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### **Prioritization of factors affecting the development of industrial clusters in small and medium industries with a multi-criteria decision approach**

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#### **CHRONICLE**

#### **Abstract**

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Today, the role of industrial clusters as a spatial representation of small and medium industries in providing development in its general sense, both in less developed countries and in more developed countries, is not hidden from anyone because industrial clusters are the location of industries. Small and medium appear in relation to each other and together in a geographical context, due to having wide horizontal and vertical links, provide a high level of productivity and efficiency for business formation. The purpose of this study is to prioritize the factors affecting the development of industrial clusters in small and medium industries. The method used in this research is Analytic network process. The statistical population of the present study is the experts of industrial clusters. Finally, spatial factors were in the first place and policy factors were in the second place and economic factors were in the third place finally practical suggestions were provided

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**Introduction:**

The main purpose of this study is the role of small and medium enterprises in the development of economic activities in the country and achieving a local model for organizing industrial clusters. From the second half of the twentieth century until now, different patterns of industrial growth and development have been experienced in countries around the world. One of these patterns is small and medium-sized enterprises and industrial clusters. Small and medium-sized enterprises are recognized in most countries as important elements in socio-economic development. These firms are especially important in creating job opportunities with low investment, regional development, organizational development of companies based on the principles of technology, product innovation and the creation of new methods. A look at the socio-economic system in many developed and newly developed countries of the world shows that the establishment and support of small and medium enterprises is one of the main priorities in the economic development programs of these countries. Although they require less investment, these enterprises are more profitable and play an important role in creating jobs, creating a favorable environment for innovation and inventions, and increasing their exports. In many countries, these firms have been the main suppliers of new employment, the cradle of transformation and innovation, and the pioneer in inventing new technologies. On the other hand, these industries due to their unique characteristics can have many attractions for the private sector, which depending on the domestic economic conditions of countries, laws and protection policies in different countries as a successful model for scientific empowerment. And industrially introduced

**Definition and problem statement:**

Due to the many content and quality changes that have taken place in global markets in the last two decades, the movement towards regionalization or globalization of markets has begun and the customer-centric approach is maturing. At the same time, the production-oriented period is coming to an end, and industrial producers have taken measures to optimize the use of facilities and prevent the waste of valuable resources, which will result in a change in the industrial structure. One of the main characteristics of changing this structure is the promotion of more than just small industries.

One of the common development models that has been considered by researchers in the field of economic development for about three decades is the model of industrial clusters. Industrial clusters have become economically viable and cohesive over time due to the advantages based on skills and expertise developed over time in the respective regions. Although many skills have existed in different parts of the world, they have been the cradle of Italy's industrial clusters. Which has attracted the attention of experts since the decade. Following the publication of the results of research and studies by researchers, international and UN-affiliated organizations have proposed industrial clusters as a model for regional development in many parts of the world. Since then, many countries in South, North and Europe have used this model of development by making changes to adapt it to their regional conditions. (Majidi, 2, 2)

It should be noted that in Iran, despite the fact that more than 90% of production units are small and medium industries, but several problems have caused that these industries can not make a significant

contribution to creating added value. Some of these problems are:

- Lack of the necessary ability to participate in regional and international markets
- Lack of cooperation networks between companies
- Lack of coherent communication with the country's banking and financial networks
- Lack of sufficient knowledge of target markets

- Customer-centric activities

The above problems have caused small and medium industries to not experience significant growth and to be successful in various fields, including job creation, added value and achieving significant income in Rials and foreign exchange (Majidi, 2.9). For this reason, it is necessary to make efforts to strengthen small and medium industries and improve their productivity in order to provide the ground for their growth and dynamism by creating a suitable environment.

In our country, the discussion of cluster development has been seriously pursued for several years in all provinces of the country under the supervision of the Small Industries and Industrial Towns Organization of Iran, and specifically in the Industrial Clusters Development Office. The statistics of this organization have been selected for about 40 clusters, the CDA cluster development factor and a development contract has been concluded.

It is clear that not using such cluster systems in the country will only result in deprivation of opportunities, capabilities and advantages of this system and, conversely, the development of these clusters, achieving the advantage of mass production, group efficiency, The benefits of integration (co-location), urbanization,

scale and diversity, as well as attracting domestic and foreign investment will follow, while the experience of the United Nations Industrial Development Organization (Uindo) shows the positive impact of this Clusters have focused on the economy, development and development of industry in the studied countries. It is hoped that by conducting this research and achieving the desired result, a small step will be taken towards the growth and promotion of our country's industry.

