

Providing a Model for the Supplier Selection Process in the Supply Chain Management with Hybrid Model of Decision Making

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ABSTRACT

In recent years, supply chain management has developed into one of the most critical strategies for achieving competitive advantage in different industries and the supplier selection process has increasingly been distinguished as an important and vital decision in supply chain management of manufacturing and service industries. On the other hand, with so many suppliers having different capabilities it is difficult to make decision about number and combination of suppliers, type of relations with them, and other matters related to supplier selection. In decisions related to the number of suppliers, there are two topics which are uniquely important: First, what criteria are considered when selecting the suppliers, and second, what methods can be used for comparing different suppliers. Decisions on suppliers' selection are very complex because various criteria shall be considered. This study seeks to present a model of supplier selection process in supply chain of OFOGH KOOROSH Chain Stores.

Keywords

Supplier Selection, Supply Chain Management, Decision-Making Models, Hierarchical Analysis Process, Criteria for Supplier Selection, Multi-objective Mixed Integer Linear Planning

1. INTRODUCTION

In the past two decades, the activities in high-tech industries, fundamentally has changed. At the beginning of the 21st Century, the world faces significant changes in almost all aspects, especially marketing competition, technological innovations and customer demands. Mass markets are continuing to fragment as customers become increasing demanding and their expectations rise. These

developments have caused a major revision of business priorities and strategic vision [9].

Supply chain as one of the essential and undeniable elements for success in producing and there is this belief that superior supply chain can be leading to a competitive advantage. Today, most companies share knowledge, skills and experience with their suppliers to help them and instead they profit of improvements in performance, quality and delivery. Also, it is clear that the proper selection of suppliers and effectively manage supplier relationships is a key factor in increasing the competitiveness of companies [4].

Despite the large number of suppliers with different capabilities, deciding on the number of suppliers, their combination, Communication and other related items to choose how they will encounter problems [8].

Thus selecting the right and proper suppliers is one of the most effective elements of higher efficiency and effectiveness in supply chain and involves a complex decision-making process which covers a set of qualitative and quantitative criteria involves. By definition, supply chain covers all activities related to circulation of goods and services from supplying the raw materials to reaching the final product usable by the user. The definition presented for supply chain, covers topics such as order processing, inventory management, warehousing, servicing the customers. Efficiency and effectiveness of an organization is the result of supply chain management and structure. The secret of survival of present-day organizations lies in understanding and realizing the needs of customers and rapid response to these needs. This is possible through improvement of supply chain. A supply chain generally consists of a producer, one or more supplier, and distribution centers, and the retailers who render services to versatile downstream customers. In the past the companies were focusing on inter-organizational affairs or the affairs companies had direct control on them. But, in the world of today, mere

attention on improvement and optimization of internal affairs is not a strategy for success. It is here that the issue of supply chain and the role of supply chain management are highlighted.

In decisions related to the number of suppliers, there are two topics which are uniquely important: First, what criteria are considered when selecting the suppliers, and second, what methods can be used for comparing different suppliers.

Weber and colleagues (1991) point out that decisions on suppliers' selection are very complex because various criteria shall be considered. According to what we can get over the issue of choice of supplier is placed in Multi Criteria Decision Making-MCDM pp. [7].



Diagram 1. Conceptual Model of the Research

2. Factors Affecting the Selection of Suppliers

Throughout the world, vast researches and studies have been made on the factors affecting the selection of suppliers. Every researcher has considered factors based on their own research environment. However, what are obvious are many similarities and common features between the factors considered in these researches. The factors affecting the selection of suppliers in present study have been given in Diagram (1) which also shows the theoretical framework of the research.

