

A SITE SELECTION MODEL FOR ESTABLISHING A CLOTHING LOGISTICS CENTER

KONFEKSİYON LOJİSTİK MERKEZ KURULUMU İÇİN BİR YER SEÇİM MODELİ

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Received: 26.10.2010

Accepted: 04.04.2011

ABSTRACT

Logistics is defined as a business planning framework for the management of material, service, information and capital flows. Logistics is a very important strategy to get competitive advantages like time, cost and customer satisfaction. The supply chain of the clothing sector has very distinctive processes. The supply chain from sourcing of raw materials to distribution and marketing must be well organized as an integrated production network. This paper presents a model establishing a logistics center for Turkish Clothing Industry in Marmara Region in Turkey. A numerical study with a survey database aimed at the clothing industry of Turkey was conducted and Analytic Hierarchy Process (AHP) was used to evaluate the questionnaire results. As a result of survey, Hadimkoy was chosen the best place to establish a clothing logistics center.

Key Words: Site selection, Logistics center, Analytic Hierarchy Process (AHP), Clothing industry, Supply chain management.

ÖZET

Lojistik hammadde, servis, bilgi ve para akışı için bir iş plânlama çerçevesi olarak tanımlanmaktadır. Lojistik zaman, para ve müşteri hoşnutluğu sağlayarak rekabet üstünlüğü elde etmede önemli bir şirket stratejisidir. Konfeksiyon sektörü, diğer sektörlerden farklı ve önemli bir tedarik zinciri yapısına sahiptir. Hammadde temininden dağıtım ve pazarlamaya uzanan tedarik zinciri, bütünlük üretim aşında iyi bir şekilde organize edilmelidir. Bu çalışmada, Türkiye’de Marmara bölgesinde Türk konfeksiyon sektörü için bir lojistik merkez kurulumu sunulmuştur. Anket tabanlı sayısal bir çalışma Türk konfeksiyon endüstrisinde gerçekleştirilmiş ve anket sonuçlarını değerlendirmek için Analitik Hiyerarşi Süreci kullanılmıştır. Anket sonucunda konfeksiyon lojistik merkezi kurmak için en iyi yer olarak Hadımköy seçilmiştir.

Anahtar Kelimeler: Yer seçimi, Lojistik merkez, Analitik Hiyerarşi Süreci (AHP), Konfeksiyon endüstrisi, Tedarik zinciri yönetimi.

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1. INTRODUCTION

Logistics, in its most basic definition, is the efficient flow and storage of goods from their point of origin to the point of consumption. It is the part of the supply chain process that plans, implements and controls the flow of goods. It can also be seen as the management of inventory, in rest or in motion. Logistics is also defined as a business planning

framework for the management of material, service, information and capital flows. It includes the increasingly complex information, communication and control systems required in today's business environment (1).

The clothing sector is both a labor-intensive, low wage industry and a dynamic, innovative sector, depending on which market segments one

focuses upon. In the high-quality fashion market, the industry is characterized by modern technology, relatively well-paid workers and designers and a high degree of flexibility. The competitive advantage of firms in this market segment is related to the ability to produce designs that capture tastes and preferences, and even better – influence such tastes and preferences – in addition to cost

effectiveness. The core functions of firms servicing this market segment are largely located in developed countries and often in limited geographical areas or clusters within these countries (2). The other major market segment is mass production of lower-quality and/or standard products. Manufacturers for this market segment are largely found in developing countries, often in export processing zones and/or under so-called outward processing agreements with major importers. In the low to middle priced market, the role of the retailer has become increasingly prominent in the organization of the supply chain (3).

The supply chain of the clothing sector has very distinctive processes. Different supply methods, push and pull logistics as well as the non replenishment approaches especially for the fast fashion sector are affecting processes in the supply chain. In addition, the depth and range of assortments such as different sizes, colors, and cuts of a collection requires very efficient and optimized logistics. Furthermore time efficiency is one of the key factors for this industry to provide a competitive advantage. Logistics is a very important strategy to get competitive advantages like time, cost and customer satisfaction. This paper presents a locational decision making of a logistics center for Turkish Clothing Industry in Marmara Region in Turkey. A numerical study with a questionnaire survey database aimed at the clothing industry of Turkey was conducted and Analytic Hierarchy Process (AHP) was used to evaluate the questionnaire results.

