**Determine the Priority of Industrial Investment in Conditions of Risk and Uncertainty: The Case Study Mazandaran Province**

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**Abstract**

The expansion of production and development in the industrial sector, it is necessary to increase the investment in that. But limits of the financial resources to the investment and high risk for investments in industrial and production activities on the one hand, and the frequency of necessities and goals of the other hand, is inevitable to planning and priorities of investment.

This study to follow, in condition of risk and uncertainty and the exist fluctuations in supply and demand market of industry, optimization of model to determine priorities and economic feasibility to the investment in this sector. This study, in three scenarios (optimistic, pessimistic and uncertain market), will examine its purpose. The model used in this study is a fuzzy multi-criteria decision method. This research has been made for Mazandaran Province from 2005 to 2010.

The results of this research involve the investment criteria and specify the priority of these sectors. The final results of this study indicate that in conductions of uncertainty and volatility of market, the current pattern of investment in the industrial sector was not optimal and needs to be adjusted in the percentages and amounts of investment.

**Keywords:** Investment, Industry, interval TOPSIS, Mazandaran.

**1. INTRODUCTION**

Making suitable policies for the industrial development in various country regions can to ensure the business development and extension of mercantile markets for industrial outputs. The development of output and non- oil exports need the increased investment in overloaded activities, especially in the industrial sector. Limited financial resources to invest or high risk of investment in the industrial and productive activities involves the require for planning and to specify the funding priorities. Planning and priority setting in the investment need to understand the environmental, sector and sectional opportunities and potentialities. The most main factors to achieve improvement through planning for the future expansion are to recognize country various sections.

So, now the basis for the expansion of industrial productions and business has been based on their products penetrance in foreign markets and a large section of the universal exchange of commodity and products is organized. Countries that have been successful in achieving high levels of economic development, most industrialized countries have been planned developing their exports from ago decades; they encouraged the essential investment in export industries and so they have expanded it. I.e., in addition to know its benefits; they made new benefits in the field of industrial outputs and easily got much success in their proper share of the global market, the orders in the international society to alter conditions quickly, and countries that are incapable to get on time and following the quick variations in world economy will be driven.

Trend towards free trade and WTO accession needs the attitude on diversification of exports and foreign exchange reserves to prohibit unfavorable effects that this can prepare the basis for sustainable development. But the increase of non-oil exports, to take foreign currencies, domestic value added and employment, commonly depends on the export of factory products, which utilize the abilities and talents of the country lies in the national economy. However, the optimal use of the resources needed to recognize the benefits of existing and new trade and milt the several regions of the country. The quantitative and qualitative development of industrial exports will head to economic increase and extension dynamics.

But the basic subject in the frame of the development program of macroeconomic modeling is to relinquish the role of the several regions, It is important in view of the spatial planning. Planning of national development determines a point that these programs have met with the economy and society. Talking points they are briefed in the whole economy and society. The major development in all areas of the country cannot be assumed as homogenous, and a according to this, investment, employment and production rate were the same for all. Requirement of "space resources allocation" needs that to the major strategic plans is taken the space to develop more quickly. National growth and development is subject to the space ones. Such that each region to grow in according to their needs and capacity, and accordingly, the assets and facilities to be provided.

This study used a composition of methods and techniques of analysis, interval TOPSIS by determining the investment priority for two periods from 2005 to 2010 in Mazandaran province. Finally, it offers combining the results for the two periods 2005 and 2010 based on the industrial investment priorities in Mazandaran province.The main purpose of the research is to recognize the capacities, resources and capabilities of Mazandaran and priorities of investment in the industrial sector to get development goals.