3. RESEARCH METHOD

Concerning the aim, the research is an applied research. In application dimension, the results of the research would be used in decision making, in policy making, and in planning. On the other hand, methodologically the research is an explorative research. For gathering data, the expert populations of GOLRANG Industrial Group and OFOGH KOOROSH Chain Stores Company have been used. The instruments for data gathering were LIKERT Spectrum Questionnaires and paired comparison. In determining the criteria affecting on supplier selection 30 persons and in finding the degree of the importance of determined criteria 15 persons were participating. In finding the importance of criteria in respect of each other in paired comparison the number of participants was 9 persons. For analyzing the data, a complete list of the criteria which were used in selecting the suppliers was extracted and non-parametric statistics was used with due regard to the hypotheses and their types. Then, the degree of importance of each criterion was evaluated by

obtaining the opinion of the experts and authorities of the company and taking benefit from hierarchical analysis method and the scores of each supplier in respect of any single criterion were calculated. For testing the data fitness and reliability of the questionnaire, CRONBACH's Alpha was used which showed whose value is 0.775. Since this value is more than 0.70 the reliability of measuring instrument is considered to be acceptable. There are different methods for evaluating the validity and reliability of measuring instruments. We here have used Content Validity Method. For this purpose, we got benefit from Delphi Technique and found the validity degree of the questionnaire by aid of relevant experts and authorities of OFOGH KOOROSH Chain Stores Company. Thus, two weeks after collecting the questionnaires filled by the members, again they were asked to fill the questionnaire for second time. After calculating the median of each question and calculating the median of the question medians, the questions whose median was less than the median of the question medians were recognized as invalid factors and the validity of the received answers were confirmed. [1, p.20]

4. RESEARCH PLAN

Considering what was pointed out above, the research is seeking to achieve following aims:

“Presenting a Model for Selecting the Best Suppliers to Supply Items for OFOGH KOOROSH Chain Stores Company with Due Regard of Determined Criteria and Indices”

Based on above mentioned general aim, the subsidiary purposes of the study which can be considered as measures toward achieving the general aim are enumerated as follows:

- Identification of the sub-criteria affecting financial situation index
- Identification of the sub-criteria affecting service situation index
- Identification of the sub-criteria affecting technical situation index
- Identification of the sub-criteria affecting capability-in-delivery index
- Identification of the sub-criteria affecting store profitability index
- Identification of the degree on important of each criterion and index affecting selection of the supplier in OFOGH KOOROSH Chain Stores
- Identification of the Most Suitable Suppliers for OFOGH KOOROSH Chain Stores
- Identification of the Share of Each Selected Supplier

5. QUESTION AND HYPOTHESIS

For achieving the aims of this study, answers to following questions are sought:

- What are the sub-criteria affecting the financial situation index?
- What are the sub-criteria affecting the service situation index?
- What are the sub-criteria affecting the technical situation index?
- What are the sub-criteria affecting the capability-in-delivery index?
- What are the sub-criteria affecting the profitability situation index?
- What is the degree of importance of each criterion and index affecting selection of suppliers?
- Who are the most suitable suppliers of OFOGH KOOROSH Chain Stores?
- Is it possible to design a valid mathematical model with decision-making approach for determining the purchasing share of each supplier of OFOGH KOOROSH Chain Stores Company?

In drawing up the hypothesis related to question I, the following hypotheses are put forward in frame of general hypothesis (main hypothesis) and special hypothesis (subsidiary hypothesis):

5.1. General Hypothesis:

Hypothesis I: In the view of the expert staff of OFOGH KOOROSH Chain Stores Company, the financial, service, technical features, capability in delivery, and profitability indices are equally effective in selecting the best suppliers.

5.2. Subsidiary Hypotheses:

Hypothesis 1.1: In the view of the expert staff of OFOGH KOOROSH Chain Stores Company, Financial power, volume of annual sales and financial leverage are sub-criteria equally effective on financial situation index.

Hypothesis 1.2: In the view of the expert staff of OFOGH KOOROSH Chain Stores Company, support and after-sales

services, quality in packing, and suitable advertisement are sub-criteria equally effective on service situation index.

