

Identifying and Prioritizing the Factors Affecting and Affected by the Performance of Small and Medium Enterprises by using Dematel Technique (The Case Study of a Province in Iran)

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Abstract

Background/Objectives: The purpose of the present study is to identify the factors affecting and affected by the performance of small and medium enterprises (the case study of a province in Iran). **Methods/Statistical Analysis:** The research method used in this study, in terms of target, is of applied type and in terms of data collection it is a descriptive survey; the method utilized for data analysis is Dematel technique. **Findings:** The present article seeks to answer questions such as: what is the most effective factor on the performance of small and medium enterprises in Semnan? Which factor is mostly affected by the performance of small and medium enterprises in Semnan? How are the factors affecting and affected by SMEs performance in Semnan ranked? Therefore, after studying literature of the review and investigating viewpoints of SMEs experts and scholars, after refining the indices, seven factors were identified as the key factors affecting SMEs performance. Then by using Dematel, a powerful technique in this field, the seven factors were classified into two groups of affecting and affected factors. **Conclusion/Improvements:** The results indicate that the amount of financial resources to guarantee financial contracts is the most effective factor and the amount of entrepreneurs' abilities is the most affected factor.

Keywords: Dematel Technique, Performance, Small and Medium Enterprises, SME

1. Introduction

In recent years, the significance of small and medium enterprises has been growing in industrial and developing countries. SMEs businesses are a key to understanding business approach for market orientation¹. In the last two decades, by emerging modern technologies in production and communication, revolutions have appeared in capabilities of industrial units, production and distribution methods and enterprises organizational structure, which has generally enhanced the significance of small and medium units². Performance usually involves the evaluating and analysis of productivity. Performance measurement is used to provide information to decision makers, to measure strategies and ensure that they remain effective and to measure continuous improvement³. Some

reasons of developing countries' attention to small and medium enterprises compared to large ones are high flexibility, low cost investments, orientation towards target groups, and dynamic management in these kinds of industries which can create job opportunities, reduce poverty, improve income distribution, and meet basic needs as well as increasing gross national product⁴. 98% of enterprises in Canada are small and medium and in Japan, 60% of exports in industries belong to these enterprises⁵. Regarding definition of small and medium enterprises, it must be mentioned that each country has presented a definition according to its specific conditions. Hence, one of the issues related to research on SMEs is the fact that there is no universal consensus on the method of distinguishing the boundary between small, medium, and large enterprises. Nevertheless, there are some criteria such

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as the number of staff, amount of sales, and the amount of assets that distinguish small and medium enterprises from large ones⁶.

Various definitions of SMEs have been presented. In its report, UNIDO (2003) indicated that the definitions of SMEs in Iran are not in agreement, and different organizations and institutions have provided different definitions⁷. Most companies that rank first in these industries are those with a staff of less than 50⁸. Although over 95 percent of all productive units in Semnan province are small and medium enterprises, due to lack of development strategy based on existing industrial structures and ignoring small productive units, these institutions do not have a major role in gross national product and creating value-added and they also suffer serious shortages⁹. Small and medium enterprises have plenty of competitive advantages compared to big companies. For instance, they have more ability for originality and innovation, and due to their flexibility, they can respond better to environmental changes and satisfy their customers' emerging needs¹⁰. In spite of the importance of SMEs in countries' economies, researches have revealed that a great percentage of SMEs encounter failure in the initial years. In Germany, SMEs account for over 99% of total corporations (they account for over 40% in terms of total revenue)¹¹. Ballantine, for instance, illustrated that 11% of the SMEs set up one year ago and also 80% of the new SMEs set up five years ago experience failure¹². SMEs in Korea play a pivotal role in the proportion of national economy. Despite the importance of SMEs in national economy, South Korea's SMEs are in charge of only 34.9% of total sales, but large corporations, accounting for less than 1% of total number of firms, are in charge of 65.1% of total sales¹³. The main issue of the present research is which factors basically affect the performance of small and medium enterprises and which of these factors are effective and which of them are affected and how these factors are ranked so that by identifying and analyzing these factors, managers and planners are assisted to improve their performance in a more precise and scientific way and they can improve the affected factors and thus the performance of active companies in small and medium industries by investing more on the effective factors since improvement in SMEs performance and thus their development leads to improvement in level of democracy and creation of a civilized society¹⁴.

