

A new approach to develop entrepreneurship of the industry using fuzzy DEMATEL

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ABSTRACT

Today, development of economic activity and employment is known as an effective strategy for economical and social development of the countries. Entrepreneurship in Iran is also as the most executive and practical strategy to exit the economical and social deadlock and problems. However, entrepreneurship development needs identifying and removing existed obstacles and problems. There are a lot of researches about obstacles and restrictions on entrepreneurship but, to the best of our knowledge, there is no research to identify vital factors and degree of their effect on the network of factors.

In this paper using DEMATEL technique, the entrepreneurial barriers in the industry of Iran are categorized in 2 groups of cause and effect. We also use fuzzy concept to handle any ambiguity on the feedbacks gathered from decision makers. To achieve this purpose, at first using views of professors and active managers in the field of entrepreneurial and also related books and using Delphi technique, 9 vital factors are identified and they are analyzed in two groups of internal and external obstacles in the industrial sector of Iran.

The research chooses 100 most active companies in one of the industrial poles of Iran for the proposed study of this paper. Furthermore, questionnaires are distributed among the top managers of these companies, to analyze the barriers in entrepreneurship in the industry. The results show that two factors of "kind of management" and "organizational structure" are the most important factors. In addition, "legal obstacles" and "optimum use of financial resources" are at the highest degree of impression on business units.

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1. Introduction

Entrepreneurship and Innovation are always considered some of the main factors in the discussions related industries cope vulnerability so that it affects the structure, the process, products and strategic growth in industrial companies and finally the national development of each country (Gunday et al., 2011). The previous researches on the industry of different countries indicate that active companies in the industry sector of each country play important roles in national and economical development of these countries (Javalgi et al., 2011). Entrepreneurship identifies not only the technological inefficiency but also the inefficiency of the time and place in an economy (Shane & Venkataraman,

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2000). To promote entrepreneurship, it is necessary to discover the obstacles, which affect entrepreneurship and adopt good policies and new measures to overcome the obstacles. Identifying and examining the obstacles of entrepreneurial success is the main cause of industrial development of any country (Mostafavi, 2011). How much did we attempt in preparing the necessary infrastructure for the development of entrepreneurship?

What factors do prevent the implement and development of entrepreneurship in the country? What are the vital and effective factors on the network of the factors? What factors do influence the other factors? What factors influence on other factors?

In this paper regarding the background of researches and the view of network experts we try to determine the factors and their effect on each other using DEMATEL and fuzzy-logic.

2. Entrepreneurship

Nowadays, entrepreneurship is known as an effective strategy in social and economic development of countries. Entrepreneurship is the process of discovering and exploiting opportunities to create value in different economic, social and cultural areas and is considered as foundation of sustainable and comprehensive development. Therefore, entrepreneurship development has a desirable role to participate in global markets, dealing with competitors, sustainable employment, developing justice, decreasing poverty and solving problems of society, government and public sector. Entrepreneurship has always been foundation of human's developments and advances and has various and wide definitions. Social sciences, physiological, economic and management scientist each have special definitions for entrepreneurs. There are two completely different approaches for definition of entrepreneurship. The first approach is that we define who an entrepreneur is. Then they should be observed and according to the results, the entrepreneurship would be identified. The second approach is to present an overall definition of entrepreneurship and its related behaviors so we would define the entrepreneur as the people who are involved with entrepreneurship (Yaghoubi, 2010).

What can be seen in most definitions is that entrepreneurs are driver of economic development and with destructing previous old and inefficient method and replacing it with efficient and modern method, we may destroy dynamics the economy. Entrepreneurship is an important and main component of development. Promoting and fostering entrepreneurship is one of the fundamental measures performed to expedite and accelerate economic and social development (Feili et al., 2011).

