

## Determine the priority of industrial investment in conditions of risk and uncertainty: the case study Mazandaran province

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P A P E R   I N F O	A B S T R A C T
<p><b>Chronicle:</b> Received: 31 July 2017 Revised: 28 August 2017 Accepted: 04 September 2017 Available : 07 September 2017</p> <p><b>Keywords :</b> Investment, Industry. Interval TOPSIS. Mazandaran.</p>	<p>The expansion of production and development in the industrial sector is due to increase the investment on the activity of this sector. On one hand limits of the financial resources to the investment and high risk of investments in industrial and production activities, and by the other hand, the frequency of necessities and goals is inevitable to planning and priorities of investment. This study wants to provide optimize pattern by attention to the condition of risk and uncertainty and fluctuations in supply and demand market of industry, to determine priorities and economics feasibility to the investment in this sector. This study will examine its purpose in three scenarios (optimistic, pessimistic and uncertain market). 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 conduction 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.</p>

### 1. Introduction

Making suitable policies for the industrial development in various country regions can ensure the business development and extension of mercantile markets for industrial outputs. The development of output and non- oil exports need to increased investment in overloaded activities, especially in the industrial sector. Investment priorities are unavoidable due to the limited financial resources available for investment, or the high risk of investment in manufacturing and industrial activities. Planning and priority setting in the investment need to comprehensive understand of 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 briefed in the whole economy and society. The major development in all areas of the country cannot be assumed as homogenous, and according to this, investment, employment and production rate were the same for all. Requirement of "space resources allocation" that needs to major strategic plan is taken the space to develop more quickly. National growth and development is subject to the space ones. Such that each region grow 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 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 Mazandaranan priorities of investment in the industrial sector to get development goals.

## **2. Literature and Background**

Nowadays economy is 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 how effectively is government macro strategy will be influential in interesting investment of 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, etc is considering by officials. The second factor has been referred to internal factor facilities and capabilities of the region and by examining and identifying relative advantages of each region can be used as lever for guiding and optimal use of capital considered. Therefore, for understand this facilities and capabilities of the region, we need to identify and monitor key indicators to measure the amount of facilities and capabilities on various regions of fields (industrial). Exporting constitutes the most popular, quickest and easiest way for industrial [1] and [2].

Lotfi and et. al [3] did research to identify the industrial development and industrial sectors of the technique (FauzzyTopsis). West Azerbaijan industrial development priorities are identified and ranked. The results of this paper suggest that the West Azerbaijan Province is 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 [4] did an investigation to identify the industrial activities and capacities of Ardabil province, for directing investments towards these industries. The obtained results show that activities, artifacts and furniture manufacturing didn't classified elsewhere in 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 Haghghi [5] have done the research to prioritize the investment of accepted industries in securities exchange and used TOPSIS as a pattern. The results of this study indicate that the priority of investment in both 2009 and 2010 is for telecommunications industrial group, and it means that the investment in this section has more success because of a partial advantage.

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Akbari and Moradi [6], 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 show in Table 1. Priorities for investment indices or combinations are named.

**Table 1.** Investment Priority Indicators

Index title	Index relation	comment
Productivity Indicator	$L_j = [(v_j/N_j)/(v_T/N_T)]$	$v_j$ : value-added of industrial activity j
share of value-added output	$VQ_i = V_i/Q_i$	$v_T$ :value added of all industries.
Independence on Foreign Resources	$IOF_i = \ln n_i / \ln n_t$	$N_j$ : employment of activity J
Profitability Index	$I\pi = (Y_i - C_i)/L_i$	$N_T$ : employment of all industries
Capital intensive index	$I_i = (V_i - W_i)/L_i$	$Q_i$ : production of employment i
Export orientation	$XM = X_i/V_i$	$X_i$ : export of activity i
Revealed comparative advantage Balassa	$RCA_{ij} = \frac{X_{ij}/\sum_i X_{ij}}{\sum_j X_{ij}/\sum_i \sum_j X_{ij}}$	$\ln_{fi}$ :value of fore ingrown materials industry
Location quotient in terms of value-added	$LQv_{ij} = \frac{V_{ij}/\sum_i X_{ij}}{\sum_j V_{ij}/\sum_i \sum_j V_{ij}}$	$\ln_{ti}$ :value of industrial activity data $Y_i$ :value of industrial production i
Location quotient in terms of employment	$LQl_{ij} = \frac{L_{ij}/\sum_i L_{ij}}{\sum_j L_{ij}/\sum_i \sum_j L_{ij}}$	$C_i$ : cost of industrial activity i $L_i$ : Employee of industrial activity i $W_i$ :wage of industrial activity i

## 3. Methodology

This study is the applied type. In this research, to determine the industrial investment priorities, the library method is used in Mazandaran 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- 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 above mentioned criteria. The theoretical basis for analysis is based on statistical methods interval TOPSIS.