**2. Literature and Background**

Nowadays that economy is a very important and vital issue therefore from the perspective of macroeconomic, industrial rising and finally economic success of a country is affected by many factors. The first factor is government macro strategy how effectively it will be influential in interesting investment in different sectors. One of these cases have been small industries that particularly in this cases after the Islamic Revolution in our country has provided a positive context for growth and achieve to self-sufficiency and alongside regard to industry's infrastructure and main such as industry of oil, steel, gas, nuclear energy... is considering by officials. The second factor that has been referred to as the internal factor facilities and capabilities of the region and can be as lever for guiding and optimal use of capital considered by examining and identifying relative advantages of each region. Therefore, for understand this facilities and capabilities of the region, we need to identify and monitor key indicators to measure the amount Facilities and capabilities on region various fields (industrial). Exporting constitutes the most popular, quickest and easiest way for industrial (Stoian et al, 2010; Gilaninia & Etal, 2011)

Lotfi and et al (2014) did the research to identify the industrial development and industrial sectors of the technique (Fauzzy Topsis) West Azerbaijan industrial development priorities are identified and ranked. The results this paper suggest that it is The West Azerbaijan Province of good potential for its proper role within the regional planning And national industrial development in order to achieve the objectives of Vision is a country.

Mokhtari Yoznab(2013) did an investigation to identify the industrial activities and capacities of Ardabil province, for directing investments towards these industries. The results obtained show that Activities, artifacts and furniture manufacturing not elsewhere classified, Manufacture of medical instruments, optical instruments, etc. Apparel manufacturing, processing and fur color along with recycling and manufacturing of electric machinery and apparatus not elsewhere classified, and etc, constitutes activities with investment priority for the province.

Danaei and Moradi Haghighi(2013) have done the research to prioritize the investment in accepted industries in securities exchange and the used pattern is TOPSIS. The results of this study indicate that in both 2009 and 2010, the priority of investment is for telecommunications industrial group and it means the investment in this section has more success because of a partial advantage.

Akbari and Moradi (2008), have done a study entitled "economic evaluation and to determine the

industrial investment priorities in Kurdistan" in 2004, based on ISIC Code and a regional analysis methods such as factor analysis and numerical taxonomy and data base. The result of this research is that Industrial minerals, metallic craft and related grains, plastic, stone cutting and weaving of have the highest priorities of industrial investment in Kurdistan.

**2.1. Investment Priority Index**

The priority indicators of investment are obtained by the combination of some indexes that they come in Table 1. Priorities for investment indices or combinations are named.

Table 1. Investment Priority Indicators

|  |  |  |
| --- | --- | --- |
| Index title | Index relation | comment |
| Productivity Indicator | $$L\_{j}=\left[{\left({v\_{j}}/{N\_{J}}\right)}/{\left({v\_{T}}/{N\_{T}}\right)}\right]$$ | $v\_{j}$: value-added of industrial activity j$v\_{T}$:Value added of all industries.$N\_{J}$: employment of activity J$N\_{T}$: employment of all industries$Q\_{i}$: production of employment i$X\_{i}$: export of activity i$In\_{fi}$**:** value of foreign raw materials industry$In\_{ti}$**:** value of industrial activity data$Y\_{i}$**:** value of industrial production i$C\_{i}$**:** cost of industrial activity i$L\_{i}$**:** Employee of industrial activity i$W\_{i}$**:** wage of industrial activity i |
| share of value-added output | $$VQ\_{i}={V\_{i}}/{Q\_{i}}$$ |
| Ind[ependence on Foreign Resources](https://www.thetrumpet.com/article/2834.2.0.0/world/globalization/dependence-on-foreign-resources-threatens-us) | $$IOF\_{i}={In\_{fi}}/{In\_{ti}}$$ |
| [Profitability Index](http://www.investopedia.com/terms/p/profitability.asp) | $${Iπ=\left(Y\_{i}-C\_{i}\right)}/{L\_{i}}$$ |
| Capital intensive index | $$I\_{i}={\left(V\_{i}-W\_{i}\right)}/{L\_{i}}$$ |
| Export orientation | $$XM={X\_{i}}/{V\_{i}}$$ |
| Revealed comparative advantage Balassa | $$RCA\_{ij}=\frac{{X\_{ij}}/{\sum\_{i}^{}X\_{ij}}}{{\sum\_{j}^{}X\_{ij}}/{\sum\_{i}^{}\sum\_{j}^{}X\_{ij}}}$$ |
| Location quotient in terms of value-added | $$LQv\_{ij}=\frac{{V\_{ij}}/{\sum\_{i}^{}X\_{ij}}}{{\sum\_{j}^{}V\_{ij}}/{\sum\_{i}^{}\sum\_{j}^{}V\_{ij}}}$$ |
| Location quotient in terms of employment | $$LQl\_{ij}=\frac{{L\_{ij}}/{\sum\_{i}^{}L\_{ij}}}{{\sum\_{j}^{}L\_{ij}}/{\sum\_{i}^{}\sum\_{j}^{}L\_{ij}}}$$ |