Hypothesis 1.3: In the view of the expert staff of OFOGH KOOROSH Chain Stores Company, Using Expert Manpower, Stability of Quality, All-Embracing Knowledge of Self-Product, and production infrastructures are sub-criteria equally effective on technical index.

Hypothesis 1.4: In the view of the expert staff of OFOGH KOOROSH Chain Stores Company, on-time delivery, strict observation of order volume and flexibility in delivery of the order are sub-criteria equally effective on capability-in-delivery index.

Hypothesis 1.5: In the view of the expert staff of OFOGH KOOROSH Chain Stores Company, sales profit margin, repayment time, and discount and sales promotion are sub-criteria equally effective on store profitability index.

Hypothesis II: In determining the superior supplier for OFOGH KOOROSH Chain Stores, Technical Feature is the most important index.

Hypothesis III: The most suitable supplier for OFOGH KOOROSH Chain Stores is Supplier No.5.

Hypothesis IV: Presenting a mathematical model of multiple objectives Integer Linear Planning is a perfect model to determine the amount of purchasing each supplier for OFOGH KOOROSH Chain Stores.

6. RESULTS AND DISCUSSION

For evaluating the main and subsidiary hypotheses, table (1) was drawn up separately for each hypothesis. With the hypothesis test of the second question of the research, the results gained from Expert Choice Software, as be seen at diagram (2), the hypothesis of the research that “Technical Feature is the most important index in determining the superior supplier for OFOGH KOOROSH Chain Stores” is rejected and consequently, the profitability of the store is found to be the most important index in finding the superior supplier in OFOGH KOOROSH Chain Stores. For gathering the information needed for giving relatives scores of each supplier in relation to recognized criteria, the questionnaire of “Finding the Scores of Suppliers in Relation to Recognized Criteria” was used. For achieving the aim and hypothesis test of the most suitable supplier of OFOGH KOOROSH Chain Stores, the importance of each criterion shall be calculated and then the situation of each supplier in relation to these criteria shall be determined. The results leads up to rejection of the hypothesis and the priority of superior suppliers are determined for suppliers Nos.1, 2, 3, 4, and 5 in order of priority.

7. ASSUMPTIONS OF RESEARCH MODEL

Before introducing the model designed for this research, it is needed to point out the assumptions assumed during designing period of the model. Some of these assumptions were directly related to features of the issue and some were assumed as a result of the restrictions existing in research process. The assumptions are as follows:

The nature of this study is such that different aims, some contradictory, were considered. The study will be a multi objective research. Since the model used in this research is of Mixed Integer Linear Planning type therefore, the primary assumptions of linear planning will be true for that.

Table 1: evaluating the main and subsidiary hypotheses

| Hypothesis | Variables | X ² | d.f. | Significance Level | Acceptance or Rejection H ₀ |
|---------------------------------------|--|----------------|------|--------------------|--|
| 0 | Financial, Service, Technical Features, Capability in Delivery, Profitability | 30,331 | 4 | 0.00504 | Rejected |
| 1 st Subsidiary Hypothesis | Financial Ability, Volume of Annual Sales, Financial Leverage | 606,911 | 2 | 0.035 | Rejected |
| 2 nd Subsidiary Hypothesis | Support and After-Sales Services, Standing for Moral Values, Quality in Packing, Suitable Advertisement | 6,450. | 3 | 0.0094 | Rejected |
| 3 rd Subsidiary Hypothesis | Using Experts, Stability of Quality, All-Embracing Technical Knowledge on Self-Product, and Production Infrastructures | 0.384 | 3 | 0.0094 | Rejected |
| 4 th Subsidiary Hypothesis | On-Time Delivery, Strict Observance of Orders Volume, Flexibility in Order Delivery | 0.531 | 2 | 0.0076 | Rejected |
| 5 th Subsidiary Hypothesis | Sales Profit Margin, Re-Payment Time, Discount and Sales Promotion | 4.173 | 3 | 0.0024 | Rejected |



Inconsistency = 0.02
With 0 missing judgment

Diagram 2: the superior supplier for OFOGH KOOROSH Chain Stores

7.1. Selecting the Intended Products Group

For implementation of the model, the intended products group was chosen by using Pareto’s law and by having the information related to goods group of chain stores in mind.