2. LITERATURE REVIEW

Sheu presented a hybrid neuro-fuzzy methodology to identify appropriate global logistics (GL) operational modes used for global supply chain management (4). The proposed methodological framework included three main developmental phases: first the establishment of a GL strategic hierarchy, second formulation of GL-mode identification rules, and third development of a GL-mode choice model. By integrating advanced multi-criteria decision-making (MCDM) techniques including fuzzy analytical

hierarchy process (Fuzzy-AHP), Fuzzy MCDM, and the technique for order preference by similarity to an ideal solution (TOPSIS), six types of global logistics and operational modes coupled with corresponding fuzzy-based multicriteria decision-making rules were specified in the second phase. Using the specified fuzzy decision-making rules as the input database, an adaptive neuro-fuzzy inference system (ANFIS) was then developed in the third phase to identify proper GL modes for the implementation of global supply chain management. A numerical study with a questionnaire survey database aimed at the information technology (IT) industries of Taiwan was conducted to illustrate the applicability of the proposed method.

Chen et al. considered the planning of a multi-product, multi-period, and multi-echelon supply chain network that consists of several existing plants at fixed places, some warehouses and distribution centers at undetermined locations, and a number of given customer zones. The supply chain planning model was constructed as a multi-objective mixed-integer linear program (MILP) to satisfy several conflict objectives, such as minimizing the total cost, raising the decision robustness in various product demand scenarios, lifting the local incentives, and reducing the total transport time. For the purpose of creating a compensatory solution among all participants of the supply chain, a two-phase fuzzy decision-making method was presented and, by means of application of it to a numerical example, was proven effective in providing a compromised solution in an uncertain multi-echelon supply chain network (5).

A freight village is defined as a specific area where all the activities relating to transport, logistics and goods distribution –both for national and international transit –are carried out by various operators. In order to encourage intermodal transport for goods handling, a Logistics Center should preferably be served by a variety of transport modes (roads, rail, sea, inland waterways, air) (6). UNECE has defined the freight transport as a

geographical grouping of independent companies and bodies which are dealing with freight transport (for example, freight forwarders, shippers, transport operators, customs) and with accompanying services (for example, storage, maintenance and repair), including at least a terminal (7). Tsamboulas and Kapros (8) presented a method and models for assessing the financial viability of a new freight village financed by private and public investments. The financial evaluation model constituted an integrated part of a wider planning methodology, with four distinct phases, namely (a) site selection and traffic forecasts, (b) definition of services offered and corresponding dimensions, (c) estimation of investment and operation costs and (d) evaluation of investments. An application of developed methodology and models is done for the case of a freight village in Northern Greece, demonstrating its potential to application for similar cases. Ozdemir (9) studied a research project involving logistics firms in Istanbul designed to investigate the strengths and weaknesses of Istanbul in its quest to become as a logistics center serving a wider region beyond Turkey. The results of the interviews and survey have shown that, logistics activity in the Marmara region (and Istanbul in particular) is mainly the result of economic activities taking place in a national context, rather than the result of logistics node operations at a regional or global level.

Atılğan (10) investigated the position of the products in “value chain” analysis, produced by the firms that were active in the Turkish textile sector and also researched the value spent for the product in the links of the value chain. Kayalı (11) examined the technical, pure technical and scale efficiencies of profitability of textile companies in Turkey for 2007. The paper gave information about where the textile sector in part of Turkish economy, conception of efficiency and Data Envelopment Efficiency. The result of analyse showed that efficiency score of textile sector was low. Eryuruk et. al. (12) presented an external analysis of the Turkish clothing industry to see whether or not the Turkish clothing industry utilizes globalization market

strategies. Important factors effective to implement these strategies, perceived problems, and execution of the strategies to compete in the global environment in addition to the modeling of the current situation of the strategies were studied. Eryuruk et. al. (13) presented logistics as a strategic solution and investigates important problems and necessary solutions according to the needs of Turkish clothing industry. In the first section of the article a profile of clothing industry in Turkey and in the world was presented. Then, the situation of logistics sector in Turkey and in the world is explained. Finally, the evaluation of logistics as a global strategy in clothing industry was presented.

