

# A SUPPLIER SELECTION, EVALUATION AND RE-EVALUATION MODEL FOR TEXTILE RETAIL ORGANIZATIONS

## TEKSTİL PERAKENDE ORGANİZASYONLARINA YÖNELİK TEDARİKÇİ SEÇİM, DEĞERLENDİRME VE YENİDEN DEĞERLENDİRME MODELİ

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### ABSTRACT

In general, supplier selection is a multi-criteria decision problem that contains tangible and intangible factors. This paper identifies and organizes these factors into a three-phase supplier selection model for a textile retail organization. The first phase of the model is designed to identify the relative importance of the factors associated with the identification of a portfolio of suppliers from rather a large set of candidate suppliers. In the second phase of the model, factors required for the evaluation of the suppliers, selected in the first phase, depending on their ability to meet the product requirements are identified and their weights are suggested. In the last phase, the factors related to system performance of the certified suppliers determined in the second phase of the model are identified and their relative importance values are suggested. The model utilizes Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP) as decision-making tools. Both model and the weights of the factors determined present a valuable insight on supply processes of a wide range of textile products supplying departments of all retail chain companies.

**Key Words:** Supplier selection, Textile industry, Retail organizations, AHP, ANP.

### ÖZET

Genel olarak, tedarikçi seçimi birçok nitel ve nicel faktörü bünyesinde barındıran çok-kriterli bir karar problemidir. Bu çalışma, tekstil sektöründe faaliyet gösteren bir perakendeci için sözkonusu faktörleri belirleyerek üç aşamalı bir tedarikçi seçim modeli içinde değerlendirmektedir. Modelin ilk aşaması geniş bir aday tedarikçi havuzundan daha az sayıda nitelikli tedarikçilerin belirlenmesinde etkili olan faktörlerin göreceli önem derecelerini belirlenmesi amacıyla tasarlanmıştır. İkinci aşamada ise birinci aşamada belirlenmiş tedarikçilerin ürettiği fiziki türlerden beklentileri karşılama düzeyini sorgulamakta önemli olan kriterler ve bu kriterlerin önem derecelerinin ortaya çıkarılması amacıyla tasarlanmıştır. Son aşama ise bir gözden geçirme aşaması olup birlikte çalışılan tedarikçilerin sistem performanslarını irdelemekle ilgili faktörlerini ve bu faktörlerin önem derecelerini tespit etmeye yöneliktir. Modelde, Analitik Hiyerarşi Süreci (AHS) ve Analitik Serim Süreci (ASS) karar verme araçları kullanılmıştır. Geliştirilen model ve elde edilen faktör ağırlıkları perakende zincir firmalarından üreticilere kadar geniş bir yelpazede yer alan firmalara fayda sağlayacak niteliktedir.

**Anahtar Kelimeler:** Tedarikçi seçimi, Tekstil endüstrisi, Perakende kuruluşları, AHS, ASS.

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### 1. INTRODUCTION

The financial crises force the global retail chain suppliers to reduce the product costs to preserve the market share and stay profitable while ongoing changes in customer demands and expectations require increase in the characteristics of the product and service quality. Big retail chains

textile/apparel departments usually use a multiple sourcing strategy to reduce risk and to lower down cost, while at the same time, to establish close relationships between both customers and suppliers. Retail companies need to improve their supply chain operations continuously, and meanwhile, add new suppliers to the existing supply chain as part of

improvement activities if necessary. How to select new partners and evaluate current partners becomes critical in management and implementation of supply chain operations (1).

Turkey is one of the important actors in textile industry for global market. Since 1980s, some Turkish domestic firms especially located in the cities such as

Denizli, Bursa, Gaziantep, Kahramanmaraş, Kayseri in the home textile industry have found ways of connecting themselves to the global webs of manufacturing, distribution, and retailing of garments. Tokatli (2) stated two related developments that have occurred during the process. First, a number of manufacturing firms have acquired enough capability to develop and exercise their own strategies, have upgraded their operations, and, as original brand-name manufacturers, have evolved into global competitors. Second, some large domestic manufacturers, which are the logistic partners of the global retailers, have also experienced a cautious and gradual transformation from industrial capital to commercial and financial capital.