Although creating a successful small and medium enterprise is a difficult and complicated task in each section

of industry and business, these challenges and difficulties reduce by identifying and prioritizing the factors affecting and affected by performance. Therefore, the necessity of this study is evident since if SME owners know which factors are effective and which ones are affected and how factors in each group are ranked, they will be able to manage the affairs related to investing money and time more precisely and rapidly and planners will have a better plan to prioritize the processes.

2. Literature of the Review

Karpak and Topcu utilized network analysis process to prioritize the factors affecting the success of manufacturing SMEs in Turkey. According to the results of this research in which ANP has been used, rules and regulations are the most effective factor in the success of small enterprises¹⁵. Chorev and Anderson analyzed crucial factors of success of small newly formed enterprises possessing superior technology in Israel. According to the results of this research, the most important factors affecting the success of these enterprises include the commitment of the management group, expertise, organization methods in general and marketing methods in particular, relation with customers, and managerial capabilities and research¹⁶. In a study, Man reviewed the literature of SMEs' success and showed that three features affect the success of these enterprises: endogenous factors, personal qualities, and entrepreneurs' personal qualities¹⁷.

Rogoff identified 11 factors affecting the success of small enterprises: personal qualities, managerial issues, financial affairs, marketing activities, human resources issues, economic conditions, product characteristics, competition, discipline, technology, and environmental factors¹⁸. In another study, Benzing investigated the factors of success and failure of entrepreneurship in Turkey by utilizing factor analysis statistical method. According to the results of this research, entrepreneurs in Turkey believe that the popularity of the firm and its management including sincerity and social skills, previous experience and the manager's character traits are the most important factors of success of small enterprises. Additionally, a complicated tax system and inability to absorb and keep reliable staff were mentioned as the most important problems of entrepreneurship¹⁹. Sepehrdoost and Kamran in an article entitled "The amount of availability of efficient technology, the evaluation of technical efficiency of small industries in Hamedan province" showed that the average

technical efficiency of the performance of small industries in the provinces of the country is 96% during the study. Analyzing the sensitivity of the factors affecting the efficiency proved that factors such as employment, value of investment, and products value have an important role in the improvement of efficiency of the country's small industries. The average efficiency of small industries in Hamedan province was obtained 92% during the study and ranked 12 on average among the provinces of the country. Also, the analysis of efficiency index of all production factors showed that efficiency growth of small industries in the province does not have a positive and expected procedure⁴.

Amin Aqae in an article entitled "The study of factors affecting the performance of small industries from rural development experts' viewpoints" obtained the following results. The present situation of Iran's small rural industries is not able to justify extra staff in agricultural section, significant difference of welfare level between villages and cities, not immigration of villagers to big cities, and economic and social development in Iran's villages. The study of the factors affecting the performance of Iran's small rural industries can clarify some important points concerning reasons of lack of agreement between Iran's small rural industries and rural development goals and clarify basic planning lines of enterprises managers and government policymakers. In this article, the factors affecting the performance of Iran's small rural industries have been categorized into three groups, namely structural, environmental and content factors²⁰.

Aminbeidokhti and Zargar in an article entitled "The study of existing obstacles to SMEs development and presentation of a framework supporting them" maintain that SMEs in Semnan province have encountered various endogenous and exogenous obstacles and problems. Besides, the results of the statistical analyses showed that facilities and financial and nonfinancial supports from SMEs have not been sufficient in financial, technical, marketing, and executive fields⁹. Piri et al. indicated that the purpose of this research was to study the direct and indirect effects of competitive industrial forces on adopting strategies and performance of small and medium industries in industrial cities and areas in Hamedan province that was tested by 3 hypotheses. The method of this research is applied based on the purpose of research, but in terms of procedure and nature, it is a causative research. The population of study, i.e., the managers of manufacturing companies of industrial cities and areas in Hamedan province, is

501 people. In this research, a questionnaire was designed to collect data, and after testing its validity and reliability, was given to the sample including 273 managers employed in manufacturing companies of industrial cities and areas in Hamedan province. Data analysis in this research is carried out by utilizing modeling techniques of structural equations with the software LISREL. The research findings confirm the moderating role of managers' performance by adopting strategies and show that the managers of small and medium industries can moderate some of the negative effects of competitive industrial forces by adopting appropriate strategies in production, study of environment, and adjusting decision-making. This research also indicates that the managers' performance can be assessed by comparing direct and indirect effects of competitive industrial forces on performance. The obtained results of this research confirm the moderating role in the performance of managers of industrial units in Hamedan province by adopting an appropriate strategy²¹.

