

## SUPPLIER SELECTION OF A TEXTILE COMPANY WITH ANP

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### **ABSTRACT**

*Textile companies have made quite a progress in opening retailers all over Turkey in recent years. Along with the increase in production volume, this situation brings other requirements. One of these is furnishing the stores with similar furniture.*

*The supplier selection of a leading textile company is analyzed in this study. Analytic Network Process (ANP) of multi-criteria decision making (MCDM) methods is employed for the selection of the best alternative among certain suppliers. We determined the criteria and the relations between them, made pairwise comparisons and rated alternatives with the help of an expert from the company. Finally the supplier with the highest rank is selected.*

**Keywords:** supplier selection, analytic network process

### **1. INTRODUCTION**

A company that aims to be world-wide needs to compete in cost, technology and quality, as well as in the market share. An important task to make this possible is evaluating a company's suppliers. Thus, the company can know working with whom would be of its best interest. Some of the latest studies about supplier selection in this area are as follows: Chan and Chan [1] gave an example of an AHP model for supplier selection in the fast changing fashion market. Kivijärvi, Hallikainen and Penttinen [2] developed an ANP model to aid a textile and clothing design company in selecting suppliers for adopting electronic invoicing. Chen [3] used TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method to rank suppliers in the Taiwanese textile industry. Güngör et. al. [4] introduced a three-phase supplier selection model that utilizes AHP (Analytic Hierarchy Process) and ANP as decision-making tools but didn't give an example using that model.

### **2. ANALYTIC NETWORK PROCESS**

ANP is a MCDM method which was introduced by Saaty (1996)[5]. The steps of ANP can be summarized as follows: First we define the goal, the criteria, the sub-criteria and the alternatives. Then, we define the relations between criteria, sub-criteria and alternatives. We do the pairwise comparisons of alternatives with respect to criteria and of criteria with respect to related criteria. For those comparisons, the scale which is shown in Table 1 can be used. This scale was also introduced by Saaty (1980)[6]. Results of these comparisons form a super matrix. We transform the super matrix into a weighted super matrix which's sum of the weights in each column is equal to one. After that, we raise the weighted super matrix to a larger power until we get the limit matrix, the matrix in which the values in each column are equal. The priorities of alternatives can be seen in that limit matrix.

Table 1. Scale of relative importance

Intensity of importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong or demonstrated importance
9	Extreme importance
2,4,6,8	Intermediate values between adjacent scale values

For our model, we worked with an expert professional and defined five criteria and eighteen sub-criteria. These criteria and sub-criteria are as follows.

## 2.1. Production Capability

This criterion defines the performance of alternatives in production process.

### 2.1.1. Production Capacity

It's affected by technical capability, quality of products, variety of products, price appropriateness, financial condition, amount per delivery and shortness of delivery time.

### 2.1.2. Technical Capability

It's affected by production capacity, packing capability, experience and installation capability.

### 2.1.3. Packing Capability

It's affected by production capacity, technical capability, variety of products and shortness of delivery time.

### 2.1.4. Quality of Products

It's affected by production capacity, technical capability, variety of products, price appropriateness, delivery quality and installation capability.

### 2.1.5. Variety of Products

It's affected by production capacity, technical capability, price appropriateness, ease in payment and amount per delivery.

## 2.2. Financial Capability

This criterion defines the ability of the alternatives to actualize required investments, etc.

### 2.2.1. Price Appropriateness

It's affected by financial condition, ease in payment, flexibility and after sales service.

### 2.2.2. Financial Condition

It's affected by production capacity and experience.

### 2.2.3. Ease in payment

It's affected by price appropriateness, financial condition and experience.

## 2.3. Delivery Capability

This criterion defines the ability of the alternatives to meet present and future delivery requirements of the customer.

### 2.3.1. Amount per Delivery

It's affected by production capacity, technical capability, variety of products, delivery quality, shortness of delivery time, after sales service and installation capability.

### **2.3.2. Shortness of Delivery Time**

It's affected by production capacity, technical capability, packing capability, experience and communication capability.

### **2.3.3. Delivery Quality**

It's not affected by any of the other criteria.

## **2.4. General condition**

This criterion defines the condition of the alternatives among their rivals in the business.

### **2.4.1. References**

It's affected by technical capability, experience, quality of products, price appropriateness, financial condition, ease in payment, shortness of delivery time, after sales service and problem solving capability.

### **2.4.2. Flexibility**

It's affected by price appropriateness, financial condition and ease in payment.

### **2.4.3. Experience**

It's affected by production capacity, technical capability, quality of products, variety of products, price appropriateness, delivery quality, shortness of delivery time, references and problem solving capability.

## **2.5. Service Quality**

This criterion defines the quality of the service provided by the alternatives.