In Jahanshahloo et al. [7] and Jahanshahloo et al. [8], an interval extension of classical TOPSIS method was proposed. This approach may be described as follows. Let  $[X_{ij}] =$

$[X_{ij}^L, X_{ij}^U]$  be an interval value of  $j$ th criterion for  $i$ th alternative ( $X_{ij}^L$  and  $X_{ij}^U$  are the lower and upper bounds of interval, respectively),  $W = (w_1, w_2, \dots, w_n)$  be the weight vector satisfying  $\sum_{j=1}^n w_j = 1$ . Then,  $D = [X_{ij}^L, X_{ij}^U]_{m \times n}$  is an interval valued decision matrix. The method proposed in Jahanshahlo et al.(2006) and Jahanshahlo et al.(2009) consists of the following steps:

1. Normalizing the decision matrix using the following expression:

$$r_{ij}^L = \frac{x_{ij}^L}{\sqrt{\sum_{i=1}^m (x_{ij}^L)^2 + (x_{ij}^U)^2}} \quad r_{ij}^U = \frac{x_{ij}^U}{\sqrt{\sum_{i=1}^m (x_{ij}^L)^2 + (x_{ij}^U)^2}} \quad i = 1, 2, \dots, m; j = 1, 2, \dots, n$$

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

$$v_{ij}^U = W_j r_{ij}^U v_{ij}^L = W_j r_{ij}^L \quad i = 1, 2, \dots, m; j = 1, 2, \dots, n$$

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

$$A^+ = \{v_1^+, v_2^+, \dots, v_n^+\} = \left\{ \left( \max_i v_{ij}^U \mid j \in J^+ \right), \left( \min_i v_{ij}^L \mid j \in J^- \right) \mid i = 1, 2, \dots, m \right\}$$

$$A^- = \{v_1^-, v_2^-, \dots, v_n^-\} = \left\{ \left( \min_i v_{ij}^L \mid j \in J^+ \right), \left( \max_i v_{ij}^U \mid j \in J^- \right) \mid i = 1, 2, \dots, m \right\}$$

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

$$d_i^+ = \left\{ \sum_{j \in J^+} (v_{ij}^L - v_j^+)^2 + \sum_{j \in J^-} (v_{ij}^U - v_j^+)^2 \right\}^{\frac{1}{2}} \rightarrow i = 1, 2, \dots, m$$

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

$$d_i^- = \left\{ \sum_{j \in J^+} (v_{ij}^U - v_j^-)^2 + \sum_{j \in J^-} (v_{ij}^L - v_j^-)^2 \right\}^{\frac{1}{2}} \rightarrow i = 1, 2, \dots, m$$

5. Calculate the relative closeness to the ideal alternatives:

$$\bar{R}_i = \frac{d_i^-}{d_i^- + d_i^+}, \quad i = 1, 2, \dots, m$$

6. Rank the alternatives according to the relative closeness to the ideal alternatives: the bigger is the  $R_i$ , the better is the alternative  $d_i$ .