7.2. Finding the Degree of Importance of the Criteria Affecting Supplier Selection Process

There are several indices for any issue which in front of a decision-maker for being decided. Therefore, knowing the relative importance of indices is a must. In this study, for determining the Importance coefficient of the criteria affecting the supplier selection, hierarchical analysis technique has been used.

7.3. Finding the Rank of the Suppliers

In this stage, the degree of importance of each supplier in respect of the determined criteria is calculated by using the hierarchical analysis technique and a weigh is given to each supplier.

7.4 Selecting Suppliers for Implementation of the Model

Getting through the documents and records of the company, the suppliers of different items are known. These are the suppliers whose records exist in the company and mainly have had cooperation with the company.

7.5. Determining the Quantity of Purchase for Allocating to Each Supplier (Making Mixed Integer Linear Planning Model)

In this stage, for determining the quantity of the order allocated to each supplier, the researcher makes the model with due regard to the aims, parameters, restrictions, and the made assumptions. **Determining the Aims:** For determining the aims of Multi-objective Mixed Integer Linear Planning Model (designed in this research) two aims were taken as the main aims: minimizing the purchase price and maximizing the quality of the purchased goods. The purchase price of the items studied in the model as well as the percentage of their acceptance was extracted from the documents of the company. Maximizing the outcome of hierarchical analysis approach which includes the final weighs given to the suppliers for other criteria (which is called “desirability function”) was taken as third aim. It is noteworthy that these criteria enjoy lesser importance. Below, the mathematical expression of the aims has been given:

$$z_{\min} = \sum_i \sum_j p_{ij} \times x_{ij} \tag{1}$$

$$\left\{ \sum x_{ij} = D_i \tag{2}$$

$$\left\{ x_{ij} \leq c_{ij}$$

$$z_{\max} = \sum_i \sum_j q_{ij} \times x_i \tag{3}$$

$$\left\{ \sum x_{ij} \geq 1500 \times Y_i \tag{4}$$

$$z_{\min} = \sum_i \sum_j s_{ij} \times x_{ij} \tag{5}$$

$$\begin{cases} \sum x_{ij} \leq M \times Y_i \\ x_{ij} \geq 0 \text{ Integer } \forall_{i,j} \\ Y_j = 0 \text{ or } 1 \end{cases} \tag{6}$$

7.6. Definition of the Parameters of the Model

The parameters used in the model are as follows:

- A_{ij} Acceptance Rate of the i item from the Supplier
- P_{ij} Supplying Cost (purchase, transportation, and...) of the i item from the Supplier
- S_j The Score of the Supplier
- D_i The Demand Volume of the i item
- C_{ij} The Capacity of the Supplier (for supplying the i item)

8. IMPLEMENTATION OF THE RESEARCH MODEL

For earning the results of the research we need to implement the research model. Thus, when the numerical model was made the model was implemented, or solved, by using the approaches existing for solution of multi-purpose models. For this purpose, at first the model was implemented while the aims were dealt with one by one and then while entire aims were taken into account. Running the model was assisted by Version VIII of Lingo software. The results are given at table (2), (3) and (4). [2]