Overall, these aspects of textile industry, to be the selected one is still the most important management scope for all parts: Being a selected retailer by the customers, being a selected producer or distributor by retailers, being a selected raw materials supplier for producers in the global industry chain (3).

This study focuses on the issue of "how to identify the best supplier". The answer to this question provides some very valuable information to both manufacturers and retailers. This paper aims to find a practical answer to this question for home textiles sector. The paper identifies and organizes factors related to determining the best supplier into a three-phase supplier selection, evaluation and re-evaluation model for a textile retail organization using Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP) as decision-making tools. When determining the relative weights of the factors using AHP and ANP, the data are collected from experts in the home textile industry.

## 2. SUPPLY CHAIN IN TEXTILES AND RELATED STUDIES

The rings of the supply chain in textiles are sorted as raw material producers,

manufacturers, distributors and vendors that are being organized as an integrated production network where the production is sliced into specialized activities and each activity is located where it can contribute the most to the value of the final product (4). The supply chain in the textile and apparel sector is illustrated in Figure 1.

The dotted lines represent the flow of information, while the solid lines represent the flow of goods. The circles in rectangle block represent a relationship framework that for a certain type of product many companies may be in a supplier-customer relationship. To create a satisfied customer, it is necessary for the retail chain firm as well as the manufacturers to choose the right set of companies as suppliers and form a long-term cooperation with them.

The retailer must select supplier(s) carefully with the help of some evaluation criteria. This problem is called as the supplier selection problem. The objective of the supplier selection problem is to determine appropriate suppliers, which meet a firm's needs and strategies at an acceptable cost and quality. Dickson (5) presented 23 supplier-selection-criteria taken into consideration during decision-making. Criteria and measures are chosen to be applicable to all suppliers being considered and to reflect the firm's needs and its supply and technology strategy (6). In determining the best supplier or evaluating the performance of suppliers, usually multiple factors are considered (7, 8, 9, 10, 11, 12, 13, 14). In recent years, due to the uncertainty in the decision process, fuzzy theory is also integrated in decision-making process (6, 15, 16).

Gencer and Gurpinar (17) propose an ANP model in supplier selection owing to the evaluation of the relations between supplier selection criteria in a feedback systematic and implement the proposed method in an electronic company. Lin (18) studies the problem of supplier selection and

order allocation at the same time and suggests a comprehensive decision method based on ANP to identify top suppliers first and then achieves optimal allocation of orders among the selected suppliers. Considering the uncertainty in human preferences, fuzzy numbers are used in ANP. Önüt et al. (19) propose an integrated approach consisting of ANP and TOPSIS with fuzzy numbers. To obtain the best weights of the criteria in ANP, Razmi et al. (20) adopt a special optimization model along with the fuzzy numbers for the supplier selection problem. As it is sometimes difficult to make comparisons using crisp values, Amid et al. (21) develop a fuzzy multi-objective linear model for supplier selection problem.

There are also hybrid approaches in supplier selection problem. For example, Çebi and Bayraktar (22) structure the supplier selection problem as an integrated model including AHP and Lexicographic Goal Programming, which includes both quantitative and qualitative conflicting factors. Another integrated model consisting of AHP and Preemptive Goal Programming (PGP) is proposed by Wang et al. (23) including both quantitative and qualitative conflicting factors in supplier selection. Ghodsypour & O'Brien (24) integrate AHP and Linear Programming considering both quantitative and qualitative factors in choosing the best supplier and placing the optimum order quantities among them such that total value of purchasing (TVP) becomes maximum. Another hybrid approach consisting of AHP and multi-objective mixed integer programming is used in the study of Xia and Wu (25). In order to get the full picture of the related literature on the general supplier selection and evaluation, please refer to recent up-to-date literature survey by Ho et al. (26).

