Prioritized and weighted decision criteria to select Roll foam factory in Kurdistan using the fuzzy AHP and TOPSIS

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Abstract. Research locate one of the key steps in the process of construction or service industries, which is important due to the success of the centers have an important role. The importance of these research so that recently re-done studies on the active centers and in some cases lead to a change in the location of industrial units. The purpose of this research identify and prioritize decision criteria to select Roll foam factory in Kurdistan using fuzzy AHP methods and select the optimum location of selected places in Kurdistan to establish a factory is a foam roll. Based on the results of the expert panel 6 as the main indicators of the Roll foam factory location were identified. Using fuzzy AHP method, criteria for proximity to the market by a factor of (0/274), a measure of the supply of raw materials by a factor of (0/192), a measure of energy resources by a factor of (0/19), a measure of labor by a factor of (0/143), the benchmark cost index (0/11) and the benchmark index rules (0/095), respectively ranked the first six factories located in the province of Kurdistan gained foam roll. Also among the 10 selected locations in Kurdistan to establish a factory foam roll, using TOPSIS Barazan Industrial Park, Industrial Park 3 and Industrial Park 1 in the rankings from first to third.

Keywords: Positioning, decision-making criteria, fuzzy AHP method, TOPSIS, foam roll corset factory

INTRODUCTION

Location of factories and industrial plants are a major concern for the establishment and developing units. In order to have a desired location, a detailed assessment of the location and correct estimates in accordance with the standards and policies of decision-makers need to be selected. To select the appropriate criteria, one has to evaluate the options and select the correct and rational alternatives with the important influences (Zadegan Bavi and Graily, 1392). The location of the factory is essential to the success of the strategic decision-making levels of funding. Convenient location has an important role in the competitiveness of a company and should be selected in such a way to achieve strategic competitive advantages compared to the other competitors (Faizi Bege Jan et al., 1392).

Choosing the best location for the proposed plant between two or more locations is a multi-criteria decision-making process, with respect to the type of factory and the choice of location, type and number of different indicators. Index features of an issue are decisions that affect our decision. The major decisions such as the selection of the optimal location of industrial units in the country, should be based on the need for effective measures in regard to the capabilities of different areas. The determination and recognition criteria for evaluation of the capabilities of the different areas due to the needs of different industrial groups is very important even though this issue in countries with limited resources are facing more urgent cases. Construction of one or more industrial units at the optimal location is the best possible condition, this not
This research uses the AHP (Analytical Hierarchy Process) for the best positioning, this is one of the MCDM methods. This decision-making and selecting process will create options using several criteria. However the experts and the people we dealt with during this research have expressed their opinions in words so we face uncertainty. Actual results of fuzzy logic is used in this research. The theory of fuzzy sets and fuzzy logic tools are very useful for this research. The theory of fuzzy sets use, mathematical modeling and mathematical formulation and is designed to ambiguity and imprecision in cognitive processes (Lootsma, 1997). The scope of this theory covers many areas of science, including the natural, biological, social sciences, engineering, computer science, system science and management (Claire and Folger, 1988). It is essential to note that traditional analytic hierarchy process may not fully reflect the style of human thinking. In other words, the use of fuzzy sets more compatible with some vague description of human language and so it is better to use fuzzy sets (using fuzzy numbers) to predict long-term decisions in the real world. TOPSIS, another multi-criteria decision-making technique, which in 1981 was first proposed by Huang and Yoon. TOPSIS in the definition of the concept of similarity to ideal solution. This technique is ranked by similarity to ideal solution. The ideal solution, a way that is all for the best that there is in general practice our answer is that it is trying to close. In this way, options to best solve the Al-ranked based on similarity, so that the ideal solution is to solve a more similar option, is more rating(Agahi and Abdi, 1387). TOPSIS is based on the concept that the option should be a minimum distance with the ideal solution and maximum distance with the negative ideal solution.

In this research we try to find the right location to build a factory in Kurdistan province of foam roll. In this research the fuzzy AHP and TOPSIS multi-criteria decision-making methods in order to determine the right location and it is used to enhance the accuracy of the selected location already used.

The theoretical literature research

One of the issues that should be considered in the early stages of industrial design, is the location and the facilities required. Industrial centers that have to determine the location of a plant, equipment and distribution centers of its products face such problems. Efficient use of their limited resources to priority tasks will be to invest in the most appropriate way to be applied (Atani, 1991; 1994). Lack of proper use of funds investors have not only missed the opportunity, but may be justified irreparable losses. In order to prevent such losses and efficient use of funds, it is necessary to execute the investment plan before, with the help of logical criteria evaluated. Plant is one of those issues that must be constructed according to the principles (Ataei, 2005).