Undoubtedly, trend of economic development in developed countries indicates to this reality that economy is affected by entrepreneurship in a way that entrepreneurs have a central role in economic development of countries. Global economy is providing fundamental and essential changes for organizations and industries all over the world. These changes require commercial companies to investigate their goals carefully and pay abundant attention to select and follow strategies, which lead to increase the levels of activities. Many of established companies in response to rapid and dramatic changes provided in their internal and external environment have provided a new foundation for their operation structure (Mostafavi, 2011). In fact, the new century witnesses companies' emphasis on entrepreneurship. This new emphasis on entrepreneurship thinking was developed during entrepreneurship economy in 1980 and 1990 decades (Histrich & Pirez 2005) and since then we can see its more prominent and fundamental role as a key factor in economic success of each country.

There were different studies on the obstacles of the entrepreneurship in the industry in different countries. Mooali et al. (2011) discussed challenging dimensions of bureaucracy and its distraction and obstacles in the development of entrepreneurship. The results of this study performed by Tabatabayi (2010) indicated that unknown entrepreneurship, not being proper structures and obstacles of entrepreneurship based on six criteria are the most important barriers to entrepreneurship. Amiri et al. (2010) analyzed the problems of entrepreneurs in Tehran and ranked them based on multi criteria decision making methods. They categorized the problems of entrepreneurs in 7 groups: 1-Financial

limitations 2-cultural limitations 3-teaching limitations 4- market and job places limitations 5-fundamental and supportive limitations 6- personal limitations 7- legal and departmental limitations. Then the researchers ranked these limitations and cultural one was at the first level and personal one at the last level.

Zali and Razavi (2009) presented an empirical study on obstacles in entrepreneurship in Iran. Their statistic community was the best Iranian entrepreneurs who were selected in the festival superior national entrepreneurs in 2007. They identified 11 obstacles; 1.financial risk, 2. Lack of access to financial resources, 3. Departmental obstacles 4. Social dangers 5.illalegality at departments 6. Lack of skill 7.Challenges 8.requirement of the market 9.gener 10. The fear of defeat 11- too working. Lamei (2007) performed an empirical study on legal barriers on entrepreneurship development in Iran's small industry and determined five important factors including kind of business and work, labor law, bank credits, the laws related to export and import and the tax related laws. Moqimi (2005) studied the obstacles of entrepreneurship in the industry of the country and the solution to overcome them. In this study, obstacles were categorized in three groups of behavioral, structural and field obstacles. The results of the structural obstacles indicated that the companies did not have the structure of research and development, marketing, evaluating, budgeting and informing the management. In the issue about the field obstacles, the politic of the government, logical and cultural problems were studied.

Samad aghayi (2000) investigated on the barriers of entrepreneurship in terms of two aspects of internal and external obstacles in nine different companies. They found that external barriers include work law, high rate of insurance, tax rates and laws play important role on the success of various business units. In addition, the most important internal-obstacles include; threatening feature of the companies, lack of enough opportunity presented to the employees to follow the new ideas and lack of enough entrepreneurship-instructions to employees. James et al. (2006) investigated on the limitation of the staffs, the financial limitations, legal limitations of the tax and found out that they play important role on preventing a business model to succeed. Aristidis et al. (2005) performed an empirical study in Albania on business and transportation to identify the relative importance of the obstacles of entrepreneurship. According to their survey, unfair competition, lack of financial resources, lack of social order, continuous changes of tax laws and energy crisis were realized as the most important obstacles in entrepreneurship. Energy crisis was the most important and the lack of social order the least important. Susana (2004) investigated revision and reform obstacles, social and cultural barriers and economic and financial obstacles in entrepreneurship.