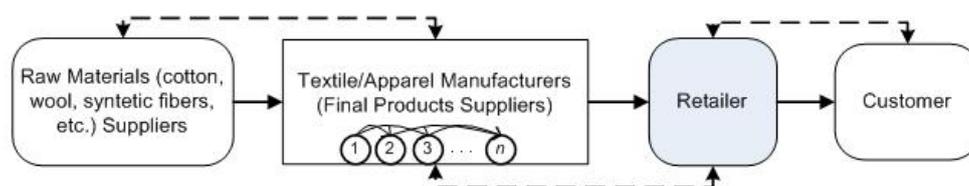


Figure 1. General representation of supplier-retailer relationship

Although there are many studies on supply chain management and supplier selection available in the published literature, there are a limited number of studies for the case of supply management (27, 28, 29, 30, 3) and supplier selection (31, 32) in textiles. As stated earlier, the intensive global competition in textiles gives decision-making process an essential role in reducing the costs and selecting the appropriate suppliers to provide sufficient production volume with good quality. Teng and Jaramillo (31, 32) discuss the strategies for textile/apparel companies to remain competitive in the global market and to enhance quality management in textile/apparel supply chains. Güner (33) used AHP to select the best outsourcing company in textiles. Findings from the study point out that, companies should continuously improve their supply chain operations by evaluating their suppliers and adding new suppliers to the existing supply chain in order to survive in the competition.

From this point of view, this study contributes to the related literature by providing a better understanding of the supplier selection, evaluation and re-evaluation process in a complex textile supply-management for the case of home textiles using the strong analytical decision making tools.

### 3. A BRIEF BACKGROUND ON THE DECISION MAKING TOOLS USED

Analytic Hierarchy Process (AHP), developed by Saaty (34), is designed to solve complex multi-criteria decision problems. AHP decomposes the complex decisions in a hierarchical structure and makes it easy to manage the complex decisions in this way. So

the decision maker can determine the trade-offs among objectives related to all criteria, sub-criteria and their pairwise comparisons. The output of AHP is a prioritized ranking of the decision alternatives based on the overall preferences expressed by the decision maker. AHP is the most widely used approach in supplier selection literature. AHP uses a verbal scale developed by Saaty, which enables the experts to incorporate subjectivity and experience (35). Please refer to (34) for details of AHP.

Analytic Network Process (ANP), also introduced by Saaty (36), is a generalization of AHP. It incorporates feedback and inner dependencies among decision criteria and alternatives. ANP can be used as an effective tool in cases in which the interactions among the elements of a system form a network structure. ANP replaces hierarchies with networks, in which the relationships between levels are not easily represented as higher or lower, dominated, or being dominated directly or indirectly (37). Please refer to (36) for details of ANP.

### 4. THE PROPOSED METHODOLOGY

As stated in the previous sections of the paper, supplier selection is a multi-criteria decision problem that contains tangible and intangible factors. This paper identifies and organizes these factors into a three-phase supplier selection model for a textile retail organization. The first phase of the model is designed to identify the relative importance of the factors associated with the identification of a portfolio of suppliers from rather a large set of candidate suppliers. In the second phase of the model, factors required for the evaluation of the

suppliers, selected in the first phase, depending on their ability to meet the product requirements are identified and their weights are suggested. In the last phase, the factors related to system performance of the certified suppliers determined in the second phase of the model are identified and their relative importance values are suggested. The model utilizes AHP and ANP as decision-making tools. The suggested model is designed in a flexible structure to make it practical in a wide range of textile products supplying departments of all retail chain companies. When determining the relative weights of the factors using AHP and ANP, data are collected from the experts in the home textile industry.