As mentioned above there are many types of studies related to the logistics such as global logistics operational modes, the planning of supply chain network, transportation and warehousing management, transport project, performance measures and logistics center. The concept of flow has become particularly important in logistics and freight distribution. From a simple question of capacity, the issues of timing, frequency and punctuality are now of significant relevance in freight movements since they are part of supply chain management strategies. In particular, transport terminals and freight distribution centers have been the major elements permitting improvements in the efficiency and throughput of commodity chains from global production networks to local distribution. This paper presents a model for selection best place for a logistics center for Turkish clothing industry in Marmara Region in Turkey.

3. METHODOLOGY

According to the data gathered from TurkStat (Turkish Statistical Institute) it was seen that 59% of the clothing firms were founded in Marmara Region and 49% of the clothing firms were also established in Istanbul (14,15). As a result, it was decided to select Marmara Region for a logistics center establishment and for selecting clothing firms interviewed. Then a contact list was obtained randomly from two sources: ISO (Istanbul Chamber of Industry) and ITKIB (Representation of Turkish Textile and Ready-made Garment Exporters Association). AHP is a multiple criteria decision making method based on expert opinion so sample of this research fits into convenience sampling since the information was collected from the top-level management teams of each of the clothing firms who are reliable to provide the answers of the questionnaire (16, 17).

The research design for this study consisted of a case study form of methodology involving 55 Turkish clothing manufacturers. The results were evaluated according to two criteria. First criterion was according to clothing manufacturers and clothing firms that use sub-contractors. The second evaluation criterion was according to firm types that produce knitted garment, woven garment or both types of garments (Table 1). The method of collecting data during these studies was face-to-face interviews with management teams at their workplace. A numerical study with a questionnaire survey database was conducted and Analytic Hierarchy Process (AHP) was used to evaluate the questionnaire results.

The Analytic Hierarchy Process (AHP) for decision-making is a theory of relative measurement based on paired comparisons used to derive normalized absolute scales of numbers whose elements are then used as priorities (16,17). Matrices of pairwise comparisons are formed either by providing judgments to estimate dominance using absolute numbers from the 1 to 9 fundamental scale of the AHP, or by directly constructing the pairwise dominance ratios using actual measurements. The AHP can be applied to both tangible and intangible criteria based on the judgments of knowledgeable and expert people, although how to get measures for intangibles is its main concern. The weighting and adding synthesis process applied in the hierarchical structure of the AHP combines multidimensional scales of measurement into a single "uni-dimensional" scale of priorities (19).

The Analytic Hierarchy Process is a powerful and understandable methodology that allows groups or individuals to combine qualitative and quantitative factors in decision making process. It is a Multi Criteria Decision Making method for complicated and unstructured problems. Also, it is an approach that uses a hierarchical model having levels of goal, criteria, possible sub-criteria, and alternatives. AHP captures priorities from paired comparison judgments of the elements of the decision with respect to each of their parent criteria (20). As the evaluation scale, the Saaty's scale of 1-9 will be used as shown in Table 2.

Table 1. The evaluation method (18)

EVALUATION 1	
CRITERION: MANUFACTURER FIRMS-SUB-CONTRACTOR USER FIRMS	
CLOTHING MANUFACTURERS	32
CLOTHING FIRMS USING SUB-CONTACTORS	23
TOTAL	55
EVALUATION 2	
CRITERION:FIRM TYPE (KNITTED-WOVEN GARMENT MANUFACTURERS)	
KNITTED GARMENT MANUFACTURERS	26
WOVEN GARMENT MANUFACTURERS	19
BOTH KNITTED AND WOVEN GARMENT MANUFACTURERS	10
TOTAL	55

Table 2. The fundamental scale for making judgements

1	Equal
2	Between Equal and Moderate
3	Moderate
4	Between Moderate and Strong
5	Strong
6	Between Strong and Very Strong
7	Very Strong
8	Between Very Strong and Extreme
9	Extreme