Table 2. Results of Solving the Model by Using the Function of First Aim

| Goods | Suppliers | | | | | Total |
|----------------|-----------|-------|-------|--------|-------|--------|
| | S1 | S2 | S3 | S4 | S5 | |
| 1 | 0 | 5,060 | 0 | 28,940 | | 34,000 |
| 2 | 0 | 0 | 0 | 0 | | 0 |
| 3 | 0 | 0 | 0 | 615 | | 615 |
| 4 | 0 | 0 | 0 | 215 | | 315 |
| 5 | 0 | 0 | 8,200 | | | 8,200 |
| 6 | | 0 | 590 | | | 590 |
| 7 | 3,390 | 0 | 0 | | | 3,390 |
| 8 | 2,492 | 0 | 307 | | | 27,995 |
| 9 | 60 | 0 | 0 | | | 60 |
| 10 | 4,600 | 0 | 0 | | | 4,600 |
| 11 | 2,900 | 0 | 0 | | | 2,900 |
| 12 | 0 | 0 | 0 | | 4,300 | 4,300 |
| 13 | 2,500 | 0 | 0 | | | 2,500 |
| 14 | 0 | 0 | 0 | 105 | | 105 |
| 15 | 2,250 | 0 | 0 | | | 2,250 |
| Y _i | 1 | 1 | 1 | 1 | 1 | |

As it is seen when the model is solved by using the function of first aim, all supplier were chosen for implementation of the model. But, when the function of second aim was involved the supplier No.4 was deleted from

the list of suppliers. When the model is solved by using the function of third aim, the suppliers Nos. 4 and 5 are deleted from the list of suppliers. When the Model is solved by using the aims in a single manner, the problem shall be solved while all three functions of aims are considered. But before that, it is necessary the values of aim functions be calculated for each function. These values have been given in Table (5).

Table 3. Results of Solving the Model by Using the Function of Second Aim

| Goods | Suppliers | | | | | Total |
|----------------|-----------|-----|-------|----|--------|--------|
| | S1 | S2 | S3 | S4 | S5 | |
| 1 | | | | | 34,000 | 34,000 |
| 2 | 1,500 | | | | 5,060 | 6,560 |
| 3 | | | | | 615 | 615 |
| 4 | | | | | 215 | 215 |
| 5 | | | 8,200 | | | 8,200 |
| 6 | | | 590 | | | 590 |
| 7 | | | 525 | | 2,865 | 3,390 |
| 8 | | | | | 2,800 | 2,800 |
| 9 | | | 60 | | | 60 |
| 10 | | | | | 4,600 | 4,600 |
| 11 | | | | | 2,900 | 2,900 |
| 12 | | | | | 4,300 | 4,300 |
| 13 | | | | | 2,500 | 2,500 |
| 14 | | | | | | 105 |
| 15 | | 750 | | | 802 | 2,249 |
| Y _i | 1 | 1 | 1 | 0 | 1 | |

Table 4. Results of Solving the Model by Using the Function of Third Aim, Hierarchical Analysis Approach

| Goods | Suppliers | | | | | Total |
|----------------|-----------|--------|-----|----|-----|--------|
| | S1 | S2 | S3 | S4 | S5 | |
| 1 | | | | | 885 | 855 |
| 2 | | 5,060 | | | | 5060 |
| 3 | | | | | 615 | 615 |
| 4 | | 215 | | | | 215 |
| 5 | | 8,200 | | | | 8,200 |
| 6 | | 590 | | | | 590 |
| 7 | | 3,390 | | | | 3,390 |
| 8 | | 2,800 | | | | 2,800 |
| 9 | | | | | | 0 |
| 10 | | 4,600 | | | | 4,600 |
| 11 | | 2,900 | | | | 2,900 |
| 12 | | 4,300 | | | | 4,300 |
| 13 | | 33,115 | | | | 33,115 |
| 14 | | | 105 | | | 105 |
| 15 | | | | | | 0 |
| Y _i | 0 | 1 | 1 | 0 | 1 | |

In next stage, considering the fact that the model is a multi-purpose model and the necessity of considering all aims, the model was solved by using the function of first aim (that is, minimizing the purchased price), its extraordinary importance, the comments of the experts of OFOGH KOOROSH Chain Stores Company. The results of solving the model have been given in table (6).