The selection criteria placed in all three phases of the model used in this study are based on the items of the contracts signed between the global retail firms and textile product suppliers and experience of the decision makers. In the literature, the supplier evaluation criteria determined for supplier selection are intended for general industrial applications and they use the common criteria such as cost, quality, flexibility in the delivery, communication and service as basis (38). Most of the supplier selection studies focus on only the model structure and solution techniques instead of the sector based suitability of selection criteria. On the other hand, the current study was designed according to textile sector based criteria. In the proposed model, the methods, which are applied by using modern selection criteria, are integrated to involve selection, evaluation and re-evaluation of the suppliers as three phases (Figure 2).

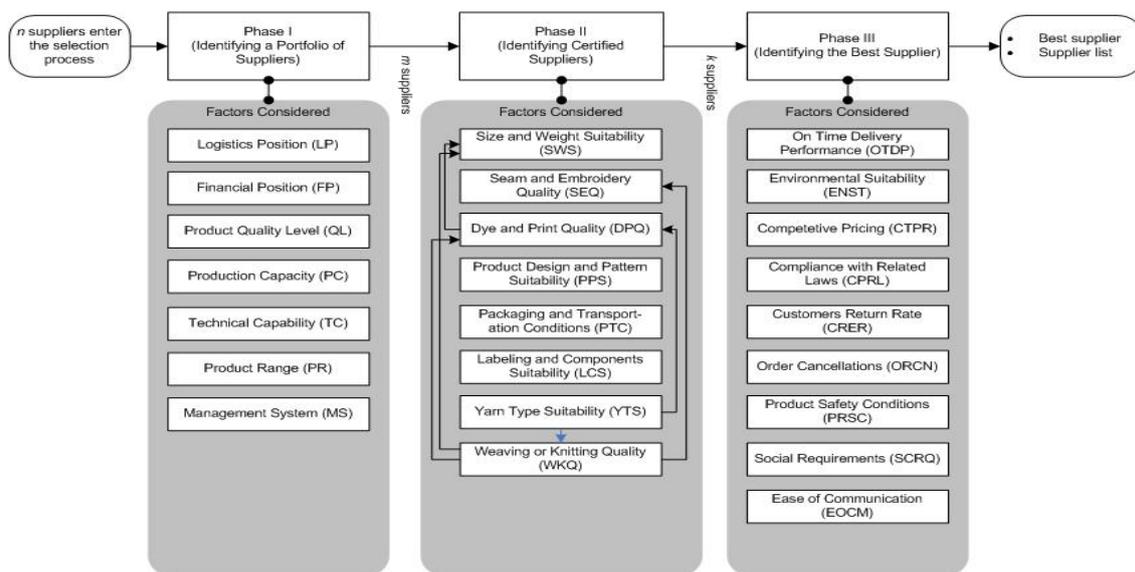


Figure 2. Supplier selection, evaluation and re-evaluation phases

The first phase criteria belong to general evaluation factors, which can be defined independent from each other. The second phase criteria are special for textile industry and can form interaction between each other in accordance with the structure of textile product. In Figure 2, it can be seen that the factors interact with each other. In the third phase, evaluation factors to measure the performance of the system established between supplier and customer (retailer firm) are defined as independent criteria.

The criteria of the first phase in the supplier selection process are explained as follows:

- Financial position (FP): Low financial risk and high credibility are preferred. Economical regulations, stability of the market and the effect of currency rate on domestic platform of the supplier should be considered during global supplying activities.
- Logistic position (LP): Logistic position is an important criterion for optimizing timing, transportation and storage costs besides providing suitable price and quality.
- Management system (MS): The presence of management systems certificates prove that the supplier provides the legal conditions related with environmental issues, health and safety requirements, besides providing the product quality conditions.
- Product quality level (QL): It is important to achieve consistency in product cost-quality level defined by analysis of the global retail and supplier firms.
- Product range (PR): The variety of the products that can be presented by the supplier in the same or different categories such as home textile, underwear, outdoor clothing, et. are important factors for selection.
- Production capacity (PC): The amount of production capacity that can be allocated to the retailer orders is an important factor. The supplier should also cope with the fluctuations in demands and changes in sale politics of the retailer.
- Technical capability (TC): The production facilities, machinery park, equipments and human resources profession of the supplier should qualify the technical requirements of production with the related product.