#### 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.

**Table 2.** 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	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

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

$$IOP = \frac{IVI_i}{\sum_{i=1}^{16} IVI_i} \times 100$$

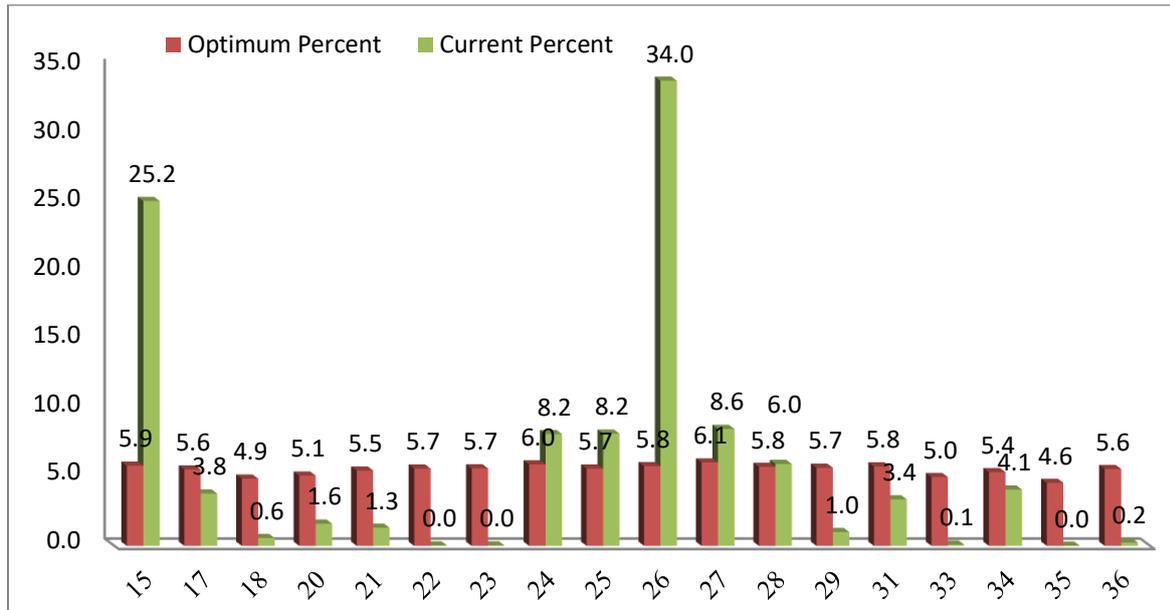
Where  $IVI_i$  indicates the investment index for each of the sectors of industry. In Table 3, we show the investment optima and current in industry subdivisions of Mazandaran province.

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.

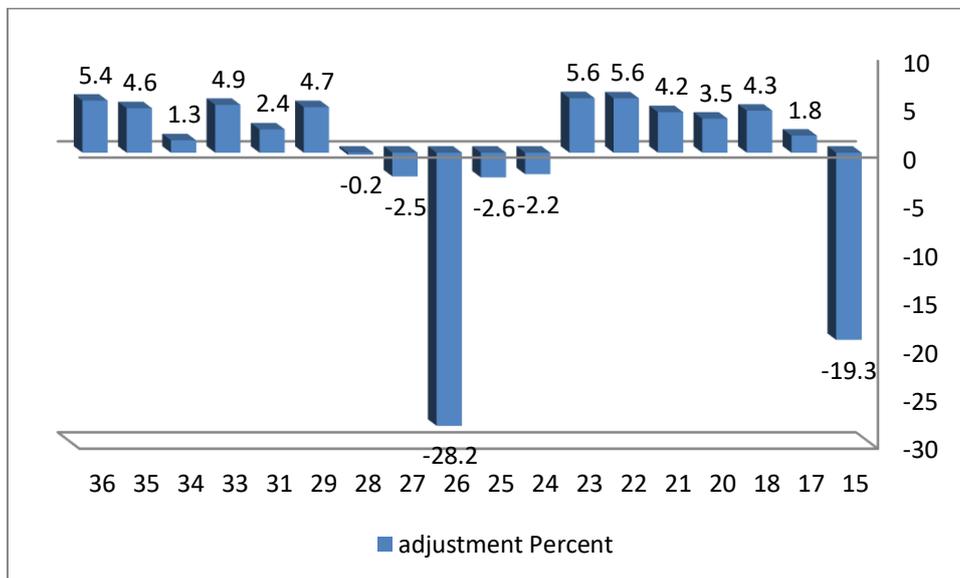
**Table 3.** Investment current and optima Index with risk and uncertainty condition

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	8.6	4.9	0.6	4.3
18	Manufacture of other transport equipment	8.1	4.6	0.0	4.6

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 and 15 showed greatest difference of 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.



Graph1. The optima and current model in investment.



Graph 2. The difference between of optima and current model in investment.

### 5. Conclusion

According to the studies that based on the selective measures, final result about industries in the province can be presented in the following. 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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