Today, the role of industrial clusters as a spatial representation of small and medium industries in providing development in its general sense, both in less developed countries and in more developed countries, is not hidden from anyone because industrial clusters that are located Small and medium-sized industries emerge in conjunction with each other in a geographical context, providing a high level of productivity and efficiency for business formation due to their extensive horizontal and vertical links (Ismalina, 2010). ). In fact, industrial clusters contribute to the economic development of societies by increasing specialization and division of labor, and thus by increasing employment opportunities and improving productivity and income levels; At the same time, these clusters provide the ground for social development by raising the level of knowledge, spreading the work culture and increasing social relations in the form of industrial organizations, and thus pursue spatial development for their surrounding area. Brought (Cruz and Texeria, 2010).

The selection of industrial clusters in small and medium industries is very important to study the related cases due to its unique characteristics. At the same time, the soft systems method approach is appropriate in order to apply its features because it

represents a rich image and a related conceptual model. The soft system method for structuring thoughts in a complex problem is presented. This includes human activities as it involves a large number of stakeholders, each with different points of view, different interests and beliefs. In this research, the method of soft system of Chicland (1980) will be used, which has seven stages. As a preliminary research, its rich picture will be presented based on the views of researchers, so such a case requires subsequent research from the point of view of stakeholders in the industrial cluster (Eghbalian and Azar, 2016).

In general, it can be said that the most important point in the cluster is economies of scale, and this is one of the most fundamental concepts in industrial clusters. Centralization happens with industrial clusters, which, along with specialization, leads to the use of learning curves, followed by lower costs for learning, and a reduction in costs, which strengthens competitiveness, increases target markets, and Profitability and ultimately sustainable development. An industrial cluster development project is a planned effort implemented by an institution or cluster development agent (from inside or outside the cluster) in collaboration with local institutions to enhance the dynamics of the cluster and improve its competitive advantage. It comes. A cluster development project focuses on the internal communication of different parts of the cluster on the one hand, and on the economic value chain of which the cluster is a part, on the other hand. Therefore, it tries to direct the raw materials to the output, ie the presentation of the product, in the right and competitive way. Cluster development projects are usually carried out under the responsibility of government, public, and sometimes

intra-cluster development organizations. The direct responsibility for leading a cluster development project lies with the cluster development agent (Hajji and Pasbani, 2009).

#### **Literature review:**

Changwei Mo et al.(2020) By investigating 46 industrial clusters in 286 Chinese cities, shows that: (1) regional innovation occurs mainly in traded industrial clusters; (2) regional innovation is positively related to the level of industrial cluster specialization but irrelevant to industrial cluster diversification; (3) R&D is consistently conducive to regional innovation.

Chitiavern et al. (2019) also believe that the factors affecting the success of industrial clusters of small and medium businesses include 10 factors: entrepreneurial characteristics, small and medium business characteristics, management and associate, products And services, customers and markets, how to do business and cooperation, resources and finance, strategy, Internet access and external environment, of which the first to ninth cases are related to the micro level of institutions and the tenth case is related to the level It is a large institution.

Ghosh and Kwan (2019), in their comparative study on the factors affecting the success of industrial clusters of small and medium enterprises on variables including customer relationship quality, service quality, ability to understand market needs and focus on It, the availability of financial resources, the availability of human resources, the amount of financial support from the family, the status of the management system, the status of human resource management, the ability to create vision

and attention to initial goals, the number of competitors, the intensity Competitiveness has emphasized the ability to develop and sustain technological advantages and the degree of democracy in management.

Idis (2018), in a study entitled Institutional Barriers to the Performance of Industrial Clusters of Small and Medium Enterprises in Transition Countries, these institutional factors are classified into four categories: formal, informal, environmental and skill. While among the mentioned institutional factor, the skill institutional factor, which is defined by the two variables of growth ability in new markets and management problems, is considered as one of the factors affecting the performance of industrial clusters and other factors. Exterior of small and medium enterprises.

Jundabanka (2017), in a study in Tanzania, shows that the four main factors, including the skills and business knowledge of managers, access to capital, access to goods and the degree of competition in the target market, are the most important factors influencing growth. Small and medium-sized enterprises are in the food and drug industry. In this study, the first two factors are related to the micro level of institutions and the next two factors are related to the macro level of institutions.

### **Research Methodology**

This research is applied in terms of purpose and descriptive-analytical in terms of method.