The second phase criteria are related with product qualifications. The quality

control staff of the retail chain firms or independent auditors mostly uses these criteria during controls and inspections in supplier evaluation. Definitions of the criteria, which can also be defined as quality properties, are explained as follows:

- Dye and print quality (DPQ): This criterion is tested in the laboratory for suitability. It can also visually be defined by the customer. It has importance due to the benefit it provides to the product by chemical processes.
- Labeling and components suitability (LCS): Labeling is an important factor for presentation of the products, providing information about their proper usage. All the related materials and accessories used on the product have to comply with the design and product safety conditions.
- Packaging and Transporting Conditions (PTC): It is required to sustain the suitability of the product during packaging, storage, transportation.
- Product design and pattern suitability (PPS): PPS is an important criterion for providing customer expectations by following the new fashion trends in professional product design.
- Seam and embroidery quality (SEQ): This property is one of the customers' inspection criteria in terms of product quality.
- Size and weight suitability (SWS): Size and weight factors are used in a wide range while defining textile products order requirements.
- Weaving or knitting quality (WKQ): The fabric quality is one of the directly perceived properties by the customers. The production type of the fabric is selected as weaving or knitting during design period depending on the fabric properties.
- Yarn type suitability (YTS): The selection of suitable fiber, yarn type and linear density (NE) during design of the product has a great importance as it affects the product qualifications.

The performance of the suppliers will be regularly monitored with the third phase criteria, which are defined in the model as follows:

- Competitive pricing (CTPR): The importance of the price suitability, which is directly influenced from high competition and economical crisis, is increasing day by day in textile sector.
- Compliance with related laws (CPRL): In a global supply system, it is

required for suppliers to obey not only the legal conditions of the domestic region but also the legal conditions of the countries where the product is presented.

- Customer returns percentage (CRPG): The most important criterion to provide customer expectations is reducing the customer complaints and product returns to a minimum. The suppliers should be able to participate in related applications.
- Ease of communication (EOCM): This criterion requires a proper substructure in communication of retailer with supplier. It can also be needed as an integrated contact system among the related departments of supplier by enterprise resource planning (ERP) software.
- Environmental suitability (ENST): The suppliers have to consider the environmental conditions in production processes and during the procurement of raw materials, dyes and other chemical substances, accessories, labels, packaging materials etc.
- On time delivery performance (OTDP): Suppliers are required to deliver the products on time for proper proceeding of the supplier chain.
- Order cancellations (ORCN): The order cancellations, which are made by suppliers, can result in loss in money and prestige of the retailer firm.
- Product safety conditions (PSC): It is an important criterion, which considers taking precautions to control the products and provides legal requirements for protecting customers from physical, chemical and microbiological hazards.
- Social requirements (SCRQ): Social suitability conditions necessitate from the social and legal responsibilities of the suppliers to its employees, customers, society and government. The compliance to these legal responsibilities is provided by applicable standards prepared by different organizations in order to improve the textile supply chain socially and sustain the ethical performance.

## 5. RESULTS AND DISCUSSION

### 5.1. Procedure and Results

A group of experts contributed to this study. This group consisted of five experts specialized on marketing and

supply chain activities and knowledgeable on textile production processes. The experts came from a manufacturing firm, a global retailer company and from a university. These experts provided information through comparison matrices<sup>1</sup> of AHP and ANP (34, 36).

