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Logistics Centre Design for the Turkish Clothing Industry

Abstract
Global expansion is the key to success for many firms and an effective logistics system is essential to the success of a global marketing effort. Developing a successful logistics strategy depends on the company's individual supply chain in terms of their major product services and competitive challenges. The clothing industry is one of the most competitive and high value-added sectors in the world, which also has a complex supply chain structure consisting of a number of discrete activities. Logistics is a very important strategy to gain competitive advantages like time, cost reduction and customer satisfaction. The objectives of the study were to determine the activities, services, ownership and management structures and the corresponding size of the areas of a logistics center required for the Turkish clothing industry. A two-stage numerical study with a questionnaire survey database aimed at the clothing industry of Turkey was conducted.

Key words: *logistics center design, turkish clothing industry, competitive strategy.*

Introduction

The development of a responsive logistics strategy is crucial to the overall success of an organisation. Today, firms are looking for ways to integrate their logistics activities both internally and externally. An organisation's chosen logistics strategy is based on its size, strength, costs and customer objectives. However, any size or type of firm must develop a flexible, long term plan for using the power of logistics to increase the value delivered to its customers.

Many logistics activities have been affected by the growing needs and continued expansion of the global business environment. Firms must find a way to integrate their logistics systems with those of their channel members. There is a need to maximise the value added to each activity in the supply chain for both customers and suppliers [1].

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 the different sizes, colours, and cuts of a collection require very efficient and optimised logistics. Furthermore time efficiency is one of the key factors for this industry to provide its competitive advantage [2].

In the first part of the study, a profile of the clothing industry in Turkey and its position in the world was provided. Moreover, the situation of the logistics sector in Turkey and the world and an evaluation of logistics as a globalisation strategy in the clothing industry were presented [3]. In this part of the study, logistics are presented as a strategic solution for Turkish clothing companies. Building on the questionnaire, the designing of a logistics centre for the Turkish clothing industry and important variables were discussed with experts working in the clothing industry by using the face to face interview method.

Literature review

The globalisation of markets and competitiveness has forced many companies to go for global operations. In order to compete in such a competitive environment, companies have started to decentralise their operations with the objectives of focusing on core competencies and building virtual enterprises through strategic alliances. As companies operate globally, the integration of various processes along the supply chain or among the network of firms (through the physical inflow of materials, manufacturing and the physical outflow of materials) poses a great challenge in the supply chain. This necessitates the use of appropriate logistics resources to ensure the timely reaching of the right products and services to the market [4].

A freight village is defined as a specific area where all 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 centre should preferably be served by a variety of transport modes (roads, rail, sea, inland waterways, and air) [5]. UNECE has defined freight transport as a geographical grouping of independent companies and bodies which deal with freight transport (for example, freight forwarders, shippers, transport operators, customs) and have accompanying services (for example, storage, maintenance and repair), including at least a terminal [6].

Tsamboulasa and Kapros presented a method and models for assessing the financial viability of a new Freight village financed by private and public investments. The paper presented the overall methodology and presented analytically the evaluation method with the corresponding model. An application of the methodology and models developed was made in the case of a Freight village in Northern Greece, demonstrating its potential for application in similar cases [7]. Sheu presented a hybrid neuro-fuzzy methodology to identify appropriate operational modes for global logistics (GL) used for global supply chain management [8]. A numerical study with a questionnaire survey database aimed at the information technology industries of Taiwan was conducted to illustrate the

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applicability of the method proposed. Chen et al. studied 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 centres at undetermined locations, as well as a number of given customer zones [9]. Ellinger et al. proposed that market orientation and certain employee development practices (service-related training, coaching and empowerment) influenced both employee and organisational performance, building on the resource-based view of the firm. The hypotheses were tested using data from 123 large logistics service provider organisations [10].

Llach et.al. tried to identify differential traits of successful SMEs (Small and Medium Enterprises) in comparision to average SME firms in the textile and clothing sector [11]. They used a multiple case-study of 12 firms based on qualitative and quantitative data obtained from interviews. The results indicated that a higher R&D intensity and knowledge acquisition do not explain success. Successful companies had a higher level of innovation capacity and niche strategy.

Kingsley et.al. reported on an empirical study that examined a suite of distribution and logistics services commonly used to manage inbound materials en route to plants [12]. The sourcing decision was examined through the lenses of transaction cost economics and the resource-based view of the firm, the results of which lend limited support for both theories in the context of such services. The results further indicated that there is little evidence supporting differences between internal versus external decision-makers.