Robertson et al. (2003) performed an investigation in England researched in the entrepreneurial obstacles on the two groups of student's eager to entrepreneurship in two different universities. The researchers also concluded that financial obstacles prevented the students for both groups. Lack of impulse, idea and skill were also the obstacle for most of the students. Van Auken (1999) did a study in the obstacles in launching business on the participants in small workshops before launching. The participants talked about the existing obstacles on the way of operation and business development and finally regarding their answers, Van Oven recognized 5 important factors ;1.lack of money 2. Lack of time 3. Borins (1998) in his study introduced intra-organizational factor as the major obstacle in innovation in this field and believed external factors and political ones were less effective than internal ones and these internal ones were often related with bureaucratic activities.

3. Methodology

3.1. Statistical society

Statistical society is associated with the whole group of people, events and things that researcher wants to investigate about them. Among Iran's industries, we have studied one of the main industrial poles to evaluate entrepreneurship barriers. Therefore, for this purpose, we selected 100 companies in

Semnan province as the statistical society that according to the country’s Industries and Mines Organization had the highest economic rebound in the last year.

3.2. Statistical sample

Sampling is the process of selecting enough numbers among from members of statistical society. Given to Morgan’s sampling table and given to the research’s statistical society, statistical sample in this research will be 80.

3.3. The obstacles of developing entrepreneurship in the industry

In this study, first using different entrepreneurial resources and also domestic and foreign articles related entrepreneurship, the obstacles of this issue were identified and then using Delphi and experts' view and scholars of entrepreneurship field. These factors are refined and finally 9 factors are categorized in two internal and external obstacles demonstrated in Fig. 1 and their relationships are shown in Fig. 2. Table 1 demonstrates details of the description of each item.

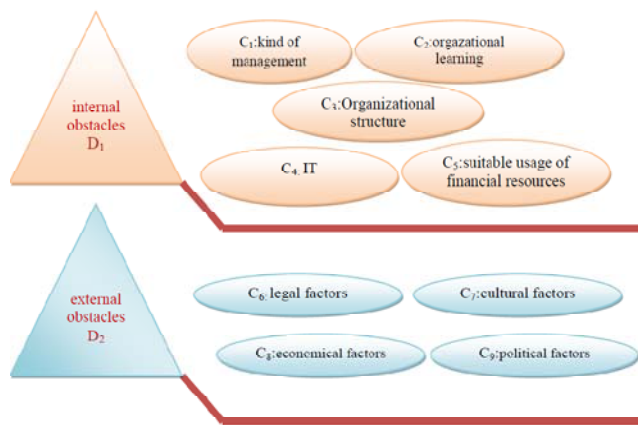


Fig. 1. The obstacles of developing entrepreneurship in the industry

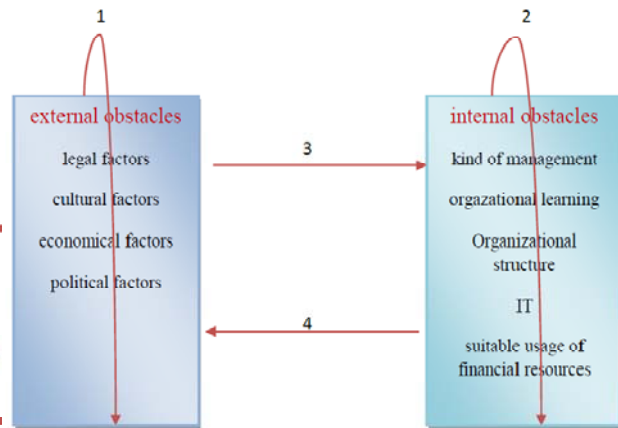


Fig. 2. Relations between obstacles of developing entrepreneurship in the industry

Table 1

Factors description

factors	Factors description
kind of management	lack of attention to performance - lack of a reward system-multiplicity and ambiguity in the goals - too cautious managers - short-term strategies instead of long-term-lack of independence in management decision making - policies of the limited personnel
organizational learning	Lack of intendance of the employees to learn entrepreneurship - lack of necessary trainings
Organizational structure	Bureaucratic structures and fundamentalist threat
IT	using information technology to facilitate the flow of information
suitable usage of financial resources	Budgeting
legal factors	working and insurance law, Taxes law-monetary banking laws - import and export law
cultural factors	The issue of unfamiliarity of entrepreneurship-lack of communication between industry and for university to use graduated from the field
economical factors	lack of support for the financial entrepreneurs-lack of economical and investment security
political factors	kind of relations of the country with other countries - political boycotts