In the seventeenth century, the employer raised the problem of locating in the following way: suppose you are given three points on the screen, quarter-point to find a way that the sum of the distances to three points given minimized. Tvrchy in 1640 to solve the problem and hence the name of this point, point of Tvrchy. In 1909, Weber was the first theory to locate modern paper. In 1964 Hakimi the objective function with two methods category and the lowest total and minimax location problem on the network. Since then, the idea took shape location and drew the attention of many people today as a branch of operations research is important (Faizi bege Jan et al., 1392).

The factory location is a strategic decision-making level of funding and is essential to its success. In addition, it is an important role in a company's competitiveness in the market place and should be selected in such a way that achieve strategic competitive advantages compared to the other competitors (Partovi, 2006).

Locating factories is one of the key steps in the establishment of the factory, because the long-term results of this decision appear to have a significant impact on the economic, environmental, and social issues. One of the aspects of internal influences, direct impact on the profitability of the company and the external
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dimension, to build large factories in the region can accept a variety of economic, social, cultural, environmental and influenced it. Locate factory economically important role in the establishment of the factory at the time of the initial investment. Also, when the operation of the decision key influence on the price of finished goods / service. Construction of one or more industrial units in the optimal location in the best condition possible, not only improves the circulation of raw materials and services to customers, but also puts the factory in a favorable situation (Forghany, 1386).

The studies related to location of the factory, of the most interesting things because discussion about the physical equipment, human resources for maximum efficiency of a product, shorten production time, minimize costs and reduce the cost of transportation (Apple, 1383), mainly under 3 are the following theory:

• The Least Cost Approach

According to this theory, a manufacturer chooses to reduce the cost, according to the conditions and restrictions, to a minimum. This includes reducing the following costs a minimum: the total transportation cost, the cost of transportation of raw materials, finished goods, fuel supply and product transport to consumption centers. Proponents of this theory are Wilhelm Lunhart, Von Thunen, Alfred Webber, Tord Palander (Hosseinzade Dalir, 1384, Salahi Esfahani and Nafisi, 1382).

• Market Area Analysis

According to this theory, economic employers try in addition to reducing production costs (including transportation costs, competition for development and access to the markets) to emphasis on demand and try to maximize their revenues. Since the establishment of point minimum cost, maximum benefit and profit will not necessarily lead to the creation, thus generating units to increase sales and generate additional revenues, strive to gain profit, so the optimum location, where the most profitable that income with the maximum possible amount, more than costs. Proponents of this theory are Losch, Perrou and Christaler (Salahi Esfahani and Nafisi, 1382).

• The Profit Maximization

The main character of this theory, is the integration of the two ideas of "least cost" and "maximum income" 1 As well as the costs are minimal, incomes have the highest value. This theory focuses on locating industries dependent on raw material and transport costs in addition concerned to production costs in the cost of labor, capital and taxes, demand and competition in the market. Theorists profit, Greenhot, Walter Ayzard, Rastrvn, Rostow, George Rainer and Smith (Salahi Esfahani and Nafisi, 1382; Paply Yazdi and Ebrahimi, 1381).

With regard to the above theory, location of industries using scientific methods of decision-making is important, because after research in the localization industry and the establishment of a specific location, changes are impossible or very difficult. The localization industry is in three stages, the first is regional organization, then the range is selected in the region and is determined to the point in that range (Alvani and Mir Shafie, 1379).

Research Objectives

• The main purpose: Select the appropriate place to roll foam factory in Kurdistan

• Secondary objectives of the research:
  - Identify decision criteria to select Roll foam factory in Kurdistan
  - Priority and weighted decision criteria to select Roll foam factory in Kurdistan using the fuzzy AHP and TOPSIS;
RESEARCH METHOD