**3. METHODOLOGY**

This study is the applied. In this research, to determine the industrial investment priorities, the library

method is used in Mazndaran province, the studied Population, all staff manufacturing factories with more than ten workers in Mazandaran province are based on ISIC two-digit codes for the years 2005 to 2010. Authorities also include statistical yearbooks, provincial Statistics, census results and data from large industrial workshops of the Iran Statistics Center. Three groups in terms of profitability indicators, employment, profitability and employment as a combination of selected priority industrial investment and industries to identify and rank are based on 3 criteria above mentioned. The theoretical basis for analysis is based on statistical methods interval TOPSIS.

 In Jahanshahlo et al. (2006) and Jahanshahloo et al. (2009), an interval extension of classical TOPSIS method was proposed. This approach may be described as follows. Let $\left[X\_{ij}\right]=\left[X\_{ij}^{L},X\_{ij}^{U}\right]$ be aninterval value of jth criterion for ith alter- native ($X\_{ij}^{L}$and$X\_{ij}^{U}$ are the lower and upper bounds of interval, respectively), W= (w1,w2, . . . ,wn) be the weight vector satisfying $\sum\_{j=1}^{n}w\_{j}=1$. Then $D\left[\left[X\_{ij}^{L},X\_{ij}^{U}\right]\right]\_{m×n}$ is the interval-valued decision matrix. The method proposed in Jahanshahlo et al. (2006) and Jahanshahloo et al. (2009) consists of the following steps:

1. Normalizing the decision matrix using the following expressions:

$$r\_{ij}^{L}=\frac{x\_{ij}^{L}}{\sqrt{\sum\_{i=1}^{m}\left(x\_{ij}^{L}\right)^{2}+\left(x\_{ij}^{U}\right)^{2}}} r\_{ij}^{U}=\frac{x\_{ij}^{U}}{\sqrt{\sum\_{i=1}^{m}\left(x\_{ij}^{L}\right)^{2}+\left(x\_{ij}^{U}\right)^{2}}} i=1,2,…,m;j=1,2,…,n$$

2. Taking into account the importance of criteria, the weighted normalized interval-valued decision matrix is obtained using the following expressions:

$v\_{ij}^{U}=W\_{j}r\_{ij}^{U} v\_{ij}^{L}=W\_{j}r\_{ij}^{L} i=1,2,…,m;j=1,2,…,n$

3. The positive and negative ideal solutions are obtained as follows:

$$A^{+}=\left\{v\_{1}^{+},v\_{2}^{+},…,v\_{n}^{+}\right\}=\left\{\left(j\in J^{+}\right),\left(j\in J^{-}\right)\left|i=1,2,…,m\right.\right\}$$

$$A^{-}=\left\{v\_{1}^{-},v\_{2}^{-},…,v\_{n}^{-}\right\}=\left\{\left(j\in J^{+}\right),\left(j\in J^{-}\right)\left|i=1,2,…,m\right.\right\}$$

4. The separation of each alternative from the positive ideal solution is calculated using the n-dimensional Euclidean distance:

$$d\_{i}^{+}=\left\{\sum\_{j\in J}^{}\left(v\_{ij}^{L}-v\_{j}^{+}\right)^{2}+\sum\_{j\in J}^{}\left(v\_{ij}^{U}-v\_{j}^{+}\right)^{2}\right\}^{\frac{1}{2}}\rightarrow i=1,2,…,m$$