3.4. DEMATEL

DEMATEL was first introduced at Battelle Memorial Institute of Geneva Research Center and it has been applied for many complicated problems in the world such as famine, energy, environmental protection and etc in that time (Fontela & Gabus, 1976). DEMATEL is one the multi criteria decision making instruments and has the ability to convert the qualitative designs to the quantitative analysis (Lee et al., 2011). The aim of DEMATEL is to convert the relationships among criteria, causal dimensions from a complex system to an understandable structural model of that system (Dalalah et al., 2011). All criteria of a system, directly or indirectly, are mutually related to each other in a general reciprocal system. So each change in one of criterions will influence on other criterions (Tzeng et al., 2007). This technique is successfully applied in other circumstances such as development methods, management systems, electronic learning evaluation, knowledge management, etc. (Kuo & Liang, 2011). Japan, Korea and Taiwan have widely used DEMATEL technique for successfully solving different problems in various fields (Lin & Wu, 2008).

3.5. Fuzzy-logic

Many of the organizations accepted group decisions in order to find a solution. Group decision means to achieve an agreement through dialogue among many experts and in this case an acceptable decision can be adopted. Of course, in the decision related to complex systems, assessment by experts or decision-makers about a qualitative criteria object will be presented, always couched in language (and not in the form of determined quantities) and based on experience and skill of them. The theory of fuzzy collection can be used to measure ambiguous concepts based on unreal (personal) judgments. Based on Table 2, we can change the vague judge to fuzzy triangle numbers.

Table 2

The correspondence of linguistic terms and values

Linguistic values	Linguistic terms
[0.75,1,1]	Very high influence(VH)
[0.5,0.75,1]	High influence(H)
[0.25,0.5,0.75]	Low influence (L)
[0,0.25,0.5]	Very low influence (VL)
[0,0,0.25]	No influence (NO)

Fuzzy triangle number can be a regular triplets of the form of (l, m, n) or $1 \leq m \leq n$. For both fuzzy triangle numbers $A_1 = \{l_1, m_1, r_1\}$ $A_2 = \{l_2, m_2, r_2\}$, the arithmetic operations are performed as follows,

$$A_1 + A_2 = (l_1 + l_2, m_1 + m_2, r_1 + r_2)$$

$$A_1 - A_2 = (l_1 - l_2, m_1 - m_2, r_1 - r_2)$$

$$A_1 \otimes A_2 = (l_1 l_2, m_1 m_2, r_1 r_2)$$

$$\lambda A_1 = (\lambda l_1, \lambda m_1, \lambda r_1), (\lambda > 0)$$

In recent years, different types of defuzzy methods have been implemented (Opricovic & Tzeng, 2003). In the meantime, the especial unknown and instable environment where fuzzy numbers are used should be considered by selecting the method of defuzzy. Presently, the process of defuzzy, santroid, (the center of gravity) proposed by Yager and Philo in 1994 is usually used (Kanter, 1985). But this method is not able to differentiate two fuzzy numbers with different forms changed to a deterministic numbers, using this method (Kouriloff, 2000), so this study used CFCS (changing the fuzzy data into determined values) proposed by Opricovic and Tezeng in 2003 to de- fuzzy. According to process of CFCS method, first, right and left values are determined with a minimum

and maximum fuzzy based on the fuzzy numbers based in the group evaluating and then the final definite number are calculated in the form of average weight based on membership subject.

