quality and clarity. Content validity was used in this study. In this study, the judgment validity of the questionnaire was obtained by surveying the supervisor and other university professors and including their corrective opinions in the questionnaire. To determine the reliability of the present study, Cronbach's alpha was calculated using SPSS software. After collecting the data, to answer the research hypotheses and perform inferential statistics, inferential analysis was performed using LISREL software.

Results
Checking the normality of the data

Table 1

Kolmogorov-Smirnov test

	Behavioral intention	Telepresence	Attitude	Content quality	System quality
Kolmogorov-Smirnov test	06.1	08.1	06.1	95.1	41.2
Significance level	21.0	33.0	08.0	12.0	40.0

Based on the significant levels in Table 1, since all significant levels for the variables are greater than 0.05, it can be said that for all variables, the assumption that states collected data is normal is accepted.

Research measurement model

Measurement model in X-MODEL mode

In this section, the model for measuring exogenous latent variables (X) is examined. Figure (2) shows the measurement model of content quality, system quality and clarity variables.
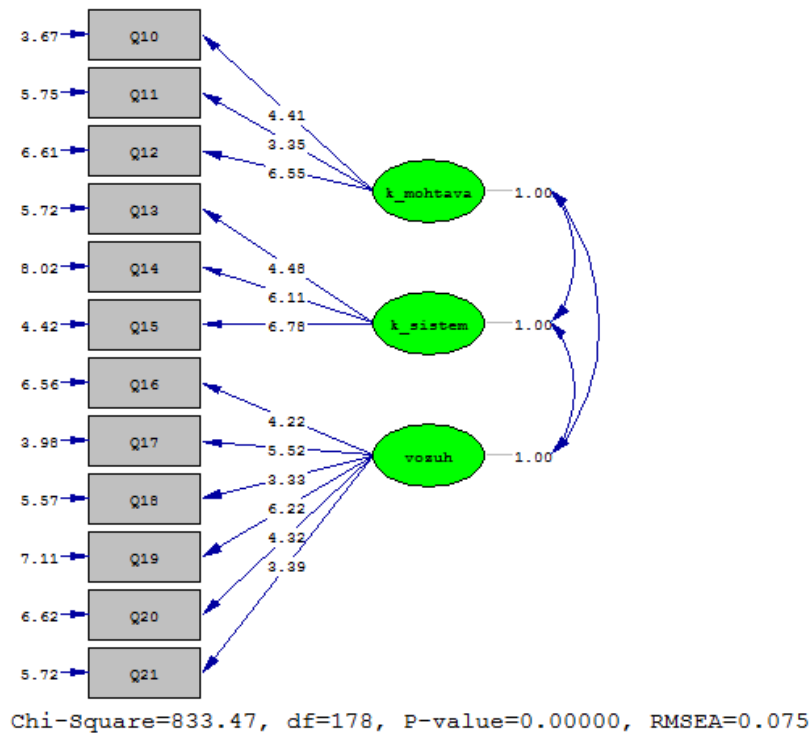
Figure 2- Model of measurement of independent research variables in the significant state
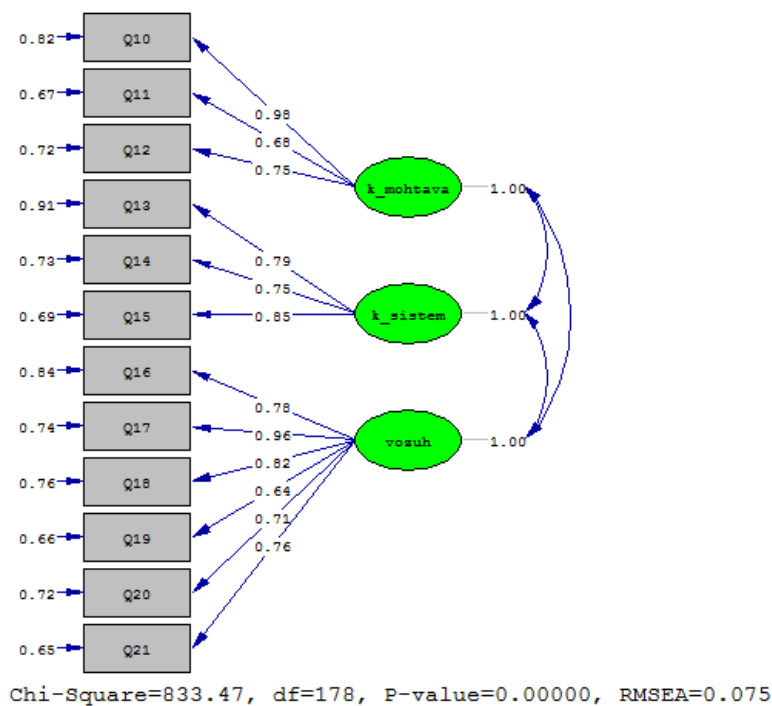
Figure 3- Model of measurement of independent research variables in the standard state

Measurement of factor loads

Table 2

Model for measurement of independent variables

Construct	Item	Factor load	AVE	CR
Content quality	Item 10	98.0	66.0	70.0
	Item 11	68.0		
	Item 12	75.0		
System quality	Item 13	79.0	64.0	71.0
	Item 14	75.0		
	Item 15	85.0		
Clarity	Item 16	78.0	61.0	75.0
	Item 17	96.0		
	Item 18	82.0		
	Item 19	64.0		
	Item 20	71.0		
	Item 21	76.0		
Fit indices	Chi-Square=833.47, df=178, P-value=0.00000, RMSEA=0.075			

The results of Table 2 show that the AVE value and the composite reliability and fit indices have expected values.

Measurement model in Y-MODEL mode
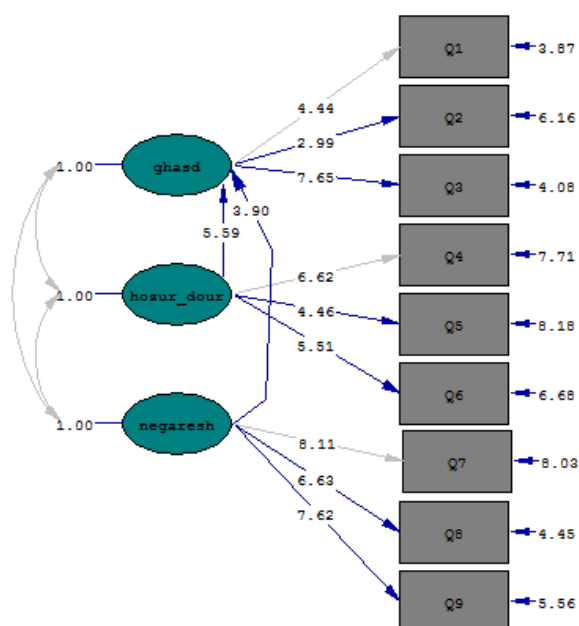
Chi-Square=833.47, df=178, P-value=0.00000, RMSEA=0.075

Figure 3- Model for measurement of dependent variables of research in the significant state

As shown in Figure 3, it can be stated that the critical ratio between all items and latent variables is greater than 1.96.
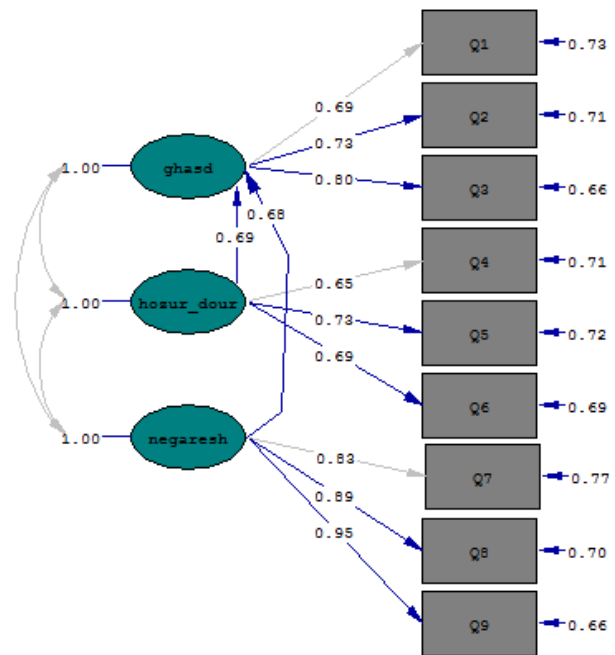
Chi-Square=833.47, df=178, P-value=0.00000, RMSEA=0.075

Figure 4- Model for measurement of dependent variables of research in the standard state

According to Figure 4, it can be stated that the factor loads between all items and latent variables is greater than 0.5.

Reliability and validity of dependent variables

Convergent validity in this study has values above 0.5 for all constructs, which indicates that the fit of the desired construct (Table 3).

Table 3

Reliability and validity of the construct of dependent variables

Construct	Item	Factor load	AVE	CR
Behavioral intention	Item 1	69.0	55.0	73.0
	Item 2	73.0		
	Item 3	80.0		
Telepresence	Item 4	65.0	58.0	70.0
	Item 5	73.0		
	Item 6	69.0		
Attitudes of tourists towards virtual reality	Item 7	83.0	79.0	78.0
	Item 8	89.0		
	Item 9	95.0		
Fit indices	Chi-Square=833.47, df=178, P-value=0.00000, RMSEA=0.075			

Fit indices of research measurement model

The table of fit indices of the research measurement model is shown in Table 4:

Table 4

Fit indices of the measurement model

indices	abbreviation	Acceptable value	Obtained value	Acceptance/rejection
Goodness-of- fit index	GFI	$9.\geq0$	943.0	Accepted
Adjust goodness- of- fit index	AGFI	$9.\geq0$	908.0	Accepted
Comparative fit index	CFI	$9.\geq0$	920.0	Accepted
Relative fit index	RFI	$9.\geq0$	941.0	Accepted
Normed chi-square	CMIN/DF	≤5	68.4	Accepted
Root mean squared error of approximation	RMSEA	$08.\leq0$	077.0	Accepted

Structural Equation Model

Figure 5 shows the structural equation model based on the conceptual model.

Chi-Square=833.47, df=178, P-value=0.00000, RMSEA=0.075
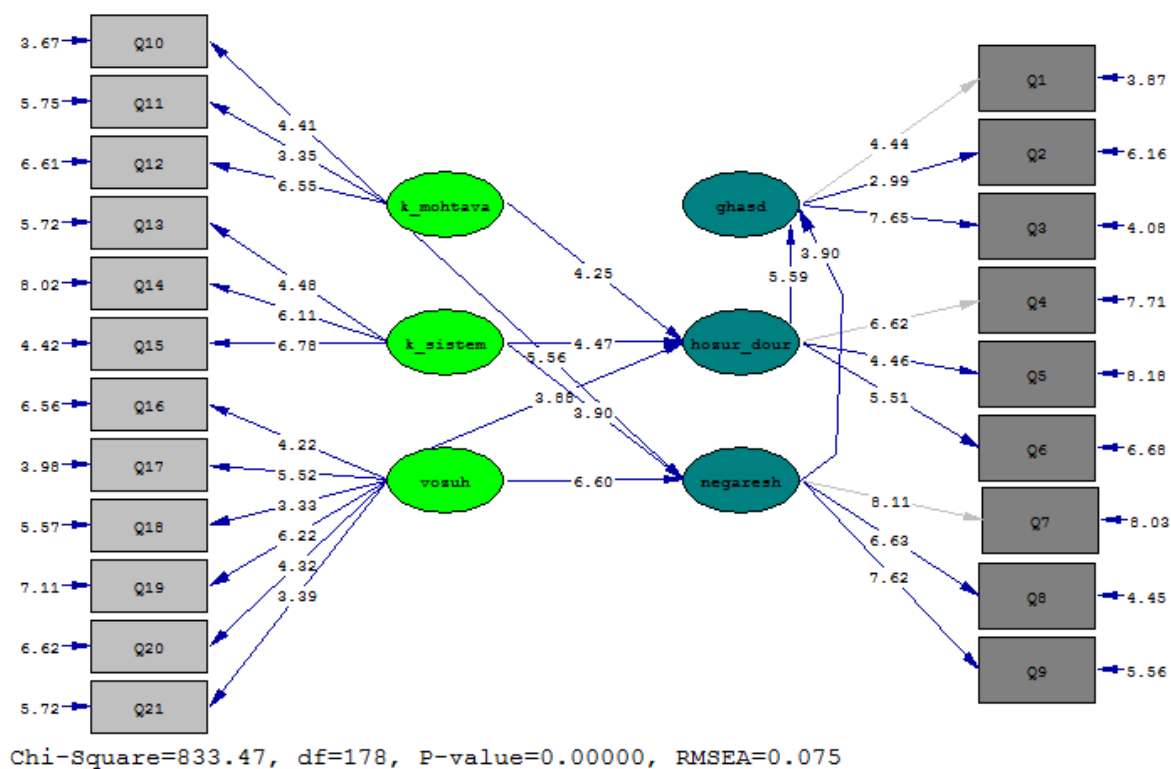
Figure 5 - Structural equation model in the significant state

Chi-Square=833.47, df=178, P-value=0.00000, RMSEA=0.075
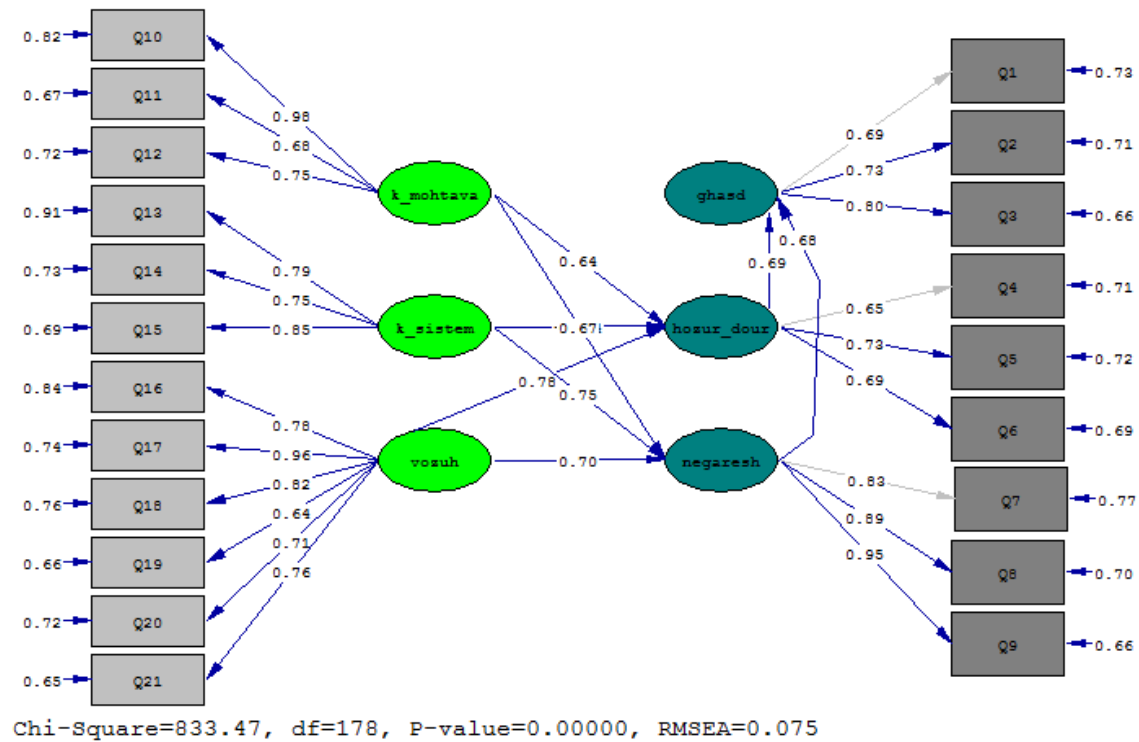
Figure 6- Model of structural equations in the standard state

The results of the research hypotheses are summarized in Table 5:

Table 5

Results of research hypotheses

Research hypotheses	Factor load	Test statistic	Result
Quality of virtual reality content <--- Attitudes of tourists towards virtual reality	67.0	56.5	H₁ is confirmed
Quality of virtual reality content <--- feeling of telepresence of tourists	64.0	25.4	H₁ is confirmed
Quality of virtual reality system <--- Attitudes of tourists towards virtual reality	75.0	9.3	H₁ is confirmed
Quality of virtual reality system <--- feeling of telepresence of tourists	65.0	47.4	H₁ is confirmed
Clarity of virtual reality <--- attitudes of tourists towards virtual reality	70.0	6.6	H₁ is confirmed
Clarity of virtual reality <--- feeling of telepresence of tourists	78.0	88.3	H₁ is confirmed
Attitudes of tourists towards virtual reality <--- Their behavioral intention to visit the destination	68.0	9.3	H₁ is confirmed
Feeling of telepresence of tourists <--- Their behavioral intention to visit the destination	69.0	59.5	H₁ is confirmed

Conclusion

The present study examined the role of virtual reality quality in tourists' behavioral intention to visit their destination. Based on the results of this study, a virtual reality quality framework was created to measure the effects of the quality of the virtual reality system on customers' psychological perception (attitude) and customers' feeling of telepresence, which ultimately led to their behavioral intention. Three factors of content quality, system quality and clarity have positive effects on attitude and telepresence. Attitude and telepresence are statistically significant mediators in the relationship between the constructs of virtual reality quality and behavioral intention, which supports Hypotheses 7 and 8. Regarding the variables of tourists' attitude and their behavioral intention, two mediating factors of clarity and quality of content have the greatest impact, respectively. It seems that their intention to visit is more affected by attitude than feeling of presence. Results of this study identified the main quality factors that were effective for respondents' use of virtual reality to maximize experience and increase the intention of tourists to travel to their destination in the future.

Among the three main factors of quality, clarity (6.6) and content quality (5.56) are the main predictors of tourist attitudes and system quality with an impact of 4.47 predicts telepresence, while in the research conducted by Lee et al. (2020), clarity was the most powerful predictor of attitude, followed by content quality and system quality. Thus, the quality of virtual reality content can be a key factor that makes customers have a positive attitude towards virtual reality and lead to the intention to visit a destination. This issue requires that hospitality and tourism industry experts use quality characteristics in the design of virtual reality tours. Also, virtual reality should develop user-friendly, interactive, and completely rich content so that customers feel at their destination and create a positive reality experience. Respondents' positive attitudes toward virtual reality and their feeling of presence ultimately lead to their intention to visit the destination.

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INVESTIGATE AND EXPLAIN THE RELATIONSHIP BETWEEN EMOTIONAL INTELLIGENCE AND INTERNAL MARKETING (CASE STUDY: COMPANY SIMAND CABLE ABHAR CITY)

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ABSTRACT

Since the formulation of EI by Goleman, much attention has been. Many researchers, emotional intelligence in various disciplines and areas of research have been carried out. In the field of management and marketing, and research in this regard has been paid to it. However, still there is no consensus about the importance and its place in management. Considering the importance of both of these categories, they can explain the relationship between organizations in order to achieve greater internal marketing and organizational staff to achieve self-motivation, self-control; social skills and empathy are able to love. In the present study, designed to gain the full economic potential of solar energy production sites, the independent variable, and the needs of customers and technical characteristics, are the dependent variable. This study sought to examine the impact of customer requirements and technical specifications on the design and obtain the full economic potential of solar energy production sites.

Keywords: marketing; emotional intelligence; enterprise Simand; business management.

Introduction:

Present world with the acceleration is becoming industrialized increasingly. This requires innovation, flexibility, productivity and account ability for the survivaland success of organizations and more.

The new standards should be developed for organizations to meet global challenges and provide grounds for the employee to have the most appropriate skills. Therefore, psychologists have emphasized their official duties in the organization should go beyond act(Bradbry, 1386).

Research scientists are very different:"Goleman", "Boyatziset al" etc. indicate that one of the factors that play an important role in successful job duties are"emotional intelligence" is. EI represents a person's ability to solve problems and daily challenges and anticipate a person to succeed in life, including professional success and helps the person'spersonal life (Aghayari, 1386). Internal marketing is a marketing issue over 20 years ago as a way to solve problems relating to staff and provide quality services to their organizations by taking on. Despite the expansion of the marketing literature, it has been little used in practice. The next debate was conducted in the domestic market reflects the fact that this branch of marketing requires extensive research and wider. The main proble mof this research is to explain the relationship between emotional intelligence and internal marketing, internal marketing help organizations to succeed.

Research Methodology:

In this paper,to analyze data from samples of descriptive statistics(percent ages, averages, frequency, etc.) to describe the research sample, Kolmogorov–Smirnov test for normality of the distribution of test data, for calculation of reliability, Cronbach's alpha coefficient, and inferential statistics(correlation and regression) to analyze the data and test research hypotheses will be used. In this study,descriptive statistics to classify, organize, calculate the mean, standard deviation, percentages, frequency and graphs of data, and inferential statistics to analyze the data in the software SPSS, EXCEL and solid arity to the test the independent variables were used to evaluate the impact of the dependent variables.

The main hypothesis:

- Positive correlationis between emotional intelligence and internal marketing there.

Subassumptions:

- There is a significant positive relationship between consciousness and internal marketing.

- There are positive and significant relationship between self-control and internal marketing.

- There is a significant positive relationship between empathy and internal marketing.

Literature:

On the relationship between emotional intelligence and internal marketing research, little has been done. However, some of the research that generally this type of intelligence and other components have to be mentioned.

Mortazavi et al (1392) in a study entitled "The relationship between emotional intelligence and leadership style among business managers in the food industry and automobile manufacturing companies" conclude that a significant positive correlation between emotional intelligence and leadership style there.

Hoffmannet al(2010) in astudyentitled "The impact of emotional intelligence, relationship marketing, and trust in the bank" to reach the conclusion that the relationship between emotional intelligence and marketing relationship is a significant positive correlation. In this study,221were examined bank manager.

Foca and Francis (2012), a study entitled "The relationship between emotional intelligence and the effectiveness of the marketing major Nigerian companies" The study of 108 large companies to reach the conclusion that the effectiveness of emotional intelligence and relationship marketing companies there are significant. In this study, the marketing has been effective component of customer satisfaction, marketing, integrated marketing activities, strategic orientation and operational efficiency).

Emotional Intelligence:

According to your feelingsareand how tobestusethem indecision making, the ability to manage and control stress and anxiety, motivation, hope and optimism in the face of obstacles to reach the goal and the way to sober emotional intelligence.

Emotional intelligence is empathy that others understand what you are feeling. Emotional intelligence is a kind of social skills, along with the management of emotions in relationships and the ability to motivate and lead others[9] intelligence is supposedly one of the main structures of the time of its introduction in the early twentieth century by Alfred Binethas to explain career success and is used efficiency. Daniel Golemane emotional intelligence when considered that in 1995his book titled "Why emotional intelligence can be more important than IQ" published. At the beginning ofthe formation ofthese structures, as well as memory and cognitive psychologists more on problem solving were emphasized. But soon found that non-cognitive aspects such as emotional and social factors are also important.

Experts, emotional intelligence with respect to the features and functions that are defined as follows: Daniel Goleman: Emotional intelligence is a skill that can through their own self-awareness, self-control mentality, through self-management to improve through empathy, to understand the effects of forces through relationship management, behavior in ways that raises your spirits and others through relationship management, in a manner that spirit of self and others. John Mayerand Peter Salovey: Emotional intelligence is the ability to evaluate the expression and regulation of emotions in self and others, and efficient use of it. Emotional intelligence is the ability of a person in the face of environmental challenges and successes of the individual in life predicts.

History ofemotional intelligence:

Two thousand years ago, Plato said: "All learning has an emotional base." According to Plato, it has since scientists, researchers and philosophers to prove or negate the role of emotions, have done a lot of discussion of emotional intelligence goes backto1985, a series of art would one PhD students from American University Thesis went to the end of them. That emotional intelligence(EQ) was studied. Thenin 1990,twouniversity professorsin the United States, "John Mayer" and "Peter Salo" wrote two articles about emotional intelligence and research to drive this relationship began. The professor found that some people and others to identify their feelings and emotional problems are more powerful, they report that their theory of emotional intelligence, motivator Goleman to write a book his best-selling in 1995, the way. Goleman's research (1995) shows that emotional intelligence important management and technical experience is required, with more ready than others to resolve conflicts and weaknesses in the group will be addressed. Since the beginning of the 1990s, the debate on the effects of psychological and emotional adaptive functions, as well as the nature of the relationship between emotion and cognition by introducing the concept of emotional intelligence took on a new dimension. In fact, the concept of emotional intelligence, the latest advances in the understanding of the relationship between emotion and thought and researchers [1] believe that the application of the concept of "intelligence" is a metaphor for the structure of the term emotional intelligence can be learned. The concept developed by Salvvy and Mayer [1] in the 1990s took place. Salvvy and Mayer 1997 researchersare noted that definition four components are:

1. Perception and expression of emotion, 2.facilitating emotional thinking 3: Understanding and analyzing emotions and use emotional information 4: Set response to promote emotional development and intellectual excitement.

