Print ISSN: 2008-448X
Online ISSN: 2538-3310
International Journal of Business and Development Studies
University of Sistan and Baluchestan
Homepage: https://ijbds.usb.ac.ir

The Design of Industrial Development Model of Iran based on Hybrid Approach (OR:Soft - Fuzzy)

Roholah Hosseini[1]

[1] Corresponding Author: Assistant Professor, Faculty of Management , Payame Noor University, Tehran, Iran, Email: r.hosseini59@pnu.ac.ir.

ARTICLE INFO
Article type:
Research

Article history
Received: 12.01.2023
Accepted: 04.10.2023

Keywords:
Industrial Development,
Interpretive Structural Modeling (ISM),
Process Development,
Yeager Fuzzy model.

Abstract:
Industrial development depends on planning and formulation of strategy and systematic policies. The purpose of this research is to analysis phase of conventional strategies in order to progress of Iran's industry in the international atmosphere. The statistical community of this study is included of experts and academic pundits. To do this at first identification of significant conventional industry's strategy was determined. six strategies was founded and then was specified, using the criticality of each phase's approach.

According to data analysis, $\mu\widetilde{D}$ efficiency of technology transfer on industrial progress is more than other elements. On the second rank, domestic and foreign investment's strategies, development of parent industries, development of infrastructure industries and designing strategy and industrial policies and finally government support strategies has been placed at the lowest level that means third rank. Therefore technology transfer plan was recognized as the most important strategy and specially it should be considered as the strongest strategy for developing industry. The insight that this model offers to managers and decision makers of the country's industry can help them to plane strategy for developing.

Introduction:

Industrial development gradually requires to make change and transformation all-round in qualitative and quantitative dimensions. Philosophy of industrial development and progress, empowerment of country is to provide needs and dependence and general welfare of the country. Aim of the current study is how to design a interpretive structure model industry development for Iran according to phase informations. In this research has been tried to discuss about variable

Cite this article: R. Hosseini (2024) The Design of Industrial Development Model of Iran based on Hybrid Approach (OR:Soft - Fuzzy), 16 (1), 147-168. DOI: 10.22111/ijbds.2024.45241.2019.

affecting the growth and development of the industry in Iran and finally it is provided and designed according to opinion of industrial development model exports.

Review of Literature

One of the most important factors for countries industrial development is to make network of related business in special geographical areas, in order to play the role of supporting activities. These networks are known as industrial clusters or business clusters in industrial development since. These clusters arise spontaneously based on primary available resources in region and existing opportunities and threats among businesses in region. (Mirghaderi et al.2015). The importance and benefits of clusters in creating a large group of small and medium companies, which enables them to overcome common problems and cooperate as a coordinated group in challenges with big companies and reduce the risk of being an small company. The proximity of active business in industrial unit leads to decreasing costs, increase innovation, accessing to skilled workers and impressing competitiveness. (Mansoori and Azizimohammadi 2008-Mirghaderi et al. 2015) Dos and Dos (2011) also investigated on clusters importance of efficiency in enhancement of countries economy. Measuring efficiency is of double importance for growing countries such as Iran. (Montazeri et al. 2015). The digital economy enables the development a modern industrial system and will lead to development of a modern structure (Wu & Shao 2022). Li Yiming believes that the digital economy has gradually become an important part of the new economy (Li, 2017). The digital economy plays an important role in the formation of new industries and business formats. Advancing the development of the digital economy plays an important role in the transformation and upgrading of industry. Zhang Yuzhe explained the important role of the digital economy in promoting the industrial structure, and introduced the digital economy's development ideas, main principles, and main tasks in promoting industrial upgrading. The digital economy can broaden market scope by reducing transaction costs and betterment transaction efficiency, also improve industrial quality, optimize industrial structure (Zhang, 2018) and enhance efficiency of factor all types resources allocation (Lin & Chen,2020). In addition, the digital economy has the characteristics of high innovation frequency, high degree of influence, and strong spillover (Li, 2019), which is conducive to enterprises learning and application new technologies and business Pattern and Models (Xu et al, 2020). The most important strategies of country's industrial development which were formulated in 1383 are as follow and continuous industrial development, reliance on industrial experts, production of competitive goals, access to high technology, entering global production corporation. Foreign investment, positive introduction for foreign political relations, the strategy role of technology progress, the significant expansion of information technology,

equipping and promotion of human capital, revision in quality and quantity of engineering training courses, increasing ability to design production process of engineering graduates, foreign investment, scientific and applied universities development , deepening university education up to the PHD level in some areas where country has natural advantages for example petroleum, distinguished quality sciences. development, establishment of technology parks, clear orientation in research and development, establishment support institutions (Nilly and et al. 2003) One of the effective strategies for industrial development is the acquisition of advanced technology. One of the effective ways to acquire technology, especially advanced technology, is technology transfer. Technology transfer in its most comprehensive form is a systematic process of purposeful activities through which a set of technology elements is applied in a place other than the initial place of technology creation (Smyynsr, 2002).

India and Japan have followed a strong industrial policy with active government involvement in the trade sector. Although it had common goals, the path chosen by the respective governments was different and the results were also different, and Japan was able to quickly improve the situation and achieve delayed economic success. This country joined the ranks of developed nations and its GDP became the second largest country in the world after the United States of America. On the other hand, India achieved less benefits. Its economy operated at a much lower level than its potential power and this country remained at the level of third world nations. (Godarzvand Chegini, 2010) based on the research of Mir Qadri et al (2015). under the title "Identification of the functional dimensions of industrial clusters by hierarchical consensus cluster analysis" the formation of industrial clusters is one of the new and important discussions in the industrial development of the countries It is developing, which has recently attracted the attention of many researchers and policy makers. Clustering has positive economic effects on the region as well as increasing the competitiveness of small and medium companies.

Mesti et al. consumption of steel is one of the signs of economic development. The consumption of steel products largely depends on the fixed capital formation and gross domestic product. During the last three decades, significant investment has been made in Iran's steel industry. But because the beginning and continuation of the process of creating steelmaking capacities has been done with less economic incentives and because this industry is a largescale industry, there are problems in the field of continuing activity of these units, it is felt that these problems show themselves in the cost of the product. In recent years, there have been many developments in the global market of steel products. The continent of Asia has emerged as the most important hub of production and consumption, and it is expected that the current trend will continue in the future. During this period, the producers have focused their research and development activities in various

fields, including the acquisition of quality steel production technology, while reducing the cost of the product. In order to enter the world market, Iran's steel industry has a relative advantage compared to others despite some potentials such as rich sources of raw materials, energy, cheap manpower and suitable regional location. Rahmani et al. the importance of foreign investment as a measure to measure the dynamism and prosperity and development of any country is undeniable, especially from the perspective of countries in need of development. The use of foreign investment mechanism is one of the effective and strong solutions in this case. In recent years, the statesmen of our country have tried to present a favorable picture of the foreign investment situation in Iran, and the aforementioned efforts have been useful to some extent, but in this context, the most important point is to provide security and stability from various economic and social aspects. , political, and diplomatic, and especially the use of legal standards and legal mechanisms to guarantee foreign investment in different stages of "entry, presence and exit" of capital. Iran's laws and regulations have many shortcomings in this field, some of which have been resolved by the legislator in recent years. For example, with the approval of the foreign investment promotion and support law, foreign capital guarantees have been increased to a great extent. Iran has been unsuccessful in attracting foreign capital and due to the inadequacies caused by the lack of an efficient legal and legal system in relation to the issue, especially until the approval of the law on the encouragement and support of foreign investment at the macro level of the country's management, along with some obstacles. In the constitution and other related laws, not much success has been achieved in this field .(Maziati et al, 2010)

Industrialization is the engine of economic development and the most important factor of technical changes. In the process of economic development, the production structure also changes. In his research, concluded that there was a positive relationship between industry growth and survival. The results of research conducted by Helmers and Rogers (2010) indicate that in higher-growth industries, it specifically increases survival. One of the most important sectors in the country is the industry sector, which plays a vital role in the country's economic and comprehensive development due to its structural characteristics. Foreign investment is one of the relatively classic and very important topics of international law in the field of international economic relations, which covers the economic activities of producing goods and services across the border of the investor's country. This important international economic legal issue has a significant impact on other issues of international law, including economic sanctions. The creation of "industrial poles" was one of the strategies that after the Second World War, for the purpose of development, many thinkers of the countries such as Friedman, Myrdal, Hirschman and especially François Perrault received attention. According to the theories of Francois Perrault, growth occurs

in specific regions or poles at a specific time. The "driving" or "leading" industries that are created in the pole have continuous effects on each other and promote economic growth in all industrial groups that increase production. Also, the mentioned industries are effective in innovation and expansion .Globalization parallel to the rapid growth of organizations is the formation of regional agreements such as the European Union, NAFTA, ASEAN, Mercosur, etc. in the last few decades, and in many cases the authority of these organizations is higher than the governments themselves. Unfortunately, globalization in the Persian Gulf region only means raising the standard of living in a western-style and consuming the products of industrialized countries.

Research Methodology

The current research is based on the paradigm of positivism and is practical in terms of the type and purpose of the research. In terms of data collection method, it was descriptive-analytical. The process of this research consists of two main stages: calculating the importance of indicators and the fuzzy degree of strategies. In the first step, the importance and weight of the criteria are determined by hourly model and then, with Ronald R. Yager fuzzy logic, the fuzzy degree of strategies is calculated. The statistical population of this research consists of academic experts and experts. The sampling method used in this research is purposive sampling. The sample of this research includes six academic experts and experts.

Fuzzy Model of Yeager

Fuzzy logic or theory, which is interpreted as imprecise logic, is a part of quantitative discussions such as operations research, in which the transformation of qualitative and quantitative data is done in a new way .The results obtained from the studies of the researchers show that the Jaeger fuzzy technique is an effective method in analyzing options according to the purpose and criteria of the study, based on the opinion of applied experts, and in the process of helping experts in decision-making as a scientific and practical method. It has had a great role, which is consistent with the results of the present study .Among the advantages of the mentioned method, speeding up the decision-making process, formulating the problem analytically and hierarchically, taking into account qualitative and quantitative fuzzy indicators at the same time, judgments, wide applicability in solving various problems, using the method for experts. The possibility of team participation in decision-making (facilitating collaborative decision-making), integration of people's opinions and optimization and the like . Another prominent advantage of this method is the use of qualitative indicators in the decision-making process, the results of which are presented quantitatively using mathematical concepts. The use of quantitative results makes the obtained

results understandable and makes it possible to make better judgments in decision-making.

On the other hand, due to the use of experts' opinions, acceptable results are provided. In general, the results of the study show that Jaeger's fuzzy technique can be used as an efficient and effective method in decision-making processes in various fields, using a scientific and systematic method, and can be presented as a reliable method.(Azer et al., 2013, p. 200) Zadeh (1965) proposed a mathematical scheme called fuzzy set theory for decision making in this type of situation, which overcomes this deficiency.

The most used fuzzy number ranking methods are Dubois and Prades' dominance probability method, Jager's method and Baas and Kwakernaak's fuzzy set method.

Yager's fuzzy model has been widely used in organizational issues, such as: Hassanzadeh (2012) "Selecting the optimal production project for investment using the fuzzy multi-indicator decision making model (FMADM) of Yager's method", Nezakhti et al. (2012) "Review of the model Yager (multiple fuzzy indicators) in environmental risk assessment".