3.6. The Fuzzy DEMATEL steps:

1. We specify evaluation factors according to expert committee's opinion and research background.
2. We determine each factor influences on whole system, according to expert's opinion. To do so, we use discussed wordy expressions in Table 3 and Fig. 3. Then, we used CFC method (Eqs. 1-9) to convert the fuzzy results into crisp values.

Table 3

The correspondence of linguistic terms and values

Linguistic values	[0.75,1,1]	[0.5,0.75,1]	[0.25,0.5,0.75]	[0,0.25,0.5]	[0,0,0.25]
Linguistic terms	Very high influence(VH)	High influence(H)	Low influence (L)	Very low influence (VL)	No influence (NO)

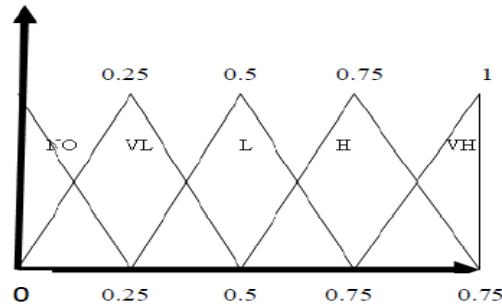


Fig. 3. Fuzzy triangle numbers

$$XL_{ij}^k = (L_{ij}^k - \min L_{ij}^k) / \Delta_{min}^{max} \quad (1)$$

$$XM_{ij}^k = (M_{ij}^k - \min L_{ij}^k) / \Delta_{min}^{max} \quad (2)$$

$$Xr_{ij}^k = (r_{ij}^k - \min L_{ij}^k) / \Delta_{min}^{max} \quad (3)$$

$$\Delta_{min}^{max} = \max r_{ij}^k - \min L_{ij}^k \quad (4)$$

$$Xls_{ij}^k = \frac{Xm_{ij}^k}{(1 + Xm_{ij}^k - Xl_{ij}^k)} \quad (5)$$

$$Xrs_{ij}^k = \frac{Xr_{ij}^k}{1 + Xr_{ij}^k - Xm_{ij}^k} \quad (6)$$

$$X_{ij}^k = [Xls_{ij}^k(1 - Xls_{ij}^k) + Xrs_{ij}^k \cdot Xrs_{ij}^k] / (1 + Xrs_{ij}^k - Xls_{ij}^k) \quad (7)$$

$$BNP_{ij}^k = \min L_{ij}^k + X_{ij}^k \Delta_{min}^{max} \quad (8)$$

$$a_{ij} = \frac{1}{k} \sum_{1 \leq k \leq k} BNP_{ij}^k \quad (9)$$

A= [a_{ij}] is direct relations matrix of experts opinions.

3. We obtain total relations matrix T- I where I is an identity matrix $n \times n$ and $T = [t_{ij}]$ represent the elements indicating the direct and indirect influences of factor i on factor j . Therefore, matrix T can be indicator of general relations between each pair factor in the system. Matrix D is the normalized matrix $D = [d_{ij}], 0 \leq d_{ij} \leq 1$.

$$D = \frac{1}{\max_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}} A \tag{10}$$

$$T = D(I - D)^{-1} \tag{11}$$

4. We calculate row summation and column summation of T matrix – i row summation is indicator of all direct and indirect influences of i factor on all other factors and so can call r_i as the influencing degree. C_j is similarly, the column summation and we can call it as influenced degree of j factor.

$$r_i = \sum_{1 \leq j \leq n} t_{ij} \tag{12}$$

$$C_j = \sum_{1 \leq i \leq n} t_{ij} \tag{13}$$

Therefore, when $i = j, r_i + C_i$ shows both the influence of which i factor can have on other factors of system and also the influences of other factors of system on i factor. So, $r_i + C_i$ show the significant degree of i factor in whole system, and $r_i - C_i$ indeed shows the influence of i on system. If $r_i - C_i$ is positive, i factor belong to the cause group and if $r_i - C_i$ is negative, i factor belong to the effect group.