The research from the perspective of the target is applied, the method of data collection, interview and library and information processing, athletics - is a survey. The research experts and scholars in Kurdistan on the location of the factory is a foam roll. In this research random sampling is being used, the questionnaires and interviews are with experts. The experts are available and are willing to cooperate in this research. For this purpose the 11 experts in the field of information and the establishment of the factory, who were familiar with the different parts of Kurdistan were interviewed and their comments were collected and analyzed. Theoretical and research literature is obtained from the library resources, articles, books and Internet resources. These were used to collect data for the analysis of questionnaires and interviews. In the first stage measures affecting the factory location was identified using articles and Internet resources, then list of indicators were collected by the expert. Experts expressed their comments about the importance of each of these indicators of the Roll foam factory 1. Then we collected information with an initial questionnaire that includes the parameters affecting the positioning of Kurdistan province Roll foam factory and in between 6 as the main indicator of the main indicators of foam Roll factory located in Kurdistan Were chosen the highest importance for experts in locating their factories. In the second step, parameters and criteria are identified through the questionnaire and interview technique with the help of fuzzy analytic hierarchy process AHP's rating and finally were prioritized by selected sites using the criteria and methods TOPSIS. The first questionnaire is to identify factors influencing the location of the factory. The first questionnaire included 12 questions related to the location of various factories, using the research literature and theoretical literature that has been compiled in the questionnaire. Respondents were asked to comment on the main index of the foam roll specified to the location of the factory. After data collection and analysis of the 12 indicators, we obtained 6 main index of the highest importance among the indicators. The 12 basic indicators are of the initial questionnaire:

1)Environmental and possible disposal of industrial waste, 2) raw materials procurement, 3) access to transport infrastructure, including roads, 4) labor available, 5) proximity to the market, 6) cost of land, 7) Resources energy, 8) weather, 9) Security, 10) laws and regulations, 11) industrial history of the site and future development and 12) General expenses (including transportation costs, cost of raw materials .... )

The second survey in order to prioritize the main indicators of effective positioning of the factory foam Roll of Kurdistan and the selection of the location in Kurdistan prioritized in terms of the main criteria.

• The first to compare the importance of effective measures the factory location Foam Roll in Kurdistan, which is designed to compare a couple of groups.

• The second part of the priority areas selected on the basis of the main criteria's Kurdistan province.

In this research we evaluated the validity and face validity by giving the, five questionnaires to teachers who had expertise in the field of location and finally after making their final comments, the final questionnaire was compiled and thereby a face validity questionnaire. Cronbach's alpha was used to determine the reliability of the test. Cronbach's alpha coefficient was calculated using SPSS software, the value obtained for the questionnaire 0/94. For data analysis we used, fuzzy AHP and TOPSIS methods.
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Research findings

Table 1. Identify factors affecting the location of the factory foam roll Kurdistan using descriptive statistics.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental and possible disposal of industrial waste</td>
<td>1</td>
<td>5</td>
<td>3/75</td>
<td>1/35</td>
</tr>
<tr>
<td>Raw materials procurement</td>
<td>2</td>
<td>5</td>
<td>4/41</td>
<td>0/99</td>
</tr>
<tr>
<td>Access to infrastructure including transport routes</td>
<td>3</td>
<td>4</td>
<td>3/75</td>
<td>0/45</td>
</tr>
<tr>
<td>Available labor force</td>
<td>2</td>
<td>5</td>
<td>3/83</td>
<td>0/83</td>
</tr>
<tr>
<td>Proximity to Market</td>
<td>2</td>
<td>5</td>
<td>4/08</td>
<td>0/79</td>
</tr>
<tr>
<td>The cost of land</td>
<td>3</td>
<td>5</td>
<td>3/83</td>
<td>0/71</td>
</tr>
<tr>
<td>Energy sources</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>0/95</td>
</tr>
<tr>
<td>Weather</td>
<td>1</td>
<td>4</td>
<td>2/75</td>
<td>1/05</td>
</tr>
<tr>
<td>Security</td>
<td>3</td>
<td>5</td>
<td>3/80</td>
<td>0/57</td>
</tr>
<tr>
<td>Rules and regulations</td>
<td>3</td>
<td>5</td>
<td>4/33</td>
<td>0/65</td>
</tr>
<tr>
<td>Industrial history of the site and future development</td>
<td>3</td>
<td>5</td>
<td>3/80</td>
<td>0/71</td>
</tr>
<tr>
<td>General expenses (including transportation costs, the cost of purchasing raw materials, etc.)</td>
<td>2</td>
<td>5</td>
<td>3/66</td>
<td>1/07</td>
</tr>
</tbody>
</table>

Based on the results obtained in the above table, the 6 indicators, which achieved the highest average among the indicators, are the main factors influencing the location of the factory foam roll Kurdistan. These are as follow:

- Procurement of raw materials
- Available labor force
- Proximity to markets
- The cost of land
- Energy Resources
- Rules and regulations