3. Methodology

The present study is applied in terms of purpose and analytical in procedure. It was conducted in companies in industrial cities in Semnan province in 2014. The main purpose of the present research is identifying and prioritizing the factors affecting and affected by the performance of small and medium enterprises in Semnan province. In order to analyze the data, Dematel technique was used. Dematel technique was first presented in the institute related to Buttle in Geneva research center²². At the time this method was employed in the world's complicated researches such as famine, energy and environmental protection. Dematel is one of the multi-criteria decision-making techniques and is able to transform qualitative projects into quantitative ones²³.

Dematel technique can help develop a table to reflect the relationships between variables when there is dependence between them and thus is used in research to solve complicated problems that include a great number of variables related to each other. The other feature of this technique is that it considers not only the direct effects but also the indirect ones²⁴. In order to solve Dematel technique, by considering the experts' viewpoints and also studying the review of literature and screening the indices, seven factors were ultimately identified as the key factors affecting SMEs' performance. In Table 1, we are going to explain these factors and abbreviations used

in Matlab software that has been used in order to solve Dematel technique:

In order to clarify the method of conducting the research, we will mention the phases of Dematel technique:

3.1 The Phases of Dematel Technique.

- Phase 1: Selection of scale to compare the criteria.
- Phase 2: Conducting pair comparisons and preparing matrix of direct relationships.

In this phase, the initial matrix (\hat{M}) is obtained based on the amount of relationship and effect of factors on each other and through matrix of pair comparisons.

$$\text{Max } \hat{M} = 11$$

The Table above indicates that the fourth factor, i.e., the amount of financial resources to guarantee financial contracts (D) has the highest sum of row, which shows this index has the highest position by experts and managers of small and medium enterprises.

Table 1. The key factors affecting SMEs' performance obtained by review of literature and statistical investigations

The factors affecting SMEs' performance	Abbreviations used for these factors
Amount of entrepreneurs' abilities in having healthy and comprehensive competition	A
Amount of demand for production	B
Amount of availability of efficient technology	C
Amount of financial resources to guarantee contracts	D
Amount of capital	E
The ability of managers in making timely decisions	F
Taxes	G

Table 2. The scale of comparisons in Dematel technique

Definition	numbers
With no effect	0
Little effect	1
Medium effect	2
Much effect	3
Very much effect	4

Table 3. The matrix of pair comparisons

	A	B	C	D	E	F	G	sum
A	0	0	0	0	0	0	0	0
B	4	0	0	0	0	3	0	7
C	4	3	0	2	0	0	0	9
D	4	3	3	0	0	1	0	11
E	3	4	0	0	0	1	1	9
F	4	0	0	0	0	0	3	7
G	3	3	0	0	2	2	0	10

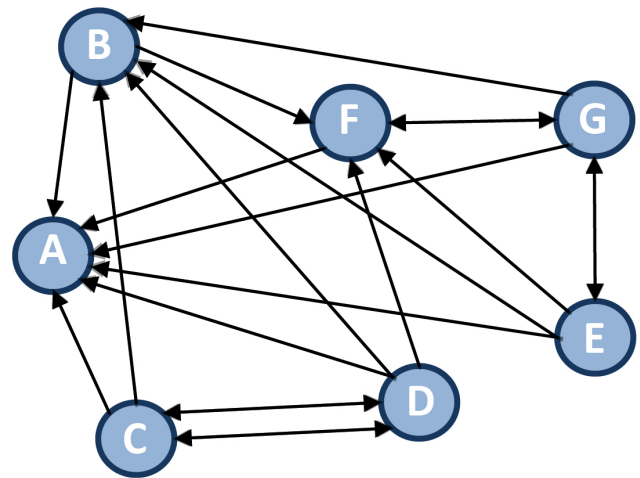


Figure 1. Network plot of the factors affecting small and medium industries.

- Phase 3: Obtaining normalized matrix (M).