The statistical population of this research is all managers and experts of Khuzestan Industrial Towns Company, part of industrial clusters, since in this research, the expert opinions of all existing and available experts in the field of industrial clusters have been used, so the statistical population is the same. Is a statistical example of research? Existing experts are

working in organizations or companies related to or in charge of clusters, such as the Industries and Mines Organization, the Governor's Office, the Provincial Industrial Towns Company, and the Small Industries and Industrial Towns Organization of Iran.

An example is a set of signs that are selected from a larger section, group, or community, so that the set represents the qualities and characteristics of that larger section, group, or community.

In this type of sampling, people are selected for the sample who are in the best position to provide the information needed. Judgmental sampling scheme is used when a limited class of people have the information that the researcher is looking for. In such cases, any kind of random sampling from different sections of the population is aimless and useless. Judgmental sampling, however, may reduce the generalizability of the findings because we have used samples of experts who are readily available. But this method is the only sampling method that can be used to obtain the necessary information from certain people who have relevant science and knowledge and can only provide the desired information, due to the small statistical population. The sample is a statistical population that includes a total of 20 people who have been considered according to the objectives and method of research. Features such as work experience, related education, and familiarity with concepts related to the research topic and ... The criterion for selecting individuals is in this research

The present research is descriptive and survey based on soft systems methodology and ANP algorithm. The method of data collection in this research is library, questionnaire and interview. The statistical population is the employees, managers and

experts of the Industrial Towns Company, which has tried to collect information from 20 managers and experts and 70 employees as a statistical sample. During the implementation of the methodology

**Creating a network structure to prioritize effective factors for creating and developing industrial clusters in software**

First, a model of criteria and indicators affecting the problem under study is drawn

In this form, the purpose of the problem is to prioritize the factors affecting the creation and development of industrial clusters, which is the mission of this research. C1 to C5 are related to the criteria of "spatial factor", "socio-cultural factor", respectively. "Policy and institutional factor", "organizational factor", and "economic factor". Similarly, I1 to I18, which are the indicators related to the main criteria, are listed in Table (4-1) below.

Index code

**Table (1):** Selected indicators and their codes

I1 Spatial proximity
I2 Existence of appropriate infrastructure
I3 Face-to-face contacts with economic agents
I4 Existence of a sense of trust in social and business relationships
I5 Existence of a common social origin
I6 Ease of social relations and low conflict
I7 Adherence to ethical principles
I8 Government support for planning, with the aim of completing the value chain
I9 Existence of financing facilities and capital assistance
I10 Proper policies of government and other support institutions in support of innovation and entrepreneurship
I11 Exemption from administrative rules and regulations
I12 Existence of an efficient information system in the field of technology, market, suppliers and competitors
I13 Degree above division of labor
I14 Flexibility
I15 Existence of suitable and competitive

technology
I16 Existence of a network of economic agents to supply products to final markets
I17 Existence of competition between existing firms
I18 Existence of venture capitalists

After drawing the criteria and indicators affecting the problem under study, it is time to find the dependencies and connections between network components and prepare a model of communication between components. This step is the most important part of a network analysis decision. Once the network categories have been identified, they must be connected to each other, which is done based on the type of communication of their effective criteria. Group discussions have been used to determine the relationship between the criteria. After interviewing experts and thinkers about the five criteria affecting the creation and development of industrial clusters, the dependence of the criteria was considered that all the effective criteria at level 2 of the model structure are internally related to each other. Therefore, the final model of problem relations is considered in the above figure (Figure 1).

Using super decision software, the data collected in the questionnaire were prioritized. These data are first related to the ranks obtained for the sub-criteria of each criterion, and then the importance of the criteria and finally the ranking of all criteria were calculated by the software. Excel software The matrix of pairwise comparisons and then the matrix of cumulative pairwise comparisons of experts' opinions have been obtained using arithmetic and geometric averaging method (which was described in the third chapter) and the results will be presented in the following tables. (2 & 3).

After the consensus of experts on weighting the above criteria and sub-criteria, a questionnaire was collected

separately to obtain the relationships and the intensity of their impact on the criteria under study, the results of which can be seen in the table 3.