Fuzzy Model of Yeager

In a decision matrix $A=\{A_1, A_2, A_3, A_4, A_5, \ldots\ldots, A_m\}$ Represents a set of options $X=\{X_1, X_2, X_3, X_4, X_5, \ldots\ldots, X_m\}$ Represents a set of indicators, $\tilde{C}_1, \tilde{C}_2\tilde{C}_3\tilde{C}_4, \tilde{C}_5 \ldots\ldots\tilde{C}_n$ Indicates that the degree of fuzzy sets j satisfies my criteria by various options, a decision can be known as a subscription of all fuzzy sets $\tilde{C}_1, \tilde{C}_2\tilde{C}_3\tilde{C}_4, \tilde{C}_5 \ldots\ldots\tilde{C}_n : \tilde{D}=\tilde{C}_1^{W1} \cap \tilde{C}_2^{W2} \cap \tilde{C}_3^{W3} \cap \tilde{C}_4^{W4} \cap \tilde{C}_5^{W5} \ldots\ldots \cap \tilde{C}_n^{Wn}$ Is where in W_j Weight Indicates j. in this equation, Optimum option is an option which has the greatest $\tilde{D}$ degree of membership. Yeager suggests that to gain W_j The method we use clock /time hierarchical method. Yeager model steps are as follows:

- determine weight of various indicators of W_j by doing pairwise comparisons (clock method) .
- Assess the degree of membershipof each option in various indices $(\mu_{\tilde{C}_j}(A_i))$ And exponent it to W_j to get The fuzzy set $(\tilde{C}_j(A_i))^{Wj}$.

- Share fuzzy sets $(\tilde{C}_j(A_i))^{Wj}$ Obtain and form the fuzzy set decision $\tilde{D}$ based on it.
- $\tilde{D}=\{A_i, \min_j(\mu_{\tilde{C}_j}(A_i))^{Wj}\}$ Choose the option with the highest degree of membership $\tilde{D}$ as the optimal choice (Azar et al, 2008, p. 220).

Data analysis

Yager's Fuzzy Data Model

In general, fuzzy data analysis was conducted in two main stages as follows: The first step is to calculate the importance coefficient of each index, Secondly: Ranking the elements and strategies of industrial development

Table 1 – The abbreviations of Indicators

Indicators	abbreviation
Role in Development	**X_1**
Importance in development	**X_2**
Development Effectiveness	**X_3**

Table 2 - The abbreviations of Elements of industrial development

Elements of industrial development	abbreviation
Foreign and domestic investment	A.
Technology Transfer	B.
government support	C.
primary Industrial Development	D.
Infrastructure Industrial Development	E.
Design strategy and industrial policy	F.

We normalize the matrix of pairwise comparisons with indexes above. The normalized matrix coefficients of various indices can be obtained as follow:

Table 3 - normalized matrix pairwise comparison matrix indicators

D	X_1	X_2	X_3	Wj
X_1	0.763636364	0.837209302	0.5	2.100845666
X_2	0.127272727	0.139534884	0.428571429	0.69537904
X_3	0.109090909	0.023255814	0.071428571	0.203775294

Based on data analysis, playing roleole in development is a criteria which weighs most in the analysis and evaluation of industrial development .

Decision matrix of elements of industrial development

In this matrix, the degree of satisfaction numbers represent the various indicators of options. For example, 0.70 shows that option A satisfies number X1 as much as 0.70. To select the optimal option based on the steps mentioned above are:

Table 4 - making matrix elements of industrial development

DE	X_1	X_2	X_3
A.	0.7	0.7	0.7
B.	0.8	0.7	0.8
C.	0.6	0.7	0.6
D.	0.7	0.8	0.7

Decision matrix elements are modulatory based on different indicators.

Table 5. Matrix modulatory of industrial development

DE	X_1	X_2	X_3
A.	$0.7^{(2.100845666)}$	$0.7^{(0.69537904)}$	$0.7^{(0.203775294)}$
B.	$0.8^{(2.100845666)}$	$0.7^{(0.69537904)}$	$0.8^{(0.203775294)}$
C.	$0.6^{(2.100845666)}$	$0.7^{(0.69537904)}$	$0.6^{(0.203775294)}$
D.	$0.7^{(2.100845666)}$	$0.8^{(0.69537904)}$	$0.7^{(0.203775294)}$
E.	$0.7^{(2.100845666)}$	$0.8^{(0.69537904)}$	$0.7^{(0.203775294)}$
F.	$0.7^{(2.100845666)}$	$0.7^{(0.69537904)}$	$0.7^{(0.203775294)}$

Fuzzy set decision is obtained from Shared fuzzy sets $(\tilde{C}_j(A_i))^{wj}$ .The result is as follo::

Table 6. The data matrix $\tilde{C}_i$ elements of industrial development

$\tilde{C}_i$	
$\tilde{C}_1$	{(*A*, 0.7),(*B*, 0.8),(*C*, 0.6),(*D*, 0.7),(*E*, 0.7),(*F*, 0.7)}
$\tilde{C}_2$	{(*A*, 0.7),(*B*, 0.7),(*C*, 0.7),(*D*, 0.8),(*E*, 0.8),(*F*, 0.7)}
$\tilde{C}_3$	{(*A*, 0.7),(*B*, 0.8),(*C*, 0.6),(*D*, 0.7),(*E*, 0.7),(*F*, 0.7)}

Table 7. The data matrix $\tilde{C}_j^{wj}$ elements of industrial development

$\tilde{C}_j^{wj}$	
$\tilde{C}_1^{w1}$	{(*A*, 0.472688339),(*B*, 0.625758877),....,(*G*, 0.472688339)}
$\tilde{C}_2^{w2}$	{(*A*, 0.780340996),(*B*, 0.780340996),.....(*G*, 0.780340996)}
$\tilde{C}_3^{w3}$	{(*A*, 0.929896916),(*B*, 0.955547177),.....(*G*, 0.929896916)}

We make matrix membership degree of fuzzy set $\tilde{D}$ decision. According to Jaeger's techniques the option with the highest degree of membership in the fuzzy set decision $\tilde{D}$ has to be chosen as elements of effective industrial development.