### **2.5.1. After Sales Service**

It's affected by technical capability, quality of products, financial condition, shortness of delivery time and installation capability.

### **2.5.2. Communication Capability**

It's affected by technical capability and installation capability.

### **2.5.3. Problem Solving Capability**

It's affected by technical capability, shortness of delivery time, price appropriateness, financial condition and installation capability.

### **2.5.4. Installation Capability**

It's affected by technical capability, quality of products, production capacity, shortness of delivery time, price appropriateness, delivery quality and financial condition.

Three suppliers, namely A1, A2 and A3, were considered as alternatives for the selection. The relations between the criteria, sub-criteria and alternatives are given in Figure 1.

The decision making procedure was handled with Super Decisions software, which calculates all the necessary matrices once the relations and comparisons based on the priority scale are defined. Following the steps mentioned above, we obtained the super matrix, the weighted super matrix and finally the limit matrix. At the end, we have the rankings of alternatives shown in Table 2.

As seen in Table 2, supplier A1 has the highest ranking. This means supplier A1 is the one that should be selected.

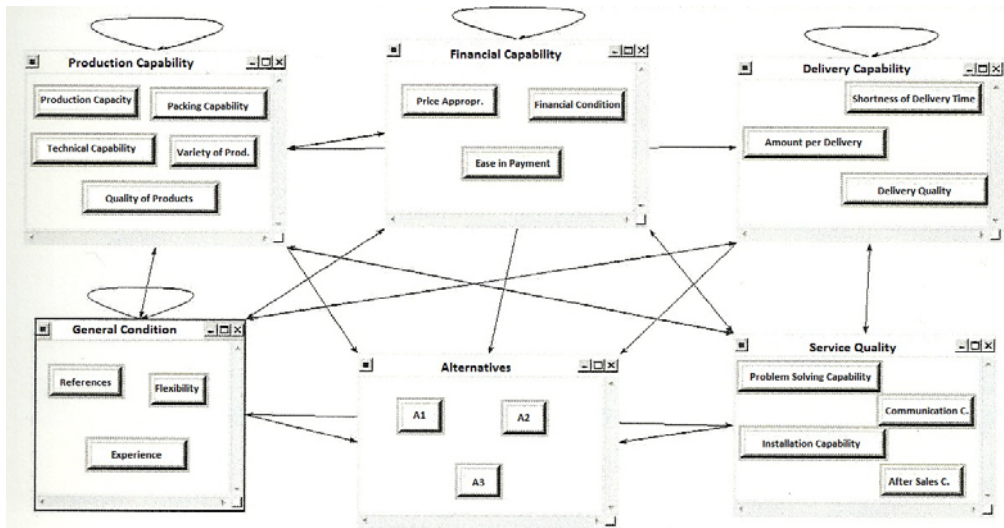


Figure 1. Selection network

Table 2. Priorities and rankings of alternatives

Alternatives	Total	Normal	Ideal	Ranking
A1	0.120851	0.458831	1.000000	1
A2	0.084477	0.320733	0.699021	2
A3	0.058060	0.220437	0.480431	3

### 3. CONCLUSION

In this study, we aimed to handle a supplier selection problem in textile retail business and thus, offer a set of criteria and sub-criteria. While defining those, we collaborated with an expert professional who was working for a textile retail company.

We defined the relations and made pairwise comparisons of these elements. Then we followed the steps of ANP and reached the priorities and rankings of alternatives.

As the result of our ANP model, supplier A1 has the highest ranking, which means that it's the best-fit supplier to our company's conditions.

The criteria and sub-criteria can be modified with opinions of other experts for further research. Also other MCDM methods may be applied to the same problem.

### 4. REFERENCES

- [1] Chan F. T. S., Chan H. K.: An AHP Model for Selection of Suppliers in the Fast Changing Fashion Market, Int J Adv Manuf Technol, 51, 1195 - 1207, 2010.
- [2] Kivijärvi H., Hallikainen P., Penttinen E.: Supporting the Supplier Scheduling Decisions in the E-Invoicing Implementation Projects – An Application of the ANP Method, Proceedings of the 44th Hawaii International Conference on System Sciences, Kauai, Hawaii, U.S.A., 2011.
- [3] Chen Y. J.: Structured Methodology for Supplier Selection and Evaluation in a Supply Chain, Information Sciences, 181, 1651 - 1670, 2011.
- [4] Güngör A., Coşkun S., Durur G., Güner Gören H.: A Supplier Selection, Evaluation and Re-Evaluation Model for Textile Retail Organizations, Journal of Textile and Apparel, 20: 3, 2010.
- [5] Saaty T. L.: Decision Making with Dependence and Feedback: The Analytic Network Process, RWS Publications, Pittsburgh, Pennsylvania, 1996.
- [6] Saaty T. L.: The Analytic Hierarchy Process, McGraw-Hill, New York, 1980.