4. RESULTS AND DISCUSSION

In this study we prepared a detailed analysis of a clothing logistics center location selection. First, a geographical evaluation of Turkish clothing sector was investigated to select the region for a logistics center. According to the data gathered from TurkStat (Turkish Statistical Institute) (14,15) it was seen that 59% of the clothing firms were founded in Marmara Region and 49% of the clothing firms were also established in Istanbul. As a result, it was decided to select Marmara Region for a logistics center establishment. In North Marmara Region, three sites (Tuzla, Hadimkoy and Gumusyaka)

were selected to analyze the benefits they could provide if a logistics center to be developed (Figure 1) (21,22). These three sites were preferred by Istanbul Metropolitan Planning department in order to establish a logistics center because they all three places have good transportation advantages (port, airport, highway and RO-LA, RO-RO connections). Hadimkoy is very near to widely used Ataturk Airport, Ambarli Port, highway and railway. Gumusyaka and Tuzla also have the advantageous of being very close to the port, airport, highway connection and railway connection.

Table 3 shows the site selection criteria that were developed as a result of intensive researches in literature and individual discussions with logistics sector professionals. For the study, next step will be to evaluate the below criteria for the best logistics center placement for the Turkish Clothing Industry.

Figure 2 shows the Hierarchical model for site selection of a clothing logistics center. The goal of the study is site selection for a clothing logistics center and alternative places are Hadimkoy, Tuzla and Gumusyaka.

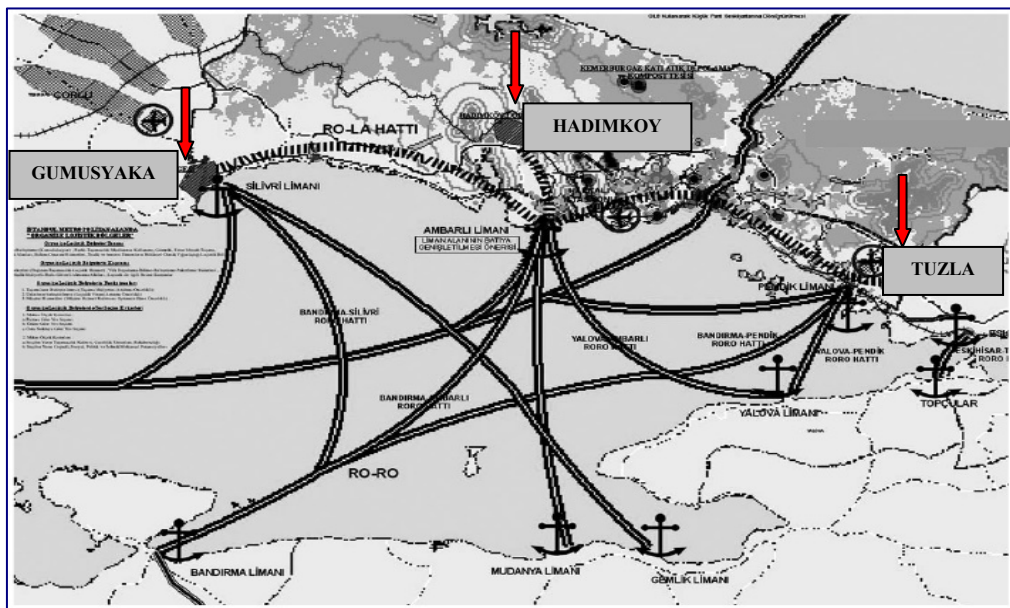


Figure 1. Clothing logistics center candidate places

Table 3. Clothing logistics center site selection criteria

SITE SELECTION CRITERIA	
PHYSICAL ANALYSIS	
1	Land size
2	Expansion of Physical Facilities
3	The Geological Status (as in the earthquake zone)
LOCATION ANALYSIS	
1	Promotion opportunities in the region
2	Proximity to Supply Point
INFRASTRUCTURE SERVICES	
1	Communication infrastructure
2	Electricity, Gas and Water Networks
3	Sewage and waste treatment plants
TRANSPORTATION OPPORTUNITIES	
1	Proximity to the motorway
2	Proximity to the airport
LABOR FORCE SUPPLY	
1	Labor supply
2	Labor cost
FIXED COST AND CAPITAL SUPPLY	
1	Cost of land
2	Construction costs
3	Cost of usage