Table 8. The degree of membership in the fuzzy set decision $\tilde{D}$ of the Industrial Development Options

$\tilde{D}$	
$\tilde{D}$	{(*A*, 0.472688339132131),(*B*, 0.625758876955242),(*C*, 0.341924338876149), (*D*, 0.472688339132131),(*E*, 0.472688339132131),(*F*, 0.472688339132131)}

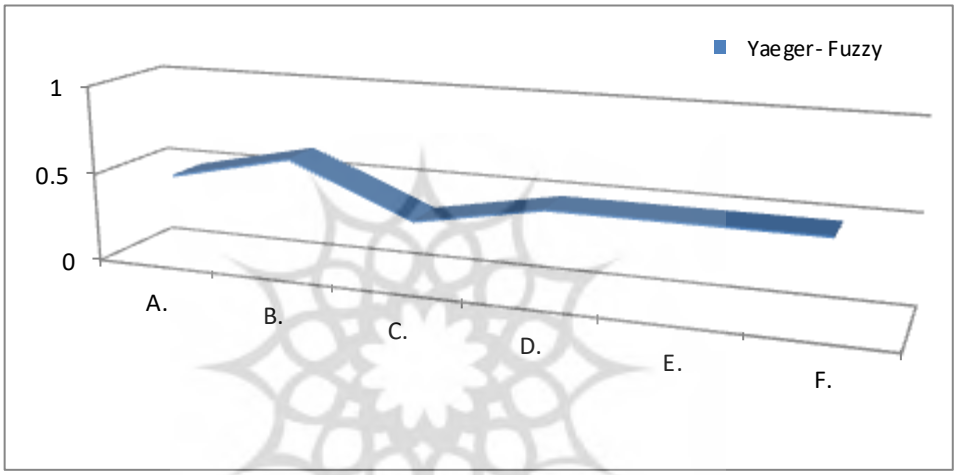


Figure 1. The implementation of the decision options in terms of degree of membership in the fuzzy set $\tilde{D}$ Elements of industrial development

Based on data analysis and due to $\mu\tilde{D}$, the transfer of technology is more effective than other elements of industrial development.

Interpretive Structural Modeling (ISM)

In several studies interpretive structural modeling – ISM has been used to design the model some of which are: Aghaei and colleagues, (2015) "Designing a model of lean supply chain, using structural equation", Azar and colleagues (2010) "model for supply chain agility", Azar and colleagues (2008) "process-centric business model," Faisal and colleagues (2006), "supply chain risk", Agrval et al. (2007) and "agile supply chain", Pfahl et al. (2011) "structural analysis of

potential supply chain risks", Jytsh Sachar (2007) "balanced scorecard", Jafari and colleagues (2012) evaluated the critical factors of knowledge management in project-based business, Mohammadi et al. (2012), "provide interpretive structural model achieving agility through IT in manufacturing organizations "Hoseini et al (2009)" designing agility in new product development process using structural equation modeling in automotive Iran "Talyb (2011)," a model of obstacles to the implementation of total quality management "Mohammad and Amir, (2012) "interpretive structural modeling achieving agility through IT in manufacturing organizations," Ansari and Sadeghimoghadam, (2014) "establishing relationships and ranking of green supply chain management incentives with interpretive structural modeling approach"

To implemen ISM and explain the relationship of elements the following process shuld be established :

1 Determinig model variables:

Interpretive structural modeling starts with the identification of related factors and. (Affection, et al., 2014) these variables are obtained from relevant literature and interview with experts . Variables to design industrial vevelopment model are the same as factors to vevelop industrial development mentioned before. These variables include six factors which are:

2. Structural Self-Interactional Model SSIM:

The dimensions of this matrix are those elements of industrial development proposed in first line and column respectively. The relations between the two variables will be determined by symbols based on expert's opinions (Shankar, 2005 & Ravi) Therefore, the suggestioins of six experts of relationships between elements in a matrix SSIM were defined.

Table 9: Modes used in the conceptual relationship between the elements

Conceptual Relationship status	Signs
Row element (i) to the element column (j) is	**V**
Row element (j) to the column element (i) is	**A**
Bilateral communication between the rows(i) and columns (j) there	**X**
Lack of relationship	**O**

Table 10: Self-structure interaction matrix (SSIM)

j to i	i to J	Sconceptual symbol
0	1	V
1	0	A
1	1	X
0	0	O

3. The basic access matrix:

SSIM matrix is designed by substituting symbols of relations according to the following rules designed to achieve the numbers zero and a one. (Azar and Bayat, 2008; Fysal et al., 2006, Ansari and Sadeghimoghadam, 2014)

Table 11: Conversion of conceptual relationships to numbers (Jetish Thakkar et al., 2007)

.F	.E	.D	.C	.B	.A	j / i
A	A	X	A	X	-	Foreign and domestic investment .A
A	A	X	A	--		Technology Transfer .B
X	V	V	-			State support .C
X	X	-				Mother Industrial Development .D
X	-					Infrastructure Industrial Development .E
-						Design strategy and industrial policy .F

If home (j, i) in the matrix SSIM, took the symbol A, respective home in the matrix is zero and its home counterpart (i, j) is the number 1.

If the home (j, i) in the matrix SSIM symbolizes x in the matrix ,the related hometakes 1and its counterpart (i, j) is 1.

Table 12: Matrix basic access (RM)

F.	E.	D.	C.	B.	A.	j / i
0	0	1	0	1	-	A. Foreign and domestic investment
0	0	1	0	--	1	B. Technology Transfer
1	1	1	-	1	1	C. State support
1	1	-	0	1	1	D. Mother Industrial Development
1	-	1	0	1	1	E. Infrastructure Industrial Development
-	1	1	1	1	1	F. Design strategy and industrial policy

4. The final achievement matrix (matrix compatible access):

After initial acquisition matrix, its internal consistency should be established. Among the factors must considered at this stage sequential mode is considered too. If i results in j and J results in k , then I should result in k. (Olfat, et al., 2014), Huang and colleagues used mathematical rules to work to achieve matrix (K + 1). Of course, the ability to deliver Matrix K> 1 is due to rule Boleyn (1 + 1 = 1 and 1 * 1 = 1) (Huang et al., 2001). In the present due to the compatibility of comprehensive data, data compatibility matrix aboveis applied triangular.