It can be basic enough to engage in emotional intelligence includes emotional perception of themselves and others, understanding emotions and managing motion scan be cited. Many researchers have assumed that between emotional intelligence and effective in accordance with the demands of everyday life, there is a link.

Emotional intelligence factor in determining life out comes such as success in school, success in business and personal relationships between health and productivity is generally act Syarvchyet al.,2002. LaVenicein 2005found that high emotional intelligence is correlated with high public health risk behaviors has a negative relationship between smoking and health and life style productivity, is so essential act is personal.

Marketing:

Marketing is the analysis, organization, planning and control off actors affecting customers at is faction policies and operations to the needs and desires of a select group of customers in exchange for profit.

Marketing is a set of measures to create favorable reaction of the audience, the goods, services or anything else is done. Marketing management is the analysis, planning, control, Implementation and control of programs set to provide the desired exchange markets in order to achieve the objectives of the organization.

Marketing managersinclude:

Sales managers, sales people, managers, advertising, sales promotion advertising staff, marketing research, product management, pricing and other experts.

Marketing management tasks include the following:

Creating a demand for the products

(B)The level of demand and the timing of its regular

(C)Provide the information requested in order to achieve organizational goals.

In simple terms, we can say: demand management, marketing management, he is responsible for coordinating the flow of supply and demand:

-If the supply is less than demand, provided no changes to the conditions of supply of raw materials, laborand capital,or changetheirreasonableincrease, supplywill increase.

-If supply exceeds demand should purchase motivation, stimulate demand, advertising and sales promotion methods, the demand increases.

- If the supply is equal to demand, the conditions must be maintained.

Marketing management process

Management means the coordinated and continuous process of data collection, classification, analysis and understanding of them, and finally obtaining a logical result of processing operations.

In marketing, which is a subset of business management, marketing management process means a coordinated and continuous process of marketing research to determine the long-term goals (executive), planning marketing activities in the fields of production, distribution, sales promotion, packaging, customer service of sales. To achieve the objectives and the monitoring and evaluation and discussion of strategies, action plans and other actions and decisions made during the process and the success or failure of the program's implementation.

Marketing management process includes analysis of market opportunities, selecting target markets, and marketing and management efforts by providing the composition of the market.

Inferential statistics:

Test - The main hypotheses:

"There is a positive and meaningful relationship between emotional intelligence and internal marketing."

The following table shows the results of testing this hypothesis:

Table 1

The main hypothesis test results

Internal marketing	Emotional intelligence		
0/577	1/000	Correlation coefficient	Emotional intelligence
0/000		Significance level	
283	283	Number	
1/000	0/577	Correlation coefficient	Internal marketing
	0/000	Significance level	
283	283	Number	

As it can be seen in table above, in error level: $\alpha = .05$, we have $0 \cong Sign < \alpha = .05$, and this means that the main hypothesis of this study is approved based on "There is a positive and meaningful relationship between emotional intelligence and internal marketing."

Testing the first sub-hypothesis

"There is a significant and positive relationship between self-awareness and internal marketing."

The following table shows the results of testing this hypothesis:

Results of testing the first sub-hypothesis

Internal marketing	self-awareness		
0/472	1/000	Correlation coefficient	self-awareness
0/000		Significance level	
283	283	Number	
1/000	0/472	Correlation coefficient	Internal marketing
	0/000	Significance level	
283	283	Number	

The above table shows that in error level: $\alpha = .05$, we have $0 \cong Sign < \alpha = .05$ and this means that the first sub-hypothesis of research is approved based on"There is a significant and positive relationship between self-awareness and internal marketing."

3. The second sub-hypothesis

"There is a significant and positive relationship between self-control and internal marketing"

The following table provides the results of testing this hypothesis:

Results of testing the second sub-hypothesis

internal marketing	self-control		
0/622	1/000	Correlation coefficient	self-control
0/000		Significance level	
283	283	Number	
1/000	0/622	Correlation coefficient	internal marketing
	0/000	Significance level	
283	283	Number	

The above table shows that in error level of $\alpha = .05$, we have $0 \cong Sign < \alpha = .05$ and this means thatthe second sub- hypothesis of research is approved based on"There is a significant and positive relationship between self-control and internal marketing"

4. The third sub-hypothesis

"There is a significant and positive relationship between sympathy and internal marketing".

The above table shows that in error level of $\alpha = .05$, we have $0 \cong Sign < \alpha = .05$ and this means that the third sub- hypothesis of study is approved based on"There is a significant and positive relationship between sympathy and internal marketing".

Table 4

Results of testing the third sub-hypothesis

Internal marketing	Sympathy		
0/425	1/000	Correlation coefficient	Sympathy
0/000		Significance level	
283	283	Number	
1/000	0/425	Correlation coefficient	Internal marketing
	0/000	Significance level	
283	283	Number	

Conclusions:

The core of interpersonal intelligence is the first ability to understand and provide an appropriate response to the mentality and temperament, motivation and demands of others. In intrapersonal intelligence the main key is: Awareness of their own feelings which is results of self-consciousness and ability to distinguishing and using them to guide their behavior.Interpersonal intelligence is the ability to understand other people, means that what would motivate them, how they work and how we can do a common work with them. Successful businessmen and managers are among those who have high interpersonal intelligence. Hatch and Gardner expressfour separate capacity as interpersonal intelligence factors as follows:

Organizing group: having initiative in coordinatingthe efforts of people groups. These skills are necessary for leaders and can be seen in effective leadership of every type in business organizations.

Provide solutions: Mediation talents, avoiding conflict or resolving conflicts that have been created.People who have this ability at high level, have a great ability in making transactions and arbitration and mediation too.

Individual communication: Having this talents will facilitate dealing with others or understanding and respond appropriately to people's feelings and interests. These people are good trading partners and they are successful managers and sellers in business world and they are very successful in the field of finding others feelings through facial expressions and enjoys great popularity.

Social analysis: Means the ability to receive emotion, motivations, other interests and having a deep understanding of them. This awareness of others' feelings makes these people will easy be intimate with others. In the best case we can say that a person will be a good business consultant with this ability.

Optimism and hope are those characteristics of these people who have high emotional intelligence. Hope has a surprising role in business success and people's managing, professional life of every people who deals with trading business is significantly depend on his hope. Hope is bright prospects and a clear future thatshows that eventually everything will go well. Snyder, is define hope as: Believe that whatever is your goal, you will have access to it and its way is open to you. When hopeful people who their hope won't be finished fail to reach their targets as in contracting transaction, believes that they should work and try harder and think of what could cause their success in mentioned transaction and learn from them.

Optimism, like hope has a great impact inbusiness success working. Optimism means that a person has lots of patience and waiting. Expectation that makes everything goes well despite-

obstacles and disappointment in whole life. Optimism considers failure as an event that can compensate it.

A research that Sylkman have conduct on MetLife Insurance Company's marketers, have revealed thatmarketers who are inherently optimistic, have insurance people onaverage 37% higher than pessimistic people in their first year work and abandonment of work in the first year among pessimistic people were twice as optimistic. Ability of individuals in hearing and accepting negative response with an open face is a decisive power in all aspects of sales and trade exchanges.

This paper reviews and explains the relationship between emotional intelligence and internal marketing. Research hypotheses were as follows:

- There is a significant and positive relationship between emotional intelligence and internal marketing.

- There is a significant and positive relationship between self-awareness and internal marketing.

- There is a significant and positive relationship between self-control and internal marketing.

- There is a significant and positive relationship between sympathy and internal marketing.

After data analysis by using SPSS software, all hypotheses were confirmed.

Buying and selling and marketing and business management are inevitably deal with human factors. Whether in internal environment which the main constituent of units are individuals and whether outside of organization that management is concerned with multiple human factors. Bureaucrats who are formulating business rulesand community reference groups such as athletes and artists who organized people tastes inbuying goods and promoting fashion, and the family that are especially the main center of consultation in large shopping, and final customers who are the main buyers and also sales and distribution representatives, all are carrying human factor as the central core. Emotional intelligence as the ability to understand feelings and others' needs is a great and useful help in order to guiding others in a way that leads to long-term and short-term organizational goals and personal and society's satisfaction.

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INVESTIGATING THE RELATIONSHIP BETWEEN MANAGEMENT ABILITY AND CASH FINAL VALUE IN TEHRAN STOCK EXCHANGE

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ABSTRACT

Managers pay attention to a variety of information, including market information, accounting information, and future operating cash flows, in future investment decisions. The accounting system provides additional information for managers to make decisions about capital projects. It is unclear how managers choose between consuming and holding cash reserves for their own benefit. Information asymmetry theory, agency theory, balance theory, financing hierarchy theory and free cash flow theory are some of the theories related to the level of holding cash of companies. For this purpose, the relationship between management ability and the cash final value in the Tehran Stock Exchange was examined. The required data of the models were collected from the companies listed on the Tehran Stock Exchange from 2013 to 2018 for 5 years and offered their shares in the Tehran Stock Exchange and their transactions were not interrupted for more than 6 months. Accordingly, 132 companies were selected as a statistical sample by systematic elimination method. The research method is applied in terms of aim and library in terms of information and data collection method. The results indicate that there is a significant and positive relationship between management ability and the cash final value of the companies listed on the Tehran Stock Exchange. The results also showed that with increasing management ability, the final value of cash will increase.

Keywords: managerial ability; cash final value; Tehran stock exchange.

Introduction

Capital structure has been proposed as the most important parameter affecting the influence of companies and their orientation in capital markets. The current changing environment has made the rating of companies to depend on their capital structure in terms of credit. It has made their strategic planning as effective resources for the goal of maximizing shareholder wealth. Cash can be thought of as the beginning and end of the operational cycle, meaning that each cycle of a business unit operation begins with payment or a commitment to pay cash and ends with the receiving an obligated cash (Abbaszadeh and Manzarzadeh, 2011). The ability of a profit unit to obtain cash is an important criterion for deciding and judging that unity. Users of financial information to judge the future of cash flow in a profit unity specifically pay attention to the impact of events and activities that lead to inflows or outflows of cash Investors are always interested in buying shares from those profit units that have rich cash flow, and they avoid investing in that group of profit units that do not have free cash. The problem of shortage of cash must be eliminated by borrowing, increasing capital, or even sometimes receiving government subsidies. Providers of loans, credit and other financial facilities also pay special attention to the cash flow of such profit units (Rezazadeh and Zarei Moravaj, 2009).

Based on the balance theory, companies determine the optimal amount of cash by establishing a balance between the benefits and costs of holding cash. Based on the theory of financing hierarchy, the manager tends to accumulate cash so that he can finance from inside the company in the first stage and does not go outside the company (Hasas Yegane et al., 2006). Based on the free cash flow theory, managers are motivated to accumulate cash to increase the resources under their control to be able to use the power of judgment and discretion in c investment decisions of the company (Hasas Yegane et al., 2008). Also, establishing a balance be-

tween the available cash and the cash needs of each profit unit is one of the management goals. Users of financial information are also aware of the importance of management decisions in this area. The reasons for cash inflows into the profit unit and the reasons for cash outflows from it reflect the management decisions regarding short-term and long-term operational planning and investment and financing plans of the profit unit. A company's investors, creditors, sellers, and employees consider the company as a source of cash to pay dividends or interest, repay loans, and pay for goods and services, and pay salaries. Thus, these individuals are interested in being aware of the company's ability to generate positive cash flows. The present study was an attempt to examine the importance of the role of management ability on the cash final value.

Theoretical foundations of research
The cash final value

Cash can be considered as the beginning and end of the operating cycle, meaning that each cycle of a business unit begins with payment or a commitment to pay cash and ends with the receiving obligated cash (Kashanipour, Rahmani and Parchini Parchin, 2009). The ability of a profit entity to obtain cash is an important criterion for deciding and judging that unit. Users of financial information to judge the future of cash flow in a profit unit specifically pay attention to the impact of events and activities that lead to cash inflows or outflows of cash in that unit. Investors are always interested in buying shares from those profit units that have rich cash flow, and they avoid investing in that group of profit units that do not have free cash. The problem of shortage of cash must be eliminated by borrowing, increasing capital, or even sometimes receiving government subsidies. Providers of loans, credits and other financial facilities also give special importance to the circulation of cash of such profit units (Alivar, 1994). Also, establishing a balance between the available cash and the cash needs of each profit unit is one of the management goals. Users of financial information are also aware of the importance of management decisions in this area. The reasons for cash inflows into the profit unit and the reasons for cash outflows from it reflect the management decisions regarding short-term and long-term operational planning and investment and financing plans of the profit unit. In other words, investors, creditors, sellers, and employees of a company consider that company as a source of cash to pay dividends or interest expenses, repay loans, and pay for goods and services, and pay salaries. Thus, these individuals are interested in being aware of the company's ability to generate positive cash flows (Francis and Krishnan, 1999).

Management ability

In general, management ability and its various measures is one of the dimensions of organizational capital, which in a general classification is a component of intangible assets. Demirjian et al. define management ability as the efficiency of managers over competitors in converting company resources into revenue. These resources in companies include inventory costs, general, sales, and administrative costs, tangible fixed assets, operating leases, research and development costs and intangible assets of the company (Demirjian, 2012).

It is believed that more capable managers have a better understanding of technology and industry trends and can more accurately predict product demand. Also, more appropriate investment in more valuable projects and efficient management of employees are the characteristics of capable managers. It is expected that these managers can earn more by using a certain level of resources in the short term or achieve a certain level of revenue by using less resources (maximizing the efficiency of the resources used) (Lin and Ming, 2009). The most well-known model for measuring the ability of managers is the model presented by Demirjian et al. (2012). For the first time, they designed a model that quantitatively measures management ability using account-

ing variables. In this model, by measuring the efficiency of the company and then entering it into multivariate linear regression as a dependent variable and controlling the inherent characteristics of the company, the management ability is calculated.

Demirjian et al. (2012) used data envelopment analysis model to measure management ability. Data envelopment analysis model is a statistical model that is used to measure system performance using input and output data. In the model used in this research, sales revenue was considered as output and 7 other variables, including the cost of goods sold, general, sales and administrative costs, net assets, machinery and equipment, operating lease, research and development costs, goodwill and intangible assets were considered as inputs, which largely cover the management choice in achieving the desired revenue. The company performance model, like the Fama and French (1997) model, is designed for the industry so that the performance of each company can be compared with companies operating in the industry. In this model, a specific coefficient is also considered for each of the input variables, because the effect of all input variables on the output (sales) is not the same. The value calculated for the performance of the company is a number between zero and one, in number 1 indicates a maximum efficiency. The lower number indicates the lower efficiency of the company. In any industry, the company with the highest efficiency is the leader in that industry (Lev, Petrovits, & Radhakrishnan, 2010).
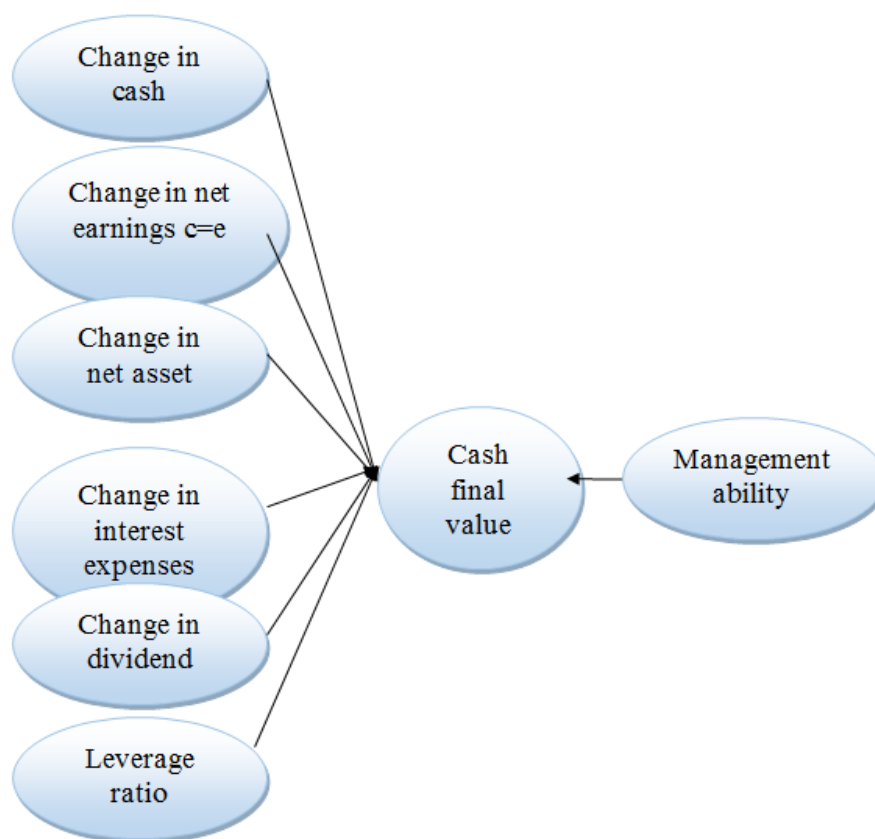

Figure 1 – Conceptual research model (Jean and Park, 2017)

Methods

The present study is a descriptive and inductive research and applied in terms of aim. This study is correlational in terms of implementation method and post-hoc in terms of data. Based on the objectives of the research, the statistical method is a mixed correlational (time series and cross-sectional) to examine the relationship between variables through regression. To test the research hypotheses, the information of financial statements of companies should be used. For this purpose, the companies listed on the Tehran Stock Exchange are the statistical population of

the study. The study period is from the beginning of 2013 to the end of 2017. Therefore, in this study, the information of all companies that have offered their shares in the Tehran Stock Exchange in the mentioned 5-year period, and their stock transactions have not been interrupted for more than 6 months and their financial year are the last day of a given year, and are not a part of investment companies, banks and insurance, was used. Finally, after applying the above criteria in the selection of samples, 132 companies were selected as the statistical sample of the study. To access the financial statements and market prices of the sample research companies, Rahavard- Novin software database was used. Multivariate linear regression model was used to test the research hypotheses. The hypotheses of this study are based on the results of Jean and Park (2017) and were presented as follows:

1- There is a significant relationship between management ability and the cash final value

2- In companies with higher management ability, the cash final value is higher.

The following models are used to test the hypotheses in this study:

$$
\begin{aligned}
EXRET_{it} = \beta_0 + \beta_1 \frac{Ability_{it}}{M_{it}} + \beta_2 D1 * \frac{Ability_{it}}{M_{it}} + \beta_3 \frac{\Delta CASH_{it}}{M_{it}} + \beta_4 \frac{\Delta Earnings_{it}}{M_{it}} \\
+ \beta_5 \frac{\Delta NetAsset_{it}}{M_{it}} + \beta_6 \frac{\Delta IntrestExpense_{it}}{M_{it}} + \beta_7 \frac{\Delta Divindedns_{it}}{M_{it}} \\
+ \beta_8 Leverage_{it} + \varepsilon_{it}
\end{aligned}
$$

In the first model above, if β1 is significant, the first hypothesis of the research is confirmed, otherwise, it is rejected. Finally, in the above model, if β2 is significant, the second hypothesis of the research is confirmed, otherwise, it is rejected.

Its components are:

β0 - intercept;

EXRETit – cash final value of company i in year t;

Abilityit- the management ability of the company i in year t;

Mit- market value of equity of company i in year t;

ΔCASHit – cash change of company i in year t;

ΔEarningsit- change in net earnings of company i in year t;

ΔNetAssetit- change in the net asset value of the company i in year t;

ΔIntrestExpenseit- change the interest expenses of the company i in year t;

-ΔDivindedndsit- change in dividend of company i year in t;

ΔLeverageit- leverage ratio of company i in year t; and

e- Model error.

Cash final value (EXRET): In this study, surplus stock returns are used to measure the cash final value in accordance with the research of Jean and Park (2017). The surplus of the company's share return will be measured in terms of the difference between the actual return and the expected return.

ABILITY: According to the research conducted by Demirjian, Lu, Lewis and Mc Vey (2012), the managers' ability is obtained in this way.

$$
\begin{aligned}
Firm\ Efficiency_{it} \\
= \beta 0 + \beta 1 Size_{it} + \beta 2 MarketShare_{it} + \beta 2 Free\ Cash\ Flow_{it} + \beta 2 Age_{it} \\
+ \beta 2 MForeign\ Currency\ Indicator_{it} + \varepsilon_{it}
\end{aligned}
$$

Where:

Firm efficiency: which is obtained from the calculations of data envelopment analysis pattern *. The input and output variables of data envelopment analysis are as follows:

$$\max \theta_v = \frac{Sales}{v1CoGs + V2SG\&A + V3NetPPE + V4OpsLease + V5GoodWill + V6Intan}$$

Where,

Sales: derived from sales and revenue stated in the financial statements.

COGS: The cost of goods sold, which is extracted from the financial statements.

G SG&A: General, sales and administrative costs, which are derived from the sum of general and administrative and sales costs in the financial statements.

P NetPPE: The net Property Plant and Equipment, which is extracted from the text of financial statements.

OpsLease: The cost of operating leases extracted from the text of financial statements.

Goodwill: Goodwill purchased that is extracted from the text of the financial statements.

Lan Intlan: The net balance of intangible assets that is extracted from the text of financial statements. To build the model, suppose n units are available and the purpose is to evaluate the efficiency of the unit (zero unit or decision-making unit) that uses $x_{m,0},...,x_{2,0},x_{1,0}$ inputs to generate $y_{s,0},...,y_{2,0},y_{1,0}$ output.

If the weights assigned to the outputs (or the price of the outputs) are denoted by $u_m,...,u_2,u_1$ and the weights assigned to the inputs (or the cost of purchasing the inputs) are denoted by $v_m,...,v_2,v_1$, the following fraction must be maximized to find the maximum efficiency.

$$\frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}}$$

This method should be used for other units as well in this way:

Zero unit efficiency= $MaxZ_0$

st ≤ 1: Efficiency of all units

The variables of above problem are weights and the answer to the problem provides the most appropriate and favorable values for the zero unit weights and measures its efficiency.

Its mathematical model is as follows:

$$MaxZ_0 = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}}$$

st:

$$\frac{\sum_{i=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \qquad (j = 0,1,2,...,n)$$

$$u_r, v_i \geq 0$$

For each unit:

Size: The size of the company, which is the logarithm of the total assets of the company at the end of each year.

MarketShare: Company's market share in year t, which is the ratio of company sales to industry sales

Free Cash Flow: If the company has a positive operating cash flow, it is given a score of one, otherwise, it is given a number of zero.

Age : The age of company listed on the stock exchange, which is the natural logarithm of the years in which the company has been listed on the stock exchange.

Foreign Currency Indicator: is a dummy variable and if the company has exports, it gets score 1, otherwise, it gets score zero.

ε: The percentage of error that can be attributed to the management ability.

In this study, control variables are:

(ΔCASHit): the ratio of change in cash divided by the market value of equity;

(ΔEarningit): is the ratio of change in net earnings divided by the market value of the equity of company i in year t;

(ΔNetAssetit): the ratio of the change in net assets divided by the market value of the equity of company I in year t;

(ΔInterestExpenseit): the ratio of changes in interest expenses divided by the market value of the equity of the company i in year t;

(ΔDivindedndsit): the ratio of the change in the net earnings divided by the market value of the equity of company i in year t; and

Leverage ratio: is the amount of total liabilities to total assets of the company i in year t.

Results

Table (1) presents the central indices such as mean and scatter indices such as standard deviation, kurtosis and skewness for different variables.

Table 1

Descriptive statistics for research variables

Variable name	abbreviation	n	mean	SD	variance	skewness	kurtosis
The cash final value	EXRET	660	-.27366	17.652845	311.623	-7.546	213.664
Management ability	ABILITY	660	.12040	.273216	.075	12.612	174.689
Change in net earnings	ΔEarningit	660	.05519	.448611	.201	8.637	146.384
Change in net asset value	ΔNetAssetit	660	.37046	2.360212	5.571	12.454	208.604
Change in interest expenses	ΔInterestExpense$_{it}$	660	-.00202	.632588	.400	-9.166	173.980
Change in the dividend	ΔDivindedndsit	660	-.00074	.353181	.125	.061	2.286
Leverage ratio	Leverageit	660	.60899	.187065	.035	.081	.078

As seen in Table (1), the standard deviation of the variables is not zero and they fulfill this condition. Also, in the statistical population, the maximum and minimum values of this parameter are 17.652845 (the cash final value) and .187065 (leverage ratio), respectively.

Table 2

Matrix of correlation coefficient of regression model variables

variables	EXRET	ABILITY	ΔEarning	ΔNetAsset	ΔInterestExpense	ΔDivindednds	Leverage
EXRET	1	-.006	-.030	-.010	.011	-.032	-.147-**
ABILITY		1	.022	.013	.010	-.046	-.009
ΔEarningit			1	.630**	-.009	-.019	.010
ΔNetAsset				1	-.005	.051	-.014
ΔInterestExpense					1	-.013	-.019
ΔDivindednds						1	-.016
Leverage							1

Table 3

Test to determine the method of using panel data for research models

Test type	Cross-sectional Fisher statistics (Chi-square(	Significance level	Model used
F-Limer	1.183800	0.1027	Common effects (panel data)

As seen in the table, the results of the F-Limer test show that the probability obtained for the F statistic is more than 5%, so the research model has common effects (panel data).