Matrix (M) is obtained from relations (1) and (2).

$$1. S = \frac{1}{\text{Max } \hat{M}} = \frac{1}{11} \quad S = 0.09$$

- Phase 4: Calculating the matrix of general relationships (C).

After calculating normalized matrix (M), the matrix of general relationships (C) is obtained from development of relation (3). In this relationship, matrix (I) is identity matrix.

$$2. C = M \cdot (I - M)^{-1}$$

$$3. B = (I - M)^{-1}$$

$$C = M \cdot B$$

Here $R = I - M$ and B equals reversed R.

- Phase 5: Investigating the results of cause group and effect group.

Calculating the values of $D - R$ and $D + R$ by utilizing relations of (4), (5), and (6).

$$4. T = t_{ij} \quad (i, j = 1, 2, 3, \dots)$$

$$5. D = \sum_{j=1}^n t_{ij}$$

$$6. R = \sum_{i=1}^n t_{ij}$$

Since R is sum of columns and D is sum of rows, by considering the obtained values, some factors have higher positive values of $D-R$, which in fact indicates greater impact than the other factors. Therefore, they have higher priority than the others and are called the cause group. Those containing the negative values are more affected and have lower priority and thus constitute the effect group²⁵.

- Phase 6: Drawing the map of relations.

By means of obtained values of $D-R$ and $D+R$, the map of relations is drawn to clarify internal relations, and the degree to which factors affect or are affected²⁶. So, Dematel technique follows two main purposes: it classifies the factors in two groups of cause and effect. It shows the internal relations between the factors.

4. Data Analysis

After employees' viewpoints were collected using questionnaires and the initial matrix (\hat{M}) of was established based on the amount of relation with and effect of each factor on others and by means of mean pair comparisons, we will draw matrix R according to the mentioned phases:

$$7. R = I - M$$

Table 4. Matrix (R)

1	0	0	0	0	0	0
-0/3636	1/0000	0	0	0	-0/2700	0
-0/3636	-0/2700	1/0000	-0/1800	0	0	0
-0/3636	-0/2700	-0/2700	1/0000	0	0/0900	0
-0/2700	-0/3636	0	0	1/0000	0/0900	0/0900
-0/3636	0	0	0	0	1/0000	-0/2700
-0/2700	-0/2700	0	0	-0/1800	-0/1800	1/0000

Table 5. Degree of direct relations (the final matrix of Dematel)

0	0	0	0	0	0	0
0/5056	1/0270	0	0	0/0145	0/2931	0/0804
0/6292	0/3456	1/0511	0/1892	0/0058	0/1166	0/0320
0/7173	0/3796	0/2838	1/0511	0/0103	0/2083	0/0572
0/5553	0/4157	0	0	1/0280	0/2327	0/1554
0/5259	0/0999	0	0	0/0536	1/0854	0/2979
0/6011	0/3701	0	0	0/1986	0/3164	1/1033

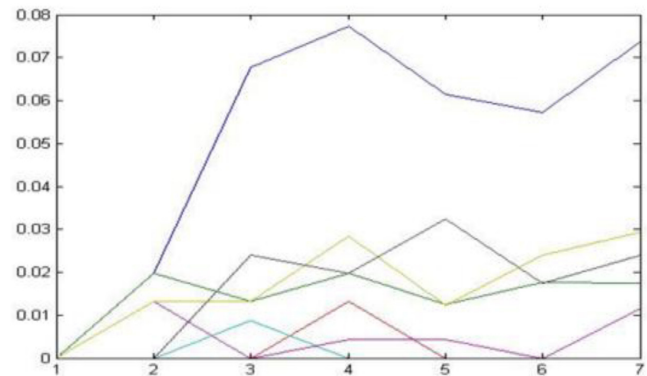


Figure 2. Matrix of direct relations (\hat{M}) obtained from pair comparisons.

The possible degree of indirect relations is calculated from the following relation:

$$8. T = M^2(I - M)^{-1}$$

$$T = D \cdot B$$

4.1 Investigating the Results of Cause Group and Effect Group

After utilizing Dematel technique and drawing the map of relations between indices, they were divided into two groups of cause and effect based on the degree to which they affect or are affected. The results are as follows: the greatest sum of rows (D) represents the order of elements that definitely affect the other ones. The greatest sum of columns (R) represents the order of elements that are affected by the others. Therefore, order of elements of rows (D) shows the hierarchy of affecting elements and order of elements of columns (R) shows the hierarchy of affected elements²⁵. By considering the obtained values, some factors have higher positive values of $D-R$, which shows greater impact on the other factors, so they have higher priority than the others and are called cause group.