Table 13: Matrix adapted achievement

Common Set	Input Set	Output Set	Model of Elements
،1,2,4	1،2,3,4,5,6	،1,2,4	Foreign and domestic investment
،1,2,4	1،2,3,4,5,6	،1,2,4	Technology Transfer
4,5,6	4,5,6	2 ,4,5,6،1	State support
1،2,3,4,5,6	1،2,3,4,5,6	1،2,3,4,5,6	Mother Industrial Development
3,4,5,6	3,4,5,6	1،2,3,4,5,6	Infrastructure Industrial Development

Influence Power	F.	E.	D.	C.	B.	A.	j / i
3	0	0	1	0	1	1	A. Foreign and domestic investment
3	0	0	1	0	1	1	B. Technology Transfer
5	1	1	1	0	1	1	C. State support
6	1	1	1	1	1	1	D. Mother Industrial Development
6	1	1	1	1	1	1	E. Infrastructure Industrial Development
6	1	1	1	1	1	1	F. Design strategy and industrial policy
	4	**4**	**6**	**3**	**6**	**6**	**Dependence Rate**

6 .Determine the matrix of variables:

To determine the level and the type of relations, access set elements and prerequisity set are determined for each variable. Then access set consists of variables that can be reached through this variable and prerequisity set includes elements that can be reached through this element. Afterwrds the intersection of both access and prerequisity sets are established and if equal, that/those factor(s) is/are considered as as the surface. To get other levels, the previous levels must be seprated from matrix and the process should be repeated. After determining the obtained matrix is arranged based on the levels. New matrix is called a cone. (Olfat, et al., 2014)

To determine the type and level of elements of the model ,output and input sets should be defined for each element of the matrix identified. The bilateral relations of each element is determined, ie the number of elements repeated in two sets of input and output sets. Based on sets obtained, elements are ranked. Normally, elements with output set and the same set of d bilateral relations form the upper level of model. Therefore, the upper elements will not be the source of any element. When a high level was defined, it is separated from other elements, by a similar process, the next levels are determined. Designed model is presented below. (Azar and Bayat, 2008; Agarwal, et al., 2007, Ansari and Sadeghimoghadam, 2014)

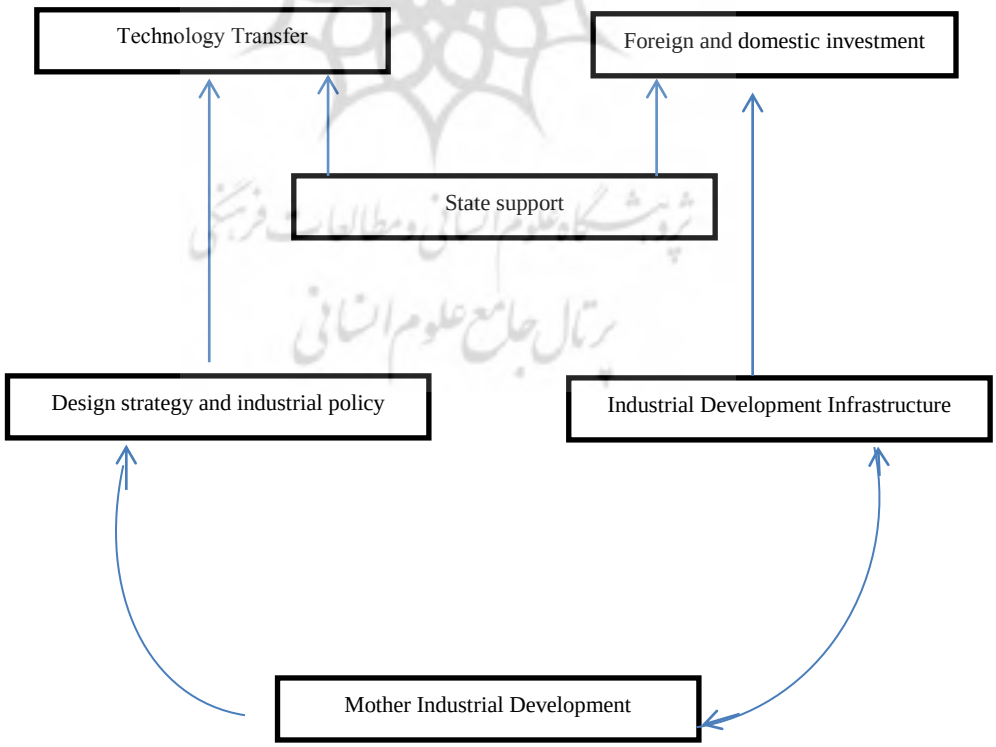
Table 14: Determination of varying levels

Level	Frequency Output Set + Common Set	Model of Elements
I	6	A. Foreign and domestic investment
I	6	B. Technology Transfer
II	8	C. State support
IV	12	D. Mother Industrial Development
III	10	E. Infrastructure Industrial Development
III	10	F. Design strategy and industrial policy

ISM Interactive Network model is designed according to the classified data table. At the lowest level, there is the design of developingt primary industries and at highest, the first level, foreign and domestic investment. The higher the location of elements, the lower their stimulating power and more dependence will be . The graph has been designed by squares and lines. The direction of their relation was specified by arrow lines . This diagram is known as the structural model or diagraph in the interpretive structural modeling. (Azar and Bayat, 2008; Huang, 2005, Ansari and Sadeghimoghadam, 2014)

7.Drawing the chart:

First, based on the criterion, we sort standards according to priority from top to bottom. Using the resulting matrix from the sorted matrix received, the structural model is drawn by lines and nodes. (Olfat, et al, 2014).