The results of regression analysis of the research model to examine the hypothesis of its research are presented in Table (4).

VIF values (variance inflation factor) are an indices for examining the collinearity between independent variables. If its value is higher than 10, there will be a possibility of collinearity between the independent variables. The value of this index for variables is less than 1.670. The value of t-statistic for ABILITY is 1.983133 and is significant and positive at 95% confidence level. The value of t-statistic for D1 * ABILITY is 3.779366 and is significant and positive at confidence level of 0.95. The value of t-statistic for $\Delta Earning_{it}$ is 0.361355 and is non-significant at 95% confidence level. The value of t-statistic for $\Delta NetAsset_{it}$ with -0.420779 and is non-significant at 95% confidence level. The value of t-statistic for $\Delta InterestExpense_{it}$ is 0.706854 and non-significant at 95% confidence level. The value of t-statistic for $\Delta Divindednds_{it}$ is -0.020139 and non-significant at 95% confidence level. The value of t-statistic for $Leverage_{it}$ with -6.513443 is significant and negative at 95% confidence level. The value of t-statistic for the intercept is 3.704230 and in the area of non-rejection of the null hypothesis at 95% confidence level. It means that intercept is significant, so the fitted model for this study is as follows:

$$EXRET_{it}=0.520224+2.244536 \ ABILITY_{it} +2.083560696D1* \ ABILITY_{it}-1.359502 \ Leverage_{it} +\varepsilon_{it}$$

Table 4

Results of research model estimation

Parameters	Value of coefficients	T value	Probability value	Result	VIF
B	0.520224	3.704230	0.0002	Significant and positive	-
ABILITY	2.244536	1.983133	0.0478	Significant and positive	1.003
D_{1*} ABILITY	2.083560	3.779366	0,0006	Significant and positive	1.666
ΔEarningit	0.040667	0.361355	0.7180	Non-significant	1.670
ΔNetAssetit	-0.008989	-0.420779	0.6741	Non-significant	1.001
ΔInterestExpense$_{it}$	0.043640	0.706854	0.4799	Non-significant	1.010
ΔDivindedndsit	-0.002239	-0.020139	0.9839	Non-significant	1.001
Leverageit	-1.359502	-6.513443	0.0000	Significant and negative	1.012
F value		6.772739	F probability value		0.000000
Coefficients of determination		0,624834	Durbin-Watson		1.781156

According to "Durbin-Watson" statistic of the first model shown in Table (4), the value of this statistic is 1.781156, which is between 1.5 and 2.5. Therefore, it can be stated that there is auto-correlation between observations in the model. The t-statistic for the explanatory variable of ABILITY (with beta of 2.244536) is 1.983133 and the significance level of this variable is 0.0478, which is statistically significant and positive at the 95% confidence level (Table 4). Therefore, the first hypothesis of the research that there is a significant relationship between management ability and the cash final value is confirmed. The t-statistic for the explanatory variable of D1 * ABILITY (with beta 2.083560) is to 3.779366 and the significance level of the mentioned variable is 0.0006, which is statistically significant and positive at the 95% confidence level (Table 4). Therefore, the second hypothesis of the research that states in companies with higher management ability, the cash final value is higher is confirmed.

Conclusion

The present study aimed to investigate the relationship between management ability and the cash final value in companies listed on the Tehran Stock Exchange. The present study was conducted based on the theory and research presented by Jean and Park (2017). The results of the statistical test of research hypotheses indicate the confirmation of research hypotheses. According to the research results, there is a significant relationship between management ability and real earnings management. This means that the final value of one Rial of cash earned by companies increases in line with the increase in management ability. This issue can be justified based on the balance and agency theories. Finally, the results revealed that the final value of cash changes and

improves over time and the management ability improves. In companies with higher management ability, the cash final value is higher and the level of this impact per unit is 2.083560 units.

The root of non-consistency between the effectiveness of the first hypothesis and the second hypothesis of this research with Jean and Park's research (2017) can be attributed to statistical populations of these two studies. Due to the similarity of the test model in both studies, Jean and Park (2017) used the information of American companies listed in the US stock market to collect the data needed for their research. However, the data required for this study were selected from the population of companies listed on the Tehran Stock Exchange. Therefore, the only fundamental difference in these two studies is due to their statistical populations. The first hypothesis shows that there is a significant relationship between management ability and the cash final value. Managers as regulators of corporate liquidity policies should note that having high liquidity in the company reduces the cash final value, and this is especially true for the inflationary conditions in Iran.

Thus, managers are recommended to pay attention to the issue of low cash return and devaluation of the final cash over time when formulating the company's liquidity policies. It should be also noted that just having high liquidity does not mean a good company. Also, according to the research results, having surplus liquidity has reduced the return of shareholders. Thus, investors and analysts are recommended to pay attention to the cash final value as one of the important and effective components in the future status of the company in their investment decisions. The results of testing the second hypothesis show that the manager's abilities can increase the cash final value. Based on the Hambrick and Mason (1984) theory, the outputs of the organization as well as strategic choices and levels of performance are greatly influenced by the managerial characteristics, which is in line with the conducted research. Thus, investors and creditors in the Tehran Stock Exchange are recommended to consider this impact in their analysis and decisions, and to consider the ability of companies to use resources. Shareholders of companies listed on the stock exchange are also recommended to review the background of managers in terms of the ability to use the resources of companies according to the model presented in this study when selecting board members.

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COGNITIVE FACTORS ON EXPORT PERFORMANCE CONCERNING BEHAVIORAL FACTORS (CASE STUDY: SOUTH ZAGROS OIL EXPLOITATION COMPANY, NATIONAL IRANIAN OIL COMPANY)

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ABSTRACT

The present study aims to investigate the influence of cognitive elements on export performance, with a focus on the mediating role of behavioral components (Case study: South Zagros Oil and Gas Exploitation Company - South Zagros Headquarters of Tehran Ministry of Oil). This research is applied in terms of purpose and a field-correlational study in terms of nature. To gather data, a library-field technique and a questionnaire were utilized. The study's statistical population included all employees at the South Zagros Oil and Gas Exploitation Company's headquarters in Tehran. The questionnaires were sent to a sample of 207 persons after the calculations were used to ensure the validity and reliability of the created scales. The data were analyzed using descriptive and inferential statistics, as well as the structural equation approach, and the questionnaire data were analyzed using LISREL-8.80 and SPSS-26 software. The findings of the study show that cognitive variables influence the company's behavior and export performance. Export performance is also influenced by behavioral variables. The findings also revealed that behavioral variables mediate the influence of cognitive elements on export performance.

Keywords: export performance; cognitive factors; behavioral factors.

Introduction

Exports are crucial in modern economies because they give consumers and businesses greater markets for their products. Strengthening economic trade, encouraging exports and imports for the advantage of all trade participants, is one of the fundamental purposes of diplomacy and foreign policy between states. Companies must identify elements impacting their export performance in order to survive and prosper in the development of export activities (Mosleh et al., 2016). A substantial portion of the basic demands of a successful export may be recognized and the necessary capabilities can be applied by evaluating the elements impacting export performance (Bakhtiari and Bakhshandeh, 2019). Examining cognitive influencing variables might help decision-makers better understand how they think about and solve challenges. Companies are facing the shadow of development and success in exports due to numerous obstacles (such as low competitiveness of export products, inadequate transportation systems, lack of accurate identification of customer needs, lack of accurate identification of climatic, cultural, social, economic, etc.). (Ghazizadeh et al., 2011). The importance of exports in the success of the economy at the micro (organizational) and macro (national, regional, and international) levels, as well as their sensitivity due to the presence of numerous obstacles, necessitates paying attention to and understanding the effective and supporting factors in this area. So far, studies have focused on either understanding the interaction between individual and organizational level elements in the development of dynamic skills (Salvato and Vasolo, 2018) or focusing on the behavioral triggers

of dynamic capacities (Arendt, 2018). However, little study has been done on how various elements interact at the firm level and the nature of their combined influence on international expansion and market debate. Many cognitive and behavioral aspects influence how investors make decisions. As a result, behavioral variables in financial concerns and even exports have emerged (Saif Elahi et al., 2015). Several studies have attempted to identify the essential measures of success in financial markets and exports, emphasizing the study of export performance as a critical topic, among which cognitive and behavioral aspects may be noted, among all the elements impacting export performance. Cognitive variables are a collection of internal and environmental elements that influence interpersonal interactions (Mahmoudi et al., 2017). According to Wojcik et al. (2020), three behavioral elements - corporate business model redesign (business modeling), participation capability, and the level of learning about foreign markets - are directly linked to export performance. These are caused by two different sorts of management cognitive processes. The first is managers' "pull strategy" thinking and their "global mindset," which allows them to learn more about overseas markets. These three behavioral characteristics when combined can lead to exceptional export success.

The Pars Oil and Gas Company (POGC), a subsidiary of the National Iranian Oil Company, is in charge of developing South Pars' 24 stages, which are expected to cost more than $100 billion. Each of the 24 stages combines natural gas production with gas condensate or natural gas liquids production (NGPL). When all phases are completed, annual gas production is expected to reach 270 billion cubic meters. The initial concept for Iran's comprehensive gas plan was to use phases one to ten of South Pars for domestic consumption and re-injection of fields, while assigning the gas generated from the remaining phases to exports (Bakhtiari and Bakhshandeh, 2019).

Generally, the majority of study in the topic of export performance reveals a worse than ideal condition in businesses. The improper position of cognitive-behavioral elements among the members of the organization appears to be one of the causes of this problem. As a result, the influence of cognitive and behavioral aspects on export performance must be investigated. While determining the state of cognitive and behavioral elements, attention and relevance to this problem also exposes the impact of these factors on export performance.

Theoretical foundations
Export performance

The relative success or failure of a company's or country's efforts to sell domestically produced products and services in foreign nations is known as export performance. Because exports indicate a country's success in international commerce, export performance is an important aspect of international rivalry (Tavalier and Conte, 2021). Different performance indicators may be used to evaluate the amount of export performance, including objective performance indicators such as profit, subjective performance indicators such as customer behavior indicators, or a mix of these two indications (Mosleh et al., 2016). In recent years, many research on export performance have been examined, but there is still no universal and complete idea for it. The export performance of a corporation is one of the metrics used to determine its success rate (Sanobar et al., 2019). In the study of export marketing, export performance has been an important structure. In this sense, objective indicators are connected to indications of absolute performance, whereas subjective indicators are related to the business' performance in comparison to its primary rivals or in comparison to the company's expectations.

Cognitive factors
There are two types of cognitive factors: (Wojcik et al., 2020):

1. Stretching mindset: Regardless of the resources available, stretching stresses strategy formulation, the necessity of creativity, activism, risk-taking, and grabbing chances. In reality, the traction strategy mentality is linked to an element's managerial understanding at the individual level of worldwide dynamic capability. In other words, business leaders must concentrate on solutions that involve more time and risk.

2. Global mindset: A global mindset demonstrates an awareness of cultural and market variety, as well as a desire and capacity to merge this diversity. As a result, the global mentality assists businesses in finding possibilities in foreign markets and enhances the international economic activity process.

Behavioral factors

One of the key concerns of these firms' executives is the factors that influence their export performance. One of the most essential components in achieving a balance between the country's economy and the global economy is identifying the variables that influence export performance and improving it. Lack of attention to the elements impacting the development of export performance in these firms will result in several obstacles that will ultimately limit exports, profitability, and the company's position, while also having a negative impact on the economy (Aghazadeh et al., 2020).

1. Business modeling

A business model is a collection of managerial decisions and their repercussions. Business process modeling may be thought of as an analytical method for charting an organization's growth. As a result, it is an excellent tool for corporate management. Also, because business modeling is about changing how a firm functions, it must reorganize its resources and skills in some way (Wojcik et al., 2020).

2. Participation capability

Mutual commitment between the firm and its peers is required for successful worldwide export performance. As a result, the establishment and maintenance of inter-firm partnerships has become a typical organizational capability for internationalizing in a step-by-step and quick manner since it gives access to external resources (such as information) and competencies that a focal business lacks. As a consequence of this feature, the export performance will improve, and as a result, it will impact the choice to enter the international market (Wojcik et al., 2020).

3. Learning about foreign markets

Background, trends, and results are all factors in foreign market learning. The integrated model comprising multiple methodologies demonstrates how businesses may profit from and learn from variations in international markets, as well as the outcomes. The findings of a model of dependence on suitable resources to enter foreign markets are the outcomes of a resource dependency model for foreign market entrance mode in competition for developing markets (Manafzadeh Hir et al., 1400).

When it comes to upgrading internationalization models, knowledge development is crucial. International markets may present both challenges and possibilities for managers, as well as impact company export success (Sanobar et al., 2019). Tensile and global mentality techniques, in particular, have an impact on the development of business modeling and participation, enhancing one's capacity to engage, model business, and learn about international markets (Wojcik et al., 2020). The research's conceptual model is depicted in Figure (1).

Literature review

The effect of customer orientation on the export performance of home appliance exporting companies, considering the effect of modulators of trust, communication, and behavioral commitment, was investigated by Mohammadi et al. (2016), who found that all three variables of

trust, communication, and behavioral commitment affect the relationship between customer orientation and export performance.
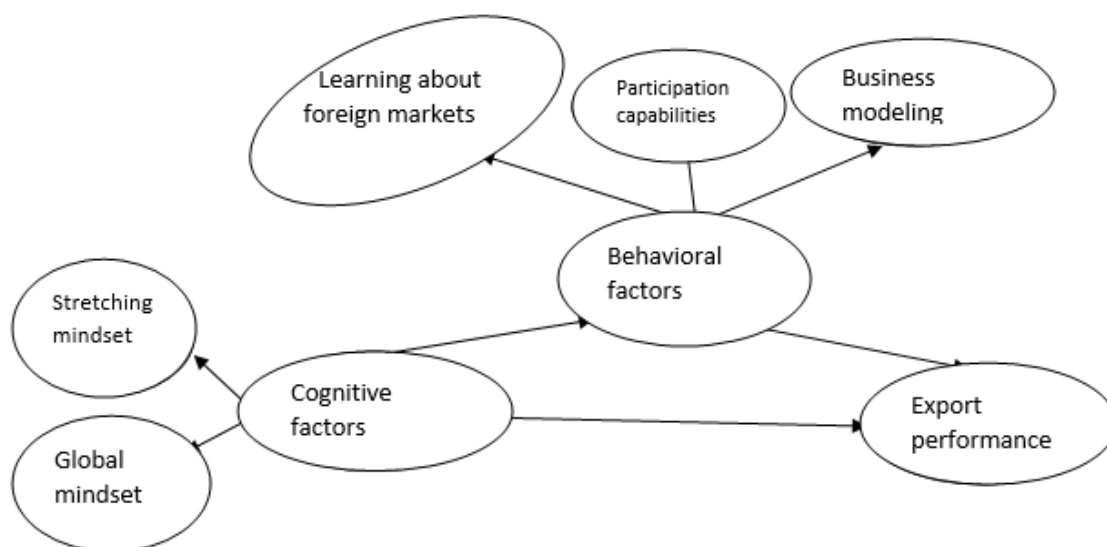

Figure 1 – Conceptual research model (Wojcik et al., 2020)

The goal of Alavi and Ghiasabadi's (202) study was to see if the influence of investors' behavioral emotions on credit and business rank might be moderated by systematic investor competition. Investors' behavioral emotions, according to the findings, have an impact on the company's credit and corporate reputation. Furthermore, the link between investors' behavioral emotions and the company's credit and commercial reputation is moderated by systematic investor competition.

Using a structural equation technique, Rezaei et al. (2021) investigated the influence of variables impacting the development of halal food exports. All health, religious, behavioral, and marketing aspects have a substantial impact on the export of halal food goods, according to the findings. When comparing the four elements that determine the export of halal food brand items, marketing considerations have the most impact. The health of the product, as determined by health factors, the transparency of the production process, as determined by behavioral factors, advertising and proper brand introduction, as determined by marketing factors, and how to present the halal product and halal brand, as determined by religious factors, all had the greatest impact on the export of halal brand food products.

Wojcik et al. (2020) examined the influence of cognitive and behavioral components on export performance from a dynamic capacities approach in another study. The findings revealed that "traction strategy" has a favorable and significant impact on two behavioral elements: business modeling and involvement. The global mindset has a big and good impact on business modeling and learning about other markets, but it has a detrimental impact on participation. Only two of the three behavioral factors had a favorable impact on export success. The direct route coefficient from learning about foreign markets to export performance was positive but small, contrary to expectations.

Mata et al. (2021) studied the influence of institutional assistance (financial and marketing support) on the success of export-oriented or so-called global enterprises. Their findings suggest that government marketing support improves competitiveness and export performance. Sponsorship, on the other hand, has no impact on competitiveness or export performance. They identified competition as an important mediator in enhancing the link between marketing assistance and export performance.

The influence of export promotion programs (EPPs) on export performance was investigated by Motta et al. (2021). The findings revealed that participation in EPP had a beneficial impact on company export success, particularly for enterprises with prior export expertise, demonstrating the value of utilizing these programs. Company size has a positive link with export success, but firm longevity has a negative relationship with export performance, according to the data. Companies' export performance suffers when they do not adapt their tactics. Finally, membership in the EPP did not appear to have an impact on the export performance of enterprises who had never exported before.

Methods

The current study is of the correlation type (due to the study of the effect of variables on each other), field (due to the use of questionnaires as data collection tools), applied nature (due to the study title in a specific community), and cross-sectional time (due to the study title in a specific community) (due to time constraints). The sample size for this study was 450 participants, and 207 samples were chosen to distribute the questionnaire using Cochran's method with a 0.05 error rate. The approach of random sampling was applied. Data were gathered via a questionnaire. Table 1 shows the results of the questionnaire (1).

Table 1

Specific information of the questionnaires used in the research

Questionnaire	Dimensions	Number of items	Authors
Cognitive factors	Stretching mindset	3	Hamel and Prahalad, , 1995
	Global mindset	6	Nummela et al., 2004
Behavioral factors	Business modeling	9	PiotrWojcik and Mariola Ciszewska-Mlinaric (2020)
	Participation capability	4	Theoharakis et al., 2009
	Learning about foreign markets	11	Musteen et al., 2014
Export performance	-	3	PiotrWojcik and Mariola Ciszewska-Mlinaric (2020)

The validity of the questionnaire is assessed using the face validity approach in this study. A number of specialists, including the instructor, will be handed the questionnaire, and questions concerning the questions and the evaluation of the hypotheses will be asked. The confirmatory factor analysis test is also used to assess the study construct's validity.

Table 2

Reliability of research variables

Variable	Dimensions	Cronbach's alpha
Cognitive factors	Stretching mindset	0.76
	Global mindset	0.85
Behavioral factors	Business modeling	0.82
	Participation capability	0.81
	Learning about foreign markets	0.78
Export performance	-	0.79

This study's data analysis is divided into two sections: descriptive statistics and analytical

or inferential statistics. The statistical Lisrel-SPSS software was employed in this case.

Findings

There were 137 males and 70 females among the 207 workers of the South Zagros Oil and Gas Exploitation Company in Tehran who responded to the survey. The age group of 30 to 40 years old had the largest frequency of responders, accounting for 37.2 percent of the total sample size with 77 participants. Participants with a bachelor's degree also had the largest sample size (113 people), while those with 6 to 10 years of employment history had the greatest frequency (65 people). The state of descriptive statistics of variables is shown in Table 3. SPSS software was used to compute the figures in this table.

Table 3

Descriptive statistics of research variables

Variable	Sign	Mean	SD	Variance	Skewness	Elongation
Stretching mindset	CF1	3.73	0.57	0.32	-0.10	0.21
Global mindset	CF2	3.57	0.66	0.44	-0.28	0.00
Cognitive factors	CF	3.62	0.56	0.32	-0.22	0.21
Business modeling	BF1	3.62	0.61	0.38	-0.05	-0.21
Participation capability	BF2	3.45	0.78	0.60	-0.16	-0.51
Learning about foreign markets	BF3	3.83	0.53	0.28	-0.38	0.23
Behavioral factors	BF	3.69	0.51	0.26	-0.08	-0.31
Business performance	EP	3.29	0.73	0.54	-0.06	0.35

Descriptive statistics indices such as the mean, which indicates the propensity to center, have been utilized, as shown in Table (4). The results indicated that the average of all components is more than 3, and that an average greater than 3 implies that the status of that variable in the above statistical population is agreed upon. As a result, this factor suggests that respondents concur with these elements. Variance and standard deviation, on the other hand, were utilized as dispersion indexes. The variable dimensions of behavioral components have the biggest standard deviation for the participation ability component, which shows the degree of data dispersion in this index relative to the average.

Furthermore, the findings of the Cognitive Factors Questionnaire's factor analysis revealed that the measurement indicators of each of the scales employed had a t-value larger than 1.96 at the 5% confidence level, indicating that the observed correlations are significant.

The measurement indicators of each of the scales utilized at the 5% confidence level of t-value are more than 1.96, indicating that the observed correlations are significant, according to the results of confirmatory factor analysis of the Behavioral Factors Questionnaire. The Export Performance Questionnaire's factor analysis revealed that the observed factor load is more than 0.3 in all situations, indicating that the correlation between hidden variables (dimensions of each of the primary structures) and observable variables is satisfactory. The measurement indices of each of the scales utilized at the 5% confidence level of t-value are more than 1.96, indicating that the observed correlations are significant, as shown in Figure (2).

Figures (2) and (3) show the final model for testing the study hypotheses (3). This model was created by modifying the LISREL program output.
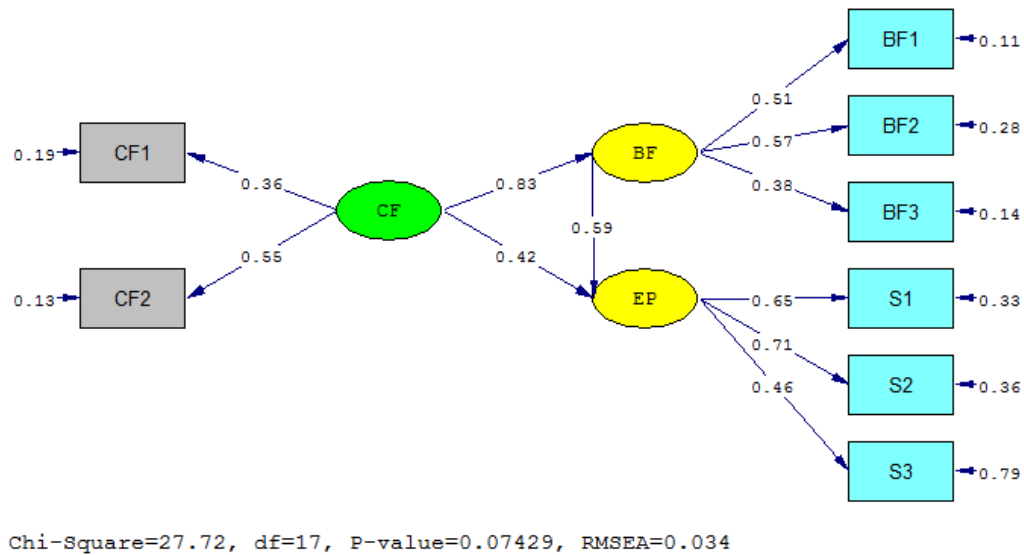
Chi-Square=27.72, df=17, P-value=0.07429, RMSEA=0.034

Figure 2 – Results of confirmation of the final model of the relationship between research variables
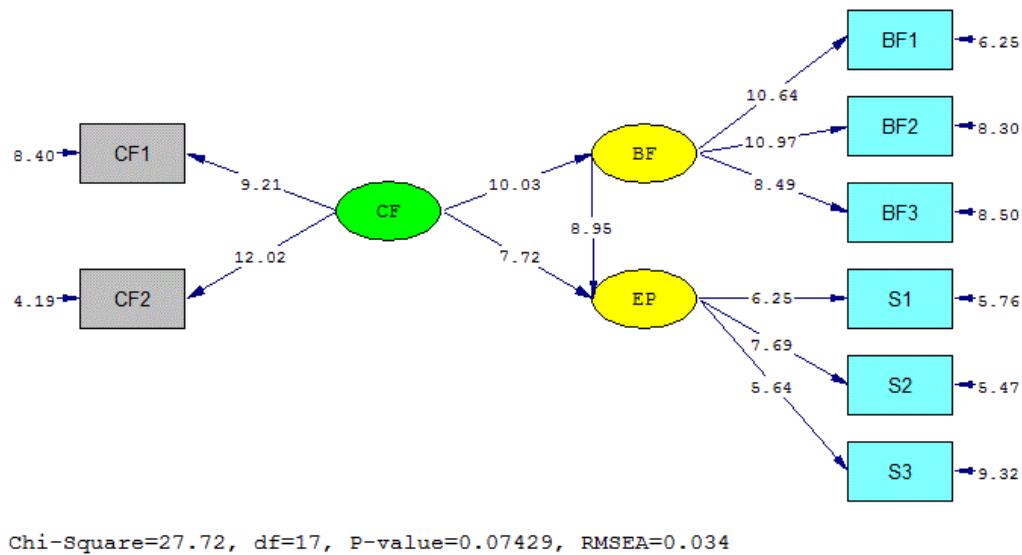

Chi-Square=27.72, df=17, P-value=0.07429, RMSEA=0.034

Figure 3 – T-value statistics, the results confirm the final model of the relationship between research variables

Figures (2) and (3) depict the outcomes of the research's final model. All communications have a factor load of observation larger than 0.3, indicating that the correlation between the study variables is adequate. Furthermore, the t-value is larger than 1.96 at the 5% confidence level, indicating that the observed correlations are significant. Because the value of its normal chi-square index is equal to 1.63, which is a number between 1 and 3, this model has a decent fit. The model also fits well since the root mean index of the mean squared is around 0.034. Other goodness-of-fit indices are allowed in the range in Table (4).

Table 4

Goodness of fit indices of research hypotheses

Fitness indicators	$\dfrac{\chi^2}{df}$	RMSEA	(GFI)	(AGFI)	(NFI)	(NNFI)	(IFI)
Acceptable values	3-1	<0.05	>0.9	>0.9	>0.9	>0.9	>0.9
Calculated values	1.63	0.034	0.94	0.95	0.98	0.93	0.97

Table 5

Test results of the main hypothesis

Path	Standard coefficient	Significance number	Test result
Cognitive factors - export performance (direct impact)	0.42	7.72	Confirmed
Cognitive factors - Behavioral factors	0.83	10.03	Confirmed
Behavioral factors - export performance	0.59	8.95	Confirmed
Cognitive factors - Behavioral factors - Export performance (indirect effect)	0.59×0.83=0.49	6.68	Confirmation of the partial mediation hypothesis
Total impact	0.49+0.42=0.91		

The direct influence of cognitive elements on export performance has been established at a 5% error level, according to the data in Table (5). (significant number 7.72). The interaction between cognitive and behavioral components was 0.83 and significant (10.03), and the interaction between behavioral and export performance was also significant (8.95). Because of the importance of the two pathways of cognitive factors - behavioral factors and behavioral factors - export performance, the indirect influence of cognitive factors on export performance with the presence of behavioral factors is substantial. Total cognitive components have an influence on export performance of 0.91, which is higher than the direct effect. As a consequence, the behavioral elements variable in this path may be considered a partial mediator, and the research's primary premise is verified. Figures (2) and (3) reveal that the strength of the link between cognitive characteristics and export performance is 0.42, indicating that the correlation is positive. The test's t-test result is 7.72, which is higher than the critical value of t at a 5% error level, i.e. 1.96, indicating that the observed correlation is significant. As a result, cognitive characteristics can be stated to have a beneficial impact on export success.

Figures (2) and (3) also reveal that the strength of the association between cognitive and behavioral components is 0.83, indicating that the correlation is positive and strong. The test's t-test score is 10.03, which is higher than the crucial value of t at the 5% error level of 1.96, indicating that the correlation is significant. As a result, cognitive considerations can be considered to have a beneficial impact on behavioral elements. According to Figures (2) and (3), the strength of the link between behavioral characteristics and export performance is 0.59, indicating a positive correlation. The test's t-test result is 8.95, which is higher than the critical value of t at the 5% error level, which is 1.96, indicating that the observed correlation is significant. As a result, behavioral characteristics can be stated to have a beneficial impact on export success.

Conclusion

The present study aimed to investigate the effect of cognitive factors on export performance with respect to behavioral factors in the South Zagros Oil Exploitation Company, National Iranian Oil Company. With regard to the mediating influence of behavioral components, the findings revealed that cognitive aspects had a considerable impact on export performance. The findings of this hypothesis' research revealed that cognitive variables had a direct influence of 0.42 on export performance and an indirect effect of 0.49 owing to the mediating function of behavioral factors. As a result of the indirect path's stronger influence than the direct path's, the

presence of a mediating variable boosted the effect, confirming the mediating function in the current hypothesis. In addition, the indirect path had a substantial value of 6.68 (more than 1.96). Wojcik et al. (2020) investigated cognitive and behavioral aspects on export performance in a similar way to the current study, with the exception that they found two of the three behavioral elements to have substantial and positive impacts on export performance.

The findings revealed that cognitive characteristics had a direct impact on export performance, with a 0.42 effect and a significant path coefficient of 7.72. (more than 1.96). As a result, an increase in cognitive components correlates to an increase in export performance at a 95% confidence level. The indicators of cognitive characteristics explored in this study, such as the tensile mentality index and the global mindset, may be stated to have an impact on export performance. This is in accordance with the findings of Ilbeigi et al. (2015), who found that export market dynamics had an impact on export performance since they alluded to the stretching of cognitive elements. According to Altern and Tadvaran (2016), the more predictable and stable the export market environment, the more likely the exporter is content with the amount of complaints and the percentage of margins that pointed to the stretched attitude, which is consistent with this study. Mata et al. (2021) discovered that competitiveness has a substantial role in improving the association between marketing support and export success, which is consistent with our study.

Furthermore, because the strength of the association between cognitive and behavioral components was 0.83 and the t-test value was 10.03, it can be concluded that there is a relationship between the two variables and that cognitive factors directly impact behavioral aspects. Because the strength of the link between behavioral variables and export performance was 0.59 and the t-test value was 8.95, the results indicated that behavioral factors had a direct impact on export success. As a result, behavioral characteristics appear to have a direct impact on export performance. To put it another way, concentrating on business modeling, involvement, and learning about overseas markets can have an impact on export performance. Given that the oil and gas industry is the backbone of our country's economic development, behavioral variables must be given specific consideration. This issue is consistent with the findings of Khademinia and Oshk Sarai (2016), Mazraati and Ravanbakhsh (2016), and Jafari and Naghiloo (2017), who found behavioral commitment to be useful in improving export performance. Rezaei (2016), who believed international marketing tactics were successful in improving export performance, mentioned the need of learning about other markets, which is in line with this study. In their research, Kavo et al. (2019) found that marketing analysis had a favorable influence on marketing choices and product development management.

Because each company has its own culture and climate, the conclusions of this study cannot be applied to any other. It is suggested that firm management assess assumptions about how companies compete and carry out hazardous initiatives on a regular basis. Regardless of the activities of rivals, corporate management should plan development independently based on its judgment of opportunities. Furthermore, based on the findings, it is preferable for firm executives to select the appropriate technique of communication with overseas markets (existing media, methods used, type of message, costs).

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A STUDY OF THE FUNCTION OF THE PROJECTS WITH THE USE OF EARNED VALUE IN MAHSHAHR'S PETROCHEMICAL PROJECTS

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ABSTRACT

The study at hand was conducted with the aim of using the system of earned value management in the petrochemical projects of Mahshahr. In terms of its objective, the project is performance-oriented and practical, and in terms of its method, it was a descriptive-survey research. The statistical society of the present research consists of the main employer, and minor contractors, experts and professional specialists in the petrochemical projects of Mahshahr at the number of 100 individuals and consensus-counting was used while the sample volume was equal to the entire research's target society amounting to 100 among whom the questionnaire was distributed. The collected data was put to analysis by the use of descriptive statistics (average, standard deviation and the etc.) and the deductive statistics. With the results attained from the variables of the earned value management system, it became clear how one can exploit this new system as a viable tool in the assessment of the performance of the projects and specially construction projects. In addition, with the reconnaissance of the effective dimensions in such indexes as time and costs, and their relation with the project's performance, we managed to come to a proper assessment of the performance of the project. What was brought into resolution through this research was the necessity of the application of this system in projects' management with the aim of gaining the maximum amount of performance in time and cost dimensions. What became established in this research was the necessity of applying and putting to use the system of the earned value management in all stages of the work and, especially, such an application was conclusively demonstrated in the petrochemical projects of Mahshahr.

Keywords: earned value management; cost; time; project control; Mahshahr's petrochemical projects.

1. Introduction

With the aim of planning and a more effective control over the projects, applying the indexes suggested in EV method, by the side of the traditional indexes (like the project's physical fulfillment percentage, the percentage of budget absorption and the like) can be rendered highly

effective. In a project-based organization, such indexes can be turned into consistent outputs of the planning system and control of the organization's projects and thus create viable feedback for the other parts. Budget and time related processes cannot be regarded independent from each other and the impact that each bears on the other one cannot be neglected. This is a topic disregarded in the traditional methods of project control (Martinsou et al, 2017).

The management of the earned value, conducted with the aim of controlling and planning costs in their various forms, is a common method in application for assessing the performance of the projects and it does bring to unity time, cost, and limits assessment and thus assists the project management team for evaluating and assessing the project's performance. The process of the production of the aforementioned indexes, which must be conducted in the Projects Management Office (PMO), can in practice result in the creation of information-based surplus value over the data pool (Banihashemi et al, 2017).

The methodology of the calculation of the percentage of the project fulfilment in the management of the earned value is the most central concept to guarantee the accuracy of the results of such analyses. The traditional and common methods used for assessing the physical progress of the activities relevant to a project and, naturally, the contractual payments is of no use here and thus for using the method of the earned value from the project in an organization, one must renew the control and calculating methods of the projects on the basis of the engineering method (Marie et al, 2017).

The information circulation in most organization regarding the financial processes, especially the financial affairs of the projects, is usually not in real time, meaning that the executed financial transactions are informed to the control units of the projects with a considerable temporal delay. As a result, gathering information in this area is one of the complications of project planning and control in companies. Assessing the liable individuals' performance in projects and even the units of one single organization is one of the most important control processes in management and also one of the outputs of the process of the improvement of the organization in the area of human resource management. The documents attained through this assessment can be put to use for improving the work process of the organization and its selected criteria for executing future activities. The first and most important stage of the process of performance assessment is to determine useful and effective indexes for doing this activity (Banihashemi et al, 2017).

The question of earned value management is quite significant in change management too. One of the determined factors in this method, with regard to the fact that it fully encircles the project, is determinant of change within the limits of the project and taking necessary corrective measures. Project managers can use this technique before the project reaching 15% of progress in its performance by studying the procedure of the project performance in order to come to an exact and reliable prediction of the final status of the project with regard to the time and costs required for completing the project; this is why the earned value management is called a light at the end of the tunnel of management. Even though the materialized earned value management is conducted for pursuing the time and costs, still the majority of the past research demonstrates that the cost aspect of it is mostly brought into attention. This is because even the existing temporal indexes are articulated on the basis of the cost unit. The research conducted recently in this area are compiled on the basis of temporal unit (Mishakowa et all, 2016).

The laws of Earned Value Management (EVM) are established on the basis of performance assessment. One of the techniques used in unifying various processes and also assessing the performance of the project from A to Z. This technique is used as a methodology in the management of the unification of the project and, in other project management areas, is used as a tool for assessing the performance against the project planning (Krikhov et all, 2016).

One of the important concerns of the project managers and individuals involved is to be able to finalize the project in accordance with the predetermined and scheduled planning and doing so with regard to the complications and added sensitivities in projects especially in the project-based organizations is particularly important. One can daresay that a manager can become aware of the ways in which the objectives are met and operations are pursued with the help of the control process and thus become enabled to assess and correct them.

In this area, earned value management is a technical tool completed for the first time by the American Academy of Project Management (AAPM) can be of great assistance to the managers. One of the most important objectives of the project management teams is that they should be able to finish a project in accordance with the budget, time-table, and by the key coverage of the work limits. As a result, it is felt that these factors are required to be under constant control. Now, with the use of the system of earned value management, we are in pursuit of address the performance of the managerial system in the petrochemical projects of Mahshahr.

2. The Methodology of the Research

With regard to the points mentioned above, the project's method is descriptive and in kind it is a survey method. In addition, in terms of its objective the present research is practical and in terms of its status is a field study. It is practical given the fact that one of the issues or problems existing in the organizations and economic sectors of country and the conclusions drawn on the basis of its findings can be helpful for the managers in providing answers to their questions. And, with regard to the method, it is descriptive-correlation. Its statistical society consists in individuals or units with at least one share attribute. The statistical society of the present research consists of the main employer and the minor contractors, experts and professional specialists in the petrochemical projects of Mahshahr amounting to 100 individuals involved as staff. In this research and due to the limited volume of the statistical society, there is no sampling done and instead a consensus-survey is applied and thus the sample volume equals the entire society under research equal to 100 individuals. In this research, two methods of statistical analysis will be used: 1) descriptive analysis. 2) The application of the methods of time-related and cost-related information-analysis, and the performance of the projects will be conducted through Gantt chart, cpm, pert, and its comparison with EMV, project management software, in addition to the use of deductive analysis and for processing and analyzing the normal data and investigating research assumptions in which structural equations, software psl and spss software, 22nd version, will be used.

Research Questions:

What is the relationship between project management techniques in surplus value management which consists of resource planning and technical costs, and also the requirements of such planning?

What is the relationship between earned value management system and its indexes in the improvement of the projects' performance?

What is the relationship between the earned value management system and its indexes in the improvement of the projects' performance and time?

What is the relationship between the earned value management system and its indexes in the improvement of the projects' performance and cost?

According to the above table, it can be observed that all scales of a significance level over 0/50; thus, they have a normal distribution. For gaining the normalcy of the data through Kolmogorov-Smirnov, if the sig of the variables is over 0/05, the data would be normal and if it be under 0/05, then the data would be non-normal. As a result, for studying the relationship between research variables, one can use correlation parametric test with regard to the distribution of the

scores in both scales. In other words, with regard to the distribution of the scores, in both scales and their relevant micro-scales are normal. Here, we use parametric statistics methods in which Pierson test is applied as a parametric test for investigating the extent of the correlation of the variables.

Research Findings:

Table 1

The data's normalcy through Kolmogorov-Smirnov (S-S) test

The result of the distribution's (lack of) normalcy	Significance level	k-s amount	number	Variables
normal	0/563	/860	100	Project performance
normal	0/512	/880	100	costs
normal	0/529	/760	100	time

3-1 Descriptive Findings

Before conducting the principal analyses, a number of preliminary analyses were done with the aim of coming to the primary insights in relation with the data. In this research, in total, the relationships among 3 variables have been studied within the suggested model. The descriptive findings pertinent to the average, standard deviation, and the highest and lowest triable scores on research variables are demonstrated in table (2) and the correlation matrix of the model's variables are demonstrated in table (3).

Table 2

The descriptive findings pertinent to the research variables for the entire triables:

The highest	The lowest	Standard deviation	average	Variables
31	5	8/28	26/14	Projects' performance
20	3	5/92	15/86	Costs
15	2	4/96	11/03	time

N= 100

As it can be discerned by the content of the table (2), the average (and standard aviation) of the entire sample (that is, 100 individuals) in the projects' performance is 26/14 (8/28), costs 15/86 (5/92), time 11/03 (4/96).

Table 3

The matrix of the correlation of the model's variables:

3	2	1		
		1	Projects' performance	1
	1	0/86**	Costs	2
1	0/74**	0/84**	time	3

**$P<0/01$

The content of the table (3) demonstrates that the assumed notion of the relationship among variables is in accordance with the expected paths. This means that the entire relations on significance levels have had a significance of 0/01. These correlation analyses provide an insight into the relations between dual variables existing in the variables of the study. For the simultaneous of the notion of the assumed relations in the present research, the path-alteration method has been exerted.

3-2. the deductive analysis of the research variables

The method of earned value management (EVM) is one of the very important techniques which, in the last three decades, has been used for calculating the actual progress of the project and/or, in other words, for the comprehensive and unified management of the project.

Using (EVM) method, in technical projects, with the intention of assessing the performance of the projects and the results in progress and it impact on budget-planning of the projects, is completely observable. This requires assessing some of the main bases such as the costs of project completion and its termination date which, in this method, one first addressed the identification and approximation of the time and costs required for fulfilling the project. In this method, after having fulfilled the assessments mentioned above, one follows with the analysis of each of the indexes pertinent to the project's performance. Here, the time and costs assessed are analyzed and determined via particular parameters, tables, and formulas.

The first question of the research

What is the relationship between project management techniques in the surplus value management which consists of the source planning and technical costs in addition to the planning requirements?

In this research, the quotes or questions in the questionnaire, consisting of 21 questions, are considered as the observed variables, where these 21 questions for the indexes of costs (8 questions), time (9 questions), and performance (4 questions) as the lurking or latent variables.

The first question of the research was investigated on the model of structural equations. Considering the results of the study of relation between the independent and dependent constructs, by the use of the relevant co-efficient, one can address the significance of the impacts between the constructs of the first research question. In the present research, smart pls software is used. This software is compatible with the existence of certain conditions such as collinearity of the independent variables related to the lack of normalcy in the data, and the smallness of the volume of the sample.

In psl models, two models are put to test. The exterior model is equivalent to the measuring model and the interior model similar to the structural model in the models of structural equations. The interior model represents the load factors of the observed variables and the relationship between the latent or lurking variables of the research. The conceptual model put to test is presented in the figure and the numbers on the lines are the beta coefficient resulted from the regression equation between the variables which is the path coefficient and expresses the load factors are demonstrated the numbers within circles represent the amount of R2 of a mode whose predictive variables have entered that circle via an arrow.

For studying the amount of the significance of the path coefficient, it is required to demonstrate the amount of t in each path in which all paths have become significant at the level of 0/95.
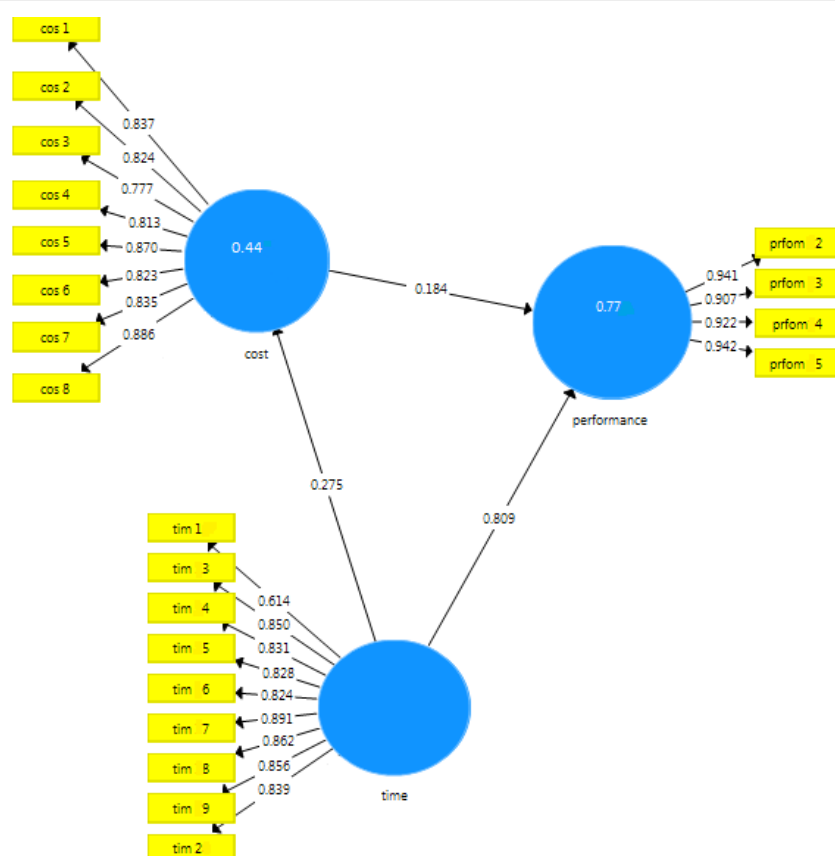
Figure 1 – The output of pls software

Table4

Results of t-test for research's variables

Significance level	t	Standard deviation	Average sample	Main sample	Variables
0/023	8/236	0/092	0/226	-0/219	time ← cost
0/018	6/237	0/072	0/208	-0/189	time ← performance
0/001	12/298	0/083	0/520	0/452	cost ← performance

As demonstrated in table (7), the amount of t of each path under study in the model is above the standard amount of the absolute value, that is, 92/5 and an evidence for the significant relationship between the research dimensions and the first question of it which is thus rendered valid.

The second research question

What is the relationship between the earned value management system and its indexes in the improvement of the projects' performance?

The stages of the analysis of the second question consists of the following:

– Time-tabling the project's activities and resources allocation and leveling
– Drawing the project's baseline
– Updating (report collecting) for the project

Time-tabling the project's activities and resources allocation and leveling

In this process, the sequential order of the commencement of the project activities and also the amount of the resources required for fulfilling the project are determined. Scheduling or time-tabling, along with the time lengths assessed for the activities, enables us to draw the Gantt graph of the activities. With the use of the Microsoft software, it is possible to draw, as done in the following figure, one can insert the project's list of activities and their relevant account in addition to Gantt graph of them.

Figure 2 – Gantt graph

With access to the limits of the project, scheduling or time-tabling, and the costs assessed for each activity, one can draw the baseline of the project. The date of the initiation of the project is 23rd of December, 2009, and, after the preliminary scheduling or time-tabling of the project, a baseline representing the primary plan is saved in the software so that after the updates and inserting the actual percentages be of use for making comparisons (the horizontal axis: the number of the activity/vertical axis: the time of the activity).

Figure 3 – Project baseline

Figure 4 – Updating the project

With regard to the updating date (22nd of October, 2016, it can be observed that 6 years after its commencement, the project has been completed at about 75% in which there are deviations in comparison with the extent of progress expected to make; this is addressed further in what follows:

The extent of the actual progress made is 25% while it is expected to be 90%. The amount of the actual cost is equal to ACWP = (3.524.958.752) while it was expected to be BCWP = (4.968.42.631).

On the basis of the cost performance index, one can deduce that out of each 100 hours of the consumed labor in the project, only 72 hours of it have been effective. On the basis of the timing performance index, too, one can deduce that in order to meet the objectives of the project,

for each 72 hours of the consumed labor, one has to plan for 100 hours. In the figure number (), the information relevant to the BCWS, BCWP, ACWP of the progress made in the project at the date of its updating are demonstrated. Since the index has attributed to itself a critical proportion, a number been 0/5 and 0/9.

The third research question

What is the relationship between the earned value management system and its indexes in the improvement of the performance and time of the projects?

The stages involved in the analysis of the second question of the research:

– Time-tabling the project's activities and resources allocation and leveling
– Drawing the project's baseline
– Updating (report collecting) for the project
– Analyzing the project's status up to its updating date (the primary report collection)
– Corrective measures and the second updating of the project

Time-tabling the project's activities and resources allocation and leveling

In this process, the sequential order of the commencement of the project activities and also the amount of the resources required for fulfilling the project are determined. Scheduling or time-tabling, along with the time lengths assessed for the activities, enables us to draw the Gantt graph of the activities. With the use of the Microsoft software, it is possible to draw, as done in the following figure, one can insert the project's list of activities and their relevant account in addition to Gantt graph of them.
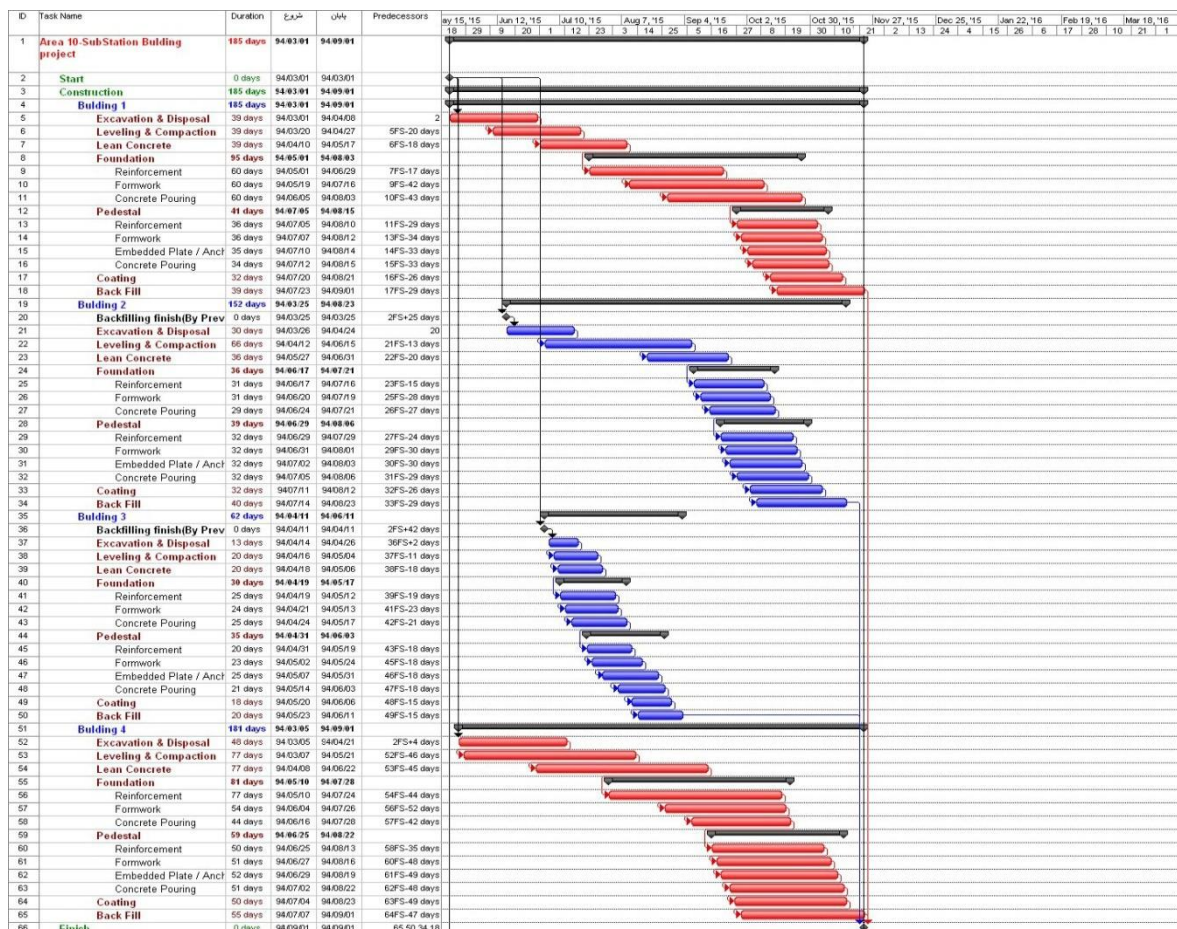
Figure 5 – Gantt graph for project costs

With access to the limits of the project, scheduling or time-tabling, and the costs assessed for each activity, one can draw the baseline of the project. The date of the initiation of the project

is 23rd of December, 2009, and, after the preliminary scheduling or time-tabling of the project, a baseline representing the primary plan is saved in the software so that after the updates and inserting the actual percentages be of use for making comparisons (the horizontal axis: the number of the activity/vertical axis: the time of the activity).
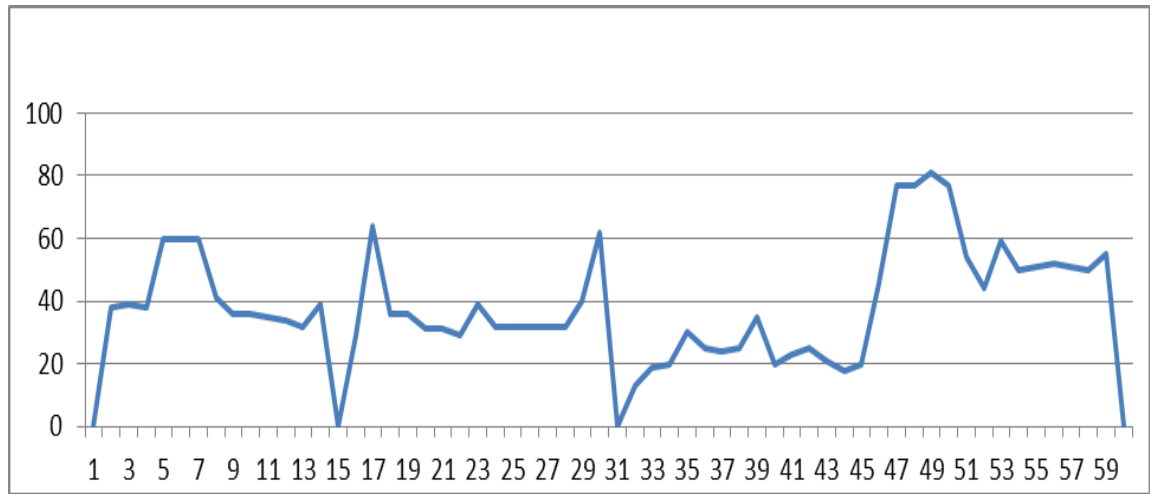
Figure 6 – Project baseline

Figure 7 – Updating the costs

With regard to the updating date (22nd of October, 2016, it can be observed that 6 years after its commencment, the project has been completed at about 75% in which there are deviations in ocomparison with the extent of progress expected to make; this is addressed further in what follows:

The extent of the actual progress made is 25% while it is expected to be 90%. The amount of the actual cost is equal to ACWP = (3.524.958.752) while it was expected to be BCWP = (4.968.42.631).

On the basis of the cost performance index, one can deduce that out of each 100 hours of the consumed labor in the project, only 72 hours of it have been effective. On the basis of the timing performance index, too, one can deduce that in order to meet the objectives of the project, for each 72 hours of the consumed labor, one has to plan for 100 hours. In the figure number (), the information relevant to the BCWS, BCWP, ACWP of the progress made in the project at the date of its updating are demonstrated. Since the index has attributed to itself a critical proportion, a number been 0/5 and 0/9.

Updating (report collecting) the project

The date of the project's update was 22nd of July, 2016 whose results are presented in what follows:

(horizental axis: the number of the activity/the vertical axis: costs)
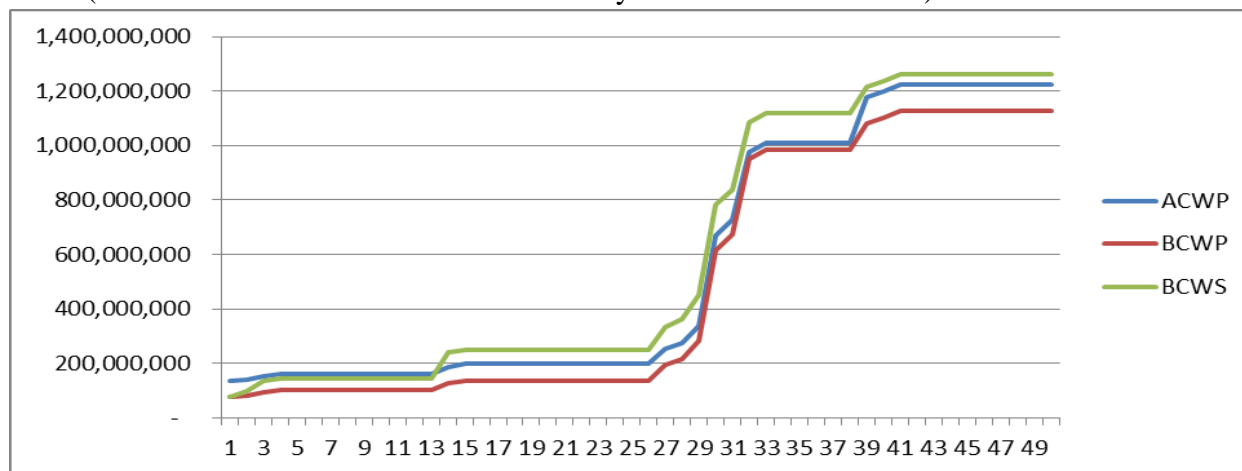
Figure 8 – Updating (report colelcting) the project

ID	Task Name	BCWS	BCWP	ACWP	CV%	SV%	EAC	VAC
1	Area 10-SubStation Bulding project	1,263,255,705.10 تومان	1,127,472,423.60 تومان	1,225,744,212.86 تومان	-9%	-11%	10,877,816,123.01 تومان	(872,108,913.41 تومان)
2	Start	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	0.00 تومان	0.00 تومان
3	Construction	1,263,255,705.10 تومان	1,127,472,423.60 تومان	1,225,744,212.86 تومان	-9%	-11%	10,877,816,123.01 تومان	(872,108,913.41 تومان)
4	Bulding 1	142,513,394.74 تومان	101,480,744.36 تومان	161,403,279.30 تومان	-59%	-29%	2,904,350,631.11 تومان	############
5	Excavation & Disposal	76,954,020.97 تومان	76,954,020.97 تومان	136,254,020.97 تومان	-77%	0%	136,254,020.97 تومان	(59,300,000.00 تومان)
6	Leveling & Compaction	19,862,599.85 تومان	3,768,801.00 تومان	3,972,519.97 تومان	-5%	-81%	20,936,253.89 تومان	(1,073,654.05 تومان)
7	Lean Concrete	38,801,918.08 تومان	12,484,095.36 تومان	13,158,911.35 تومان	-5%	-68%	69,351,019.28 تومان	(3,556,462.53 تومان)
8	Foundation	6,894,855.84 تومان	8,273,827.01 تومان	8,017,827.01 تومان	3%	20%	815,464,670.31 تومان	26,036,849.56 تومان
9	Reinforcement	6,894,855.84 تومان	8,273,827.01 تومان	8,017,827.01 تومان	3%	20%	400,891,350.40 تومان	12,800,000.00 تومان
10	Formwork	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	70,664,328.86 تومان	0.00 تومان
11	Concrete Pouring	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	357,145,840.61 تومان	0.00 تومان
12	Pedestal	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	617,587,086.31 تومان	0.00 تومان
13	Reinforcement	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	223,472,680.21 تومان	0.00 تومان
14	Formwork	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	91,674,180.21 تومان	0.00 تومان
15	Embedded Plate / Anchor Bolt	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	116,945,558.63 تومان	0.00 تومان
16	Concrete Pouring	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	185,494,667.25 تومان	0.00 تومان
17	Coating	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	76,732,540.66 تومان	0.00 تومان
18	Back Fill	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	127,649,928.74 تومان	0.00 تومان
19	Bulding 2	108,525,200.77 تومان	35,703,744.43 تومان	35,234,021.45 تومان	1%	-67%	2,867,551,947.82 تومان	38,228,818.81 تومان
20	Backfilling finish(By Previous Subcontractor)	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	0.00 تومان	0.00 تومان
21	Excavation & Disposal	97,803,263.38 تومان	24,450,815.84 تومان	24,450,815.84 تومان	0%	-75%	97,803,263.38 تومان	0.00 تومان
22	Leveling & Compaction	10,721,937.40 تومان	11,252,928.58 تومان	10,783,205.61 تومان	4%	5%	32,290,906.09 تومان	1,406,611.44 تومان
23	Lean Concrete	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	107,307,678.58 تومان	0.00 تومان
24	Foundation	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	1,347,313,786.85 تومان	0.00 تومان
25	Reinforcement	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	585,292,356.77 تومان	0.00 تومان
26	Formwork	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	112,375,286.79 تومان	0.00 تومان
27	Concrete Pouring	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	649,646,143.29 تومان	0.00 تومان
28	Pedestal	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	982,141,508.17 تومان	0.00 تومان
29	Reinforcement	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	326,628,043.26 تومان	0.00 تومان
30	Formwork	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	128,163,543.26 تومان	0.00 تومان
31	Embedded Plate / Anchor Bolt	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	232,822,997.37 تومان	0.00 تومان
32	Concrete Pouring	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	294,526,924.27 تومان	0.00 تومان
33	Coating	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	131,515,581.92 تومان	0.00 تومان
34	Back Fill	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	206,001,430.21 تومان	0.00 تومان
35	Bulding 3	868,106,546.75 تومان	847,170,807.01 تومان	811,543,636.55 تومان	4%	-2%	2,879,052,145.13 تومان	126,391,825.31 تومان
36	Backfilling finish(By Previous Subcontractor)	0.00 تومان	0.00 تومان	56,594,215.80 تومان	0%	0%	0.00 تومان	0.00 تومان
37	Excavation & Disposal	80,848,879.71 تومان	56,594,215.80 تومان	56,594,215.80 تومان	0%	-30%	80,848,879.71 تومان	0.00 تومان
38	Leveling & Compaction	30,638,880.25 تومان	22,348,359.71 تومان	21,627,444.89 تومان	3%	-27%	34,882,975.62 تومان	1,162,765.85 تومان
39	Lean Concrete	87,363,040.95 تومان	68,143,171.94 تومان	64,066,230.03 تومان	6%	-22%	109,514,923.13 تومان	6,969,131.47 تومان
40	Foundation	637,295,130.31 تومان	668,124,444.03 تومان	637,295,130.31 تومان	5%	5%	1,331,813,035.12 تومان	64,426,793.69 تومان
41	Reinforcement	331,490,331.97 تومان	331,490,331.97 تومان	331,490,331.97 تومان	0%	0%	591,947,021.37 تومان	0.00 تومان
42	Formwork	58,069,241.65 تومان	58,069,241.65 تومان	58,069,241.65 تومان	0%	0%	116,138,483.31 تومان	0.00 تومان
43	Concrete Pouring	247,735,556.69 تومان	278,564,870.41 تومان	247,735,556.69 تومان	11%	12%	611,994,952.29 تومان	76,159,371.84 تومان
44	Pedestal	31,960,615.53 تومان	31,960,615.53 تومان	31,960,615.53 تومان	0%	0%	1,019,771,144.59 تومان	0.00 تومان
45	Reinforcement	31,960,615.53 تومان	31,960,615.53 تومان	31,960,615.53 تومان	0%	0%	319,606,155.29 تومان	0.00 تومان
46	Formwork	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	140,232,155.29 تومان	0.00 تومان
47	Embedded Plate / Anchor Bolt	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	244,461,741.47 تومان	0.00 تومان
48	Concrete Pouring	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	315,471,092.54 تومان	0.00 تومان
49	Coating	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	140,169,674.35 تومان	0.00 تومان
50	Back Fill	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	215,884,646.90 تومان	0.00 تومان
51	Bulding 4	144,110,562.83 تومان	143,117,127.80 تومان	217,563,275.55 تومان	-52%	-1%	3,448,368,406.82 تومان	############
52	Excavation & Disposal	97,350,971.14 تومان	97,350,971.14 تومان	171,210,971.14 تومان	-76%	0%	171,210,971.14 تومان	(73,860,000.00 تومان)
53	Leveling & Compaction	18,935,163.53 تومان	19,499,896.47 تومان	18,928,548.01 تومان	3%	3%	24,829,611.53 تومان	749,469.02 تومان
54	Lean Concrete	27,824,428.17 تومان	26,266,260.19 تومان	27,423,756.41 تومان	-4%	-6%	89,475,815.39 تومان	(3,776,576.62 تومان)
55	Foundation	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	1,052,297,409.69 تومان	0.00 تومان
56	Reinforcement	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	499,115,510.66 تومان	0.00 تومان
57	Formwork	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	87,741,079.04 تومان	0.00 تومان
58	Concrete Pouring	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	465,440,819.99 تومان	0.00 تومان
59	Pedestal	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	743,163,902.72 تومان	0.00 تومان
60	Reinforcement	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	274,373,191.63 تومان	0.00 تومان
61	Formwork	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	105,139,981.63 تومان	0.00 تومان
62	Embedded Plate / Anchor Bolt	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	151,660,003.74 تومان	0.00 تومان
63	Concrete Pouring	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	211,990,735.71 تومان	0.00 تومان
64	Coating	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	99,346,613.25 تومان	0.00 تومان
65	Back Fill	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	164,963,003.27 تومان	0.00 تومان
66	Finish	0.00 تومان	0.00 تومان	0.00 تومان	0%	0%	0.00 تومان	0.00 تومان

Figure 9 – Temporal update

Project managers are responsible for managing the costs of a project. If the project management plan says that the organized analysis of the deviation and prediction are needed; they necessitate the use of earned value management for covering the aforesaid issue.

5. Conclusion

When project managers are in their own comfort zone and no problem leads them towards change, they, too, like others find a proper excuse for running things exactly the way they already are. This is a clear and typical example of a change management. The problem does not lie in the use or lack of use of the earned value management. The problem lies in in the project's cost control. The employer asks the project managers to control the costs of their project. They usually do not ask how, yet there is a standard called the earned value management. Whenever they are in need of controlling the costs in their project, they will also need using earned value management and there is no excuse in tools cannot be rendered acceptable. Such tools as Open-PPM, MSP, and the like are available. No business manager would refrain from controlling project's costs; since they are the main beneficiaries of the project and the project managers are liable and it would be their problem. Generally, the customers of any given project desire to see the project finished in the shortest time. Yet, it cannot be the justification to using the fast tracking method by itself. Depending of the type of the project and the experiences of the project team and the expected results this technique may not amount to a good choice. In a project that should go through a temporal line that cannot be shortened, using this technique would only end in disruption and, consequently, failure. This is while if this technique is applied effectively by means of a thorough study of the project can become a helpful tool in reaction to the changes of conditions and market demands. In addition, the uni-factorial system is considered as the best method for performing a fast tracking project. For answering these research questions, firstly, certain questions should be designed on the basis of the indexes of time and cost in the system of earned value management and then, by an estimation gained through the relationship between the aforesaid system and performance, we would be able to come to a clear and convincible answer. Thus, the questions are arranged and ordered on the basis of Likret scale, and distributed among 100 individuals of the high-ranking managers involved in the project. What was resulted as the output of that questionnaire demonstrates the meaningful relationship between the constructs of question one (cost, time, and performance). Six years since its beginning, about 75% of it was completed1which suggests the advancement of it from the plan) which equals 90% at the end of the sixth year) .%75 The index of the cost performance has increased from 50% to 70% and also the index of time performance (planning) has attributed to itself the approximated number of 0/26 which is undesirable and caused the dissatisfaction of the project managers.

What became clear by the results gained from these questions was the necessity of using this system in projects' management with the aim of attaining the maximum degree of performance in time and cost dimensions. What was certified in the present research was the necessity of applying the earned value management system at all work stages especially in petrochemical projects where its necessary application became evident and specified. With the results gained from the variables of the earned value management system, it became clear how one can exploit this new system as a convenient tool for assessing projects' performance especially with regard to the construction projects. In addition, with the identification of the effective dimension on the indexes of time and cost and their relationship with project performance, we managed to come to a proper assessment of the project's performance. The results of this research were in line with that of Adib et al (2012); Soltan'Panah, Farooghi and Abdi (2012); Jadid Gili and Arooji (2013);

Shah'Husseini and Fathi (2013); Malekiyan et al (2014); and Muslemi Naeeni et all (2014) and Krikhov et al (2016). The earned value technique an important technique for analyzing project performance which enables one to do a more precise measuring of both performance and progress of a project.

Suggestion drawn from the research

Despite the importance of the earned value management system as a valuable methodology in analyzing and controlling the project performance of Ahwaz urban train system, research conducted with the aim of developing and designing a unified approach for controlling project's performance through this methodology have been very limited. In the projects (CPI, SPI) were used. For gaining reassurance of the main conditions for using these graphs being met, the relevant tests were run. One must keep in mind that regardless of the statistical distribution of the data, the presented methodology in this research can be applied in general for bringing the project performance under control via the indexes of the earned value.

The methodology for the best methodical choice is to estimate the cost and time of the project being completed. In this method, the best way for estimating the costs of the completion of the project is attained and its performative index was used for estimating the time of the project's completion. With the use of the scientific example, various existing methods in the area of time and cost estimation of the project were compared with one another and the best method with the lowest deviation from the actually observed amounts were selected.

The model presented here is completely practical and can be used whenever time and cost of the project have been defined in an indeterminate and fuzzy manger from the very beginning.

The present research can prepare the ground for the expansion of the fuzzy model of earned value in a way that other parameters of this technique would be put to study and, if possible, turned into fuzzy numbers; as an example, one can calculate the actual progress percentage of the activities through other methods and then study the feasibility of them becoming fuzzy.

With each research the path to other research is paved and the necessity of further research felt:

− Controlling projects' costs with the use of the earned value management method

− Classification and analysis of projects' performance in controlling the project and the earned value management

− The acquisition of the management of the value project: the improvement of the prediction capacity from the planned value

− The comparison of the methods of control in various projects with the use of the earned value management method

− Studying a fuzzy method for the earned value management

− Studying the applications of the system of the earned value management in each of the contractual systems of the country

− Studying the feasibility of the application of the earned value as a criterion for the financial statement being paid to the contractor in each of the conventional payment methods in the country

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EXAMINING THE EFFECTS OF CAPITAL STRUCTURE ON CUMULATIVE ABNORMAL RETURN IN THE CERAMIC AND TILE INDUSTRY

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ABSTRACT

This study investigated the impact of capital structure on cumulative abnormal return (CAR) in the ceramic and tile industry. The purpose of this study was to answer the question of whether capital structure affects CAR or not. This is an applied research study in terms of aim and descriptive-survey in terms of method. The statistical population consisted of ceramic and tile industries listed on the Tehran Stock Exchange (TSE). Accounting information required was extracted from the financial statements of companies listed on the TSE. Eight companies were selected from the selected industries as a sample from 2001 to 2011. This study employed the multivariate regression method to test the research hypothesis. Besides, the panel data model was utilized, whose significance was determined using F and t statistics. Model autocorrelation test was also performed using the Durbin-Watson test. The results indicated that leverage had a significant positive effect on CAR in ceramic and tile industries.

Keywords: capital structure; CAR; leverage; ceramic and tile industry.

Introduction

Capital structure information is important and valuable not only for a specific user but also for a country's entire economy. To achieve their desired goals, company managers can transform their capital structure. An improper capital structure has a devastating effect on all areas of a

company's activity, leading to several issues, such as inefficient product marketing, inefficiency in and inability to employ labor effectively (Aghaei et al., 2009).

Both financing and investment decisions of companies are made prophetically. Regarding financing decisions, the company exploits the currently available funds to meet its obligations to suppliers of financial sources in the future. On the other hand, in terms of investment decisions, the company ignores some current benefits in the hope of gaining more in the future (Namazi and Shirzadeh, 2005).

Although most experimental research has been carried out on the capital structure model in the capital markets of the United States and several other developed countries, such as the United Kingdom and Japan, the capital structure also holds a special place in the market economy of developing countries. Unfortunately, the capital structure remains ambiguous in the economic systems of developing countries for two reasons. First, developing economies attach little importance to the role of economic entities in the process of economic development. Second, for the past two decades or so, economic entities in most underdeveloped countries have faced fundamental constraints in choosing the funding sources they need. These include the economic governance of the national state and the deprivation of non-governmental economic entities of the opportunity to compete, lack of market development and restrictions on the provision of financial resources. However, research on the optimal capital structure is ongoing. Each research from a specific angle helps companies examine the factors affecting their capital structure to select a combination of financing sources with the highest ROE and, at the same time, the minimum capital cost, under the existing circumstances.

In examining the capital structure of companies, the combination of different financial sources used by companies in financing their required activities and investments is explained. It can be said that the purpose of determining the capital structure is to determine the composition of financial sources in each company to maximize the wealth of its shareholders. To make a decision, users of financial statements need a measure indicating the company's success in using the resources under its control.

On the other hand, numerous studies conducted in Iran and other countries have confirmed the correlation and significant relationship between the components of companies' financial statements and reports and stock returns. One of the most important institutional performance evaluation metrics at the moment is the stock rate of return (RoR). This metric alone provides investors with the information they need and is utilized to evaluate performance. The reduced value of this criterion is an alarm for the company, indicating improper performance. It contains a lot of information because performance appraisal based on market value provides investors with the information they need (Etemadi et al., 2009).

Return is a driving force and reward for investors in the investment process. Total return refers to all gains from a stock over a specific period, typically one year. In light of the foregoing, this study aims to investigate the impact of capital structure on CAR in the ceramic and tile industry.

Theoretical Foundations
Capital structure
Nowadays, due to the wide quality level of activities and the wide development of economic affairs, corporate financing decisions are among the complex issues raised to achieve maximum return and utility under the best conditions. Therefore, since they are primarily responsible for making such decisions, finance directors seek to achieve relationships between characteristic factors in companies. These issues include capital structure decisions (Aoun & Hwang, 2008).

Modigliani and Miller (1963) studied the capital structure, where the government's assumption of non-application of income tax was adjusted. The study hypothesized that government-approved income tax laws apply to companies. They argued that because debt interest expense is deducted from taxable income, and thus tax payments are reduced in corporate income tax calculation, the higher the amount of debt in the capital structure, the lower corporate tax liability and cash flow after taxes (CFAT), and the company's market value increases. This leads to conditions that require 100% of the required funds to be provided through borrowing. Also, according to government and tax laws, interest payments for enforcing borrowing policies are considered as tax deductive expenses. Therefore, applying borrowing policies for financing causes leverage brings several benefits to the company in the form of tax exemption. They also argued that since the cost of interest and preferential payments are deducted as a deductible expense from corporate taxable income in calculating corporate income tax, the more debt is used in the capital structure, the lower the corporate tax liability and the corporate resources desired by owners and creditors are further acquired. On the other hand, if a company refuses to pay the cost of interest on its debts, funds and CFAT will increase, and firm value in the capital market will increase. This motivates capital market participants to use borrowing policies more and more to meet their financial needs (Frydenberg, 2004).

Abnormal Stock Return

The abnormal return of a stock refers to the difference between its actual return and its expected return. On the other hand, the expected return of a stock is calculated, usually using different models. Financial and investment researchers have suggested specific models for specific situations. Most research on overreaction or underreaction has used two models: market adjusted return and market models. The present study has used the market adjusted return model. This model assumes that all bonds (securities) have the same expected return, and the return of each bond (security) is similar to the market return.

1. Models based on abnormal stock return

This model attempts to test the relationship between accounting information and stock return variables, which has its roots in experimental accounting research. In such models, abnormal stock return is usually shown as a function of accounting variables. Information content of a variable can be determined by testing the coefficients and importance of various variables. Such models attach great importance to calculating abnormal stock returns, which relies above all on an active, dynamic and efficient market, where companies' stock trades are continuous and responsive to information.

2. Using a market model with independent α and β for each company

Modern Portfolio Theory (MPT) and Cumulative Average Residuals (CARs) are the most commonly used models for determining short-term returns. In this model, a company's abnormal stock return is the difference between its actual return and its expected return, and the average cumulative return is the sum of average returns over the research period. The well-known market model is the most common way to determine the abnormal stock return of companies, where there is a regression relationship between corporate stock return and return on market securities (portfolio). The expected future return on stocks of a company is estimated in proportion to the market return by calculating the regression coefficients α and β based on historical information. A company's returns are calculated using the Capital Assets Pricing Model (CAPM). This model has two basic parameters, namely risk and return, and has high predictive power. This model is used in a highly efficient capital market, where investors are fully aware, financial transaction

costs are zero, there are small restrictions on investments, no investment alone is so large to affect the stock price, all investors have the same expectations of risk and return on the market, and investors can lend or borrow at a risk-free interest rate. It should be noted that this model is not practically applicable due to an inefficient market, the selection of the problem index, the appropriate time horizon to guarantee the beta, and the fact that the real market portfolio composition is unknown.

The market model is calculated as follows:

$$R_{i,t} = \alpha_1 + \beta_1 \ R_{mt} + e_{i,t}$$
$$AR_{i\,t} = R_{i\,t} - (\alpha_1 + \beta \ R_{m\,t})$$

3. Using a market model with sample α and β

Although the usual method known in the previous paragraph is the most well-known method of measuring abnormal returns, another method can be used, which is to use the collected monthly data of companies to find more accurate α and β for sample companies and develop an expected return model for each of the sample companies. This model is used to calculate the monthly expected return for each company. An abnormal return of a company is the monthly expected return minus the actual return of that company. Also, a company's CAR in a given fiscal year is the abnormal monthly returns plus the company's abnormal annual returns.

4. The difference between firm return and market return

One way to determine abnormal returns is to differentiate between firm and market returns. In this method, it becomes simpler by losing α and making β equal to 1. This model, used in some stock return research, is used to compare the difference between market return and the company's actual return (abnormal return of the company) (Ziobrowski et al., 2004).

$$AR = R_{i\,t} - R_{m\,t}$$

Herein, abnormal return is determined using the firm return and market return difference model.

Research Background

In their study entitled "Leverage and Common Risk Factors in Stock Returns," Muradoglu & Sivaprasad (2008) examined the relationship between leverage and risk factors in stock returns. They introduced leverage as one of the important risk factors, which is ignored in the capital asset pricing model (CAPM). Their work is to shift the focus from capital asset pricing to portfolio leverage formation. They also divided stock returns into two groups, high and low, according to leverage. They argued that leverage is one of the most important factors in the stock market explaining stock returns. Their results showed that portfolio leverage could explain stock return variables better than CAPM.

In another study, Capital Structure and Abnormal Returns, Muradoglu & Sivaprasad (2012) examined the relationship between capital structure and CAR on equity and whether the capital structure is a relevant value for investors. To this end, they attempted to integrate the Modigliani and Miller theoretical framework by adopting an investment approach by estimating abnormal returns on portfolio leverage in time series for different risk groups. They divided all the industries on the stock exchange, except banks, insurance companies, financial institutions, etc., into different risk groups. They also examined the impact of capital structure on CAR by measuring CAR, firm size, leverage, interest rate, B/M, and P/E. They concluded that return on equity (ROE) increased with leverage for some risk groups and decreased for others using regression and correlation analysis. Also, CAR was added for most risk groups when the average leverage increased. This study

showed a significant inverse relationship between leverage ratio and CAR. Also, P/E and B/M ratios and size, beta and interest rates have significant negative coefficients.

In their study entitled "Investigate the Effect of Financial Leverage on the Investments of Companies Listed on the Tehran Stock Exchange," Norvesh and Yazdani (2010) concluded that the relationship between leverage and investment in companies with lower growth opportunities is stronger than in companies with more growth opportunities using regression and correlation analysis. Also, a significant positive relationship was observed between leverage, dividend policy, and profitability with firm value, while interest payment was shown to have an adverse effect on firm value.

In their study "Investigating the Effect of Financing Methods on Future Stock Returns," Kordestani and Najafi Omran (2010) examined the impact of different financing methods and how the proceeds from these methods are used on future stock returns. The data required for this study were collected from 65 companies admitted to the TSE during the period 1999-2006. The tests were performed using the panel and cross-sectional data. The findings indicated a significant correlation between the positive net forecast of change in total financing, the net change in external financing, and the change in net operating assets (NOA) provided through internal sources of finance with stock CAR. In addition, the relationship between the ratio of internal funds to external funds and stock CAR is stronger in high-growth companies than in low-growth companies. Also, cross-sectional data indicated a significant positive relationship between net change in internal financing and change in NOA provided through internal sources of finance with stock CAR.

In his research entitled "Identifying the Factors Affecting the Abnormal Return in the Initial Public Offering of Companies Newly Listed on the Tehran Stock Exchange," Garkaz (2011) investigated the possible factors affecting the abnormal return of new companies entering the TSE in the period 1999-2007. For this purpose, 73 qualified companies were selected by elimination method and surveyed for 12- and 24-month periods after being listed on the TSE. Among the six independent variables, namely firm size, type of ownership, earnings per share (EPS) forecast error, ROE, net profit margin, and debt-to-equity (D/E) ratio, debt-to-equity (D/E) ratio had a significant direct relationship with the abnormal return, while ROE had a significant inverse relationship with it. However, multivariate regression analysis generally showed that all six independent variables could simultaneously justify 13.7% of the abnormal return.

Research Hypothesis
Leverage has a significant effect on CAR in ceramic and tile industries.

Research Method
It is an applied research study in purpose and descriptive survey in method. The statistical population consists of ceramic and tile industries listed on the Tehran Stock Exchange (TSE). The required accounting information was extracted from the financial statements of companies listed on the TSE due to the greater investors' and financial analysts' attention to the stock market, the availability of information, and the transparency of their accounting information. Stock market requirements for timely dissemination of accounting information have provided the conditions for creating a more appropriate information environment for research (Bahramfar and Shams Alam, 2004). Therefore, eight companies from selected industries were selected in the research period, i.e., 2001-2011. During this period, income statements and balance sheets of companies listed on the TSE were collected. Also, stock price data was collected to calculate the abnormal return of companies.

The required data were collected from audited financial statements of TSE-listed companies, databases, Rahavard Novin software, and official company websites using document mining.

The research hypothesis was tested using the following multivariate regression model:

$$CAAR_{i,t}= \alpha + b_1 LEVERAGE_{i,t} + b_2 BETA_{i,t} + b_3 SIZE_{i,t} + b_4 \, P/E_{i,t} + b_5 ROA_{i,t} + e_{i,t}$$

Before model fitting, to test the research hypothesis, one should determine the type of data (panel or pooled) and test the classical assumptions of the regression model.

$CAAR_{i,t}$: Cumulative abnormal return i in year t

a: A constant (fixed value)

$LEVERAGE_{i,t}$: Leverage of stock i in year t

$Beta_{i,t}$: Systematic risk of stock i in year t

$Size_{i,t}$: Size of firm i in year t

$P/E_{i,t}$: Price-to-earnings ratio of each stock i in year t

$ROA_{i,t}$: Return on asset i in year t

e_t: Period error

Independent Variable

Leverage

Herein, leverage is an independent variable as well as a measure of capital structure. Leverage is defined as the use of fixed-cost financing methods (such as debts and preferred stocks). It is used in the hope of increasing common stock returns. Leverage is useful when a company provides ordinary shareholders with funds acquired through fixed-cost liabilities or fixed-dividend preferred stock to do something that returns a fixed cost of funds. Utilizing leverage will be detrimental if the company fails to achieve a return equal to fixed-cost funds by implementing predicted plans. Leverage usefulness is measured based on its impact on earnings per share of ordinary shareholders (Namazi and Shirzadeh, 2005). Leverage is measured using the following ratio:

Leverage = (Total assets) / (Total debt) × 100

Control Variables

The control variables are systematic risk, firm size, P/E ratio, and ROA.

Systematic Risk

Risk refers to a situation in which an adverse event is likely to occur or is expected to occur in the future. Systematic risk arises from general market developments over the economy (or general market movements) and is not specific to a particular company. The beta index measures a company's coordinated movement with general market movement or systematic risk. Systematic risk is non-diversifiable. Indeed, systematic risk is the minimum inherent stock [crash] risk, sometimes called fundamental risk in the investment literature. It is an irreducible risk for all bond portfolios, which cannot be eliminated by financial asset diversification. The beta index is calculated using the monthly stock returns of the sample companies (R_i) and the monthly return on the market portfolio (R_m), which are calculated using Excel spreadsheet software using the following formula (Dian, 2012):

$$\beta = \frac{COV(R_i, R_m)}{\delta_m^2}$$

Firm Size

Firm size is measured using four criteria: total sales, total sales logarithm, total average, and total assets, with total sales and total assets as the most common. That is, the larger the total sales and total assets of a company, the larger the size of that company, and vice versa. However, the total book value of assets can be a faculty as a measure of firm size in countries with high

inflation rates (Iatridis, 2008). This research used the total sales logarithm criterion to measure the firm size.

$$\text{Log}\,(SALE_{it})\ =\ SIZE_{it}$$

$SIZE_{it}$: Size of firm i in period t

$SALE_{it}$: Sale of i in period t

Price-To-Earnings Ratio (P/E ratio)

The price-to-earnings ratio (P/E ratio) is the ratio for valuing a company that measures its current share price relative to its earnings per share (EPS).

Return on Assets (ROA)

One measure of corporate management's ability to beat the market in terms of available resources is the return on assets (ROA). Management is expected to utilize available assets to maximize returns. Cost of interest and taxes do not affect how assets are used. Therefore, the profit used in this ratio is operating income (profit). This ratio indicates that the management of several rials has earned a profit for each rial of assets used (Bahramfar and Shams Alam, 2004).

The return on assets ratio (ROA) is found by dividing net income by total assets. In general, it measures the return on available assets in profitability and can be thought of as the return on capital employed (ROCE) (Aghaei et al., 2009).

ROA = (Total assets) / (After-tax profit or loss)

It should be noted that returns are calculated in monthly periods.

Dependent Variable

Herein, the cumulative abnormal rate ($CAAR_{i,t}$) is the dependent variable, which is calculated as follows:

$$CAAR_{i,t} = \sum AR_{i,t}$$

The abnormal return of any stock is the difference between the actual return and the market return of that stock, which is calculated as follows:

$$AR_{i,t} = R_{i,t} - R_m$$

where $AR_{i,t}$, $R_{i,t}$, and R_m are abnormal, actual, and market returns, respectively.

The actual return of each common stock is determined based on the following:

− Fluctuations in share prices during the investment period
− Cash earnings per share (cash EPS)
− stock rights (preemption rights)
− Stock dividends or bonus shares

where:

$R_{i,t}$: Return on stock i in year t

p_1: Stock price at the end of the year t

p_0: Stock price at the beginning of the year t

α: Percentage increase in capital

D: Cash earnings per share (cash EPS)

R_m denotes the market return. Different alternatives are usually used to calculate the expected return per share, which is calculated as follows:

$$R_m = \frac{I_1\ +\ I_0}{I_0}$$

Where, I_0 is the total market price index of all common stocks declared by TSE at the beginning of the year, and I_1 is the year-end market price index.

Findings

Table 1 lists the results of the F-Limer test. As can be seen, since p-value = 0 (<0.05), the panel data method is adopted. Also, since the p-value of the Hausman test is 0 (<0.05), the fixed-effects method is adopted.

Table 1

Results of F-Limer and Hausman tests

Model	F-Limer test			Hausman test		
	F-Limer statistic	Probability	Result	χ2 statistic	Probability	Result
1-4	12.63	0.00	Panel	41.91	0.00	Fixed-effects

Table 2

Durbin-Watson statistic

Durbin-Watson statistic	No-autocorrelation range
1.63	$2.5 < DW < 1.5$

Since the Durbin-Watson statistic is 1.63, the regression model is non-autocorrelated (if the Durbin-Watson statistic is around 2, there is no autocorrelation).

Table 3

Model homoscedasticity

Statistic value	p-value
F-statistic (1.06)	0.39

According to the table above, since the p-value of the White test is 0.39 with a significance level higher than 0.05 (p-value ≥ 0.05), H0 (homoscedasticity) is accepted, indicating the absence of the problem of heteroscedasticity of residuals. After ensuring that the classical assumptions are valid, the regression model is fitted to the data to test the research hypothesis.

Table 4

Results of data analysis to test the research hypothesis in the ceramic and tile industry

Variable	Factor	SD	t statistic	p-value
CAAR	2.16	21.0	5.35	0.00
Leverage	1.75	3.23	3.54	0.00
Beta	-0.09	0.44	-0.20	0.84
Size	1.72	3.91	1.06	0.13
P/E	0.34	0.17	3.03	0.01
ROA	0.008	0.05	0.15	0.88
R-squared		0.75	F statistic	14.75
Adjusted R-squared		0.70	Prob(F-statistic)	0.00

Since the f-statistic p-value is 0 (p-value ≤ 0.05), H0 is rejected, indicating that not all regression coefficients are zero simultaneously. Therefore, there is a significant concurrency relationship between the independent and dependent variables.

In research hypothesis testing, the effect of leverage on CAR in the ceramic and tile industries accepted in the TSE is measured. According to Table 4, since the p-value of the variable "Leverage" is 0 (p-value ≤ 0.05), H0 (lack of a relationship between leverage and CAR in the ceramic and tile industry) is rejected. Therefore, leverage significantly affects CAR in the ceramic and tile industry. Also, since the leverage ratio is positive (1.75), it positively affects CAR. Therefore, the research hypothesis is accepted.

Also, since the significant levels of systematic risk, firm size, and ROA are higher than 0.05, H0 is accepted. Therefore, with a 95% confidence interval, it can be said that the above variables do not have a significant effect on CAR in the ceramic and tile industry, while the significance level of the P/E ratio variable is less than 0.05. Therefore, H0 is rejected. With a 95% confidence interval, it can be said that the P/E ratio variable has a significant effect on CAR in the ceramic and tile industry.

The model's adjusted R^2 is 0.70, indicating that 70% of the changes in the dependent variable are explained by (or related to) the independent variable.

Conclusions

The company's financial structure is a combination of debts and equity, by which the assets of the company are financed. Different theories have been put forward about the capital structure and the factors affecting it. It seems necessary to examine and identify the factors affecting the financial structure and the combination of sources of corporate finance in any way. This study attempted to determine the effect of capital structure on CAR using fixed-effects multivariate regression models by F-Limer and Hausman tests.

Testing the research hypothesis in ceramic and tile industries showed that leverage had a significant positive effect on CAR. With an increase in leverage, abnormal returns are expected to increase. In this regard, Muradoglu and Sivaprasad (2012) examined the impact of capital structure on CAR in nine industries: oil and gas, raw materials, industry, consumer goods, health, telecommunications, utility, and technology. They considered each of the above industries as a risk group. They concluded that ROE increased with leverage for some risk groups and decreased for others. In industries such as utility, also addressed by MM, companies had abnormal returns, which increased with leverage. In most other industries, companies experienced abnormal returns, which decreased with leverage.

In their study entitled "Investigating the effect of capital structure on the profitability of companies listed on the Tehran Stock Exchange", Arbabian and Grayly (2009) showed a positive relationship between leverage and profitability. Kordestani and Najafi Omran (2010) investigated the effect of financing methods on future stock returns. They concluded a significant positive relationship between net change in internal financing and change in NOA provided through internal financing sources with stock CAR.

Considering the results obtained in this study, it is suggested to consider leverage in different industries at the time of portfolio formation because it affects CAR according to the type of industry, as shown in this study. It's not so challenging to address the leverage and calculate its variables. Therefore, the effectiveness of leverage, on the one hand, and its simple calculation, on the other hand, allows both professional and non-professional investors to use this factor as easily as possible. Therefore, it is suggested to use this factor in Iran's capital market.

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INVESTIGATING THE VIEWS OF MANAGERS AND EXPERTS ON THE IMPLEMENTATION OF KNOWLEDGE MANAGEMENT IN THE MANAGEMENT OF SEPAH BANK BRANCHES IN MARKAZI PROVINCE

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ABSTRACT

Large and developed countries are composed of successful organizations. Successful organizations are a combination of capable and knowledgeable people who are able to study, examine and make optimal use of their resources and facilities. For this reason, knowledge-based employees are the biggest and most valuable

assets of organizations. The aim of present study is investigate the views of managers and experts towards the implementation of knowledge management in the management of Sepah Bank branches in Markazi province.

The present study is an applied research in terms of aim. It is also considered a descriptive research. The statistical population of the present study included managers, deputies, and experts and heads of the Sepah Bank branches, which their number was about 50 people. To assess the current situation, a 20-item questionnaire was used. A convenience sampling method was used in this study. Data were collected from winter 2016 to spring 2017. SPSS software was used to analyze the questions. According to the analysis of data, the results showed that the mean views of managers was higher than the mean views of employees about the readiness to implement knowledge management of Sepah Bank branches in Markazi province.

Keywords: knowledge management; managers; experts; Sepah Bank.

Introduction:

Nowadays, knowledge is a valuable and strategic resource. For purposeful using of knowledge as a competitive and strategic advantage and organizing the development of knowledge management in the organization, recognizing the current situation of organization in the field of knowledge management and identifying important factors in decision-making are crucial. Organization is essential for applying and improving knowledge management. With transition from Industrial Revolution and entering the new millennium, knowledge is driving force for growth of organizations and enterprises. The effective and efficient use of knowledge assets as a valuable and strategic resource has become more important than ever. Increasing globalization of the reengineering business, downsizing of organizations, outsourcing of activities and services, and the massive development of technologies reflect the more efficient and effective use of knowledge assets as a valuable and strategic resource have become increasingly important more than ever. Hence, knowledge management is the key to achieve a success in the new economy (Naseri, 2016, 55).

In simple words, knowledge management is the creation of a structure that transforms tacit knowledge into explicit knowledge that can be transferred to others. Such a structure causes the knowledge of each person to increase with sharing of knowledge between individuals and subsets of each organization, and new knowledge is created by combining the knowledge of one person with that of another person (Malekan, 2016, 4). According to Amin et al. (2001), the focus of knowledge management is on improving organizational capability. To achieve success in knowledge management requires creating a new work environment, where knowledge and experience can be easily shared. To achieve this goal, technology and process must be considered. Organizational behaviors must be aligned so that information and knowledge are integrated and transferred to right people at the right time so that it can be more productive (quoted by Ahmadi Baladehi and Mirzaei, 2014, 33).

Some studies have been conducted in this area. In a study entitled "Identification and prioritization of factors affecting the establishment of knowledge management in the Deputy of Physical Education and Health of the provinces of Iran", Davani et al. (2016) identified and prioritized the factors affecting the establishment of knowledge management in the Deputy of Education and Health in Iran. Survey method was used in the mentioned research. It was an applied research in terms of aim. The statistical population of the study consisted of 288 deputies, heads and experts of the Deputy of Physical Education and Health of Ministry of Education. The statistical sample was equal to the statistical population. The results showed that 48.02% of the total variances are related to seven factors. The results indicated that all factors have a significant impact on the establishment of knowledge management. Also, using the hierarchical analysis process method, the factors were prioritized in this way: organizational culture, commitment of senior managers, employee engagement, employee training, teamwork, knowledge structure and information systems infrastructure.

In a research entitled "Knowledge management capabilities and organizational performance in Dubai Transportation: The mediating role of organizational learning", Ngah et al. (2016) examined the impact of knowledge management capabilities on organizational performance in the Dubai public sector. The learning organization was included as a mediating variable to examine its impact on the relationship between knowledge management capabilities and organizational performance. The required data in the study were collected using a questionnaire and structural equation model was used to analyze them. Results revealed that knowledge management capabilities have a positive and significant relationship with organizational performance. The learning organization is completely mediated by the relationship between knowledge management capabilities and organizational performance.

In a study entitled "Identification and prioritization of barriers to knowledge management implementation using fuzzy network analysis process", Valmohammadi and Ghassemi (2016) identified barriers to knowledge management implementation in industrial companies in Alborz province and prioritized them using FANP technique. To conduct this study, an in-depth review of knowledge management literature as well as interviews with experts were used to prioritize the main barriers to knowledge management implementation, including organizational culture, organizational structure, human resources, technology and various factors along with their related factors in the organization. Then, according to the collected information, a questionnaire was developed. Finally, barriers were prioritized using FANP. The results showed that human resources and organizational culture factors were ranked the highest and considered as the most important barriers. The technology factor was also ranked the lowest.

Management of organizations can make rational decisions on important issues and improve knowledge-based practices by relying on superior knowledge. Thus, knowledge management is a more important issue than knowledge itself and organizations seek to establish it to explain how individual and organizational information and knowledge are transformed into individual and group knowledge and skills. Thus, in the third millennium of knowledge management implementation, it is necessary for organizations and other institutions to take measures for its implementation through planning (Ramezani and Salimi, 2015, 1-24). Given the importance of this issue, Sepah Bank can promote the innovation of its organization by examining the correct and complete establishment of knowledge management in the organization. The main issue is whether managers and employees have different views on the implementation of knowledge management in the management of Sepah Bank branches in Markazi province.

Methods

The present study is a descriptive-applied research. The statistical population of this study included the employees of Sepah Bank in Markazi province. Using proportional sampling method, about 50 experts and managers of this bank are selected to answer the questionnaire. In the present study, the field method is used to collect the data needed to test the research hypotheses. In this study, a questionnaire is used to collect the required data. The designed questionnaire consists of two parts of descriptive questions and research questions. In the descriptive part, questions about the components (age, organizational post) have been designed, and in the research part, 20 questions have been designed to test research hypotheses. A five-point Likert scale was used to measure the indicators in the questionnaire.

Validity and reliability of questionnaire

In this research, to examine the validity of the questionnaire, content validity was used. Accordingly, the quantity and quality of questions were examined from the point of view of experts. To examine the validity, the initial research questionnaire was designed and it was submitted to the relevant professors and experts to give their opinions and views about it. After apply-

ing their corrective opinions, the final questionnaire for distribution on a larger scale was designed. To measure the reliability in the early stages of study, information was collected from the questionnaire, and SPSS software was used to analyze it. Since Cronbach's alpha coefficient was more than 0.7, the research questionnaire showed high reliability.

Data analysis method

The mean of sample test

If a hypothesis is developed on the mean of one or more samples, by using the mean tests, its accuracy or correctness can be determined at a certain level of error. Mean tests include one-sample mean test, two-sample mean comparison test, pairwise comparison test and multi-sample mean comparison test (ANOVA). In the one-sample mean test, only the desired situation in one sample is examined. If the studied situation is considered in two samples, two-sample mean comparison test is used and if more than two samples are considered, the multi-sample mean comparison test (ANOVA) is used. If the effect of one type of intervention on the sample is desired, the pairwise comparison test is used. In this test, the hypothesis about the mean of sample at the α-error level is examined. The t-statistic in this test has a degree of freedom of n-1 and it is calculated using the following relation:

Relation (1)

$$t = \frac{\overline{X} - \mu_0}{S_{\overline{X}}}$$

In this relation, $\overline{X}$ is the mean of sample, $S_{\overline{X}}$ is the standard error of the mean of sample, which is calculated by the following relation:

Relation (2)

$$S_{\overline{X}} = \frac{S}{\sqrt{n}}$$

The one-sample mean test result includes two outputs. The first output provides descriptive statistics about hypothesis test and the second output is related to inferential statistics and presents the test results.

In the second output, according to the upper bound and lower bound values, we can say:

1) If the lower and upper bounds are positive, the mean is greater than the test value. In this case, it can be concluded that the studied index under study has a good status.

2) If the lower and upper bounds are negative, the mean is less than the test value. In this case, it can be concluded that the studied index does not have a good status.

3) If the lower bound is negative and the upper bound is positive, it can be concluded that the studied index has a moderate status (Momeni and Ghayoomi, 2010, 70).

Results

Descriptive results

Organizational post status

Table 1 presents the frequency distribution of the organizational post of the respondents of study. The results show that 12% of the samples are managers and 88% of the sample are employees.