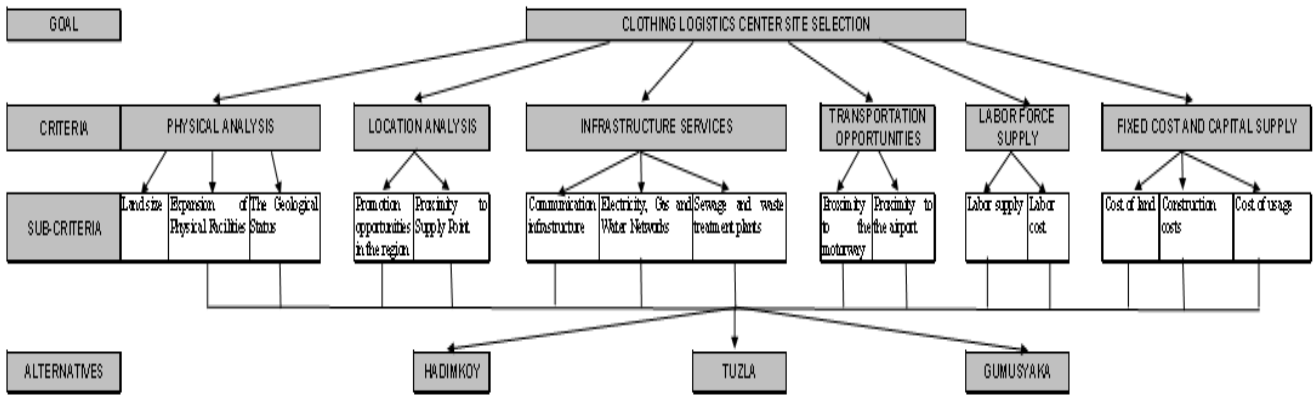


Figure 2. Hierarchical model for site selection clothing logistics center (18)

4.1. Evaluation 1: Manufacturer Firms-Sub-contractor User Firms

In this part, AHP results were investigated according to the manufacturer firms and firms that use sub-contractors. Figure 3 and Figure 4 show the site selection criteria weights of apparel manufacturers and apparel firms that use sub-contractors. When site selection model is evaluated in terms of apparel manufacturers and apparel firms using sub-contractor firms, it is seen that the most important criteria is fixed cost and capital supply with 28% and 32% share. As a result of evaluation, second the labor force supply and third transportation opportunities come.

Figure 5 shows the results of site selection criteria for apparel manufacturers. When site selection

model was evaluated in terms of apparel manufacturers Hadimkoy came in the first place with 34,8%. Gumusyaka was selected in the second place with 34,5% and Tuzla was in the third row with 30,6%. Striking result here was that, Gümüşyaka and Hadimkoy get almost equal weights. Apparel manufacturers disapproved building a clothing logistics center in Tuzla and they were evaluated Hadimkoy and Gumusyaka at the same level because apparel manufacturing is mostly concentrated in European part of the country. Apparel manufacturers gave high scores to the labor force supply and fixed cost and capital supply criteria. Especially, Gumusyaka and Hadimkoy were decided appropriate in terms of labor cost and cost of usage.

Figure 6 shows the results of site selection criteria for apparel

manufacturers. When site selection model was evaluated in terms of apparel firms that use sub-contractors Hadimkoy came in the first place with 37,2%. Gumusyaka was located in the second place with 31,2% and Tuzla was in the third row with 31,6%. Apparel manufacturers who use outsourcing (sub-contractor) companies preferred Hadimkoy as a first place for a logistics center establishment because this region is a busy area in terms of transportation opportunities and labor force supply and the concentration of garment manufacturers is also high. Moreover, widely used Ambarli Port and Ataturk Airport are very near to Hadimkoy. Since these firms outsource their production Hadimkoy were evaluated very positively by the companies and Tuzla and Gumusyaka were evaluated equally important by the companies.