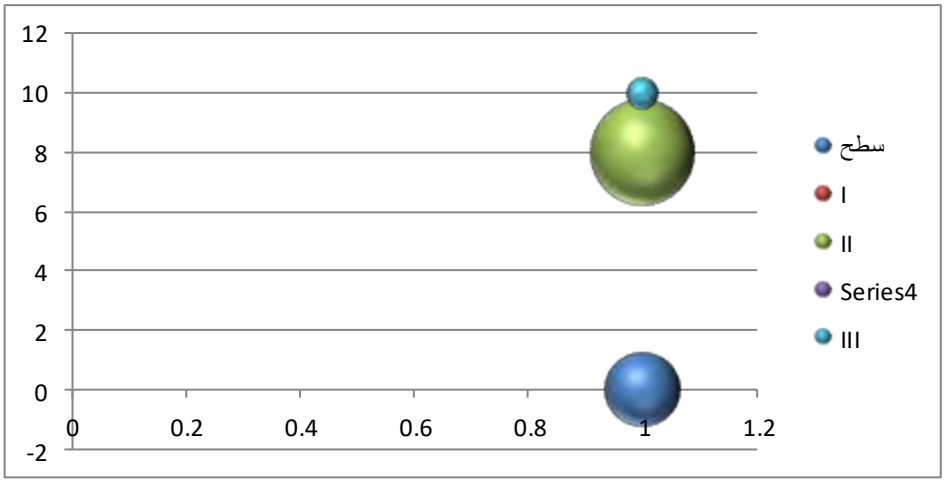


Figure 2. The graph of dimensions ISM

8. Analysis of leverage and dependence MICMAC:

Leverage and dependence of each variable can be calculated at this stage. In this analysis, the variables based on leading power and dependency are divided into four categories:

1- **Self-centered variables**: a weak leading power and dependency. These are fairly detached to the system with little communicaton to the system.

2- **Dependent variables**: a weak leading power but a high dependency.

3- **Communicational variables**: a high leading and dependency power. These are unstatic since any change upon them can affect the system and ultimately system feedback can change these variables again.

4- **Independent variables**: a strong leading power but a weak dependency. (Olfat, et al, 2014).

can leverage elements based on the dependency of each element in other elements and other elements on the four-level categories: (Azar and Bayat, 2008; Huang, 2005, Ansari, Kennan et al., 2008 and Sadeghimoghadam, 2014)

1. The independence level , elements of which has the least dependence and influence on other elements located in District 1 .

2. Dependence, elements of which are highly dependent and little penetrating power on other elements located at District 2.

3. communication, elements of which have bilateral relations with other elements (influential and high dependency)located In District 3 .any change in these elements will result in change in other elements.

4. Influence (independence), elements of which have significant influence on other elements and had little dependencylocated in District 4.

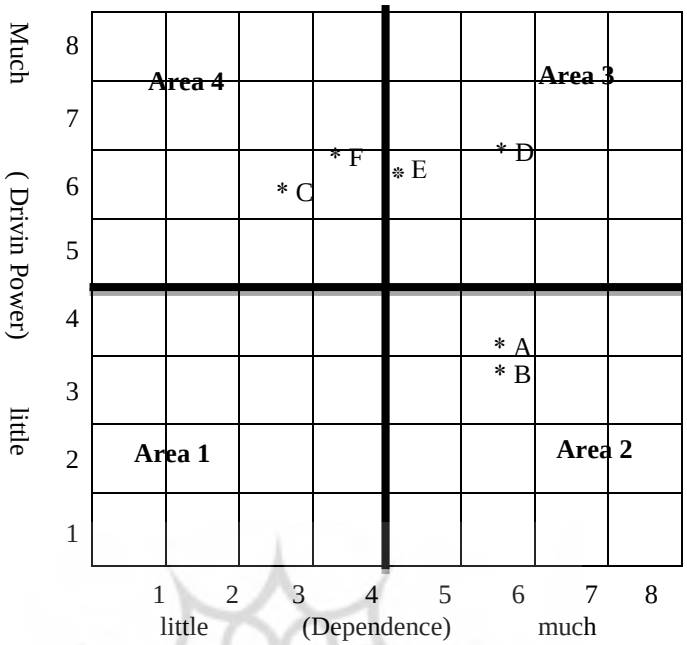


Figure 4 - Matrix Power of Influence – Dependencey

Conclusion

Industrial development forms the basis of the development of any society and For this reason, it is very important and vital. The aim of the current research is to design an Interpretive Structural Model (ISM) of Iran's industrial development based on fuzzy data.The statistical population of this research includes specialist and academic experts. For this purpose, first the important elements in industrial development were identified with a fuzzy approach, and six elements were determined in total and then by applying the interpretative structural modeling technique, the type of relationships was determined by experts .The findings of the research include an integrated structural interpretive model of industrial development at four levels in industrial development according to one-way or two-way relations. At the lowest level, the development plan of parent industries is placed and at the highest level(the first level), foreign and internal investment is placed. The higher the elements are placed,Their stimulating power decreases and the Dependency level increases.

Therefore, the parent industries development plan was the most dependent element of the model and foreign and internal investment was recognized as the most influential element of the model. Because according to the conceptual

model and the chart of penetration power and Dependency level, it is the basis of the model and the origin of other elements and it affects all the elements of the model and it should be given special attention as a stronger element in industrial development. The insight that this model provides to the managers and decision makers of the country's industry can help them in strategic planning for development. Industrial development requires Comprehensive change and transformation in qualitative and quantitative dimensions gradually. The aim of this research is to present an applied model using the Integrated Structural Modeling (ISM) method In the direction of industrial development industrial development. In the current research, the components of industrial development were first identified, and a total of six elements were determined and it was evaluated by fuzzy approach and then by applying the structural interpretative modeling technique, the type of relationships was determined by experts.

As observed, Using the proposed ISM model in this research, the industrial development model was presented. In this model, the interrelationships and influence between the criteria and the relationship between the criteria of different levels are clearly visible which leads to a better understanding of the decision-making environment.

Based on data analysis, technology transfer is more effective than other elements on industrial development. Also, the research findings include the interpretive structural integrated model at four levels in industrial development with regard to one-way or two-way relations. The ISM interaction network model is designed based on the leveling table data.