Table 1

Organizational post status of respondents

Organizational post	Frequency	Percentage
Managers	6	12
Experts and heads of branches	44	88
Total	50	100

Age status

Table 2 presents the frequency of age status of the respondents of study. The results show that 47% are under 40 years old, 16% are 40 to 50 years old and 37% are over 50 years old.

Table 2

Age status

Age status	f	%
Less than 40 years	29	46
Between 40 and 50 years	16	16
More than 50 years	5	37
Total	50	100

Examining the research question

Do managers, experts and heads of branches have different views on the implementation of knowledge management in the management of Sepah Bank branches in Markazi province?

Statistical hypothesis:

H_0: $\mu 1 = \mu 2$

H_1: $\mu 1 \neq \mu 2$

Table 3

Test results of the two-sample mean test related to the research question

Variable	Statistic t	df	Significance level	Lower bound	Upper bound
Implement knowledge management	3.478	30.315	0.002	0.12653	0.48611

As shown in Table 3, the significance level for the knowledge management implementation was equal to 0.002 that was less than the error level of 0.05, and lower bound value was 0.12653 and the higher bound value was 0.48611. Thus, it can be concluded that the mean of managers' view is higher than the mean of employees' view about the readiness to implement the management knowledge of Sepah Bank branches in Markazi province.

Conclusion

Knowledge is the most important asset of any organization and the organization that enjoys this gift will cope better with the existing challenges and will be more successful in the competition. The current age is the age of great changes and transformations in technology. The intellectual structure of this age is full of deepening information and paying attention to engagement and participation of creative human resource rather than functional human resource. Thus, knowledgeable management aims at more and better using of a tool called knowledge to deal with uncertainty, maintain position and create creativity and innovation to expand its competitive areas. It requires paying attention to knowledge management and considering it as a strategic and essential need to take the lead in the area of competitiveness. In the present study, the views of managers and experts on the implementation of knowledge management in the Sepah Bank branches in Markazi province were examined.

Based on the obtained results, it can be concluded that the mean of managers' views is higher than the mean of employees' view about the readiness to implement the management knowledge of Sepah Bank branches in Markazi province. The result of this question shows that managers are more looking to establish and implement knowledge management in their area compared to employees. It means that when knowledge management is well established and used in the organization, its performance will improve. This issue can be most beneficial for managers because it improves their performance. Thus, it can be concluded that managers are more interested in implementing knowledge management than employees. The result of this hypothesis is in line with the results of the research conducted by Mahmoudi et al. (2013).

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STUDY OF THE RELATIONSHIP BETWEEN PSYCHOLOGICAL DIMENSIONS OF EMPOWERMENT AND EMPLOYEES' ORGANIZATIONAL COMMITMENT (CASE STUDY: DEPARTMENT OF EMPLOYEES AFFAIRS-MELLAT BANK)

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ABSTRACT

This study aims to investigate the relationship between psychological dimensions of empowerment and organizational commitment. The statistical population included 140 employees working in MELLAT BANK's department of employees affairs, from among 130 employees were chosen as the statistical sample using simple random method. All examinees were asked to fill in both of the empowerment questionnaire and the organizational commitment questionnaire. Pearson's correlation coefficient and multivariate regression analysis methods were used for data analysis. Results revealed the existence of a significant positive relationship between empowerment and employees' organizational commitment. In other words, an increase in the empowerment of human resources enhances the organizational commitment of employees. In addition, it was found that there are significant relationships between organizational commitment and three dimensions of; feeling of competence, feeling of meaning, and impact. According to our findings, people are more involved in and committed to the job which is felt to have more meaning. Therefore, this dimension of empowerment should be paid further attention by managers and entrepreneurs.

Keywords: organizational commitment; empowerment; bank employees.

Introduction

Employees' empowerment is one of the most effective techniques to enhance employees' efficiency and exploit their capacities and capabilities for the sake of organizational goals. The term "empowerment" was defined for the first time in 1788 as authorizing someone so that such an authorization would have been observed in his/her organizational role. Generally, there are different definitions of empowerment. Some experts have focused on individuals' ability and tendency to get empowered. Some others have considered the concepts such as team performance, job enrichment, personal work control, independence in assignment accomplishment, working team, performance-related payment system, and employees stock ownership as the empowerment procedure (Gorelick, 2005). Fox (1998) takes employees' empowerment as a procedure by which the empowerment culture is developed. From his point of view, ideals, goals, decision making boundaries, results of their effects and attempts are all shared by entire organization during such a procedure. In such a culture, resources and the competition for earning the required resources for the effectiveness of their activities are provided and supported. Hence human resources empowerment is considered as the best way of increasing efficiency and organizational development and the necessity for enhancement of this capability has always been emphasized . Anyway, there is some evidence that organizational empowerment has not been paid sufficient attention by organizations so that in bureaucratic organizations, employees experience a feeling of powerlessness and inability and have little tendency to accomplishment of affairs and activities.

Although the models and theories on empowerment have been trying to somehow evaluate empowerment, a review of them reveals that the concept of empowerment uses the concepts such as commitment and loyalty to great extent. Organizational commitment is a variable which shows the strength of individuals' attachment to organization.

Considering the effect of organizational commitment on a lot of necessary variables in organizations. Nonetheless, neither previous studies nor recent ones have paid attention to the role of empowerment variable, while the empowerment theories, as mentioned before, and tacitly emphasize the connection between these two concepts. In study, Janssen has investigated the mediocre role of conflict with superior managers in the relationship between organizational commitment and empowerment. He has shown the relationship to be quite strong and positive which requires serious attention..

According to the empowerment theories, the empowerment components and elements can be considered in order to evaluate employees' organizational commitment. Although numerous materials seem to be available for each of empowerment and organizational commitment topics, just few studies on their connection with each other can be found in literature. There are a few researches which have investigated some organizations in limited scale. Furthermore, achieving better and convincing results in order to design a suitable model requires further studies, as previously emphasized by some other researchers like Bhatnagar (2005), and Bogler and Somech (2004). Therefore, considering the focus of empowerment theories on loyalty and commitment elements and also the current research requirements, the present study aims to predict employees' organizational commitment based on the empowerment components in MELLAT BANK's department of employees affairs.

Study Methodology

The study methodology is descriptive-correlational. In this study, the variable of organizational commitment and its dimensions are considered as the criterion variable, while empowerment and its elements are the predictor variable.

Statistical Population, Sample Size, and Sampling Method

The statistical population of present study includes 140 employees working in MELLAT BANK's department of employees affairs which 130 of them were chosen as the study sample using simple random sampling method. Morgan's table was also employed to estimate sample size.

Data Collection Tools

Following questionnaires were used to collect the required data:

Organizational Commitment Questionnaire:

This questionnaire is comprised of 18 questions and has been designed to improve intellectual-psychological problems. It is an edition of the 24-item questionnaire by Allen, Meyer, and Smith (2015). Four questions (questions 3, 4, 5, 7) are scored in reverse order (Kashiro, 2016). The present study employs this questionnaire to evaluate organizational commitment and its three dimensions (Affective Commitment, Continuance Commitment, and Normative Commitment). Questions are scored based on a five-point Likert scale representing the options (strongly agree, agree, no idea, disagree, and strongly disagree) with scores from 1 to 5. Cronbach's Alpha coefficient was calculated 0.86 for entire questionnaire and 0.78 to 0.85 for its subscales.

Empowerment Questionnaire

Mishra's psychological empowerment questionnaire, which evaluates five dimensions of meaning, self-efficacy, impact, trust, and autonomy, was used in this study. This questionnaire consists of 15 questions which are scored based on a 5-point Likert scale. The minimum and maximum total scores are 15 and 75, respectively. The higher one's score is, the more empowered he or she is. The Cronbach's Alpha was calculated 0.76 for entire questionnaire and 0.73 to 0.91 for its subscales. In addition, the correlation coefficient between questionnaire and its elements was found to vary from 0.76 to 0.91.

Study Findings

As it is seen, the magnitude of skewness and kurtosis for each of the variables are smaller than 2 which mean there is nothing wrong with them in the studied sample (Garson, 2012). On the other hand, Kolmogorov–Smirnov test results show the data gathered for all subscales are normal (p>0.05).

Table 1

Descriptive statics and Kolmogorov–Smirnov normality test results obtained for the studied variables

Signifi cance Level	Kolmogo rov– Smirnov Test	Standa rd Kurtos is Error	Kurtos is	Standar d Skewne ss Error	skewn ess	Standar d Deviati on	Mean Value	Scales
0/972	0/486	0/478	-0/320	0/241	-0/680	0/477	3/348	Empowerme nt
0/448	0/862	0/478	-0/152	0/241	-0/485	0/501	3/340	Organization al Commitment
0/053	1/188	0/478	0/228	0/241	-0/681	0/524	4/145	Competence
0/139	1/155	0/478	0/654	0/241	0/737	0/584	4/095	Meaning
0/136	1/159	0/478	0/066	0/241	-0/610	0/696	3/533	Impact
0/127	1/174	0/478	-0/131	0/241	-0/529	0/915	3/310	Trust
0/125	1/177	0/478	0/602	0/241	-0/792	0/774	3/160	Autonomy
0/290	0/982	0/478	-0/357	0/241	-0/423	0/742	3/592	Affective Commitment
0/121	1/184	0/478	0/824	0/241	0/180	0/799	3/400	Continuance Commitment
0/336	0/943	0/478	-0/005	0/241	-0/402	0/524	3/027	Normative Commitment

Pearson's correlation coefficient was also employed to investigate the relationship of organizational empowerment elements with organizational commitment and its dimensions. Table 2 shows the results.

According to the table, there is a significant relationship between organizational commitment and empowerment. Furthermore, there is a significant relationship between empowerment components of competence, meaning, and impact and organizational commitment dimensions of affective commitment, continuance commitment, and normative commitment, while no significant relationship is observed between empowerment components of trust and autonomy and organizational commitment dimensions. To achieve this, the organizational empowerment components were considered as the predictor variable and the organizational commitment dimensions were separately introduced to the regression equation in the form of 3 models. The obtained results are given in following tables.

Table 2

Pearson correlation between empowerment elements and organizational commitment dimensions

Normative Commitment	Continuance Commitment	Affective Commitment	Organizationa l Commitment	
0/259*	0/225*	0/236*	0/250*	Empowerment
0/226*	0/206*	0/210*	0/240*	Competence
0/336**	0/227*	0/310**	0/303**	Meaning
0/209*	0/202*	0/200*	0/232*	Impact
0/060	0/043	0/058	0/076	Trust
0/073	0/056	0/093	0/086	Autonomy

Table 3

Multivariate regression analysis results obtained to predict three dimensions of organizational commitment

Standard Estimation Error	R^2 Modified	R^2	R	Model
0/6452	0/078	0/127	0/356	model :1 Prediction of affective commitment from empowerment components
0/6841	0/060	0/110	0/329	Model :2 Prediction of continuance commitment from empowerment components
0/4786	0/083	0/131	0/362	model :3 Prediction of normative commitment from empowerment components

Table 3 gives the values of R, R^2, and Modified R^2. The value of modified R^2 is very important since represents properness of the model. It varies between 0 and 1 and a vale closer to 1 shows a greater accuracy of the model. The value of this statistic is nearly 0.08 for the first model showing that 8 percent of the variations in affective commitment depend upon predictor variables. This value is 0.06 for the second model showing 6 percent of continuance commitment is specified by predictor variables and finally, a value of 0.08 for the third model indicates the dependence of 8 percent of normative commitment on predictor variables. In addition, the results obtained from ANOVA (table 4) evaluate the statistical validity of the models. Since the significance level is smaller than 0.001 for all three models, predictor variables can be statistically accepted to affect the criterion variable in all three models.

Table 4

Variance analysis of the organizational commitment dimensions scores on predictor variables

Significance Level)P(	F	Mean Squares	Degree of Freedom	Sum of Squares	Statistic	
0/030	2/617	1/090	5	5/448	Regression	Mo del 1
		0/416	90	37/471	Remainder	
			95	42/918	Sum	
0/021	2/790	1/121	5	5/536	Regression	Mo del 2
			91	35/639	Remainder	
			96	40/834	Sum	
0/025	2/719	0/623	5	3/114	Regression	mo del 3
		0/229	90	20/616	Remainder	
			95	23/730	Sum	

Table 5

Standardized and Non-standardized regression coefficients

Significance Level	t	Standardized Coefficients	Non-standardized Coefficients		Variable	
		Beta	Standard Error	B		
0/000	5/534		0/471	2/607	(Constant)	
0/405	0/836	0/099	0/106	0/089	Competence	
0/025	2/278	0/262	0/087	0/198	Meaning	Model1
0/515	0/515	0/085	0/113	0/074	Impact	
0/124	0/124	0/164	0/087	0/136	Trust	
0/938	0/938	0/010	0/089	0/007	Autonomy	
0/000	5/944		0/499	2/965	(Constant)	
0/386	0/872	0/106	0/112	0/098	Competence	
0/021	2/337	0/289	0/091	0/211	Meaning	Model2
0/468	0/729	0/096	0/118	0/086	Impact	
0/153	1/1443	0/154	0/092	0/133	Trust	
0/629	0/484	0/061	0/094	0/045	Autonomy	
0/000	6/402		0/349	2/237	(Constant)	
0/391	0/862	0/102	0/079	0/068	Competence	
0/011	2/602	0/299	0/064	0/168	Meaning	Model3
0/455	0/750	0/097	0/084	0/063	Impact	
0/839	0/204	0/021	0/065	0/013	Trust	
0/302	1/037	0/127	0/066	0/068	Autonomy	

According to table 5 and significant predictor variables, the regression equation for all three dimensions of organizational commitment are as follows:

Model 1: Affective Commitment = 2.607 + (Meaning × -0.198)

Model 2: Continuance Commitment = 2.965 + (Meaning × 0.211)

Model 3: Normative Commitment = 2.237 + (Meaning × -0.168)

Briefly, the obtained results can be illustrated by the following diagram:
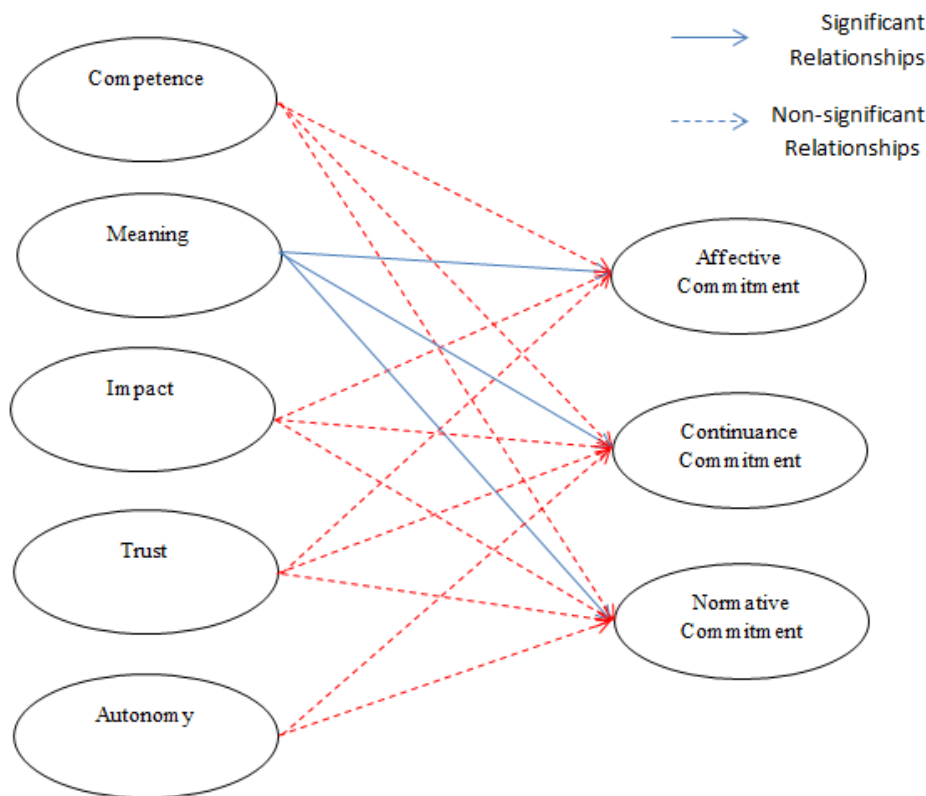
Discussion and Conclusion

Regression analysis results revealed that organizational commitment can be predicted just by the "feeling of meaning". Indeed, "feeling of meaning" was found to be capable of predicting all organizational commitment components including affective commitment, continuance commitment, and normative commitment. This can be attributed to the fundamental, inherent, and internal effect of this component of empowerment. In fact, meaning creates a kind of excitation and motivation feeling in individuals

Therefore, the followings are suggested in order to enhance the employees' feeling of meaning and their organizational commitment in MELLAT BANK's department of employees affairs:

– Standardization of activities and elimination of meaningless works: the activities which induce a feeling of meaning create a feeling of being targeted, excitation, or assignment in individuals and supplies them with a source of power and enthusiasm instead of wasting them.

– Job enrichment: job enrichment can be used as a response to satisfy employees' high demands. This may cause employees to feel the work is valuable and targeted or, in other words, job has a meaning.

– Creating an atmosphere of trust: creation of an environment which gives individuals a feeling of being empowered and conducts them towards a comprehensive and clear idea and makes them to know where the organization moves towards and how they can contribute to it as its employees, has a considerable influence on the enhancement of "feeling of meaning".

– Reduction of job stresses, worries about failure etc.:

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INVESTIGATING THE READINESS OF SEPAH BANK BRANCHES IN MARKAZI PROVINCE IN TERMS OF ORGANIZATIONAL STRUCTURE AND INFORMATION TECHNOLOGY TO IMPLEMENT KNOWLEDGE MANAGEMENT

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ABSTRACT

The aim of this study is to investigate the knowledge management implementation in Sepah Bank branches in Markazi province. This research is an applied-descriptive research in terms of aim. The statistical population of the present study included employees of Sepah Bank branches, which their number was above 360 people. To assess the current situation, a 20-item questionnaire was used. A convenience sampling method was used in this study. Data were collected from winter 2016 to spring 2017. SPSS software was used to analyze the questions. According to the analysis of data, the results showed that management of Sepah Bank branches in Markazi province had adequate readiness for knowledge management implementation in terms of information technology, organizational culture and organizational structure.

Keywords: organizational structure; information technology; organizational culture.

Introduction:

The current age is called the age of knowledge and technology.

Also, the assets of an organization are not limited to financial and physical capital, but also the knowledge capital of individuals is more important than of them and has been considered by managers. In other words, human resource management is a complex aspect of knowledge management. Knowledge management in organizations helps to create a culture of knowledge sharing among employees. Although knowledge can be acquired by individuals, it must be shared by all members of the group to be useful. Different authors have defined knowledge management from different perspectives and with different approaches. According to Robbins, knowledge management includes all the ways in which an organization manages its knowledge assets, including how to collect, store, transfer, apply, update, and generate knowledge. Graver and Madhavm have also defined knowledge management as the explicit and systematic management of critical knowledge and the processes associated with the creation, organization, dissemination, application, and exploration of knowledge. Newman believe that knowledge management is a set of phenomena that includes the creation, dissemination and application of subjective and objective knowledge in an organization (Malekan, 2016, 3).

Many organizations hope to manage their virtual assets and increase the existing benefits by implementing knowledge management in their business. However, deciding to implement knowledge management is often difficult for organizations, because implementation and application of knowledge management in any organization due to the complexity and quality of knowledge requires the necessary organizational context. Thus, investigating and recognizing the status and readiness of organizational elements of knowledge management for its application in any organization is a fundamental and undeniable necessity. Given what was stated above, the research questions are as follows:

Question 1: Does management of Sepah Bank branches in Markazi province have adequate readiness in terms of information technology to implement knowledge management?

Question 2: Does management of Sepah Bank branches in Markazi province have adequate readiness in terms of organizational structure to implement knowledge management?

Question 3: Does management of Sepah Bank branches in Markazi province have adequate readiness in terms of organizational culture to implement knowledge management?

Theoretical foundations of research

Knowledge management

Collins (2017) argues that knowledge management is an important activity in companies and organizations (Collins et al., 2017, 1). Knowledge management is one of the most important and valuable topics in academia and business world. According to the principles and rules of knowledge management, organizations develop knowledge management practices to improve the business process, increase the productivity and quality of their services, and introduce new solutions and provide new products for their customers (Donate & de Pablo, 2015, 360)

• Promotion of knowledge

• Reducing existing problems of knowledge sharing

• Reuse of knowledge

• Retaining of knowledge

In fact, effective and efficient knowledge management can be considered in projects as a tool to increase product quality, reduce project time and prevent mistakes. Hence, it can be stated that many organizations have started the knowledge management initiative with the following goals (Ibid., 13).

• Improving business processes

• Economic savings

• Earning more money

• Increasing user acceptance

• Increasing competitiveness

Knowledge management is one of the newest management methods, which have brought many debates. One of the issues discussed in knowledge management is the relationship between knowledge and organizational performance, but lack of understanding and consensus on this issue remains an important issue (Inkinen & Inkinen, 2016, 230).

Five influential factors in the successful implementation of knowledge management

1. Where does the knowledge value come from?

2. How does the organization develop and use the specific characteristics and conditions of knowledge and test its competitiveness power?

3. What action does the company take to prevent certain characteristics of the company knowledge by other companies?

4. How does the company organize the utilization or exploitation of resources to implement knowledge management?

Importance and design of organizational structure

Organizational Culture

Organizational culture is a set of common meanings and values linking the members of the organization. It forms the value system that governs the organization and distinguishes one organization from another. It is a factor determines the way of doing the works. It is so strong that every newcomer in the organization feels it and subconsciously forms his or her organizational thinking and behavior. Suthe studies show that culture can be an asset or a capital, or a debt.

Information Technology

In today's world of information technology, it is the core of development in the organization and society and determines the basic axes of development and its nature in accordance with the needs of society and employees. In professional development, it is necessary to recognize new human capacities so that they can be developed continuously. The realization of this depends on the use of information technology, because in the process of information technology, information is constantly produced, processed, distributed and managed, therefore, information technology will solve problems when it is in the service of human development and upbringing. (Reshadatjoo, 2016, 124).

Review of literature

In a study entitled "Feasibility study of implementation of knowledge management in organizations", Talebzadeh and Javanmard (2015) examined the knowledge management infrastructure in one of the petrochemical companies. They tried to answer the main question of is there knowledge management infrastructure in the study company? The results showed that the status of the studied petrochemical company was not good in terms of organizational structure, organizational culture, people and knowledge management processes, but it was a good status in terms of financial resource variables and information technology infrastructure. In a study entitled "Knowledge management status and factors affecting its implementation in Tehran University of Medical Sciences", Hosseini Shavon et al. (2015

Methods

This research is an applied-descriptive research. The statistical population of this research included 360 employees of Sepah Bank in Markazi province. In this study, Morgan table was used to determine the sample size, which is estimated to be 186 people, so the same number of questionnaires was collected using the proportional sampling method. In this research, the field method was used to collect the data needed to test the research hypotheses. The data needed for this study were collected using a questionnaire. In this study, a questionnaire was used to collect the required data. The designed questionnaire consists of two parts: descriptive questions and research questions. In the descriptive part, questions were designed about the components (gender, age, education and organizational post) and in the research part, 20 questions were designed to test research hypotheses. To measure the indicators in the questionnaire, a five-point Likert scale was used, which is one of the most common measurement scales.

Validity and reliability of the questionnaire

In this research, to examine the validity of the questionnaire, content validity was used. Accordingly, the quantity and quality of questions were examined from the point of view of experts. To examine the validity, the initial research questionnaire was designed and it was submitted to the relevant professors and experts to give their opinions and views about it. After applying their corrective opinions, the final questionnaire for distribution on a larger scale was designed. To measure the reliability in the early stages of study, information was collected from 25 questionnaires, and SPSS software was used to analyze it. Since Cronbach's alpha coefficient was more than 0.7, the research questionnaire showed high reliability. Finally, descriptive statistics methods such as mean and inferential statistics including multi-sample mean comparison test (ANOVA) were used to analyze the data.

Results

Testing the normal distribution

According to Table 1, the results show that for all the proposed variables, the standard error of the coefficient of skewness and kurtosis is in the range of -2 and +2. Therefore, it can be concluded that data distribution is normal. Therefore, due to normality of the collected data, the

one-sample mean test, two-sample mean test, and analysis of variance were used to examine the designed questions.

Table 1

Results of testing the normal distribution of data

Variables	Information technology	Organizational culture	Organizational structure readiness
Number	186	186	186
unanswered	0	0	0
Skewness	-0.566	-0.440	-0.514
Kurtosis	-0.153	-0.470	-0.063

Examining the research questions

Question 1- Does management of Sepah Bank branches in Markazi province have an adequate readiness to implement knowledge management in terms of information technology

Statistical hypothesis:

$$H_0 : \mu \leq 3$$
$$H_1 : \mu > 3$$

Table 2

T test results related to the first question

Indicator	Test value=3					Confidence level: 95%	
	Mean	Coefficient t	df	Sig	Mean difference	Lower bound	Upper bound
Information technology	3.7591	13.851	185	.000	.75914	.6510	.8673

As the significance level (Sig) is less than 0.05, the hypothesis that the mean is equal to the test value is rejected. Also, lower bound value is 0.6510 and the upper bound value is 0.8673 and both are positive, so it can be stated with 95% confidence that the mean will be greater than the test value (3). Hence, it can be concluded that the H0 is rejected and it is found that the management of Sepah Bank branches in Markazi province is ready to implement knowledge management in terms of information technology.