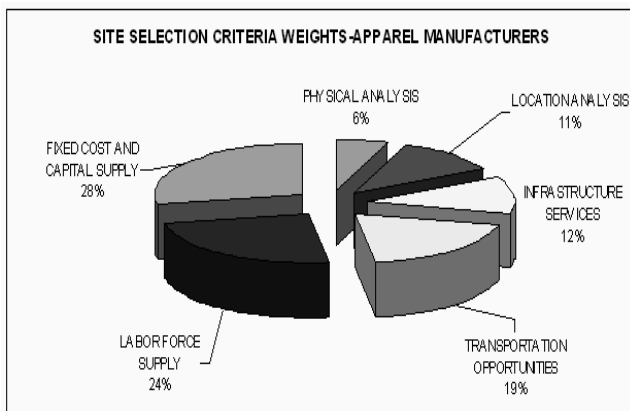


Figure 3. Site selection criteria weights of apparel manufacturers

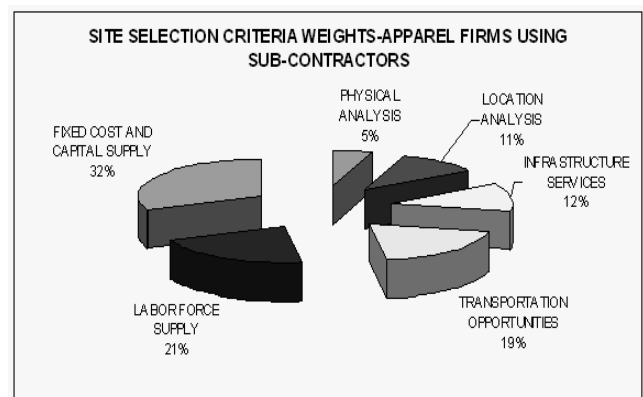


Figure 4. Site selection criteria weights of apparel firms using sub-contractors

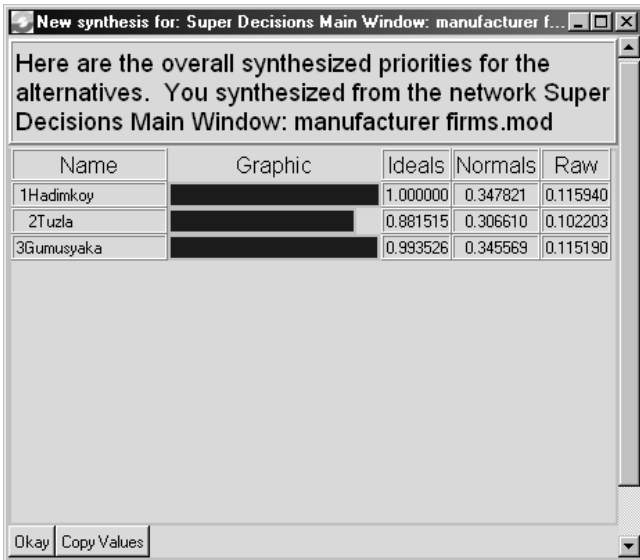


Figure 5. The result of clothing logistics center site selection decision of apparel manufacturers

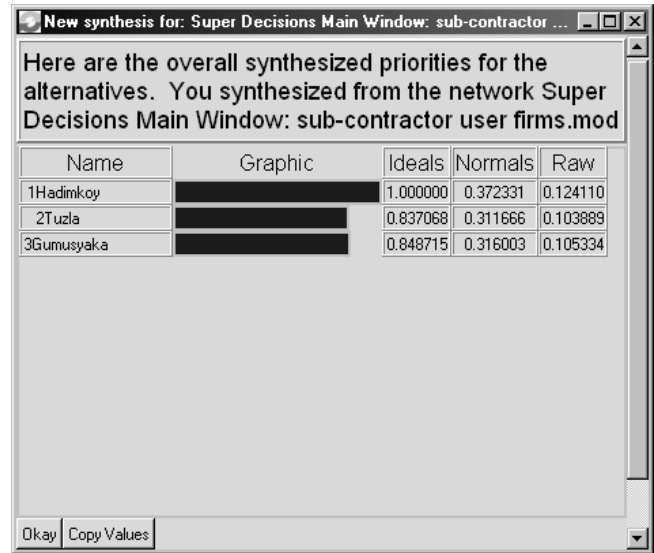


Figure 6. The result of clothing logistics center site selection decision of apparel firms that use sub-contractors

4.2. Evaluation 2: Firm Type (Knitted and Woven garment manufacturers)

In the second part, AHP results were investigated according to the types of manufacturers. Figures 7, 8 and 9 show the site selection criteria of manufacturers. Knitted garment manufacturers mostly gave emphasize fixed cost and capital supply with 32% and then labor force supply with 24%. Woven garment manufacturers attached equal importance the fixed cost and capital supply and transportation opportunities of 25%. Manufacturers that have both woven and knitted garment production selected fixed cost and capital supply (31%) as a first criterion and labor force supply (23%) as a second criterion.