As mentioned above, there have been many studies related to global logistics, freight villages, logistics and supply chain performance, transportation and warehousing management, quality management in logistics, buyer–supplier relationships, information technology, performance measures and metrics in logistics. The concept of flow has become particularly important in logistics and freight distribution. In particular, transport terminals and freight distribution centres have been the major elements permitting improvements in the efficiency and throughput of commodity chains,

from global production networks to local distribution.

In our previous studies, the first globalisation strategies of the Turkish clothing industry were evaluated, and an external analysis of the industry was presented [13]. Then the clothing industry was analysed in terms of logistics [3]. This study aims to evaluate a logistics centre as a competitive strategy to gain advantages like time, cost reduction, and customer satisfaction for Turkish clothing producers in Istanbul, Turkey. The activities, services, ownership and management structures and the corresponding size of the areas of a logistics centre required for the Turkish Clothing Industry were determined using data obtained by means of in-depth interviews.

Research objectives and data collection

Research objectives

As stated earlier, a freight village is defined as a specific area where all activities relating to transport, logistics and goods distribution, both for national and international transit, are carried out by
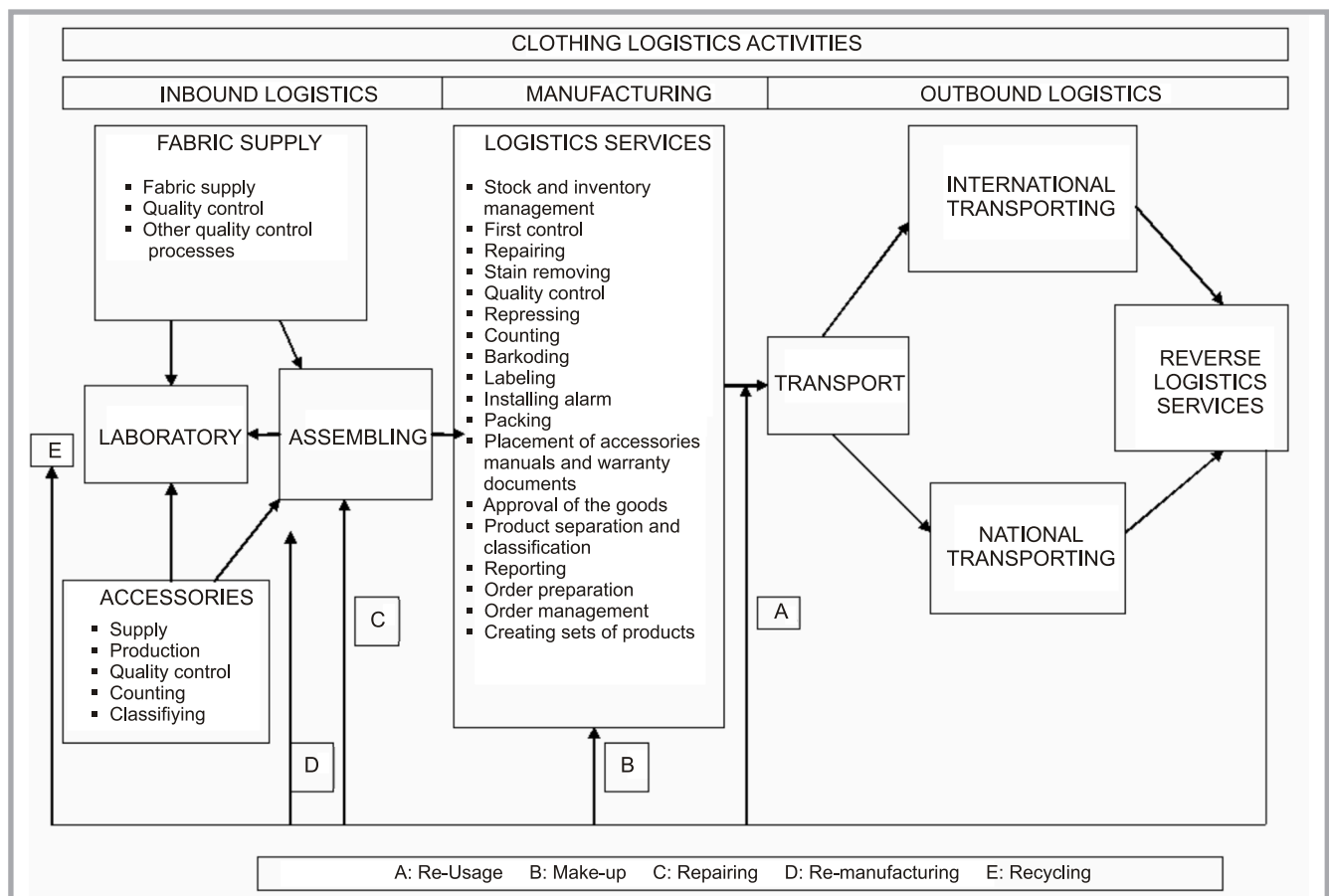

Figure 1. Logistic cycle of the clothing sector [16].

various operators. As distinct from a classic freight village, this article presents a different concept of a logistics centre which has been developed to offer common services and activities to clothing enterprises as well as comprehensive transport and logistics services. This study is a design work for the establishment of a clothing logistics centre, the main objectives of which comprise the determination of the activities, services, ownership and management structures, current sourcing structures and the corresponding size of the areas of a logistics centre required for the Turkish clothing industry. The content of the research are shown in detail below;

1. Deciding on the necessity of a logistics centre for the Turkish clothing industry,
2. Specifying the ownership, finance and management structure of the logistics centre,
3. Determining the necessary clothing production activities and facilities that should exist in a logistics centre,
4. Determining the general logistics activities, services and auxiliary services that take place in a logistics centre,
5. Allocating a corresponding size to the areas according to data gathered from the questionnaire.

Methodology and Sample:

The research design methodology for this study was in a two-stage case study form involving 75 Turkish clothing manufacturers. In the first stage, the main design questionnaire was applied to 20 clothing manufacturers and after the evaluation process; the second stage of the methodology was applied to 55 clothing manufacturers. Qualitative and quantitative data were gathered via a questionnaire which was completed by members of the management teams of randomly selected clothing firms in Turkey. The method of collecting data during these studies was face-to-face interviews with management teams at their workplace. The sampling of this research represents convenience sampling since the information was collected from expert management teams of each of the clothing firms, who could be relied upon to provide the answers to the questionnaire [14]. Analyses were conducted using frequency analyses, histograms and percentages. Approximately 49% of Turkish apparel companies are located in Istanbul, hence the questionnaire was administered in the Marmara Region. The number of firms interviewed

was equal to 11.39% of the sample in terms of the sample/mass, the value of which for the sample size selected is of an adequate level [15].

■ **Results and conclusion**

First questionnaire results

In this study, logistics centre facilities were first analysed. The necessary logistics activities and services were determined by an intensive research of literature and by individually discussing with logistics and clothing sector professionals. All aspects were discussed, including transportation, logistics, value-added services and worker services for clothing enterprises. As a result of this work, *Figure 1* was obtained, showing logistics services of the clothing sector. Depending on this structure, logistics activities of the clothing sector were evaluated in three stages: inbound logistics, logistics activities of manufacturing and outbound logistics. Then the questionnaire content was created and data collected from the sector. The data collection process took place using face-to-face interviews with the management teams of clothing companies.

The first stage of the case study involved 20 clothing manufacturers. The following question: "*Is the establishment of a clothing logistics centre necessary?*" was posed to the companies, and nearly all the enterprises surveyed expressed very positive opinions on the establishment of a logistics centre for a clothing company. Only one firm answered this question negatively (*Figure 2*).

To specify the ownership, finance and management structures of a clothing logistics centre, the question "*Who should be affiliated with the ownership, financing, and management form of a clothing logistics centre?*" was posed to the people interviewed. Thirteen firms (65% of the sample) selected a private ownership structure for a clothing logistics centre (*Figure 3*). When the financial structure was evaluated, twelve firms (60% of the sample) selected the private sector (*Figure 4*). As for the management structure, once again most of the firms (80% of the sample) selected a private sector structure (*Figure 5*).

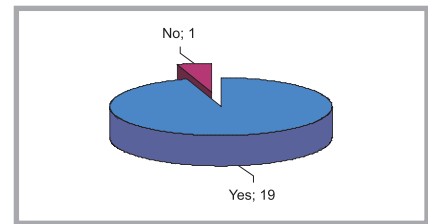After investment decisions on the infrastructure were made, it was necessary to determine the land and building owner-

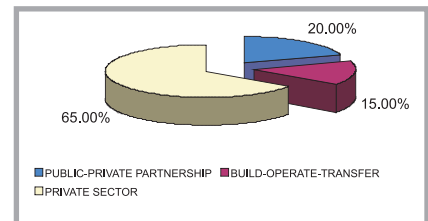***Figure 2.*** *The establisment of a clothing logistics centre is necessary.*