In order to collect data from the experts, two AHP models were developed for the first and third phases (e.g. selection and re-evaluation phases) as shown in Figure 2 using SuperDecision Software. For the second phase (i.e., evaluation phase), an ANP model was developed because some factors considered in this phase interact with each other. Each expert was asked to complete the pair wise comparison matrices in AHP and ANP models. During this process, definition of each factor was provided to every expert. In order to come up with a group decision, geometric mean was calculated for the each cell in the pair-wise comparison matrices, which contain the judgmental values collected from the experts. At the end, for each phase, pair wise comparison matrices were produced. Later the relative weights of the factors considered in each phase (i.e. the eigenvalues of the final pair wise comparison matrices) are generated using the SuperDecisions software. Table 1 presents the weights of the factors and their rankings.

## 5.2. Discussion

As presented in Table 1, the results of this study suggest a list of criteria and their importance in supplier selection process in textiles. In the phase 1, criteria that affect determination of the qualified suppliers in the candidate supplier pool are lined up according to their importance. In the focus of developing reliable market, providing the quality products that satisfy customer expectations are important factors for retail firms in selection of suppliers. This is because textile products are produced according to the fashion trends and served directly to customers' assessment. In a competitive global market, just focusing on the low price strategy and lowering the product quality can be misleading for the supplier firm. The requirement of technical capability and substructure for the production of quality textile products has more

**Table 1.** The weights of the factors and their rankings for each phase

Phase 1. Supplier Selection		
Criteria	Weights	Rank
Product Quality Level (QL)	0,31986	1
Technical Capability (TC)	0,16466	2
Production Capacity (PC)	0,16157	3
Management System (MS)	0,12990	4
Product Range (PR)	0,11410	5
Logistics Position (LP)	0,06254	6
Financial Position (FP)	0,04738	7
Total	1,00000	
Phase 2. Supplier Evaluation		
Criteria	Weights	Rank
Yarn Type Suitability (YTS)	0,31648	1
Weaving or Knitting Quality (WKQ)	0,19871	2
Product Design and Pattern Suitability (PPS)	0,16402	3
Dye and Print Quality (DPQ)	0,09364	4
Size and Weight Suitability (SWS)	0,07792	5
Seam and Embroidery Quality (SEQ)	0,05888	6
Labeling and Components Suitability (LCS)	0,04619	7
Packaging and Transportation Conditions (PTC)	0,04416	8
Total	1,00000	
Phase 3. Supplier Re-Evaluation		
Criteria	Weights	Rank
Product Safety Conditions (PRSC)	0,21248	1
Order Cancellations (ORCN)	0,17083	2
Competitive Pricing (CTPR)	0,15403	3
Customer Return Rate (CRER)	0,15222	4
On Time Delivery Performance (OTDP)	0,14255	5
Ease of Communication (EOCM)	0,06025	6
Compliance with Related Laws (CPRL)	0,04089	7
Social Requirements (SCRQ)	0,03731	8
Environmental Suitability (ENST)	0,02943	9
Total	1,00000	

importance than the production capacity levels. The suppliers have to control the age and suitability of machine parks by making regular benchmarking studies. The suppliers need to maintain flexibility as it is hard to predict the demand amounts and to provide stable sales.

As seen in Table 1, the criterion of "management systems" is the fourth in the ranking, which may suggest that retailers put value in having a management system in a supplier because it is an indication of a systematic approach of doing business. Application and certification of management systems prove that producers increase their system quality and they can form a ring in the chain of global suppliers. As there are

many producers in textile sector in the world, retail firms generally do not face any problems in finding suppliers and providing variety of products, therefore, product variety is considered as a lesser important criterion. "Logistic condition" criterion has also low degree of importance as there are improved transportation and storage systems and so the products can easily be fed into a global supplier chain no matter where they are produced. This situation can be regarded as a treat on long term competitiveness of Turkey in the global market because in Turkey it has been frequently worded as an advantage for the textile producers to stay at the center of the whole market for speeding up the supplier chain process and logistic operations.