Knitted garment manufacturers selected Gumusyaka as the best place to establish clothing logistics center

(Figure 10). Woven garment manufacturers and firms having both types of manufacturing facilities selected Hadimkoy as the most suitable for a clothing logistics center (Figure 11 and Figure 12). Tuzla and Gumusyaka were evaluated equally for the companies. Knitted garment manufacturers take care of fixed cost and capital supply with 31% and then labor force supply so they chose Gumusyaka for the logistics center establishment. Gumusyaka is outside but very near to the Istanbul and cheaper than Istanbul. However, woven garment manufacturers evaluate fixed cost and capital supply and transportation opportunities with nearly equal proportions so Hadimkoy was found more suitable because of its location.

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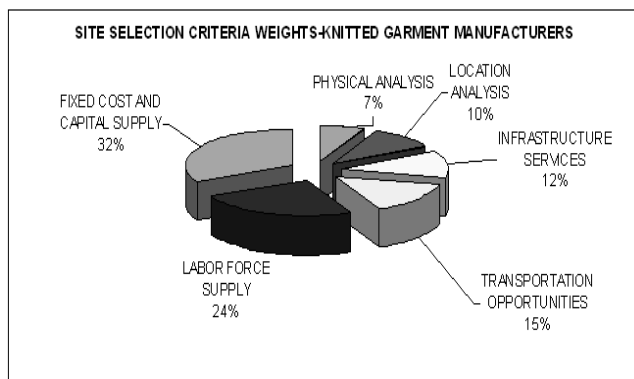


Figure 7. Site selection criteria weights-knitted garment manufacturers

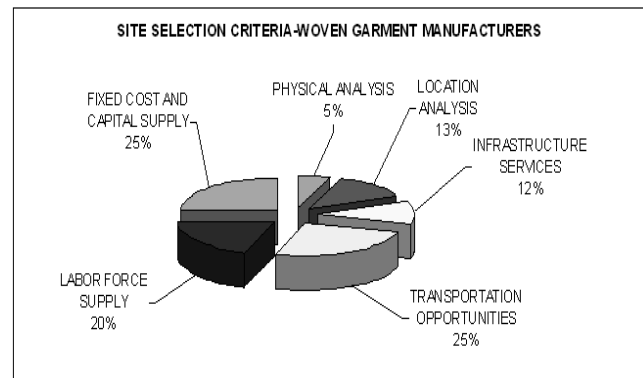


Figure 8. Site selection criteria weights-woven garment manufacturers

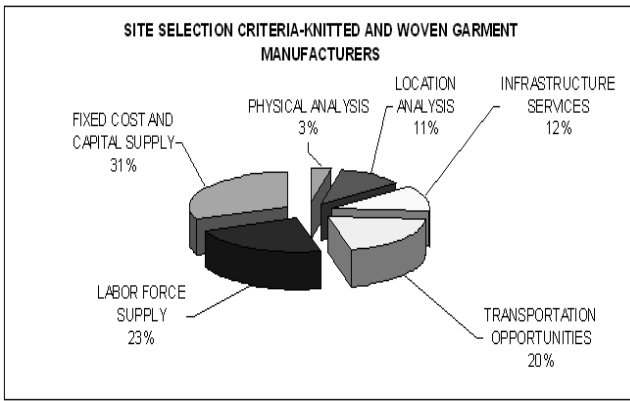


Figure 9. Site selection criteria weights-knitted and woven garment manufacturers

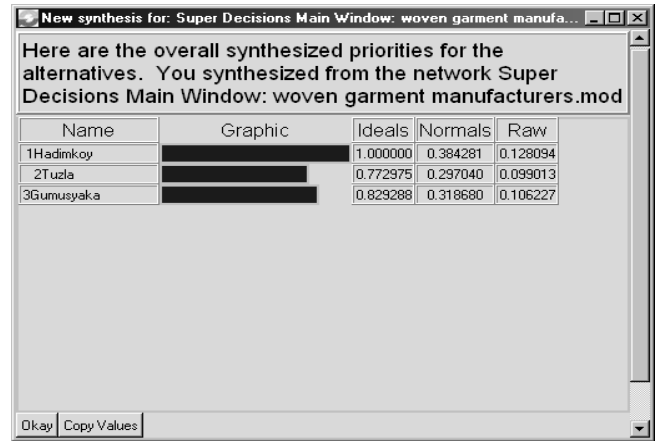


Figure 11. The result of clothing logistics center site selection decision of woven garment manufacturers