Figure 3. *Ownership structure of a logistics centre.*
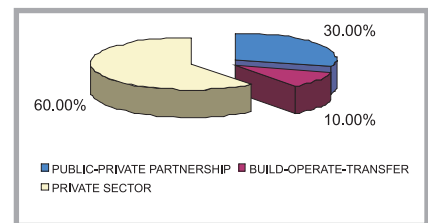
Figure 4. *Form of financial structure of a logistics centre.*
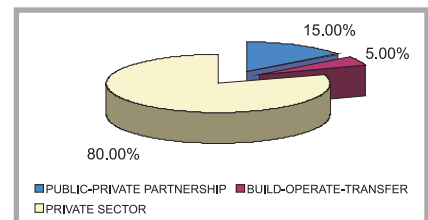
Figure 5. *Management form of a logistics centre.*
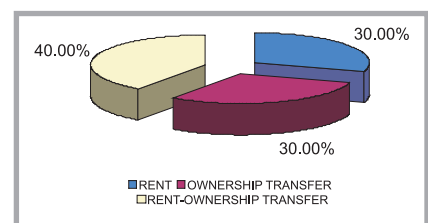
Figure 6. *Land and building ownership of a logistics centre.*

ship structures (*Figure 6*). 40% of the sample surveyed opted for a rental ownership structure for land and buildings. On the other hand, ownership transfer and rent-ownership transfer options had the same level of votes (30%) from the clothing companies (*Figure 6*). Because the values of the results were very close

| Clothing activities	OK (expert number)	OK, %	Outsourcing rate, %
Finished product store	17	85	15
Inspection room	16	80	50
Representative firms	16	80	53
Trade centre - Showrooms	15	75	10
Distribution preparation (order preparation, product differentiation, classification, product set, assortment building)	14	70	28
Fabric warehouse and bonded warehouse	13	65	8
Packaging /hanging goods	13	65	29
Design offices	13	65	16
Laboratory	12	60	56
Accessories warehouse and bonded warehouse	11	55	10
After production/before distribution operations	11	55	26
Embroidery workshop	10	50	91
Sewing and garment production	9	45	50
Cutting room	8	40	27
Printing workshop	8	40	92
Pattern room	8	40	5
Accessories production	5	15	99

to each other, it was decided to ask this question again in the second evaluation stage of the study.

The definition of activities, facilities and services offered as well as corresponding dimensions of a clothing logistics centre were examined by considering the companies' responses to the questionnaire. Firstly, as an evaluation method, the ar-

Table 2. Clothing facilities.

Clothing activities/facilities	OK (expert number
Fabric warehouse and bonded warehouse	**13**
Fabric supply	11
Fabric quality control	12
Accessaries warehouse and bonded warehouse	**11**
Accessories supply	11
Quality control	12
Counting and classifying	11
Other raw material supplies	11
Other raw material quality control	11
Last operations before distribution	**11**
First control	11
Repressing	12
Counting	11
Barkoding	11
Labeling	11
Installing alarm	10
Placement of accessories manuals and warranty documents	11
Last control	12
Repairing	11
Stain removing	12

ithmetical mean was calculated as 57.2%. Activities getting more than this value were selected to be included in a logistics centre. The standard deviation value was also calculated as 18.8%. It was decided to eliminate the activities that got less than an "Arithmetic mean – standard deviation" value of 38.4%. The activities that got scores between the "Arithmetic mean – standard deviation" value (38.4%) and the arithmetic mean (57.2%) were chosen to be asked about again in the second part of the questionnaire. As can be seen from **Table 1**, more than half of the clothing companies specified that a finished product store, inspection room, representative firms, a trade centre, distribution preparation, a fabric warehouse and bonded warehouse, design offices, laboratory, and packaging/hanging goods should be included in a clothing logistics centre. An accessories warehouse and bonded warehouse (55%), after production before distribution operations (55%), an embroidery workshop (50%), sewing and clothing production (45%), a printing workshop (40%), a cutting room (40%), and pattern room (40%) were selected to be evaluated again in the second phase of the questionnaire.

When the outsourcing rates of production activities were examined in detail, it was seen that companies had a low level of outsourcing rates. This showed that the majority of companies still operated their own production facilities. Because pattern room activities must be quick

and generally secret for design activities, companies continue their own pattern room activities or they only outsource 5% of thereof.