Question 2: Does management of Sepah Bank branches in Markazi province have an adequate readiness to implement knowledge management in terms of organizational structure?

Statistical hypothesis:

$$H_0 : \mu \leq 3$$
$$H_1 : \mu > 3$$

As the significance level (Sig) is less than 0.05, the hypothesis that the mean is equal to the test value is rejected. Also, lower bound value is 0.8026 and the upper bound value is 0.9759 and both are positive, so it can be stated with 95% confidence that the mean will be greater than the test value (3). Hence, it can be concluded that the H0 is rejected and it is found that the manage-

ment of Sepah Bank branches in Markazi province is ready to implement knowledge management in terms of organizational structure (Table 3).

Table 3

T test results related to the second question

Indicator	Test value=3						
	Mean	Coefficient t	df	Sig	Mean difference	Confidence level: 95%	
						Lower bound	Upper bound
Organizational Structure	3.8892	20.256	185	0.000	0.88925	0.8026	0.9759

Question 2: Does management of Sepah Bank branches in Markazi province have an adequate readiness to implement knowledge management in terms of organizational culture?
Statistical hypothesis

$$H_0 : \mu \leq 3$$
$$H_1 : \mu > 3$$

Table 4

T test results related to the third question

Indicator	Test value=3						
	Mean	Coefficient t	df	Sig	Mean difference	Confidence level: 95%	
						Lower bound	Upper bound
Organizational culture	3.9226	21.748	185	0.000	0.92258	0.8389	1.0063

As the significance level (Sig) is less than 0.05, the hypothesis that the mean is equal to the test value is rejected. Also, lower bound value is 0.8389 and the upper bound value is 1.0063 and both are positive, so it can be stated with 95% confidence that the mean will be greater than the test value (3). Hence, it can be concluded that the H0 is rejected and it is found that the management of Sepah Bank branches in Markazi province is ready to implement knowledge management in terms of organizational culture (Table 3).

Conclusion

1- According to the results, it management of Sepah Bank branches in Markazi province is ready in terms of information technology to implement knowledge management. It can be stated that an organization is ready in terms of information technology for the production, creation, dissemination and storage of knowledge when it is equipped with necessary equipment, including computer software and hardware. Based on the results, branches of Sepah Bank in Markazi province have an appropriate and adequate information technology system. The result of this question is in line with the results of the studies conducted by Davani et al. (2015), Hosseini Shavon et al. (2015)because they concluded that the petrochemical company was in good status in terms of

this variable. However, they are inconsistent with the results of a study conducted by Mahmoudi et al (2013)

2- Based on the results, it can be stated that management of Sepah Bank branches in Markazi province is ready in terms of organizational structure to implement knowledge management. In an organization, knowledge is created and shared when employees are not restricted due to inappropriate organizational structures. For example, when employees are not allowed to participate and make decisions and cannot communicate with their coworkers and managers due to hierarchical structure, we cannot expect the implementation of knowledge management. Hence, structure should be considered for the organization that strengthens the knowledge management process, and since the branches of Sepah Bank have the necessary readiness in terms of structure, it can be stated that suitable structure has been considered for the banks. The result of this question is in line with the results of studies conducte by Davani et al. (2015), Hosseini Shavon et al. (2015), Mahmoudi et al. (2013), Wang and Wang (2016), Valmohammadi and Ghasemi (2016). However, they are inconsistent with results of a research conducted by Talebzadeh and Javamard (2015), as they concluded that their studied petrochemical company was not at good status in terms of this variable.

3- Based on the obtained results, it is found that the management of Sepah Bank branches in Markazi province has the necessary readiness in terms of organizational culture to implement knowledge management. As the issue of knowledge and its management is nowadays being discussed in scientific communities and practical areas, providing the necessary conditions for its implementation is crucial. Nowadays, organizational culture as an infrastructure plays a key role in implementing the knowledge management system in any organization, since because culture determines the do's and don'ts and if employees are restricted by organizational culture, one cannot expect implementation of knowledge management in the organization. Hence, creating a proper organizational culture in accordance with knowledge management can help the organization to implement it knowledge management. The result of this question is consistent with the results of the studies conducted by Davani et al. (2015), Hosseini Shavon et al. (2015), Mahmoudi et al. (2013), so should be improved in light of participatory management.

INVESTIGATING THE RELATIONSHIP BETWEEN R&D EXPENDITURES AND AUDIT FEES IN COMPANIES LISTED IN TEHRAN STOCK EXCHANGE

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ABSTRACT

This study was done to explain the relationship between Expenditure on R&D and audit costs based on earnings management moderator variables in listed companies in Tehran Stock Exchange. This research is a descriptive and inferential study. The statistical population of this research is the companies listed in Tehran Stock Exchange during the years 2011 to 2015. The systematic elimination of 37 companies was selected as the statistical sample. The findings show that the estimation coefficient (0.019214) and t statistic (2.428791) are favorable for the auditor's fee variable (FEE).And the coefficient of estimation (0.0000000051) and t statistic (0.300207) of the audit fee (FEE) variable are not positive and statistically significant (0.7645). In general, the results show that there is a direct and significant relationship between Expenditure on R&D and auditors' fees. Also, earnings management does not modify the association between Expenditure on R&D and auditors' fees.

Keywords: expenditure on R&D; earnings management; audit costs.

1. Introduction

Expenditure on R&D is a whole new concept that has been thoughtfully considered since the twentieth century until before World War II; research and development activities focused mainly on the US, Japanese, and European military industries. In those years, issues were resolved at both the organizational and national levels by providing a solution and investing in it. The relationship between expenditure on R&D and the profit mechanism is implicitly and explicitly covered by all industrial studies, including all costs associated with producing a new product or offering a unique service. With the increasing global competition and the application of new technologies in the manufacture and delivery of products and services, it is more important.

The overall purpose of auditors is to protect the interests of shareholders from material misstatement and misstatement of financial statements. Auditors seek to improve the quality of auditing to safeguard their professional credibility, professional reputation and avoid litigation against them .In the meantime, managers' motivations to pursue their interests in profit quality prevent auditors from achieving their goals. On the other hand, auditors can discover earnings management done by managers by increasing the quality of auditing and put the executives at the forefront of earnings management practices.

Hypothesis 1: Expenditure on R&D is related to auditors' fees.

Hypothesis 2: Earnings management modifies the relationship between expenditure on R&D and auditors' fees.

2. Research Literature and background
2.1. Expenditure on R&D

Any coherent and creative activity aimed at increasing (R&D) research and development of knowledge about humans, culture, society, and applying this knowledge to new applications (Ahmadi, 1998). Existing studies suggest that per capita income growth cannot be seen as a result of the increased labor force and per capita capital stock alone that an essential part of the growth observed in industrialized countries is the inevitable result of technical (Solow, 1956).

In growth models based on R&D activities, long-term growth is explained by focusing on technical progress and R&D activities. As seen in the models of Romer (1990), Infoin and Hueyt (1991), Grossman and Helpman (1992), technical progress results from the effort to invent and invent; thus, any innovation will increase productivity and economic growth.

2.2. Earnings management

The philosophy of earnings management is to take advantage of the flexibility of standard methods and accepted accounting principles. When the interpretation of a standard is very flexible, the integrity of the data presented in the financial statements is reduced. The laws of compliance and conservatism can also lead to earnings management (Noroush and Sepasi, 2005).

Different real earnings management activities can have different and opposite effects on current cash flows. In this regard, Garcia Lara and Osma (2010), in their research titled "Investigating the Conservative Impact on Earnings Management," aimed at exploring; does limiting accrual manipulation lead to less conservatism through increased real earnings management? The results show a negative relationship between conservatism and accrual manipulation and a positive correlation between conservatism and actual earnings management.

In a study, Cohen and Zarowin (2010) examined both types of earnings management and found that managers are often involved in actual earnings management at the time of the seasonal release of stocks, and performance reductions at the time of the seasonally issued stocks are more the result of earnings management through actual activities than earnings management through accruals. The undercutting of real activities has real economic consequences.

2.3. Audit costs

The demand for independent audit services stems from a conflict of interest between owners and managers. Different shareholders own companies, but the day-to-day operations of the company are managed by professional executives who may not have a significant stake in the company. This means that shareholders of the company have a residual claim on the company's resources, and the company managers are required to disclose the results of their oversight of the company through disclosure of a set of financial statements. It is necessary to have the financial statements certified by an independent auditor to ensure the reliability of the financial information published by the company (Neimi, 2002).

2.4. Audit fee

The audit fee is useful in planning and executing the proper and quality financial audit work. Poor auditing quality reduces the confidence of users of financial statements, which not only leads to failure to achieve the audit objectives but also reduces the credibility of the large-scale audit process and impedes optimal allocation of capital in the securities market and increases the cost of capital and financing (Rajabi, 2004).

In his research on the relationship between audit fees and non-voluntary accrual audit fees for 8187 companies, Alali (2011) showed that there was a positive and significant relationship between non-voluntary accruals and audit fees between 2000 and 2006. Audit fees also have a negative association with company profitability. Companies in poor financial conditions (losses) expect to pay more audit fees, which increases the risk for these companies and decreases profitability.

2.5. The relationship between earnings management and audit costs

Audit Value Increases as Companies Have Enough Motivation to Manage ProfitsBecause Audit Reduces Management's Opportunity for Motivation in Financial Statements (Chen et al., 2010). Audit fees reflect the economic costs of efficient auditors. In this regard, Griffen et al. (2007) found in a study (Corporate Governance and Audit Fees in American Companies) thatHaving a better corporate governance system in the company reduces the cost of doing the audit. They believe this relationship is due to the creation of a better corporate governance system leading to a better quality of financial statements and stronger internal controls, and this will enable auditors to reduce the price of audit risk and thus audit fees.

3. Research methodology

The purpose of this study is applied and the correlational method using a multiple regression model. The statistical population of this study consists of the companies listed in Tehran Stock Exchange from 2011 to 2015. The sampling method will be randomly selected and systematically eliminated with the following conditions:

- Their fiscal year is due to end in March.

- The company has been admitted to the Tehran Stock Exchange before year 4.

-The company does not have accumulated losses.

- have disclosed the amount of research and development expenses in their financial statements.

- The financial information of the test companies is available during the research period.

Due to these limitations, 37 companies were selected for five years (90-90%).

3.1. Research Model

Multivariate regression has been used to examine the relationship between expenditure on R&D and Chi Cheng et al. model (2016).

$$FEE_{i,t} = \alpha_0 + \alpha_1 R\&D_{i,t} + \alpha_{2(}R\&D_{i,t} * EM_{i,t)} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 LEV_{i,t} + \alpha_6 OPIN_{i,t} + \alpha_7 AUDSIZE_{i,t} + \alpha_8 AGE_{i,t} + \varepsilon$$

It is used to estimate earnings management ((EM Modified Jones Model; Dechow et al., 1995, including ACCRit accruals)).

$ACCR_{i,t} = \alpha_o + \alpha_1 [\Delta REV_{i,t} - \Delta REC_{i,t} + \Delta INV_{i,t}] + \alpha_2 PPE_{i,t} + \varepsilon$

All ACCR accruals

$(REV_t - REV_{t-1})$ t, up to year t change in income from year Δ REV-1

T, Gross property, plant and equipment in PPE

$(INV_t - INV_{t-1})$,

Up to year t change in inventory of materials from year Δ INV-1

AGE, Company life from the date of admission to the exchange.

E, Error value

4. Data and statistical population of research

The research hypotheses were tested based on data collected from 93 companies admitted to the stock exchange during the years 2011 to 2015 using combined regression analysis. The first hypothesis is that there is a relationship between expenditure on R&D and audit fees.

According to Table 2, the coefficient of estimation (0.019214) and t-statistic (2.428791) of the audit fee (FEE) are positive and statistically significant (0.0164). Accordingly, the results of the first hypothesis are confirmed at a 5% error level. So based on these results, it can be concluded that there is a significant relationship between expenditure on R&D and audit firms' pay.

Table 2

Statistical results of the first research model test, the dependent variable of auditors' fees

Variable	Coefficients	Standard deviation	T statistics	Relationship type and significance (5% error)	Relationship type and significance (5% error)
Audit fee	0.019214	0.007911	2.428791	Positive and significant	Positive and significant
Expenditure on R&D	-142.8454	90.96253	-1.570377	No relationship	No relationship
Earnings management	-79.77297	185.0089	-0.431185	No relationship	No relationship
LEV	-180.0246	154.2730	-1.166923	No relationship	No relationship
LOSS	36.53486	63.25408	0.577589	No relationship	No relationship
OPIN	12.50261	59.62880	0.209674	No relationship	No relationship
AUDSIZE	56.29000	92.50422	0.608513	No relationship	No relationship
AGE	150.4538	17.19588	8.749409	Positive and significant	Positive and significant
Except disruption	-107.5244	1098.535	-0.097880	-	-
Statistic F (significance level)	(0,000000)17,14509	Watson Camera Statistics	1,877849		
Coefficient of determination	0,343468	Adjusted coefficient of determination	0,314272		

Hypothesis 2: Earnings management modifies the relationship between expenditure on R&D and auditors' fees.

Table 3

Statistical test results of the second model of research, the dependent variable of future performance

Variable	Coeffi-cients	Standard deviation	T statistics	Significance level (sig)	Relationship type and significance (5% error)
DCA	-0.025817	0.007890	-3.272200	0.0013	-
EM	1.46E-05	3.26E-05	0.447352	0.6553	No relationship
DAC_EM	5.10E-09	1.70E-08	0.300207	0.7645	No relationship
SIZE	-166.9581	203.9418	-0.818655	0.4144	No relationship
ROA	-315.0184	450.4709	-0.699309	0.4855	No relationship
LEV	-317.6189	393.7483	-0.806655	0.4213	No relationship
LOSS	33.79258	146.9182	0.230010	0.8184	No relationship
OPIN	-5.214567	126.1713	-0.041329	0.9671	No relationship
AUDSIZE	-59.96178	232.7445	-0.257629	0.7971	No relationship
AGE	175.8540	41.29253	4.258735	0.0000	Positive and significant
Except disruption	-139.1887	2391.723	-0.058196	0.9537	-
Statistic F (significance level)	(0,000000)9,189472	Watson Camera Statistics		1,673702	
The coefficient of determination	0,253886	Adjusted coefficient of de-termination		0,221848	

According to Table 3 Estimation coefficient (0.0000000051) and t statistic (0.300207) are positive for auditors' fee variable (FEE) and positive (n = 0.7645).Accordingly, the results of the second research hypothesis cannot be confirmed at a 5% error level. Therefore, these results suggest that earnings management does not modify the relationship between expenditure on R&D and audit fees.

Discussion and Results

Regarding the positive relationship between R & D expenditure with the auditors' fees, it can be said that the higher the level of research expenditure and development in a company, the higher the audit fees and also audit quality. Although the present study conforms to similar internal and external studies in accepting the first hypothesis, it has rejected the second hypothesis representing the mediating and moderating roles of profit management in relation between R & D expenditure and the audit fee. However, this relationship has been positive and significant in research like Mohammad Reza Abbaszadeh and et al. (2017). One of the reasons for this unconformity can be attributed to the higher sample size in the present study, which provides a more accurate result. In Lontis and Dimitropoulos's study (2010), profit management is a deliberate factor for opportunism in companies. So, when it increases, audit value as the corporate governance monitoring tool increases. In their research, Mohammadi and khashouee (2007) has also examined the indices of agency cost, pricing of audit services and the direct and meaningful rela-

tionship between them. Sadeghi and Dehdar (2014) address the identification and reporting of R & D expenditure in the books, records and financial statements of the auditing and services companies listed on the Tehran Stock Exchange, the way of dealing with such spending (flow, capital or capital flows), and the regard for R & D expenditure as a powerful tool for applying the profit management. The contradiction between the findings of these researchers and the result of current study is open to discussion and requires deliberation.

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THE EFFECT OF MODERN MARKETING MANAGEMENT ON THE EXPORT OF BRANDED GOODS

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ABSTRACT

The main issue of any business activity is investigating modern marketing management. This strategy shows where the company is going and what the goal is to arrive at the destination. Choosing a market and deciding on the type of product, price, and policies related to the promotion and distribution of that product is a new marketing management strategy performed by the company. A company's strategy is its plan to compete in export markets. The ability to create well-known and powerful brands in the Middle East and keep customers for ourselves is the main and lasting benefit in export. In addition to the variety of international marketing methods through internet marketing, business consultants, and business offices, this article investigates export marketing, including international marketing strategies.

Keywords: new marketing; export; brand; international marketing; strategy.

1-Introduction:

Modern marketing management has become crucial in today's business environment due to the globalization of markets and the relationship between economies. In the field of export of branded goods, all companies face the challenge of international competitors even if they want to operate only in the domestic market. It is essential to have a modern strategy on how to enter these markets and succeed in them. In terms of exports, the fundamental strategy is to ensure the growth and survival of a company.

One of the most important first steps in branding goods in the international community is exporting. To clarify our position in the market, we need to have enough information about the current state of the target markets. Because global marketing is exposed to risks that are very complex and vague. Modern marketing is a broad platform for promoting products and services. This market is open to everyone, and it is not limited to some domestic markets or for people who live in a particular place, region, or country.

People can actively participate in it from different nations with different cultures and traditions.

2- Concepts of terms:

2.1. Marketing:

To survive and continue the activities, many organizations should use all the desired facilities and strategies and seek opportunities in international markets in today's competitive world. Marketing is a bilateral process so that the company creates value for the customer and creates a strong relationship with the customer to receive value from them in return (Cutler and Armstrong, 2008, p. 85). Target market, customer needs, integrated marketing, and profitability are the concept of marketing principles. Marketing is a social and managerial diagnosis process (consumption, consumer behavior, and consumer behavior).

2-2 Marketing Management

Marketing management is defined as the analysis, planning, implementation, and control of designated programs to provide favorable exchanges with target markets to achieve organizational goals. Marketing management emphasizes some items more, such as determining the or-

ganization's products based on the needs and wants of the target market, using effective pricing, communication, and distribution to inform, stimulate and provide services to the market. In addition, marketing management is defined as the analysis, planning, implementation, and control of designed programs to achieve organizational goals.

2-3 Exports:

The most common way for companies to start overseas marketing activities is known as export. Due to the fewer resources than other internationalization methods, there are many reasons for exporting. Different companies are encouraged to export because it increases employment within their country, develops competitiveness, and improves foreign exchange earnings. Companies make many efforts to increase exports due to competitive pressure and interest in growth and development. (Kanani, Shokrchizadeh, 2016).

2-4 Brands:

Brand or business name is significantly effective in identifying the products and services of organizations. It is also an intangible property for organizations. Many researchers have stated that one of the important factors in achieving competitive advantage and long-term survival is building a strong brand. Brand value evaluation mostly involves perceptual concepts based on a consumer perspective. Perceptual concepts are the power of the brand and the set of situations that the consumer learns, feels, sees, and ultimately understands about the brand. On a perceptual basis, the property that is expected to improve customer behavior, customer willingness to buy, and the performance of corporate markets is known as the value of a brand (Mohebbi, 2017).

3. Export marketing strategy:

Companies have used different approaches to enter the global market. This approach is the most famous and easiest approach adopted by companies to enter and affect foreign markets. Because in addition to the least resources, export has the least risk and the least organizational commitment. It is impossible to maintain a competitive advantage for a long time. The company should effectively move between the four elements mentioned to win in a competitive environment. Therefore, a series of advantages are temporarily created. The proposed new strategies emphasize the creation of temporary advantages relevant to market expansion. These strategies include major stakeholder satisfaction, forecasting, positioning greater speed, positioning for surprise, changing game rules, setting strategic goals, and simultaneous and consecutive strategic threats. Therefore, the effect of competition on the organizational decline is reduced due to the high awareness of the forces that create competition and designing a means to disrupt competitors.

4. International marketing

The business activities such as delivering a company's goods and services to its customers or consumers in more than one country to have profit are called International marketing. Consumers have similar and similar characteristics. Market segmentation is based on the criteria such as geographical, demographic or demographic, psychological, behavioral, marketing, and economic factors. The marketing management should choose one of these segments as the target market after examining the market and dividing it into similar segments. Based on the composition and ability of marketing staff, competitiveness and business policy, marketing management can choose more than one department. (Abbaszadeh, 2016, p. 995).

5. New marketing methods:

In today's competitive world, the role of marketing is undeniable. Developed countries are performing some of the up-to-date advertising and marketing methods much cheaper and with high efficiency. Nevertheless, Iran has not yet realized the importance of this field. We need undoubtedly marketing to promote Iranian goods and the growth and development of exports to

global markets. If not, we cannot compete in international markets. Here are some types of new marketing methods.

1-1-5 neural marketing:

Neural marketing uses neuroscience methods to analyze and understand human behavior concerning markets and customer marketing exchanges. This method also explains why a consumer chooses a product. Neural marketing consists of a discipline of behavioral economics. In addition, it shows an analytical path related to the effects of irrational human performance in decision-making. (Ismailzadeh, 2020, pp. 327 and 326).

2-1-5 Content Marketing:

The content marketing meaning varies based on the context that is why its definition is challenging. To draw customer attention to the brand, marketers are using increasingly content marketing instead of traditional advertising. Due to the pressure-free methods to attract customers to the brand, content marketing seems an ideal technique. Content marketing also implements integrated marketing communication theories (Cronin, 2016: 88). Content marketing is a process that creates valuable content for a relevant, engaging, and targeted audience. Content marketing focuses on providing value to the consumer and relational marketing concepts (customer acquisition and retention) to achieve a company's profitability goals (Vinerean, 2017). In today's competitive age, the organization should trust customers if it wants to be sustainable for a long time. Instead of ads that annoy customers, companies prefer to create content such as blogs, and valuable videos on Instagram, through digital content marketing. Social media platforms provide marketers a voice and a way to connect with colleagues, customers, and potential customers. Marketers build lasting relationships with customers by providing valuable content to targeted customers (2019, Singli & Mathur).

Content marketing is divided into three parts (2019, Wang):

– The art of providing useful content to customers without disturbing them.

– Providing relevant information allows customers to have more information before buying instead of offering or promoting products or services

Customers will thrive on their loyalty to the business if they receive valuable and consistent information. Achieving interaction with the audience through targeted and well-crafted content is the main goal of content marketing. Businesses need to consider using this content to make consumers loyal and get their ongoing business (Gokhale, 2016).

3-1-5 Digital Marketing:

Managers can improve the current situation and move towards gaining more competitive advantages by changing attitudes from traditional methods to new methods. According to the research, chain store managers face some challenges: how to attract more customer satisfaction in the digital marketing space and provide better services to them? Is there a suitable solution to improve the performance of the marketing capabilities process? Due to the unfavorable market orientation and strategies and attention to the category of digital marketing among employees and managers, there is a decrease in customers' desire for chain stores. Therefore, having only one technological view of digital marketing management is responsible for inappropriate conditions in marketing capabilities, including customer orientation and attention to competitors' activities. Marketing capabilities in chain stores is a process that should be coordinated with all activities inside and outside the organization, the requests of managers, and the ability of human resources.

6- The effect of new marketing on the export of branded goods:

Having new marketing in foreign exchange is one of the most important tools of export development strategy. In terms of production, a country may have an advantage but no advantage in terms of trade. Due to the relative inefficiency in the marketing of goods in stages

such as packaging, transportation, quality control of production standards, and lack of access to information related to world trade. On the other hand, our export share in some global markets has decreased because strangers and brokers have entered exports. Furthermore, another reason to decrease the share of global markets is the lack of accurate information of the country's producers about the conditions of global markets.

Conclusion:

It is necessary to perform a detailed analysis of all cases and dimensions to start marketing and business operations in foreign markets. Specific information data are needed to conduct the study. This data can prepare specific models of some specific products and specific markets. After determining and selecting the potential market, the entry strategy setting and marketing plan are performed. Then, efforts focus on setting up a specific marketing plan for the same market. This program should reflect the needs of consumers and market conditions. Successful modern marketing management planning is based on accurate information. Collecting and analyzing information in the cultural, political, legal, and economic fields helps modern marketing management better understand the target market and make management decisions, planning, and controls closer to reality.

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ФУНДАМЕНТАЛЬНЫЕ И ПРИКЛАДНЫЕ ИССЛЕДОВАНИЯ
В СОВРЕМЕННОМ МИРЕ
ТОМ 2

Материалы
XXX Международной научно-практической конференции

Санкт-Петербург,
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