**Table (2): Arithmetic mean of the numbers in the questionnaire**

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	MED
q1	3.00	5.00	5.00	8.00	4.00	7.00	5.00	7.00	4.00	5.00	5.00	3.00	4.00	3.00	5.00	5.00	0.14	0.14	0.50	8.00	<b>4.34</b>
q2	3.00	5.00	4.00	3.00	2.00	3.00	3.00	3.00	2.00	2.00	3.00	2.00	2.00	2.00	2.00	6.00	0.11	0.11	0.25	4.00	<b>2.57</b>
q3	4.00	4.00	5.00	5.00	3.00	5.00	1.00	4.00	6.00	2.00	5.00	4.00	3.00	2.00	3.00	6.00	0.13	0.17	0.11	5.00	<b>3.37</b>
q4	2.00	3.00	3.00	3.00	2.00	2.00	0.20	2.00	1.00	3.00	2.00	3.00	2.00	2.00	0.33	0.14	0.11	0.50	0.14	4.00	<b>1.77</b>
q5	0.33	0.50	0.25	0.14	0.17	0.17	0.25	0.20	0.20	0.25	0.25	0.25	0.20	0.25	0.33	0.20	0.17	0.00	0.50	0.20	<b>0.29</b>
q6	0.50	0.33	0.25	0.25	0.25	0.25	0.25	0.33	0.17	0.33	0.33	0.33	0.33	0.33	0.20	0.25	0.11	0.40	0.25	0.25	<b>0.47</b>
q7	0.25	0.33	0.17	0.20	0.20	0.17	0.17	0.17	0.20	0.20	0.25	0.33	0.33	0.25	0.17	0.17	0.20	0.00	0.33	0.20	<b>0.46</b>
q8	2.00	3.00	2.00	3.00	2.00	3.00	2.00	2.00	3.00	1.00	1.00	2.00	0.50	1.00	2.00	5.00	0.13	0.80	0.50	3.00	<b>2.31</b>
q9	1.00	0.50	0.50	1.00	0.25	0.50	1.00	0.25	0.00	0.33	3.00	1.00	0.33	0.50	0.00	0.25	0.13	0.80	0.50	0.33	<b>1.12</b>
q10	0.50	0.33	0.33	0.25	0.20	0.25	0.50	0.20	0.30	0.33	4.00	0.33	4.00	0.50	0.50	0.17	0.13	0.00	2.00	0.33	<b>0.99</b>
q11	0.33	0.25	0.33	0.14	0.33	0.33	0.25	0.20	0.33	0.33	0.20	0.33	0.33	0.33	0.20	0.20	0.14	0.00	0.50	0.14	<b>0.51</b>
q12	0.25	0.33	0.25	0.25	0.33	0.20	0.20	0.20	1.00	0.50	0.33	0.50	0.33	0.50	0.33	0.33	0.11	0.80	0.25	0.14	<b>0.72</b>
q13	0.33	0.33	0.25	0.17	0.17	0.17	0.20	0.25	0.25	0.25	0.17	0.33	0.25	0.33	0.20	0.17	0.00	0.30	0.50	0.17	<b>0.72</b>
q14	0.50	0.50	0.33	0.30	0.00	0.25	0.30	0.30	0.33	2.00	6.00	1.00	0.50	0.30	3.00	6.00	0.14	0.30	0.25	0.33	<b>1.96</b>
q15	0.33	3.00	3.00	3.00	0.25	3.00	0.50	0.50	0.33	0.50	1.00	0.50	0.25	0.00	0.25	0.25	0.14	0.00	0.17	0.00	<b>1.35</b>
q16	3.00	2.00	5.00	0.25	0.33	2.00	0.50	0.50	0.33	0.33	0.20	0.33	0.30	0.50	0.25	0.25	0.13	0.40	0.00	4.00	<b>1.31</b>
q17	0.33	2.00	3.00	1.00	1.00	1.00	1.00	1.00	0.25	1.00	4.00	1.00	0.33	0.50	0.50	0.33	0.13	0.20	0.13	0.00	<b>1.04</b>
q18	0.50	0.50	4.00	0.33	0.50	0.33	0.25	0.33	0.25	0.25	0.17	0.50	0.25	0.33	0.20	0.25	0.13	0.33	0.13	0.33	<b>0.49</b>
q19	1.00	3.00	4.00	1.00	3.00	1.00	1.00	2.00	1.00	3.00	3.00	1.00	1.00	1.00	1.00	0.33	0.00	3.00	0.50	2.00	<b>1.99</b>
q20	3.00	1.00	0.50	0.33	0.25	0.50	0.33	0.20	1.00	0.33	0.25	2.00	0.33	0.17	0.50	0.33	0.17	0.80	1.00	0.50	<b>1.04</b>

The relationship between the sub-criteria and their amount for 18 sub-criteria is clear. For example, the pre-criterion of the first sub-criterion over the second sub-criterion, according to the consensus of all audiences, is 1.18, which indicates its relatively high preference.