Similarly, the separation from the negative ideal solution is calculated as follows:

 $ d\_{i}^{-}=\left\{\sum\_{j\in J}^{}\left(v\_{ij}^{,}-v\_{j}^{+}\right)^{2}+\sum\_{j\in J}^{}\left(v\_{ij}^{L}-v\_{j}^{-}\right)^{2}\right\}^{\frac{1}{2}}\rightarrow i=1,2,…,m$

5. Calculate the relative closeness to the ideal alternatives:

$$\overbar{R}\_{i}=\frac{d\_{i}^{-}}{d\_{i}^{-}+d\_{i}^{+}} , i=1,2,…,m$$

6. Rank the alternatives according to the relative closeness to the ideal alternatives: the bigger is the Ri, the better is the alternative di.

**4. Findings**

With the interval TOPSIS model and according to the 9 criteria and risk and uncertainty conditions, eventually a number is achieved which shows industry investment decision indicator in the industry of Mazandaran Province. Table 2 shows, the investment priorities, with pessimistic look obtained in 35,23,33,22,24,27,26,34,36,28 industrials sectors rating from 1 to 10, respectively. On the other hand and with optimistic look, sectors 27,24,15,33,31,29,26,34,28,25 obtained rating from 1 to 10 as the investment priorities, respectively.

For determination of the investment optima value, we use the formula:

$$IOP=\frac{IVI\_{i}}{\sum\_{i=1}^{16}IVI\_{i}}×100$$

Where $IVI\_{i}$ indicates the investment index for each of the sectors of industry. In Table 3, we show the investment optima and current in industry subdivisions for Mazandaran province. For example, this model obtained the investment optima and current indexes for manufacture of food products and beverages sector 6.9 and 25.2, respectively.

As seen in graph 1, there are differences between the current and optima models for different sectors of industry in the province. For example, the sectors 26 and15 showed greatest difference with 34, 25.2 percent, respectively. Also, the current model is more than optima model for 6 sectors and for other 12 sectors the optima model is more than current. Therefore, we need to focus on those sectors more.

Moreover, graph 2 shows the final result of the fact that Industrial activity of ISIC two-digit codes 22 and 15 should adjust about 5.6 and -19.3 percent, respectively. This result is very important for managements and planners of Mazandaran province, because the advantage, efficiency and development of the industry in the province are obtained by optima allocation investment model.

**5. Conclusion**

 According to the studies, based on the selective measures, final result can be presented in the following about industries in the province. The result of this paper shows that, based on the investment index in risk and uncertainty condition, "Manufacture of basic metals, Manufacture of chemical materials, Manufacture of food products and beverages, Manufacture of other non-metallic mineral, Manufacture of electrical machinery and, Manufacture of fabricated metal products , Manufacture of machinery and equipment, Manufacture of coke, refined petroleum products, Publishing, printing and reproduction of, Manufacture of rubber and plastics products" sectors rank from 1 to 10 for the investment priority.

Also, the current allocation model of facilities to investors is different from the optima model. Therefore, we should adjust the amounts and percentages of these facilities to each sector of industry based on investment index.

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Table2. Investment Index with pessimistic and optimist condition

|  |  |
| --- | --- |
| optimist condition | pessimistic condition |
| rank | index | subdivision | rank | index | Subdivision |
| 1 | 11.2 | Manufacture of basic metals | 1 | 10.3 | Manufacture of other transport equipment |
| 2 | 11.0 | Manufacture of chemicals and chemical | 2 | 9.9 | Manufacture of coke, refined petroleum |
| 3 | 11.0 | Manufacture of food products and beverages | 3 | 9.6 | Manufacture of medical, precision and |
| 4 | 11.0 | Manufacture of medical, precision and optical | 4 | 9.5 | Publishing, printing and reproduction of |
| 5 | 10.9 | Manufacture of electrical machinery and | 5 | 9.2 | Manufacture of chemicals and chemical |
| 6 | 10.8 | Manufacture of machinery and equipment n.e.c. | 6 | 9.2 | Manufacture of basic metals |
| 7 | 10.8 | Manufacture of other non-metallic mineral | 7 | 9.2 | Manufacture of other non-metallic |
| 8 | 10.8 | Manufacture of motor vehicles, trailers and | 8 | 9.1 | Manufacture of motor vehicles, trailers |
| 9 | 10.7 | Manufacture of fabricated metal products, | 9 | 9.0 | Manufacture of furniture; manufacturing |
| 10 | 10.7 | Manufacture of rubber and plastics products | 10 | 8.7 | Manufacture of fabricated metal products, |
| 11 | 10.5 | Manufacture of furniture; manufacturing n.e.c. | 11 | 8.7 | Manufacture of electrical machinery and |
| 12 | 10.4 | Manufacture of textiles | 12 | 8.5 | Manufacture of paper and paper products |
| 13 | 10.3 | Publishing, printing and reproduction of | 13 | 8.4 | Manufacture of food products and |
| 14 | 10.0 | Manufacture of coke, refined petroleum | 14 | 8.4 | Manufacture of textiles |
| 15 | 10.0 | Manufacture of paper and paper products | 15 | 8.0 | Manufacture of machinery and equipment |
| 16 | 9.8 | Manufacture of wood and of products of wood | 16 | 7.9 | Manufacture of wearing apparel; |
| 17 | 9.3 | Manufacture of wearing apparel; dressing and | 17 | 7.6 | Manufacture of rubber and plastics |
| 18 | 8.1 | Manufacture of other transport equipment | 18 | 7.0 | Manufacture of wood and of products |

Table2. Investment current and optima Index with risk and uncertainty condition

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| rank | subdivision | with uncertainty | optima Index(%) | current Index(%) | Adjustment(%) |
| 1 | Manufacture of basic metals | 10.7 | 6.1 | 8.6 | -2.5 |
| 2 | Manufacture of chemicals and chemical  | 10.4 | 6.0 | 8.2 | -2.2 |
| 3 |  Manufacture of food products and beverages | 10.3 | 5.9 | 25.2 | -19.3 |
| 4 | Manufacture of other non-metallic mineral  | 10.2 | 5.8 | 34.0 | -28.2 |
| 5 | Manufacture of electrical machinery and  | 10.2 | 5.8 | 3.4 | 2.4 |
| 6 | Manufacture of fabricated metal products  | 10.1 | 5.8 | 6.0 | -0.2 |
| 7 | Manufacture of machinery and equipment  | 10.0 | 5.7 | 1.0 | 4.7 |
| 8 | Manufacture of coke, refined petroleum products  | 9.9 | 5.7 | 0.0 | 5.6 |
| 9 | Publishing, printing and reproduction of  | 9.9 | 5.7 | 0.0 | 5.6 |
| 10 | Manufacture of rubber and plastics products | 9.9 | 5.7 | 8.2 | -2.6 |
| 11 | Manufacture of furniture; manufacturing  | 9.8 | 5.6 | 0.2 | 5.4 |
| 12 |  Manufacture of textiles | 9.8 | 5.6 | 3.8 | 1.8 |
| 13 | Manufacture of paper and paper products | 9.6 | 5.5 | 1.3 | 4.2 |
| 14 | Manufacture of motor vehicles, trailers and  | 9.4 | 5.4 | 4.1 | 1.3 |
| 15 |  Manufacture of wood and of products of wood  | 9.0 | 5.1 | 1.6 | 3.5 |
| 16 | Manufacture of medical, precision and optical  | 8.8 | 5.0 | 0.1 | 4.9 |
| 17 |  Manufacture of wearing apparel; dressing and  | 8.6 | 4.9 | 0.6 | 4.3 |
| 18 | Manufacture of other transport equipment | 8.1 | 4.6 | 0.0 | 4.6 |

Graph1. The optima and current model in investment

Graph2. The difference between of optima and current model in investment

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