At the lowest level, the parent industries development plan is placed, and at the highest level (the first level), foreign and internal investment is placed. The higher the elements are placed,Their stimulating power decreases and the Dependency level increases. Therefore, the parent industries development plan was the most dependent element of the model and foreign and internal investment was recognized as the most influential element of the model. Because according to the conceptual model and the chart of penetration power and Dependency level, it is the basis of the model and the origin of other elements and it affects all the elements of the model and it should be given special attention as a stronger element in industrial development.

totaly, the elements of the fourth level or the last level, which is the lowest part of the model, have the most relevance and impact on the model and by changing them, the model changes. The insight that this model provides to the country's industry managers and decision makers can help them in strategic planning for industrial development. Also, this model helps them to have a comprehensive view of the complex connections between the influencing factors in industrial development and to identify the priorities in their policies and to have a proper orientation. Other results of the research, we can refer to the results of the penetration-correlation matrix (according to the penetration power of each

element on other elements and the Dependency level of each element on other elements). The classification of the mentioned matrix shows that the design of strategy and industrial policies and government support is less dependent on other elements and they have the most penetration in other elements and These elements are included in the category of penetration or lack of dependence and the organization should pay more attention to these elements. The development of parent industries and the development of infrastructure industries are elements that are included in the category of communication, that is, these indicators have a two-way relationship with other indicators.

Industrial development need all-round change and evolution in qualitative and quantitative dimensions piecemeal. The purpose of this research is the fuzzy analysis of conventional strategies in order to progress Iran's industry in the international space. For this purpose, the important strategies in industrial progress were first identified, and a total of six strategies were determined, and then the degree of importance of each of them was determined by applying the fuzzy approach. Based on data analysis and according to, technology transfer is more effective than other strategies on industrial progress and growth and is placed at the top. Foreign and domestic investment strategies, development of mother industries, development of infrastructure industries and design of strategy and industrial policies are ranked second, and finally, government support strategies are ranked at the lowest level, i.e. third.

Therefore, the technology transfer plan was recognized as the most effective industrial development strategy in Iran because it has a higher degree of fuzzyness. Also, the findings show that, the role of a creator in development is a criterion that has the highest weight in the analysis and evaluation of industrial development strategies. The insight that this approach provides to the country's industry managers and decision makers can help them in strategic planning for industrial development. Also, this model helps them to have a comprehensive view of effective strategies in industrial development and to identify priorities in their policies and to have a proper orientation.

References:

1. Advari, M., (2009), per capita employment report comparing cooperative projects and private funds return soon, Tehran, paper manufacturing and service cooperatives Ministry of Cooperatives.
2. Agarwal, A., Shankar, R., & Tiwari, M. K. (2007). Modeling agility of supply chain. Industrial marketing management, 36(4), 443-457.
3. Aghaee. A, Salehi Sadaghiani. J; Ghorbanzadeh. V; Michael. F, (2015). Lean supply chain model is designed using structural equation modeling techniques, Journal of Industrial Management Studies - Year Issue 63, Spring. 95-113.
4. Ansari. I, Sadeghi Moghadam, M. R. (2014), identify, establish relationships and ranking of green supply chain management incentives with interpretive structural modeling approach, Journal - Industrial Management Studies - Issue 35, Winter,150-123.
5. Arab Najaf-Abadi. M, (2011), Exit and factors affecting it in Iranian industries: comparing public and private sectors, Yazd University, Faculty of Economics, Management and Accounting.
6. Azar. A, Bayat, K., (2008), process-centric business model approach to modeling (ISM) structural interpretation, Journal of Technology Management, Volume 1, Number 1, Fall and Winter, 3 -18.
7. Azar. A, H. Faraji, (2010), Management Science fuzzy, kind of publication Productivity Center, Tehran (Tarbiat Modarres University), Tehran, Fourth Edition.
8. Azar. A, Khosravi F, Jalali R., (2014), operations research software, publishing Industrial Management Institute of Iran, Tehran, Tehran, First Edition.
9. Azar. A, Tizro A, MUQBIL Ba'arz. A, Anvari Rostami. A. A, (2010) design models supply chain agility, Modeling structural Tfsyry-, professor of human sciences research in Iran, Volume 14, 4, Winter.
10.Bryce, Murry, D, (1960). Industrial Development: A Guide For Accelerating Economic Growth, New York, McGraw Book Company.
11.Das, R., & Das, A. K. (2011). Industrial Cluster: An Approach for Rural Development in North East India. International Journal of Trade, Economics and Finance, (22), 161-165 .
12.Ebrahimzadeh Pezeshki. R, Galileans .N, Mir Fakhr al-Din. S. H., (2014), present a model to control and reduce the damage caused by the earthquake bits with structural modeling-interpretative approach, Yazd University, crisis management, Issue Issue 65.
13.Faisal M. N., Banwet D.K., Shankar R. (2006). Supply chain risk mitigation: modeling the enablers; Business Process Management Journal, Vol.12 No.4,.

14.Godarzvand Chegini. M., (2010), sustainable development, comparing India and Japan monthly gimmick-year-nineteenth-201.
15.Habermas, Jurgen, (1997), a critical attitude, translated by Hussein Bashiriyeh, political and economic monthly data, the seventh, third and fourth numbers.
16.Hassanzadeh, S., (2012). Choose the optimal productive investment projects using fuzzy multi-criteria decision-making models (FMADM) Jaeger method http://www.daneshgahi.com/(X(1)S(sak3gyegi4hppg24lpyplega).
17.Holmes, P., Hunt, A., & Stone, I. (2010). An analysis of new firm survival using a hazard function. Applied Economics, 42(2), 185-195.
18.Hoshmand, M.M. (2013). The impact of foreign investment on economic sanctions, Iran Convention articles. International economic conference in terms of sanctions. Research Torud north.
19.Huang, J. J., Tzeng, G. H., & Ong, C. S. (2005). Multidimensional data in multidimensional scaling using the analytic network process. Pattern Recognition Letters, 26(6), 755-767.
20.Hughes ,H. (1878) .“Industrialization and Development” A Stock Taking, Industry and Development, No.2,UNIDO, NewYork,1-27,
21.Lin, YH., Chen, YK. (2020). Digital economy and industrial structure upgrading: A spatial econometric test based on factor flow. J Bus Econ.;09.
22.Li, XH. (2019). New features of digital economy and formation mechanism of new driving force of digital economy. Reform.;11: 40–51.
23.Li YM. (2017). The development of China’s digital economy is of great significance to the world. Communications industry journal(011); -10-16.
24.Madhoushi. M; Rezai. F, (2015), the effect of firm size and growth rate of survival of new companies entering the industry, the electrical industry in Mazandaran province, Journal - Industrial Management Studies - Year Issue 37, Summer, 37-54
25.Mansouri. A, Aziz Mohammadlou. H., (2009), cluster development projects, programs and achievements. Tehran: Small Industries & Industrial Parks Organization of Iran.
26.Maziati. A.H, Shams Ardekani. A, Kavoosi.A, Majid. M. H., (1999). Check the steel industry's advantages compared to other competitors to enter the global market, master's thesis, University of Imam Sadiq.
27.Mir Qadri. S. H, Alam Tabriz. A, Farsijani. H, Farzadi. F, (2015), identifying functional aspects of industrial clusters to deal hierarchical cluster analysis, Journal - Industrial Management Studies - Year Issue 83, fall 49. 21-1