5. Finally, We show the diagram of factors influencing on $r_i - C_i$ and $r_i + C_i$ bases. This diagram is drawn by $(r_i + C_i, r_i - C_i)$ coordinate (Huang, 2009).

4. Fuzzy DEMATEL

After making clear the main measures related to the research, the questionnaires of reciprocal effect of these features were distributed among the managers of the studied companies and then 80 of them were fulfilled by the managers of the active industrial companies process and integration the ideas so matrix of the direct relations after de-fuzzication the 1-9 equations were realized. It should be noted that the experts used the expressions of Table 3 to fulfill the questionnaire. Matrix of direct relations (A) in table 6 and normalized matrix (D) in Table 4 are shown.

Table 4
Direct relations matrix (A)

Factors	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉
C ₁	0	0.337	0.309	0.602	0.467	0.602	0.602	0.254	0.535
C ₂	0.254	0	0.082	0.791	0.833	0.607	0.203	0.124	0.203
C ₃	0.309	0.362	0	0.453	0.791	0.714	0.714	0.362	0.004
C ₄	0.082	0.082	0.124	0	0.082	0.082	0.082	0.256	0.25
C ₅	0.004	0.166	0.004	0.082	0	0.124	0.004	0.082	0.203
C ₆	0.004	0.082	0.004	0.124	0.116	0	0.25	0.116	0.18
C ₇	0.004	0.124	0.124	0.082	0.18	0.714	0	0.791	0.957
C ₈	0.082	0.124	0.166	0.166	0.67	0.67	0.957	0	0.602
C ₉	0.124	0.082	0.124	0.124	0.208	0.499	0.467	0.363	0

Table 5
Normalized matrix (D)

Factors	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉
C ₁	0.144	0.068	0.162	0.162	0.126	0.162	0.083	0.091	0.000
C ₂	0.055	0.033	0.055	0.164	0.225	0.213	0.022	0.000	0.068
C ₃	0.001	0.098	0.193	0.193	0.213	0.122	0.000	0.098	0.083
C ₄	0.067	0.069	0.022	0.022	0.022	0.000	0.033	0.022	0.022
C ₅	0.055	0.022	0.001	0.033	0.000	0.022	0.001	0.045	0.001
C ₆	0.049	0.031	0.067	0.000	0.031	0.033	0.001	0.022	0.001
C ₇	0.258	0.213	0.000	0.193	0.049	0.022	0.033	0.033	0.001
C ₈	0.162	0.000	0.258	0.181	0.181	0.045	0.045	0.033	0.022
C ₉	0.000	0.098	0.126	0.135	0.056	0.033	0.033	0.022	0.033

Finally, the General relations matrix (T) is shown in Table 6.

Table 6
General relations matrix -T Matrix

Factors	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉
C ₁	0.338	0.233	0.340	0.391	0.292	0.269	0.134	0.162	0.046
C ₂	0.189	0.138	0.171	0.300	0.321	0.281	0.059	0.056	0.094
C ₃	0.216	0.251	0.356	0.410	0.370	0.232	0.053	0.169	0.118
C ₄	0.133	0.120	0.097	0.108	0.087	0.040	0.052	0.048	0.038
C ₅	0.086	0.049	0.038	0.076	0.035	0.046	0.011	0.056	0.011
C ₆	0.105	0.077	0.114	0.065	0.074	0.059	0.016	0.039	0.012
C ₇	0.409	0.331	0.192	0.389	0.197	0.107	0.078	0.091	0.038
C ₈	0.353	0.166	0.407	0.393	0.314	0.134	0.090	0.100	0.056
C ₉	0.132	0.192	0.238	0.272	0.156	0.095	0.064	0.066	0.055

The total of the given effects and receiving effects of the factors (cause and effect matrix) and the graph of the effect of the factors were shown in Table 9 and Fig. 4, respectively.

