DOKUZ EYLÜL UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

INTEGRATED LOGISTICS APPLICATIONS IN GLOBAL SUPPLY CHAINS COORDINATION

by
Defne ANGIN

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İZMİR

INTEGRATED LOGISTICS APPLICATIONS IN GLOBAL SUPPLY CHAINS COORDINATION

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M.Sc THESIS EXAMINATION RESULT FORM

We have read the thesis entitled **"INTEGRATED LOGISTICS APPLICATIONS IN GLOBAL SUPPLY CHAINS COORDINATION"** completed by **DEFNE ANGIN** under supervision of **PROF. DR. OKAN TUNA** and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

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INTEGRATED LOGISTICS APPLICATIONS IN GLOBAL SUPPLY CHAINS COORDINATION

ABSTRACT

SMEs are considered the backbone of most economies, yet they are facing challenges in their efforts to keep up with new customer expectations emerged from globalization. However, large enterprises utilize their resources and invest in practices such as SCM to reduce costs and evidently gain competitive advantage. Unfortunately, because they don't have these opportunities, SMEs are only able to focus on individual benefits while managing their supply chains. Since logistics activities make up a big part of supply chain cost, companies put their efforts mostly on managing these. Integrated logistics and various supply chain coordination mechanisms such as supplier contracts, flow coordination and IT mechanisms are suggested as solutions to this issue. This research serves as an exploratory case study to reveal the current logistics process map (via Transportation Value Stream Mapping) and coordination level between a large food packaging manufacturer, its European customers and logistics partners. The aim of the study is to understand coordination problems that occur in the real world even in the best possible conditions (since the focal firm is among the leaders of the food packaging sector in its origin country, Turkey) and to propose solutions that are expected to also benefit SMEs. The study suggests utilizing 2 coordinated and integrated logistics solution frameworks to problems. These problems are determined via semi-structured interviews, meetings, workshops and data provided by the company. However, due to time limits and data collection challenges, the suggestions remained in-detailed in terms of the exact network design and prices. Employees in various executive-level positions of the company shared their opinions on feasibility of suggested solutions via Likert scale questionnaires. Results were analyzed and importance of further utilizing joint optimization, via including logistics and warehousing partners' data, is strongly emphasized.

Keywords: Global supply chain coordination, integrated logistics, Transportation Value Stream Mapping, export

KÜRESEL TEDARİK ZİNCİRİ EŞGÜDÜMÜNDE BÜTