A COMPREHENSIVE ANALYSIS OF THE LOGISTICS SECTOR IN TURKEY TO IDENTIFY THE REQUIREMENTS FOR TECHNOLOGICAL IMPROVEMENT

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ABSTRACT

Supply Chain Management is a management philosophy developed after realizing the necessity of coordinating the firms in order to increase profitability and survive in the market under the circumstances of rough and rapidly increasing global competition. According to this philosophy, all the processes from raw material procurement to final product sales and all the players who take place in these processes are the links of a chain. The success of the supply chain depends on the success of the each member across the chain, however the success of individual participants itself does not mean a successful SCM application is achieved. Hence the paper aims at analyzing the basic actors of the logistics sector in Turkey; namely logistics service providers, logistics service customers, the equipment and hardware providers, and logistics information system providers to reveal the snapshot of each party and to point out the gaps regarding requirements of different sectors and offered services. A field study involving face-to-face interviews with each of the 428 companies operating in the logistics sector as customers, service providers, information systems providers or equipment providers was performed for the research. The requirements for technological improvement in these four perspectives as well as in the logistics sector globally are identified by exposing open-ended questions of the interviews. The requirements are sorted according to the

strategic considerations of the sector stakeholders. Finally a global result is established for the logistic sector by using order weighted averaging operator.

Keywords: logistics service providers, logistics service customers, logistics equipment and hardware providers, logistics information systems providers, Turkey

INTRODUCTION

In the search for a competitive edge in today's turbulent and dynamic environment, business managers increasingly recognize the potential and significance of supply chain management (SCM) (Ballou, 2004). Since the 1980s, increasing global competition and attempts to find critical success factors for competitive advantage have forced companies to consider alternatives in sourcing, manufacturing, distributing and selling their products worldwide. Certain developing countries, especially Turkey, have become important to many international companies because of their geopolitical status, low labour cost, potential growth in their markets, etc. Companies entering emerging markets face a strategic challenge in the effective management of their supply chain activities.

Supply chain management activities supported by efficient logistics infrastructure will have a dominant role in the success of global firms entering emergent markets. However, these companies often face potential dangers as they globally expand their supply chains. The advantages of the developing countries are mostly reduced due to the lower quality and less reliable products and services. The promise of cheap labour may mask the threat of reduced productivity, often requiring expensive training. That is why; the global firms need to obtain information of logistics infrastructure from different perspectives in different developing countries. In the literature, research relevant to setting useful SCM guidelines in decisions to enter emerging markets appears to be meagre. Yet, it is known that effective SCM activities play indispensable roles in providing a competitive advantage. However, this necessitates efficient handling of a complex logistics network with widely dispersed nodes and different stakeholders. Thus, effective usage of logistics infrastructure as well as coordination of the stakeholders is very important. This study is an initial attempt to highlight the logistics sector in Turkey from different perspectives.

This study analyzes the basic actors of the logistics sector in Turkey; namely logistics service providers (LSP), logistics service customers (LSC), logistics equipment and hardware providers (LEHP), and logistics information system providers (LISP). It is based on the results of in-depth interviews conducted in 2007 with companies which could be regarded as either LSP, LSC, LEHP, or LISP; thus, consists of four modules (see Figure 1). A field study involving face-to-face interviews is performed with 428 companies operating in the logistics sector as LSPs, LSCs, LEHPs or LISPs. The requirements for technological improvement from the point of view of each actor individually, as well as globally for the whole logistics sector, are identified by analyzing answers to open-ended questions throughout the interviews. The requirements are classified according to the strategic considerations of the sector actors, using a prioritizing approach. Finally an analysis is conducted for the logistics sector by using an ordered weighted averaging (OWA) operator to highlight the requirements in an aggregated way. The interview lists were prepared using the lists of UTIKAD (the

Freight Forwarders & Logistics Service Providers Association in Turkey) and UND (International Transporters' Association of Turkey) - member institutions for LSPs, the ISO (Istanbul Chamber of Industry) sector classification for LSCs and sector research for LEHPs and LISPs.

The target population of the research is comprised of the groups below with varying expectations.