Table 9
Calculating the influences of each factor

Factors	r_i	C_i	$r_i + C_i$	$r_i - C_i$
C ₁	2.205	0.468	2.673	1.738
C ₂	1.609	0.788	2.396	0.821
C ₃	2.175	0.556	2.731	1.618
C ₄	0.724	1.265	1.989	-0.541
C ₅	0.408	1.846	2.254	-1.438
C ₆	0.561	2.404	2.965	-1.842
C ₇	1.832	1.951	3.783	-0.119
C ₈	2.013	1.557	3.570	0.456
C ₉	1.269	1.961	3.230	-0.692

Table 10 represents the matrix of the total relations of the dimensions and total given and received effects of the dimensions. The casual diagram of dimensions is shown in Fig. 5.

Table 10
Total relations of the dimensions and the influence of each dimension

dimensions	D ₂	D ₁	r_i	C_i	$r_i + C_i$	$r_i - C_i$
D ₁	4.153	2.911	7.064	4.788	11.852	2.277
D ₂	3.153	1.876	5.030	7.306	12.336	-2.277

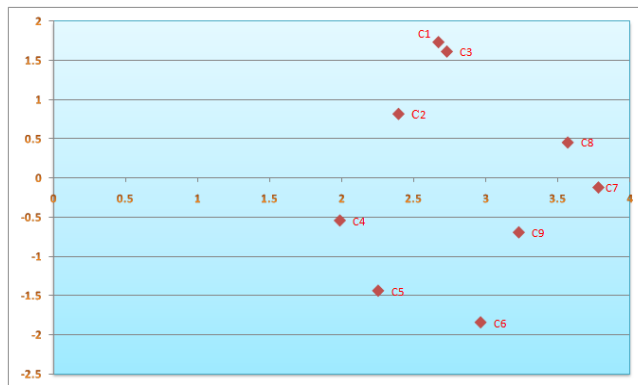


Fig.4. The casual diagram

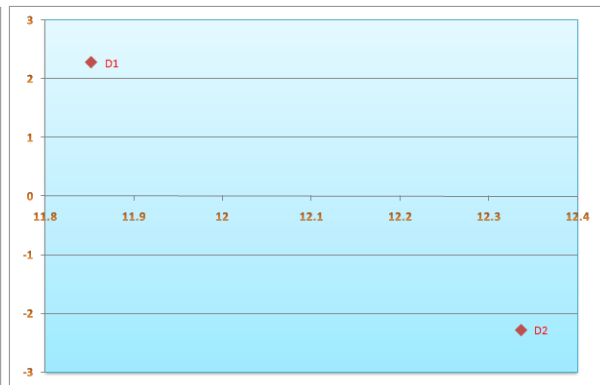


Fig.5. The casual diagram of dimensions

In summary, the results show that four factors including management type, organizational structure, organizational learning and economic factors are the most important factors influencing the success of business unit initiation. In addition, legal factors, optimum use financial resources, political factors, information technology and cultural factors are other important factors. Our survey also indicated that external barriers are influenced by internal barriers and there must be more concentration on internal factors. Two factors of kind of management and organizational structure were introduced as the most critical factors within the system. Therefore, in the development of entrepreneurial, the focus should be on these two factors. Therefore, the focus must be more on nontraditional management and on the cooperative management and implementation of non-bureaucratic structures. The role of necessary education should not be forgotten.

6. Conclusion

In this article, we have collected obstacles of Entrepreneurship development according to the existing literature and the feedbacks gathered from experts and to identify critical factors in the network of factors, fuzzy DEMATEL has been used. The results of using fuzzy DEMATEL method have indicated that “kind of management” was as the most effective factor among the entrepreneurial obstacles in the development of industries and organizational structure, organizational learning and economic factors were considered as other most impressed factors. Also in the effected group, legal factor was considered as the most impressed one among the entrepreneurial obstacles in the development of industries and optimum use of resources, political factors, information technology and cultural factors were introduced as the most impressed factors.

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