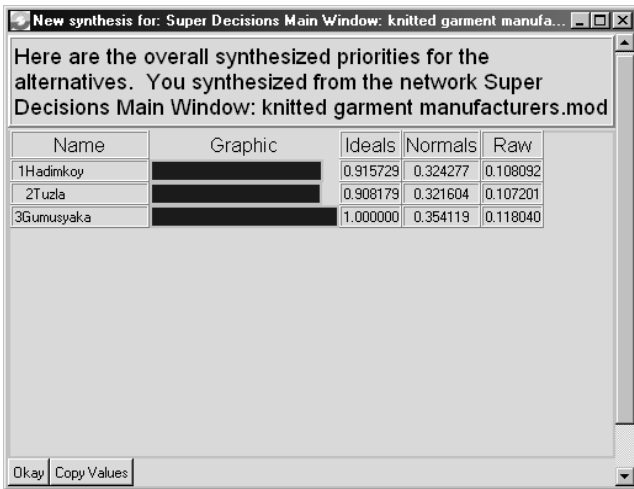


Figure 10. The result of clothing logistics center site selection decision of knitted garment manufacturers

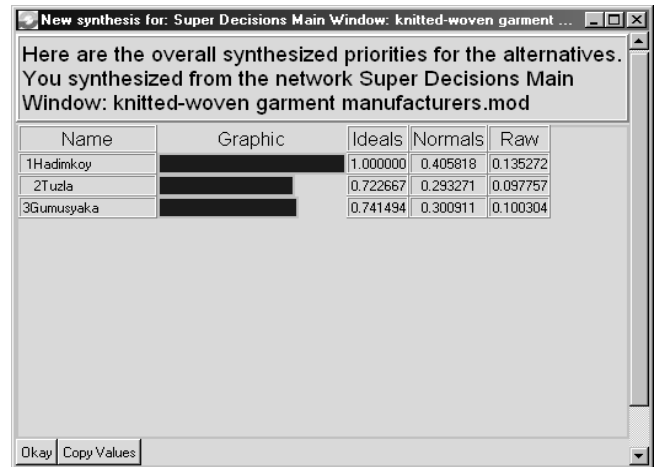


Figure 12. The result of clothing logistics center site selection decision of both knitted and woven garment manufacturers

5. CONCLUSION

The objective of this research was to find the best place for a logistics center for clothing industry. A case study methodology was selected and an AHP based questionnaire was applied to 55 clothing companies located in Marmara Region in Turkey. Clothing firms were evaluated and classified according to their manufacturing facilities. 32 firms have their own manufacturing facilities and 23 firms outsource their facilities to sub-contractor firms.

Although, all of three places have good transportation opportunities like being very close to the port, airport, highway and railway, results showed that

Hadimkoy was preferred as the first place to establish a clothing logistics center by all of the apparel companies. Hadimkoy is a busy area in terms of transportation opportunities and labor force supply and most of the garment manufacturers are located in this area. Also Turkey's biggest airport (Ataturk Airport) and high-capacity port (Ambarli Port) are very close to the Hadimkoy. Apparel manufacturers disapproved building a clothing logistics center in Tuzla and they gave high scores to Hadimkoy and Gumusyaka because apparel manufacturers are mostly concentrated in European part of the country. Apparel firms that use sub-contractors evaluated Tuzla and Gumusyaka equally because they outsource their production facilities and

only concentrate on marketing, branding and retailing activities. Hadimkoy is a commercially intensive place so this is the best choice for establishing a logistics center. Knitted garment manufacturers preferred Gumusyaka for the logistics center because of its cost advantages. On the other hand, woven garment manufacturers and companies that have both types of manufacturing facilities preferred Hadimkoy because as specified before Hadimkoy is commercially intensive and has good transportation opportunities than the other candidate places.

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