Table 2 shows some clothing facilities and services that may be provided in a logistics centre. Some clothing companies have started to outsource such operations that can be performed anywhere, providing significant advantages to the clothing companies, such as time and cost reduction. Some value-added services were also evaluated by the companies shown in **Table 3**, more than half of which stated that apart from order management, sales tracking and application and purchasing, all other activities should be undertaken at a clothing logistics centre.

A clothing logistics centre must offer comprehensive transport services (transshipment, handling, administrative operations) and basic logistics services. **Table 4** shows the results of interviews about the basic logistics services that must be in a logistics centre. Only a railway terminal was found to be unnecessary because the railway infrastructure and transportation have not been adequately developed in Turkey. All of the other services were found to be necessary for a logistics centre.

Results of second questionnaire

In the second part of the study, we attempted to identify the land and build-

Table 3. Facilities of a clothing logistics centre.

Clothing logistics centre facilities	OK (expert number)	Outsourcing rate, %
Trade serwices	15	20
Loading optimization	15	6
Fair and exhibitions logistics	14	10
Customer service management	14	4
Stock and inventory management	13	0
Information technology solutions (warehouse management software / shipping management software / order management / tracking)	13	11
Reverse logistics	13	5
Demand and supply management	12	0
Order management	7	0
Sales tracking and application	6	4
Purchasing	6	0

ing ownership structure, logistics centre activities and facilities that were not decided upon in the first section of the research, as well as the capacity of the logistics centre and space required for clothing and logistics activities. The question: "Is *the establishment of a clothing logistics centre necessary?*" was posed to 55 clothing companies, 46 of which answered "yes" for the establishment of a clothing logistics centre. 49.09% of the sample surveyed opted for a rental ownership structure for land and buildings (*Figure 7*).
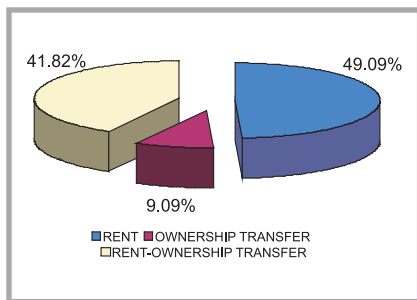

Figure 7. *Land and building ownership of a logistics centre.*

The activities, facilities and services offered, as well as corresponding dimensions in a clothing logistics centre were examined by considering the companies' responses to the questionnaire (*Table 5*). According to the decision method used in the first section of the case study, the facilities rated lower than 60% were not to be part of a logistics centre, whereas those rated over 60% were to be included in a logictics centre. As a result, it was decided that other raw material supply and quality control from accessories storage operations, a cutting room, sewing room, printing and embroidery workshops and a pattern room were not to be included in a clothing logistics centre.

Table 4. *Facilities of a clothing logistics centre.*

	Facilities	OK (expert number)
Logistics centre facilities	Intermodal terminal	19
	Airway	15
	Seaway	14
	Railway	6
	Distribution centres	16
	International shipping	16
	Customs	16
	Transport/logistic companies	15
	Container park	15
	Free trade zones	15
	Truck park	15
	National shipping	14
Auxiliary services	Cleaning services	19
	Security	19
	General administration building	18
	Social facilities	18
	Food and drink outlets	17
	Passenger carparks	17
	Building and field maintenance & repair	16
	Health centre	15
	Conference and meeting places	14
	Hotels for drivers	14
	Bank, mail courier services	13
	Vehicle maintenance and repair services	13
	Hotels for customers	13
	Insurance companies	13
	Petrol stations and car wash centres	13
	Public transport and inland transport services	12

Table 5. *Clothing activities in a logistics centre.*

Clothing activities/ Facilities	OK (expert number)	Outsourcing rate, %
Accessories warehouse and bonded warehouse	**40**	**72.73**
Accessories supply	38	69.09
Quality Control	36	65.45
Counting and classifying	33	60.00
Other raw material supplies	29	52.73
Other raw material quality control	28	50.91
Last operations before distribution	**39**	**70.91**
Barkoding	35	63.64
Counting	33	60.00
Labeling		
Installing alarm		
Last control		
Repressing	31	56.36
First control	29	52.73
Placement of accessories manuals and warranty documents		
Stain removing		
Repairing	28	50.91
Laboratory	**36**	**65.45**
Pattern room	**23**	**41.82**
Cutting room	**21**	**38.18**
Emboidery workshop		
Printing workshop	**20**	**36.36**
Sewing room	**18**	**32.73**