Based on the procedure followed in this research, the identified criteria and the weights of each criterion based on the opinion of experts are as follows (table 4).

After determining the model criteria using the pairwise comparison questionnaire, the importance and priority of these criteria in the first and second levels of the network were obtained. As can be seen in the table above, based on the weights obtained, experts have considered criterion C1, ie "spatial and spatial factors" as the most important criterion in the creation and development of industrial clusters. After and cultural factors" had the highest priorities that, C3 criteria, ie "policy and

institutional factors", C5, ie "economic factors", C4, ie "organizational factors", and C2, ie "social, respectively.

**Table (3):** Geometric mean of the numbers in the questionnaire

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1		1.18 89	0.93 95			1.55			0.94 79							0.94 76	1.05 21	
2			1.02 48					0.83 68	0.84 15	0.92 01	2.22 46	1.72 93	1.12 53	1.08 45	0.96 4	0.85 55	1.16 02	0.90 37
3																	0.82 69	1.11 32
4					0.82 24	0.83 97	0.87 53											
5						1.20 85	1.17 54											
6							1.31 07											
7																		
8										0.91 43	0.92 48	0.93 78				1.32 91		
9										1.32 25	1.18 56							1.20 33
10											1.40 26							
11																		
12													0.89 8	0.83 68	0.84 55			
13																		
14															0.82 99			
15																1.12 11	1.15 73	
16																	1.16 66	
17																		
18																		

**Table (4):** Model criteria and related weights

Row	Model Criteria	Weight	Final Ranking
1	Spatial and spatial factors	<b>0.271287</b>	<b>1</b>
2	Policy and institutional factors	<b>0.203774</b>	<b>2</b>
3	Economic factors	<b>0.186831</b>	<b>3</b>
4	Organizational factors	<b>0.177425</b>	<b>4</b>
5	Social and cultural factors	<b>0.160683</b>	<b>4</b>



**Table (5):** Ranking of indicators

COD E	Indicator	weight	Rank in subgroup	Final ranking
I1	Spatial proximity	0/111661	1	1
I2	Existence of appropriate infrastructure	0/043796	3	11
I3	Face-to-face contacts with economic agents	0/044543	2	10
I4	Existence of a sense of trust in social and business relationships	0/087092	1	3
I5	Existence of a common social origin	0/069646	2	7
I6	Ease of establishing social relationships and low conflict	0/026766	3	15
I7	Adherence to ethical principles	0/016496	4	17
I8	Government support for planning, with the aim of completing the value chain	0/086756	1	4
I9	Availability of financing facilities and capital assistance	0/064886	2	8
I10	Proper policies of the government and other support institutions in support of innovation and entrepreneurship	0/032811	3	13
I11	Exemption from administrative rules and regulations	0/015547	4	18
I12	Existence of an efficient information system in the field of technology, market, suppliers and competitors	0/069696	2	6
I13	High degree of division of labor	0/038880	3	12
I14	flexibility	0/19191	4	16
I15	Existence of appropriate and competitive technology	0/072233	1	5
I16	Existence of a network of economic agents to supply products to final markets	0/108442	1	2
I17	Existence of competition between existing firms	0/063316	2	9
I18	Existence of risky investors	0/028243	3	14

## CONCLUSION

The identified indicators of the present research model based on the opinion of experts include 18 indicators that after performing the procedure in the fourth chapter and calculating the relevant weights, the priority of each of these

indicators was determined based on the network analysis process as described in Table (2-5). In the network analysis method, the final weight of each index was calculated and determined after performing the calculations and obtaining the weights related to each level through Supper

Decision software. The criterion is in the first place, then the I16 index related to the C5 criterion is in the second place. Indicators I15, I8, I4, related to C3, C2C4 criteria, are ranked third, fourth and fifth, respectively. Similarly, the indices I12, I4, I4, I9, I3, I17 related to the criteria, C4, C2, C3, C5C1 have the sixth to tenth ranks. Index, I2 related to criterion C1, index, I13 related to criterion, C4 index, I10 related to criterion C3, index, I18 related to criterion, C5 index, I6 related to criterion, C2 index, I14 related to criterion, C4 index, I17 related to criterion C2 and in Finally, the I11 index related to the C3 criterion are in the next priorities, respectively.

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