1. *Logistics Service Providers*: This group consists of local and international companies which have been providing or are planning to provide some of the integrated logistics services under the roof of logistics and the foreign logistics companies planning to enter the Turkish market.
2. *Logistics Service Customers*: This group includes companies which have been purchasing or are planning to purchase logistics services of varying sizes and are operating in all sectors where there is a movement of products/services.
3. *Logistics Equipment and Hardware Providers*: The companies in this group can be listed as companies providing the logistics sector with forklifts, transpallets, conveyor belts, rack systems, turn-key warehouse systems (building and equipment), cranes, transtainers, pallets, warehouse security systems and occupational security systems.
4. *Logistics Information Systems Providers*: The companies in this group are those developing and selling software and applications related to logistics. As examples of these applications; Enterprise Resource Planning - ERP, Supply Chain Management, Advanced Planning and Scheduling, Transportation Management, Satellite Tracking Systems, Warehouse Management Systems, Barcode software and hardware services can be given.

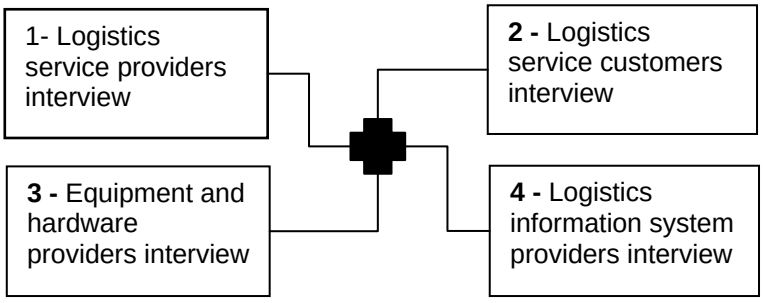

Figure 1 – Turkey logistics sector interviews

The first module provides evidence on logistics service providers in terms of types of logistics services that they offer, their fleet configuration and fleet ownership status, their usage of different transport modes, the problems that they encounter during their operation, their logistics service contract configuration, as well as the existence of strategic planning activities in their company. In the second module, the study investigates the types of in-house and outsourced logistics services in the companies operating in Textile, Retail, Pharmaceutical, Chemicals, Machinery, Automotive, Construction, FMCG, Packaging, Computers and Electronics, and Paper sectors. Additionally, the usage of different transport modes by different sectors, the critical factors that the industry takes into account in the selection of the outsourcing firms, the usage of information technologies and the basic reasons for using them for the coordination of different logistics activities are underlined. In

the third module, the research highlights the services provided by the logistics equipment and hardware providers as well as the main logistics areas that necessitate the use of new technologies and the main drivers of these needs. Finally in the fourth module, the research analyzes the logistics systems from the perspective of logistics information system providers. The information system technologies provided by these firms as well as the information technology opportunities that they offer for different logistics activities, the areas necessitating the use of new technologies, and the basic drivers of these needs are revealed.

Technology is being used intensively in almost every function of logistics in terms of equipment and information systems. This research is based on interviews conducted with four different perspectives (logistics service providers, logistics service customers, logistics equipment and hardware providers, and logistics information system providers) of the logistics sector. A cross evaluation was performed on the research data to analyze the technological requirements of the participating companies. This research exposes the results of the interviews' following questions:

1. The requirements for technological improvement in the logistics sector.
2. The reasons for these requirements (strategic considerations).

As a result, a total of 428 interviews are conducted using in-depth interviews with the managers of the companies responsible for logistics activities. Each interviewee is asked an open-ended question about the technological requirements of their firm, and to indicate the top three requirements. Following this, the rationale for these requirements is examined in the form of a multiple choice question where the choices are as follows:

- Creating new applications in existing markets
- Entering new markets
- Competing with new technologies
- Other

The results of these questions are used to identify the requirements for technological improvement of the four actors as well as the whole logistics sector. Strategic considerations are taken into account to prioritize the requirements for technological improvement.

The paper is structured as follows: The second section provides the literature survey. The third section underlines the findings of the study. Finally conclusion and further suggestions are given.

LITERATURE SURVEY

Effective technology in general and information technology (IT) in particular have become necessary to support logistics processes (LaLonde and Masters, 1994). However, the literature on logistics and technology is mainly from the perspective of logistics users. For example, Ketikidis *et al*. (2008) investigated the current and future direction of the use of information systems for logistics and supply chain management in South East Europe but their survey was based on the enterprises that use logistics and it did not include other stakeholders such as logistics service providers. Their major findings suggest that companies and governments alike in that region do not seem to be ready to play a significant and demanding role in global supply chains. Current insufficiencies, including limited abilities

in building valuable forward relations, weak strategic planning and organization, and infrastructural problems are major obstacles to fast development in logistics and SCM.

Rönkkö *et al*. (2007) used the case example of a Finnish car transportation company to present the benefits of building enterprise information systems, but while this provides an item-centric data model for enterprise-wide operations control in transportation services, it does not aim to provide integration of the stakeholders in the supply chain.

Jin (2006) focuses on US apparel manufacturing companies and based on a mail survey the study highlights that not all of the information technology investments have equal effectiveness. The bigger the size of a firm (as measured by sales volume), the stronger the impact of IT is on the three aspects of supply chain performance; namely operational, strategic and financial performance.

Gutierrez and Duran (1997) empirically evaluated IT utilization in the logistics process in the Spanish detergents and electrical appliances sectors, focusing on the issues around information integration with third-party logistics. Their research shows that larger companies, as well as those most advanced in the outsourcing process of their logistics activities, use IT the most extensively, but the research does not analyze the method of technology-based interaction with those outsourcing firms.

Empirical evidence on the ways technology influences the stakeholders is very limited. Very few studies have addressed the relationship between technology and LSPs. For example, Lai *et al*. (2006) mentioned that they provide a pioneering study that investigates the relationship between IT and competitive advantages in LSPs. The paper analyses IT and its impact on competitive advantages in China's LSPs and provides an insight for LSP managers to improve competitive advantages using IT. Through the application of spline regression, they showed that IT significantly influences LSPs' competitive advantages, and these influences are non-linear.

Wang *et al*. (2008) used a questionnaire-based mail survey conducted in mainland China. Path analysis and spline regression are used to model the relationship between IT and the financial performance of LSPs. The study found that IT can significantly improve LSPs' financial performance, but the sample size is very small and a general conclusion cannot be drawn even for China.

Evangelista and Sweeney (2006) examined small Italian 3PLs using a field survey and analysed their information and communication technology. The research shows that there are important barriers to the successful adoption of information and communication technology by small scale Italian service providers.

Swartz (2000) showed that LSPs are seeking technology-driven applications like real-time dispatch, pickup and delivery, loading of trailers and delivery of trucks and they especially

highlighted the current trends in the new technology use by retailers during their logistics activities.
Ghiassi and Spera (2003) proposed an internet-based supply chain system for mass customized markets. This system is a technology-based SCM that utilizes Internet, object-oriented, Java and mobile intelligent technologies that will allow the manufacturer and its suppliers and subcontractors to quickly and efficiently produce and deliver products. However, the basic technology needs of the stakeholders are not specified a priori through a survey or literature analysis but are assumed to be only real-time availability of order and production data to all members.

Loebbecke and Powell (1998) proposed an integrated transport tracking system that aims for greater transparency and efficiency in the logistics chain, based solely on transport integration. The authors suggest that, although there is general agreement among organizations as to their desired results from inter-organizational systems planning for full-service logistics management, they need guidelines for such collaboration.

Pokharel (2005) analyses the current status of information and communication technology used in warehouse and transportation service providers in Singapore. The research based on a survey shows that these companies use information and communication technology but their usage level depends on the size of the company and the availability of the technology.

In fact, the literature survey given above shows that no study has been conducted so far analyzes the logistics sector-technology interaction from the perspective of different actors. This study therefore attempts to provide a much broader analysis of logistics sector-technology interactions in Turkey in order to reveal the gaps as well as the inconsistencies. It is based on a questionnaire survey conducted with the different actors of the supply chain and provides a pioneering study in this respect.

FINDINGS

In order to keep up with the speed of ever-changing technology, equipment and software has to be updated in a continuous manner. Although not a solution in itself, technology is one of the prerequisites to be satisfied for integration of the supply chain components and facilitation of information flow.
In this study common questions are directed to all parties related with their technological requirements, and the reasons behind these requirements.

Requirements for Technological Improvement

The participants of the interviews were asked an open-ended question about requirements for technological improvement considering logistics sector, infrastructure, and activities. Table I summarizes the responses from the participants.
When all participants are analyzed, it has been found that 29.4% of Logistics Service Providers, 26.7% of Logistics Service Customers, 36.4% of Logistics Equipment and

Hardware Providers and 15.6% of Logistics Information System Providers did not reveal any requirements for technological improvements at all (i.e. indicated as “no requirement” and “no idea”) . Although this question was an open-ended question it is surprising that the amount of firms that require any technological improvements considerably low. One requirement area mentioned only by LSPs is *developing technology in the production area*. The areas mentioned only by LSCs are *advanced planning and optimization*, *CRM*, *ERP*, and *improving financial software*. Only LEHPs mentioned need for *increasing R&D activities*, *materials management software*, *planning*, *energy saving*, *improving order processing*, *decreasing costs*, *production packaging system* as the areas requiring technological improvements. Only 5% of LISPs stated *improving transportation software* as a fundamental requirement in terms of technological improvement

Table I Requirements for Technological Improvement for all parties

Requirements	**LSP**	**LSC**	**LEHP**	**LISP**
Increasing/improving information technology use	19.8%	23.3%	5.0%	40.0%
Improving GSM/telephone/communication network	8.9%	2.1%	0.0%	10.0%
Marketing and customer management	3.0%	5.9%	0.0%	15.0%
Improvements in manufacturing technology	0.0%	14.6%	30.0%	5.0%
Developing automation systems	0.0%	1.7%	10.0%	0.0%
Product development	0.0%	16.0%	5.0%	10.0%
Using barcode and RFID systems	4.0%	5.2%	0.0%	5.0%
Using warehouse management software	3.0%	5.2%	5.0%	0.0%
Tracking systems	36.6%	4.5%	0.0%	10.0%
Improving human resources management	4.0%	0.0%	5.0%	15.0%
Cost reduction	23.8%	32.4%	20.0%	5.0%
Foreign joint ventures	10.9%	0.0%	20.0%	20.0%
Advanced planning and optimization techniques	0.0%	6.6%	5.0%	5.0%
Financial resources	1.0%	0.0%	0.0%	0.0%
No requirement	2.0%	3.5%	0.0%	10.0%
No idea	1.0%	0.0%	5.0%	10.0%

Initially open ended responses of the participants regarding the technological requirements in the logistics sector were analyzed and common areas are identified. As a result 14 different requirement areas were obtained as given in Table I. The frequencies of these requirements according to different perspectives are also reported. According to these frequencies given in Table I, all parties recognize the need for increasing/improving information technology use. Tracking system, improving GSM/telephone/communication network, and using barcode and RFID systems are the common areas mentioned by all parties except logistics equipment providers. Improvements in manufacturing technology is emphasized by LSCs, LEHPs, and LISPs. Interestingly, while Logistics Information systems providers do not underline the need for warehouse management software, the customers (LSPs, LSCs, and LEHPs) stressed the necessity of such products. For LSCs and LEHPs developing automation systems constitute essential improvements for attaining a better logistics performance. LSCs, LEHP, and LISPs

regard improvements in manufacturing technology and product development as areas requiring technological improvement. LSPs, LSCs, and LISPs see marketing and customer management among other requirement areas.

Strategic Considerations

In order to reveal the relationship between the requirements mentioned above and the strategic goals of participants, basic motives underlying these requirements were asked to each party. Table II shows list of strategic concerns stated by the modules along with the frequencies of the responses.

Table II Strategic Concerns of the modules

	LSP	**LSC**	**LESP**	**LISP**
Creating new applications in existing markets	25%	32%	20%	70%
Entering new markets	13%	27%	20%	40%
Competing with new technologies	22%	34%	20%	60%
Strengthening organizational structure	4%	8%	10%	15%
Reducing cost	6%	6%	10%	0%
Being able to control Production/sales effectively	4%	4%		15%
Providing customer satisfaction	16%	3%		5%
Responding to customer needs more quickly	6%	8%	5%	
Increasing production efficiency	2%	3%		
Moderating staff tracking	2%			
Communicating effectively with customers		1%		
Increasing capacity	2%	1%		
Being competitive				
Providing accurate information	2%	1%		
Placing right orders and shipping				
Performing legitimate requirements				
Controlling shipping and receiving	1%	1%		
Being more ethic	1%			
Moderating vehicle tracking	2%			

Each party mentioned different reasons in terms of their requirements. LSPs especially underline the necessity of technology improvements in order to increase their competitiveness, generate new application areas, provide better customer service, and to enter in the new markets. LSCs perceive the technological development as a vehicle to improve their competitiveness, provide new application areas, increase the service speed and enter new markets. On the other hand, LEHPs stated the above-mentioned improvements would serve in generating new application areas in the current markets, entering in new markets, increasing the competitiveness, decreasing cost, and increasing the service speed. Finally LISPs believe that such an improvement in technology will help to

develop new application areas, to enter new markets, to increase competitiveness and strengthen the organizational structure.

The above mentioned reasons can be concluded as main strategies for becoming successful in the sectors they operate. Hence, in this research it is aimed to analyze the requirements of the firms that should be met primarily in order to be competitive in their sectors. It is aimed to find out the rank order of the strategies mentioned in the research. Thus the number of repetition of the reason by the interviewed companies was used for sorting the strategies. Therefore the ranking of the strategies differed for each of the parties. Afterwards a requirements-strategies matrix was developed and decimal weights are assigned to the strategies. The least important strategy was given as a weight 2^0, while the most important one was given 2^n as a weight. As a result a weighted score for each of the requirements was calculated. Finally all scores were normalized. This normalized weighted score can be assumed as an indicator showing which requirements should be met initially for becoming more successful in the area they are operating.

The results of the analysis for LSPs are shown in Table III. Tracking system is the main requirement which should be met primarily for this group. The second third most important factors affecting the success of the firms are stated as Increasing/improving information technology use and Improving GSM/telephone/ communication.

Table IIII The Analysis Results for Logistics Service Providers

Requirements	**Weighted Score**	**Normalized Weighted Score**
Tracking system	3830	1,000
Increasing/improving information technology use	2468	0,644
Improving GSM/telephone/communication network	1152	0,301
Improving human resources management	832	0,217
Marketing and customer management	448	0,117
Financial resource	416	0,109
Advanced planning optimization techniques	384	0,100
Using barcode and RFID systems	332	0,087
Using warehouse management software	292	0,076
Foreign joint ventures	32	0,008

Reviewing the answers given to questions about the technological requirements of all parties participated in the research, it is observed that the warehouse management requirements and foreign joint ventures emerged as the areas which are given least importance. Although Using barcode system and RFID are under the mentioned requirements, the percentage of the firms underline this need is under 10%.

As it can be seen in Table IV, LSCs revealed mainly Increasing/improving information technology use as a requirement. Product development and Improvements in manufacturing technology are the second and third important areas which should be emphasized. Interestingly marketing and customer management issues have a considerably high score (70%) among the logistics service customers when compared to other groups.

Table V indicates the results for LEHPs. Improving manufacturing technologies is revealed as the most important requirement followed by developing automation systems and human resource management in achieving a better performance.

Along with LSCs, also LISPs providers stressed the increasing/improving information technology use and product development as main requirements (Table VI). Improvements in human resource management and marketing and customer management are stated as 3rd and 4th important requirements. Barcode and RFID requirements seem as the least important need for LISPs.

Table IV The Analysis Results for Logistics Service Customers

Requirements	Weighted Score	Normalized Weighted Score
Increasing/improving information technology use	36412	1,000
Product development	34666	0,952
Improvements in manufacturing technology	30842	0,847
Marketing and customer management	25670	0,705
Cost reduction	9216	0,253
Improving human resources management	8576	0,236
Tracking system	6588	0,181
Advanced planning optimization techniques	5136	0,141
Using barcode and RFID systems	4920	0,135
Developing automation systems	4232	0,116
Using warehouse management software	3832	0,105
Improving GSM/telephone/communication network	3332	0,092
Foreign joint ventures	768	0,021

Table V The Analysis Results for Logistics Equipment Providers

Requirements	Weighted Score	Normalized Weighted Score
Improvements in manufacturing technology	28	1.000
Developing automation systems	8	0.286
Improving human resources management	5	0.179
Increasing/improving information technology use	4	0.143
Product development	4	0.143
Cost reduction	4	0.143
Using warehouse management software	2	0.071
Financial resources	2	0.071

Table VI The Analysis Results for Logistics Information System Providers

Requirements	Weighted Score	Normalized Weighted Score
Increasing/improving information technology use	89	1.000
Product development	56	0.629
Improving human resources management	52	0.584
Marketing and customer management	50	0.562
Financial resources	36	0.404

Tracking system	24	0.270
Advanced planning optimization techniques	22	0.247
Improving GSM/telephone/communication network	18	0.202
Improvements in manufacturing technology	8	0.090
Cost reduction	8	0.090
Using barcode and RFID systems	2	0.022

The aggregation of requirements by OWA Operator

Ordered weighted averaging (OWA) operator lies between the “and” which requires all the criteria to be satisfied and the “or” which requires at least one of the criteria to be satisfied. In many disciplines, it is a problem to aggregate criteria functions for overall decisions. In some cases all the criteria needs to be satisfied. In some cases it is sufficient for any criteria to be satisfied. Between these two cases “and” and “or” operators can be used to combine the criteria functions. It is easy to adjust the degree of “and” and the degree of “or” in the aggregation (Yager, 1988).

Similarly, the OWA provides a flexible aggregation operation which ranges between the minimum and the maximum values. The motive behind selecting the OWA is its capability to encompass a range of operators from minimum to maximum including various averaging operations, and effectively dealing with quantitative and qualitative information. The OWA weight generation provides a flexibility to incorporate decision maker’s attitude or tolerance (Sadiq et al., 2010).

In the previous section the strategies and their respective requirements are analyzed separately for each group. In this part of the research, it is aimed to aggregate the requirements of different groups in order to determine the most important needs for all parties.

The separate requirements of four different groups are aggregated by giving higher weights to high normalized weighted scores. Therefore the so-called *orlike* OWA operator (i.e., with a high *orness* degree) is used for the aggregation of the scores.

An OWA operator (Yager, 1988) of dimension n is a mapping $F:R^n \rightarrow R$, that has an associated n-dimension vector $w = (w_1, w_2,..., w_n)^T$ such as $w_j \in [0, 1]$, $1 \leq j \leq n$, and $\sum_{j=1}^{n} w_j = 1$. Furthermore;

$$F(a_1,a_2,...,a_n) = \sum_{j=1}^{n} w_j b_j ,$$

where b_j is the j-th largest element of the bag $<a_1,...,a_n>$.

A fundamental aspect of this operator is the re-ordering step, in particular an aggregate a_j is not associated with a particular weight w_j but rather a weight is associated with a particular ordered position of the aggregate. In order to classify OWA operators in regard to their location between and and or, Yager (1988) introduced a measure of *orness*, associated with any vector w as follows

$$orness(w) = \frac{1}{(n-1)} \sum_{j=1}^{n} (n-j) w_j$$

It is easy to see that for any w the *orness*(w) is always in the unit interval. Furthermore, note that the nearer w is to an or, the closer its measure is to one; while the nearer it is to an and,

the closer is to zero. Generally, an OWA operator with much of non zero weights near the top will be an *orlike* operator, (*orness*(*w*) ≥ 0.5), and when much of the weights are non zero near the bottom, the OWA operator will be *andlike*. For instance the *orness* of weight set *w*(1,0,0,0), which corresponds to max operator, is equal to 1 while the *orness* of weight set *w*(¼, ¼, ¼, ¼), which is an averaging operator is equal to 0.5. And *orness* of *w*(½, ½, 0, 0), which is between max and average operators is 0.75.

One key point in the OWA operator is to determine its associated weights. We use the following weight formula where the weights are proportional to each other.

$$w_i = \frac{1-\alpha}{1-\alpha^n}\alpha^{i-1}, \quad \alpha > 0, \alpha \neq 1,$$

$$w_i = 1/n, \quad \alpha = 1$$

In this formula, more weights given to the high scores when α approaches to 0, and more weights given to the low scores for higher values (much greater than 1) of α. *Orness* of this weight family is defined as follows:

$$orness(w) = \frac{1-\alpha}{(n-1)(1-\alpha^n)}\sum_{i=1}^{n}(n-i)\alpha^{i-1}, \quad \alpha > 0, \alpha \neq 1$$

The weight vector parameter, α, is determined according to the required *orness* degree. This study suggests selecting α to get an *orness* of 0.75 degree which is the mid-point of average and maximum operators. As a result while more importance is given to higher scores, the lower scores are also taken into account. For the particular case n=4 (i.e., the number of the perspectives); α should be determined as 0.51 to get *orness* of 0.75, so that the weights are w(0.5256, 0.268, 0.1367, 0.0697). Table VII illustrates the results of the aggregation.

Table VII The Results of the aggregation by OWA operator

Requirements	**Global Utility**	**Rank**
Increasing/improving information technology use	0,892	1
Improvements in manufacturing technology	0,765	2
Product development	0,689	3
Tracking system	0,623	4
Marketing and customer management	0,537	5
Improving human resources management	0,412	6
Financial resources	0,251	7
Improving GSM/telephone/communication network	0,225	8
Cost reduction	0,184	9
Advanced planning and optimization techniques	0,181	10
Developing automation systems	0,181	11
Using barcode and RFID systems	0,097	12
Using warehouse management software	0,086	13
Foreign joint ventures	0,013	14

The aggregated most important requirement for all parties is found as the increasing/improving information technology use. In fact, conventional service providers

have, for a long time, obtained significant results by using information systems successfully, both software applications and hardware. What is new is to be able to achieve integration via information systems, rather than utilizing the information systems on a function-specific basis. The supply chain partners can share the operational and strategic information on a real-time basis by using information systems.
This is followed by improvement in manufacturing technologies and product development. Along with the product development requirement, tracking systems plays an important role in achieving strategic goals. This implies that the importance of traceability and continuous information flow on transport management has been growing for all parties operating in logistics sector. Since marketing &customer management and human resource management needs have relatively high scores (53%, 41% respectively) it can be concluded that all of the parties emphasize organizational structure related concerns besides logistics requirements.

Future Plans

LSPs and LSCs were further questioned about their investment plans in software. At the same time, LISPs were asked about their opinion on which software solutions will be required in the logistics sector for the coming two years. Their answers were compared to those of LSPs and LSCs.
45% of the LSPs and 48% of the LSCs are not planning to invest in any information systems within the next couple of years. This is a rather high rate. The information systems in which investment is being planned are mainly transport management, accounting/finance and CRM applications.
The software that LSPs and LSCs plan to invest are summarized in Table VIII and Table IX respectively.
Softwares that the LISPs plan to develope during the following two years were cited primarily as follows: Warehouse management, vehicle tracking system and RFID (Table X)
Regarding the answers given by logistics service providers and logistics customers to the question concerning the software they plan to use in the near future, it is observed that accounting/finance applications, and warehouse management are commonly referred. Whereas the results indicates that vehicle tracking system and RFID and barcode will not be as important for LSPs and LSCs as LISPs think. Moreover, automation software, webpage design, mobile communication, logistics costs and voice logistics are areas not mentioned by either LSPs or LSCs.

Table VIII The areas that LSPs plan to invest

Investment area	**% of LSPs**
Transport Management	25%
Accounting/Finance	22%
CRM	20%
Vehicle Tracking System	18%
Warehouse management	16%
Sales – Distribution (Marketing)	15%

Materials Management	9%
Port management	8%
RFID and barcode	7%
Advanced planning and optimization	5%
Production planning	3%

Table IX The areas that LSCs plan to invest

Investment area	**% of LSCs**
Accounting/Finance	21%
Warehouse management	17%
Production planning	17%
Sales – Distribution (Marketing)	16%
Materials Management	15%
CRM	14%
Vehicle Tracking System	11%
Transport Management	10%
RFID and barcode	10%
Advanced planning and optimization	9%
Port management	2%

Table X The areas that LSPs will be of primary importance for logistics sector

Logistics solution	**% of LISPs**
Warehouse management	40%
Vehicle Tracking System	35%
RFID and barcode	30%
CRM	20%
Transport Management	20%
Sales – Distribution (Marketing)	15%
Advanced planning and optimization	10%
Materials Management	5%
Port management	5%
Automation software	5%
Webpage design with database	5%
Mobile communication	5%
Logistics costs	5%
Voice logistics	5%

CONCLUSIONS AND FURTHER SUGGESTIONS

With the advent of supply chain management, the perspective of managers changed from one of an *intrafunctional* view, where the focus was on the individual firms in the channel, to an *interfunctional* view, where emphasis is now placed on the cooperation that takes place between firms. Information technologies and processes are being incorporated into supply chain management operations in order to realize a good harmony and cooperation among the shareholders of SCM. Therefore, it is necessary to evaluate the technology infrastructure and operational processes, to determine the strategic goals and to develop a total supply chain solution that makes the most of IT and best practices.

In this study the basic actors of the logistics sector in Turkey are analyzed based on the results of interviews conducted with 428 companies in 2007 in terms of their basic IT requirements and strategic goals that they want to achieve as a result of the realization of those needs. The aim is to highlight the areas of technology improvement need by each shareholder, identify and recommend opportunities for improvement of the whole supply chain.

The requirements of the four perspectives in the logistic sector are sorted by using a prioritizing approach. According to the results tracking system is the most important requirement for logistics service providers since they consider it as an instrument to create new applications in existing markets, to compete with new technologies, to provide customer satisfaction, to enter new markets and to reduce cost. The second important requirement is found to be improving information technology use. Technological advances, including satellite shipment tracking continue to improve real-time communications, making technology an integral element of all transportation modes. This finding is parallel to the survey results showing that transportation is the most important outsourced activity in Turkey (Aktas et al., 2009). Aktas et al. (2009) also show that the transportation services most frequently used by the customers are domestic and international road transportation. Therefore tracking and tracing is of primary importance and the latter can only be effective, if it is implemented as a sector encompassing systems approach. In fact, the realization of tracking and tracing schemes that reach beyond enterprise borders involves the need for agreements and coordination between suppliers and customers

The most important requirement for logistics service customers is increasing/improving information technology use. The motive that LSC underlie this requirement is to compete with new technologies, to create new applications in existing markets, to enter new markets, to respond to customer needs more quickly and to strengthen organizational structure. Therefore, the research findings show that, in Turkey, the logistics service customers are aware of the fact that an IT-based SCM is a major driving force behind industrial progress and competitiveness. Other important requirements with similar scores are product development, investment in manufacturing technology and marketing and customer management. These diversion shows that the customers of the logistic services demand varied services from the sector.

On the other hand, improvements in manufacturing technology is the most important requirement for logistics equipment providers since they consider it as an instrument for competing with new technologies, and entering new markets.

Last of all, for logistics information systems providers, increasing/improving information technology use is again the most important requirement as to create new applications in existing markets, to compete with new technologies and to strengthen organizational structure.

In order to provide a combined point of view as a whole sector the results of the four perspectives are aggregated. The aggregation of research findings carried out by using OWA operator showed that increasing/improving information technology use is perceived as the most essential requirement to achieve stated strategic goals by all parties. In fact, this is in perfect alignment with the current trends of today's competitive world. An IT-based SCM is a major driving force behind industrial progress and competitiveness in the world market. Changes brought by new technologies are very important in shaping the future of national, regional and worldwide economies. In the past, nations have been classified as either developed or developing based on the degree of industrialization. However, currently, the advancements in IT infrastructure and usage is of crucial importance and the firms in developing countries need to realize the importance of a better and more advanced IT-based SCM for their own as well as the global company's benefits The research findings show that in Turkey, all the shareholders of SCM are aware of this fact. The strengths of this article mainly arise from the analysis of the sample size of the conducted interview. In fact, the in-depth interviews were conducted with all the LSC, LEHP, or LISP the services in Turkey. That is why; general conclusions can be easily derived. Additionally, according to our knowledge, there is no other research that analyze the technological needs of four different shareholders that exist in the chain.

However, market success requires that companies, regardless of size, offer products or services that customers value. Therefore the shareholders should have a complete understanding of the requirements of their customers in deciding on their needs of improvement in terms of technology as well as the purpose of using them. Driving forces such as demanding customers and competitive intensity may dictate a need to rely on the strengths of other SC members. For example, Murphy and Poist (2000) analyzed the gaps between logistics service customers and providers and found a mismatch between the 3PL services offered and used. Similar gaps might be present in terms of technological requirements of each module. That is why as a further research, a second research should be conducted with LSP, LSC, LEHP, or LISP in order to reveal their expectation as a customer from the other shareholders and a gap analysis should be realized. Additionally, similar to the work of Lieb and Bentz (2004) this research can be periodically repeated in order to see the trend in the evolution of responses from each module.

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