Table 5. Values of Calculated Functions of Aims

| Function of the Aim | | Minimizing the Purchase Price | Maximizing the Quality of the Purchased Goods | Maximizing the Desirability (Hierarchical Analysis Method) |
|--|-----------|-------------------------------|---|--|
| | | Min Z_1 | Max Z_2 | Max Z_3 |
| Minimizing Purchase Price | Min Z_1 | 5,136,060,000 | 64,998.38 | 13,930.1875 |
| Maximizing the Quality of Purchased Goods | Max Z_2 | 5,666,331,678 | 87,408.48 | 11,892.918 |
| Maximizing Desirability (Hierarchical Analysis Method) | Max Z_3 | 5,244,003,175 | 68,007,665 | 26,695.6 |

Table 6. Results of Final Solving of the Model with Due Regard to the Function of First Aim as Main Function and Other Two Aims as Secondary Aims (Hierarchical Analysis Approach)

| Goods | Suppliers | | | | | Total |
|-------|-----------|-------|--------|--------|-------|--------|
| | S1 | S2 | S3 | S4 | S5 | |
| 1 | | 5,060 | | 28,940 | | 34,000 |
| 2 | | | | | | 0 |
| 3 | | | | 615 | | 615 |
| 4 | | | | 215 | | 215 |
| 5 | | | 8,200 | | | 8,200 |
| 6 | | | 590 | | | 590 |
| 7 | 3,390 | | | | | 3,390 |
| 8 | 2,800 | | | | | 2,800 |
| 9 | 60 | | | | | 60 |
| 10 | | | 4600 | | | 4,600 |
| 11 | 2,900 | | | | | 2,900 |
| 12 | | | | | 4,300 | 4,300 |
| 13 | 2,500 | | | | | 2,500 |
| 14 | | | 28,940 | 105 | | 29,045 |
| 15 | 2,250 | | | | | 2,250 |

9. CONCLUSION

The first issue of the research was identification of the factors affecting the supplier selection equally. For, answering the first question of the research, the main and subsidiary hypotheses were designed. In main hypothesis, financial and service indices, technical features, capability in delivery, and profitability were recognized as the indices having equal effects in selecting the best supplier. Then, for testing these hypotheses, Friedman Statistical Test was used. Finally, this hypothesis was rejected on significance level (0.00504) being less than error level (0.5). The order of the effects of profitability, financial situation, capability in delivery, technical feature, and service situation of the store, as the factors affecting the selection of the suppliers of OFOGH KOOROSH Stores, was determined. In continuation, for determining the sub-criteria and indices of each determining factor, some subsidiary assumptions were designed in first hypothesis. In other words, for determining the effects of sub-criteria of financial criteria, the financial ability, the volume of annual sales, and the financial leverage were recognized as criteria having equal effects on financial situation index. Using Friedman Statistical Test, the hypothesis under which the above mentioned factors had equal effects on financial index was rejected because the significance level (0.035) was lesser than error value. In

continuation, the effects of financial leverage, financial ability, and volume of annual sales on the indices were recognized. In second subsidiary hypotheses, the object was equal effects of support and after-sales services, standing for moral values, quality in packing, and suitable advertisement on service situation index. With hypothesis test this hypothesis too was rejected because of significance level (0.0092) smaller than error level (0.05). So, the research hypothesis (H_0) was disproved. The hypothesis that suitable advertisement, standing for moral values, quality in packing, and support and after-sales services, and in third hypothesis, using expert human force, stability of quality, all-embracing technical knowledge on self-product, and production infrastructures are sub-criteria having equal effects on technical index was examined. With Friedman Test, this hypothesis too was disproved because of smaller significance level (0.0094) in comparison to error level (0.05). The hypothesis related to the effects of sub-criteria of stability of quality, production infrastructures, all-embracing technical knowledge on self-product, and using expert man power was tested based on Friedman Test. Fourth subsidiary hypothesis dealt with on-time delivery, strict observance of orders volume, communicative systems, supportive systems and warranty, repairs and maintenance systems, and flexibility in order delivery. By this hypothesis, the above mentioned