Table 6. Matrix of relative degree of indirect relations

0	0	0	0	0	0	0
0/1420	0/0270	0	0	0/0145	0/0231	0/0804
0/9623	0/3069	0/5108	0/0920	0/0513	1/0390	0/2849
0/4867	0/5248	0/0511	0/0092	0/0121	0/2449	0/0672
0/3537	0/1096	0/0138	0/0511	0/0103	0/1183	0/0572
0/2852	0/0521	0	0	0/0280	0/1428	0/0654
0/1623	0/0999	0	0	0/0536	0/0854	0/0279
0/3310	0/1000	0	0	0/0186	0/1364	0/1033

Table 7. Matrix of cause and effect

Indexes	D	R	D-R	D+R
A	0	3.5344	-3.5344	3.5344
B	0.9206	1.6379	-0.7173	2.5585
C	1.3695	0.3349	1.0349	1.7044
D	1.7076	0.2403	1.4673	1.9479
E	1.3871	0.3108	1.0763	1.6979
F	1.0627	1.2525	-0.1898	2.3152
G	1.5895	0.7262	0.8633	2.3157

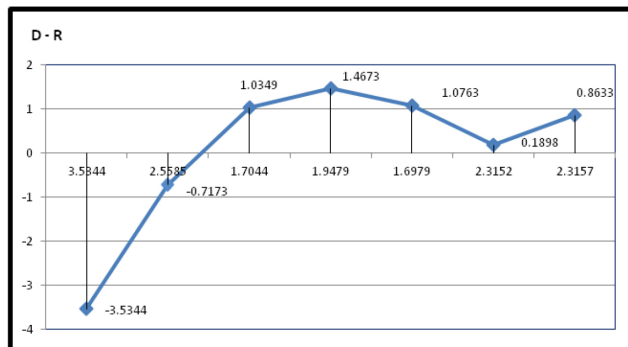


Figure 3. The map of cause and effect relations.

The ones containing negative values are more affected and have lower priority and constitute the effect group.

While R is sum of columns and D is sum of rows, by considering the obtained values, some factors have higher positive values of D-R, which shows their greater effect on the other factors. So they have higher priority than the others and are called cause group. Those containing negative values are more affected and have lower priority and thus constitute the effect group. By means of obtained values of D-R and D+R, the map of relations is drawn to clarify internal relations, and the degree to which factors affect or are affected²⁷.

This diagram shows the relations between indices, the column of which is D-R and the row of which is D + R.

In this phase, the indices containing positive values of D-R are placed in cause group and the indices containing negative values of D-R are placed in effect group. The results have been presented in Table 9:

Table 8. The rank of elements (hierarchy) of matrix $C = M \cdot (I - M)^{-1}$

Rank of elements based on greatest sum of rows		Rank of elements based on greatest sum of columns		Rank of elements based on (D + R)		Rank of elements based on (D - R)	
D	1.7076	A	3.5344	A	3.5344	D	1.4673
G	1.5895	B	1.6379	B	2.5585	E	1.0763
E	1.3871	F	1.2525	G	2.3157	C	1.0349
C	1.3695	G	0.7262	F	2.3152	G	0.8633
F	1.0627	C	0.3349	D	1.9479	F	-0.1898
B	0.9206	E	0.3108	C	1.7044	B	-0.7173
A	0	D	0.2403	E	1.6979	A	-3.5344

Table 9. Classification of factors in two groups of cause and effect

Effect group of negative (D-R)	Cause group of positive (D-R)
A: amount of entrepreneurs' abilities	D: amount of financial resources to guarantee financial contracts
B: amount of demand for production	E: amount of capital
F: the ability of managers in making timely decisions	C: amount of availability of efficient technology
.....	G: taxes

Table 10. Prioritizing the factors affecting and affected by SMEs performance

Factors ranking	Affecting factors
1	Amount of financial resources to guarantee contracts
2	Amount of capital
3	Amount of availability of efficient technology
4	taxes
Factors ranking	Affected factors
1	Amount of entrepreneurs' abilities
2	Amount of demand for production
3	The ability of managers in making timely decisions