28.Mohammad. A, Amiri. Y, (2012), interpretive structural modeling achieving agility through IT in manufacturing organizations, Information Technology Management, Volume 4, Issue 13, Winter,134 -115.
29.Montazeri, Z, Ranjbar. H, Sameti. M, (2015), to evaluate the economic performance of industry in the period 1374-1389, Economic Research, under 50, No. 2, Summer,507.
30.Nezakati. R, Sani Monfared.P, Mlmasy. S, (2013), using fuzzy multi-criteria decision-making models Jaeger in environmental risk assessment (Case Study Mangal Dam), the Eleventh National Conference on Environmental Impact Assessment, Tehran, Association of Environmental Assessment Iran, the environmental protection agency, http://www.civilica.com/Paper-IRANEIA11-IRANEIA11_004.html.
31.Nili, M., et al (2003), a summary of the country's industrial development strategy plan, Tehran, Sharif University of Technology.
32.Olfat. L, Shahriari Nia, A, (2014). interpretive structural modeling factors affecting the choice of working in agile supply chain, production and operations management magazine, newspaper production Operations management, Volume 5, Issue 2, 109 - 128.
33.Pfohl H.Ch., Gallus Ph., Thomas D. (2011). Interpretive Structural Modeling Of Supply Chain Risks. International Journal Of Physical Distribution & Logistics Management; 41(9): 839-859.
34.Rahmani. M., Glyn Moghadam. E;Maghsodi. R, (2011). Legal barriers to foreign investment in Iran, Master thesis, University of Guilan.
35.Ravi, V., & Shankar, R. (2005). Analysis of interactions among the barriers of reverse logistics. Technological Forecasting and Social Change, 72(8), 1011-1029.
36.Seyed Hoseini. S. M, Ali Ahmadi. A, Fekri. R, Fathian. M, (2009). Agility in new product development process to design a model using structural equation modeling in Iranian automotive industry. International Journal of Industrial Engineering and Production Management;, 77-89.
37.Smyynsr. M., (2002), effective transfer of technology from developed countries to developing countries, issue, Iran Khodro, the research project, Tehran Islamic Azad University.
38.Statistical Center of Iran. Census of workshops with ten workers in 1374 to 1388
39.Thakkar, J., Deshmukh, S. G., Gupta, A. D., & Shankar, R. (2006). Development of a balanced scorecard: an integrated approach of interpretive structural modeling (ISM) and analytic network process (ANP). International Journal of Productivity and Performance Management, 56(1), 25-59.

40.Talib, F. (2011). The Barriers To Total Quality Management Implementation Using Interpretive Structural Modeling Approach, Benchmarking: An International Journal; 18(4): 563-587.
41.Xu, H., Zhang, YL., Cao, YJ. (2020). Digital economy, technology spillover and dynamic competition and cooperation policy. Manag World.;36: 63–84.
42.Zhang, YZ. (2018). The development of digital economy and its Main tasks. Econ Outlook.;09: 85–91.
43.Warfield J.N.; (1976). Societal systems: Planning, policy and complexity; Willy Interscience, New York.
44.Wu, T., & Shao, W. (2022). How does digital economy drive industrial structure upgrading: An empirical study based on 249 prefecture-level cities in China. Plos one, 17(11), e0277787.
45.Youssefi, M.Q, Amadeh. H, Karimi Dstnayy.T., (2013), structural change and its impact on employment in manufacturing industries of Iran, Journal of Management Studies Industrial eleventh year, Issue 28, Spring, 119-131

طراحی مدل توسعه صنعتی ایران بر اساس رویکرد ترکیبی (OR:Soft - Fuzzy)

چکیده:

توسعه صنعتی در گرو برنامه‌ریزی و تدوین استراتژی و خط مشی‌های نظام یافته است. هدف پژوهش حاضر تحلیل فازی راهبردهای متعارف به منظور طراحی مدل پیشرفت صنعت ایران در فضای بین‌اللملل است. جامعه آماری این پژوهش شامل کارشناسان و صاحبنظران دانشگاهی است. بدین منظور ابتدا به شناسایی راهبردهای با اهمیت در پیشرفت صنعتی پرداخته شد که در مجموع شش راهبرد تعیین گردید و سپس با به کارگیری رویکرد فازی درجه اهمیت هر کدام از آنها مشخص گردید. براساس تحلیل داده‌ها و با توجه به درجه عضویت فازی، انتقال فناوری بیشتر از دیگر عناصر بر توسعه صنعتی موثر است. راهبردهای سرمایه‌گذاری خارجی و داخلی، توسعه صنایع مادر، توسعه صنایع زیر بنایی و طراحی استراتژی و سیاست‌های صنعتی در رتبه دوم و در نهایت راهبردهای حمایتی دولتی در پایین ترین سطح یعنی رتبه سوم قرار گرفته است. بنابراین طرح انتقال فناوری مهمترین راهبرد شناخته شد و می بایست به عنوان قوی‌تری راهبرد در پیشرفت صنعتی مورد توجه ویژه قرار گیرد. بینشی که این مدل به مدیران و تصمیم گیران صنعت کشور ارائه می‌کند می‌تواند به آن‌ها در برنامه‌ریزی استراتژیک به منظور توسعه کمک کند.

کلمات کلیدی: توسعه صنعتی، مدلسازی ساختاری تفسیری (ISM)، فرآیند توسعه، مدل فازی Yeager.