criteria have equal effects on capability in delivery index. With Friedman Test, here too since the significance level (0.0076) was smaller than error level (0.05) the hypothesis is rejected. Thus, the order of criteria in order of their effects on capability in delivery index is as follows: strict observance of orders volume, on-time delivery, and flexibility in order delivery. Finally, the hypothesis which says that the profit margin, the re-payment time, and the discount and sales promotion are sub-criteria having equal effects on store profitability index was examined. With relevant hypothesis test, the hypothesis was rejected because the significance level (0.0024) was smaller than error level (0.05). According to Friedman Test, the order of effects of sub-criteria on index is as follows: Re-Payment Time, profit margin, and sales promotion.

After identification of the criteria and indices which are important in supplier selection process, it was necessary to calculate the relative importance of the criteria. Thus, the second hypothesis took technical feature as the most important index of supplier selection process in OFOGH KOOROSH Chain Stores. The importance weighs of important criteria were calculated with due regard to the opinion of the experts and authorities of OFOGH KOOROSH Chain Stores. The result was that the profitability of the store (with weigh equal; to 0.390) was the most important criteria in supplier selection process. After profitability of the store, came capability in delivery, technical feature, services, and financial situation (with weighs of 0.215; 0.166; 0.162; and 0.067, respectively). Among the sub-criteria related to store profitability, the profit share with weigh of 0.390 was the most important one in the group and after that the other criteria came, that is, the volume of annual sales and the financial leverage with weighs of 0.317 and 0.293, respectively. Among the sub-criteria related to capability in delivery, on-time delivery whose weigh was 0.537 was recognized to be the most important one. The other sub-criteria, that is, flexibility in delivery (with weigh of 0.245) and strict observance of orders volume (with weigh of 0.218) stood after the on-time delivery sub-criteria. The most important criteria of technical feature were stability of quality whose weigh was 0.511. The weighs of other criteria, that is, the production

infrastructures, all-embracing technical knowledge on self-product, and using expert manpower were 0.206; 0.161; and 0.121, respectively. Among the technical features, the suitable advertisement with weigh of 0.378 was the most important one. The other criteria, that is, quality in packing, support and after-sales services, and standing for moral values, (with weighs of 0.331; 0.158; and 0.133, respectively) came after suitable advertisement. Finally, the importance weighs of sub-criteria related to financial situation, that is, the financial ability, volume of annual sales, and the financial leverage, were calculated. The weighs were 0.390; 0.317; and 0.293, respectively.

After calculating the weighs of the criteria and sub-criteria, the final scores of the suppliers should be calculated based on the criteria. So, the third hypothesis was made on the assumption that Supplier 5 was the most suitable supplier of OFOGH KOOROSH Chain Stores.

Parallel to the aim, the scores of the suppliers in respect of determined criteria were calculated through using hierarchical analysis method. Hierarchical analysis method showed the final score of suppliers 1 to 5 to be 0.339; 0.184;

0.164; 0.158; and 0.156, respectively. Considering the results of hierarchical analysis, the Supplier No.4, was realized to be the most important supplier, and thus, above mentioned hypothesis was rejected.

For answering the fourth question of the research, a multi-objective planning model was designed. The parameters, restrictions, and generally speaking, the information needed for making the model were extracted from the research literature, interview with experts, and going through the documents and records existing in the company. In running the model, the function of first aim was used and all suppliers were selected for implementation of the model. When the function of second aim was considered the supplier No.4 was deleted from the list of suppliers. The reason for this deletion was the low quality of this supplier in comparison to other suppliers. When the model was implemented through using the function of third aim, the suppliers Nos. 1 and 4 were deleted from the list of suppliers. Finally, the model was solved while all three functions were considered which resulted in selection of all suppliers.

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