5. Discussion

Aminbeidokhti and Zargar in a research showed that facilities and financial and nonfinancial supports from SMEs have not been sufficient in financial, technical, marketing, and executive fields, and financial affairs affect SMEs performance. The findings of our research confirm this result since in the present research financial resources have been identified as the most effective factor of all factors on SMEs performance. In another research, Rogoff identified 11 factors affecting the success of small enterprises including personal qualities, managerial issues, financial affairs, marketing activities, human resources issues, economic conditions, product characteristics, competition, discipline, technology, and environmental factors. In this article factors such as financial affairs and technology have been pointed out as effective factors, and personal and managerial factors such as amount of entrepreneurs' abilities and the managers' ability in making timely decisions have been mentioned as affected factors.

Metts in an article entitled "Measuring the amount of effect of managers' performance in SMEs: empirical analysis of managers' response in the industry's competitive forces" through investigating SMEs that have survived despite intense competitions and geographical limitations, found the two factors of manager's ability in participating in effective measures by adopting appropriate strategies and also fundamental structure of economics in industry significant in determining the firm survival. In the present research financial resources have been identified as the most effective factor and the amount of managers' ability in adopting strategies and appropriate and timely decisions has been known as one of the factors affected by SMEs performance²⁸. Karpak and Topcu utilized network analysis process to prioritize the factors affecting the success of manufacturing SMEs in Turkey. According to the results of this research in which ANP has been used, rules and regulations are the most effective factor in the success of small enterprises. However, in the present research, although rules and regulations are not considered as one of the factors, tax that is from the same category has been mentioned. Both these factors are out of managers' control and the government has the authority over them. Tax is the fourth factor affecting SMEs performance.

Piri et al. indicate that the managers of the industrial units located in industrial cities and areas can adopt appropriate strategies in the fields of production, investigation of environment and flexible decision-making in order to

moderate the negative effects of competitive industrial forces. In the present study, managers' ability to make right and timely decisions has been identified as one of the factors affected by the performance of small and medium industries²¹. Amin Aqae in an article entitled "The study of the factors affecting the performance of small industries from rural development experts' viewpoints", has mentioned three groups of structural, environmental and content factors as the factors affecting the performance of Iran's small rural industries. In the present study, we can consider all affecting factors except tax among structural factors and we can think of all affected factors among content factors. Tax can be one of the environmental factors. Therefore, the results of the researches above confirm the results of our research.

6. Conclusion and Suggestions

The results of this study obtained by utilizing Dematel technique consider seven factors affecting SMEs performance classified into two groups of affecting and affected factors. The results reveal that the amount of financial resources in order to guarantee contracts is the most effective factor among the factors affecting SMEs performance. And after that amount of capital, amount of availability of efficient technology, and finally taxes have been considered as the most effective factors. Also, in the effect group, amount of entrepreneurs' ability is considered as the most affected factor and after that, amount of demand for production and managers' ability in making timely decisions have been introduced as the most affected factors.

Since amount of financial resources to guarantee contracts and amount of capital rank first and second respectively among affecting factors, it is suggested that SMEs improve these factors in order to improve their performance by funding methods such as different kinds of loans and also cooperation with banks and financial institutions. Also, since amount of availability of efficient technology ranks third among affecting factors, it is suggested that SMEs purchase and access efficient technologies by setting up cooperative companies. Tax, on the other hand, is a factor affecting SMEs performance, so we suggest that SMEs managers and owners solve this problem by necessary negotiations with policymakers and statesmen. Today, however, by the law of value-added tax, the producers do not pay this tax and consumers have to pay it. But according to the results of the research, the first rank in affected factors is related to amount of entrepreneurs'

ability. It is evident that by improving affecting factors such as financial affairs, the amount of capital and amount of availability of up-to-date technology, entrepreneurs' ability enhances and they show a better performance and the industries performance, in turn, improves. The second affected factor is the amount of demand for production. It is suggested that enterprises use this factor to improve their performance by getting help from factors of marketing and marketing management and appropriate and modern sale.

The last priority among the affected factors is related to managers' ability in making timely decisions. Managers can achieve this goal by attending educational classes or employing management experts and consultants and increasing and updating their knowledge. Then they will be an affecting factor rather than an affected one.

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