Table 6. *Facilities of a clothing logistics centre.*

	Clothing facilities	OK (expert number)	OK, %	Outsourcing rate, %	Turkey clothing production, piece/month	Clothing logistic centre capacity, piece/month	Unit space, m2/piece	Total space required for a clothing logistics center, m2
First questionnaire results	Accessories production	3	15.00	99.00				
	Fabric warehouse and bonded warehouse	13	65.00	3.82		5,275,156	0.0012	6,330
	Packaging/hanging goods	13	65.00	11.76		16,224,756	0.0025	40,562
	Distribution preparation (Order preparation. product classification)	14	70.00	11.47		15,824,656	0.0026	41,144
	Finished product store	17	85.00	13.24	137,965,615	18,266,647	0.0053	96,813
	Inspection	16	80.00	58.97		81,358,323	0.0016	130,173
	Design offices	13	65.00	8.53		11,768,467	0.0005	5,884
	Trade centre-show rooms	15	75.00	3.53		4,870,186	0.0010	4,870
	Representative firms	16	80.00	68.24		94,147,736	0.0004	37,659
Second questionnaire results	Cutting room	21	38.18	12.21				
	Sewing room	18	32.73	30.88				
	Printing workshop	20	36.36	87.35				
	Embroidery workshop	21	38.18	87.79				
	Pattern room	23	41.82	2.94				
	Accessories warehouse andbonded warehouse	40	72.73	3.53	137,965,615	4,870,18	0.0015	7,531
	After production / before distribution operations	39	70.91	12.06		16,638,653	0.0053	88,185
	Laboratory	36	65.45	47.35		65,326,719	0.0004	26,131
Total space								**485,283**

Table 7. Areas of general logistics facilities and auxiliary services for a clothing logistics centre.

Facilities	Space requirement inside a logistics center, %	Space, m²
Distribution centres	10.70	89.635
Intermodal terminal	6.20	51.938
TIR park	9.22	77.236
Container park	8.39	70.284
Office spaces	1.51	12.649
Passenger vehicle parking areas	0.68	5.696
Public service areas	2.37	19.854
Auxiliary service areas	3.00	25.131
Total		**352.423**
Logistics facilities	42.07	352.423
Clothing facilities	57.93	458.283
Total space	**100.00**	**837.706**

Results for clothing logistics service facilities obtained from the first and second questionnaires are shown in **Table 6** (see page 21). First the area and production quantities/month of the firms were obtained, and the unit area (m²/piece) was calculated. Then using the monthly clothing production quantity of Turkey and the mean outsourcing usage percentages of the firms, the production capacities of the clothing facilities inside the logistics centre was calculated. Finally these production capacities were multiplied by the unit area and the necessary space for each facility was calculated. According to this calculation method, the area for clothing facilities required in a clothing logistics centre should be 485.283 m².

In the first section of the questionnaire, it was decided that the facilities in **Table 7** were to be located in a logistics centre. In order to identify the necessery areas for these facilities, twenty logistics centres located in Europe were examined [5]. As a result of the investigations, the percentages of the facilities inside the total area of the logistics centres were found. As a result, it was calculated that 485.283 m² for clothing facilities, 352.423 m² for logistics facilities and a total space of 837.706 m² were required for a clothing logistics centre.

■ Conclusions

The textile and clothing sectors can be seen as a supply chain, from the sourcing of raw materials and production to distribution and marketing, which is organised as an integrated production network. For this reason the successful combination of highly sophisticated logistics structures has become a requirement for success.

This study aimed to outline the main framework of a clothing logistics centre. The objectives of this work included determining the activities, services, ownership and management structures, current sourcing structures and the corresponding size of the areas of a logistics centre required for the Turkish clothing industry.

In the study, firstly a detailed analysis of logistics centre facilities was made. The necessary logistics activities and services were determined, and clothing sector logistics activities were classified into three classes: inbound logistics, manufacturing logistics activities and outbound logistics. After creating the basis of the study, the data collection process was started. The need to establish a logistics centre was examined by interviewing people, and nearly all the enterprises surveyed expressed very positive opinions. The large majority of firms chose the private sector for the ownership, finance and management structures of a clothing logistics centre. Then the definition of activities, facilities, services offered and corresponding dimensions in a clothing logistics centre were evaluated.

The results of this study make a useful contribution to the industry as well as to academia in the detection of changes in the structure of clothing production and logistics systems. This study also provides a preliminary design work for a clothing logistics centre, which has not been studied before in literature.

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