<sup>1</sup> Due to the page limitation of the paper, the comparison matrices were not presented here in the text. They can be supplied by the corresponding author upon request.

“Financial condition” is placed at the bottom in the ranking of phase 1 criteria. However, it is still an important criterion to be considered in developing a long-term relationship.

In the phase 2, criteria defining the level of meeting the expectations in the products of the selected suppliers and their degree of importance are given. At this stage, qualifications of the products produced by suppliers and benefit in production processes are considered in evaluation criteria and in the results priority is given compatible to the line of production processes. In textile products, “yarn and yarn properties” are the most important factors influencing the fabric structure while weaving or knitting techniques display the product quality. Properties of fiber used as the raw material and yarn production technology are strong factors affecting the yarn performance. The structural properties can also be effective as well as the fiber-yarn properties in determining general properties (physical, chemical and appearance) of the fabrics. The fabric quality is also one of the reasons of sawing defects (39).

In general, suppliers having professional “product design capabilities” are preferred during selection. This selection criterion comes after the fabric and yarn structure. It should be noted that the right fiber selection and providing the required properties in yarn level would increase the satisfaction rate in meeting expectations.

In the last phase in Table 1, factors related to the examination of system performance of the cooperated suppliers and their importance degrees are given. The PRSC has the first place in priorities of providing sustainable relations with suppliers. This result points out the increasing consumer consciousness and sensibility of retail firms on this matter. Retail firms can suffer from “order cancellations” in markets facing high uncertainties. Therefore, tolerance

range is narrowed and this criterion is placed as second in priorities. “Competitive pricing” has high importance degree as it directly affects profits in the global competition market. The results reveal that the retail firms give importance to the customer return rates for saving their prestige and market share. The criterion of “on time delivery” has the same degree of importance with criterion 2 and 3, so that it needs to be considered as an important factor in sustainable supplier relations. Technological facilities provide ease in communication with customers so the criterion has a low degree in importance scale, but taking care of the feedback systems is still important for both parties. “Customer return rates” keep its importance in the process. It is obtained that even if “compliance with related laws”, “social requirements” and “environmental suitability” criterion have lesser importance degrees, they are also important for sustaining long-term relationships with suppliers.

## 6. CONCLUSIONS AND FUTURE RESEARCH

Based on the findings of this study, the following practical suggestions can be made for textile manufacturers, which are potential suppliers for textile retailers:

- Manufacturers must pay the greatest attention to their products’ quality, which has the highest impact on becoming a selected supplier by a textile retailer. In addition, potential suppliers shall enhance their technical capability and production capacity. Especially Small and Medium Size Enterprises (SMEs) must have a Management System in place to present their business making quality to the potential retailer buyer.
- Manufacturers those are already the suppliers of retailer organizations

want to maintain their supplier-buyer relationship with retailers. Of course, having a good partnership depends greatly on the quality of the products being received from the supplier. The results show that Yarn Type Suitability should be the most important factor in evaluating a supplier as opposed to practice. Manufacturers are suggested to pay more attention to the yarn type and quality they are using in their production processes. To guarantee receiving the best yarn, a well-established yarn procurement process must be established and maintained. Weaving or Knitting Quality and Product Design and Pattern Quality are also other key supplier evaluation components to which special attention must be paid.

· Generally, manufacturers are aware of the importance of Product Safety when doing business in textile sector. Our findings prove the same; however, many SMEs do not have special processes and control mechanisms applied for product safety. They should give priority for developing such processes and mechanism.

· Manufacturers should develop performance criteria according to the factors presented in **Hata! Başvuru kaynağı bulunamadı.**<sup>1</sup> and watch them closely to stay as a competitive supplier in textiles.

This research can be extended to various segments of the textiles and comparison analysis may be beneficial as well. In addition fuzzy approach can be integrated into the decision making process to smooth the crispness assumption of the process.

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