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After determining the main index, 6 experts were asked to rank the importance of each indicator. After collecting the data and analyzing it using fuzzy AHP, were prioritized and weighted the individual indicators. Obtained based on the results:

Near the market benchmark coefficient (0/274), a measure of raw material supply coefficient (0/192), a measure of energy resources coefficient (0/19), a measure of labor force coefficient (0/143), a measure of the cost of land coefficient (0/11) and coefficient of the Criterion rules and regulations (0/095), respectively gained ranked the first to six located for the factory foam roll Kurdistan.
Selection of the optimum location of the places in Kurdistan to establish the factory Roll foam Kurdistan

After the main parameters affecting the choice of prioritization and weighting factory roll foam in Kurdistan, the experts were asked to rate each of the selected places. After collecting the data and analyzing it with TOPSIS method, were prioritized selected sites.

Table 2. Ranking of the factory locations the foam roll Kurdistan.

<table>
<thead>
<tr>
<th>Switch</th>
<th>CL</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barazan Industrial Park</td>
<td>0/976</td>
<td>1</td>
</tr>
<tr>
<td>Industrial Park 3</td>
<td>0/872</td>
<td>3</td>
</tr>
<tr>
<td>Industrial Park 1</td>
<td>0/860</td>
<td>4</td>
</tr>
<tr>
<td>Baneh</td>
<td>0/844</td>
<td>5</td>
</tr>
<tr>
<td>Industrial Park 2</td>
<td>0/753</td>
<td>6</td>
</tr>
<tr>
<td>Ghorveh</td>
<td>0/229</td>
<td>7</td>
</tr>
<tr>
<td>Dehgolan Industrial Park</td>
<td>0/160</td>
<td>8</td>
</tr>
<tr>
<td>Marivan</td>
<td>0/006</td>
<td>9</td>
</tr>
<tr>
<td>Bijar</td>
<td>0/005</td>
<td>10</td>
</tr>
<tr>
<td>Saghez</td>
<td>0/004</td>
<td>11</td>
</tr>
</tbody>
</table>

SUMMARY AND CONCLUSION

Along with the growth of cities, such as population growth, resource constraints, inappropriate location, service applications in the city and unnecessary trips, urban planners and professionals are forced to overcome these disorders of such positioning. The first concern of managers is the right to convert and upgrade existing capital resources to the maximum possible income through investments in time and space. Given that many factors are involved in choosing a suitable location, make decisions based on various factors and considering the impact of each indicators and coefficient their importance will change the result. Selecting a suitable location for an active strategic decision, requires extensive research in different aspects. Since the management and decision-making in assessing the need for comprehensive and general information, information about options considered by many to be collected and analyzed so as to evaluate the key factors in selecting the right place to do that as a result, when more factors are considered more appropriate locations will be selected. The choose of the best location for the proposed factory between two or more locations on different platforms, is a multi-criteria decision-making problem. This depends on the type of plant and the choice of location (country, state, region, etc.), the type and number of different indicators. This research has identified and assessed the impact indicators on the location of the factory foam roll Kurdistan. The main objective of this research is to identify decision criteria to select Roll foam factory in Kurdistan and the selection of the locations of the best places to build the plant. In order to achieve this goal, we referred to literature and the opinion of experts in the field. Thereby, 12 Criterions were determined to locate the optimal chain stores and was provided to experts with a questionnaire and they were asked to select the main indicator of the foam roll Kurdistan that determine the best location of the factory. After the data collection and analysis of the 12 indicators, the 6 main indicators were selected of the highest importance to locate the factory Foam Roll in Kurdistan. This 6 indicators are:
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- Supply of raw materials
- Labor force available
- Near the market
- Cost of land
- Energy sources
- Rules and regulations

After we asked experts to compare rank the importance of each indicator. As the analysis showed, near the market benchmark coefficient (0/274), a measure of raw material supply coefficient (0/192), a measure of energy resources coefficient (0/19), a measure of labor force coefficient (0/143), a measure of the cost of land coefficient (0/11) and coefficient of the Criterion rules and regulations (0/095), respectively gained ranked the first to six located for the factory foam roll Kurdistan. After determining the coefficient of each of the criteria for optimal positioning, 10 locations were assessed by using criteria from locations in Kurdistan province. The results showed that respectively Barazan Industrial Park, Industrial Park 3 and Industrial Park 1 in the rankings were the first to third, which shows that the third place compared to other places in the eyes of experts to established a more appropriate place in Kurdistan for the roll foam factory.

REFERENCES


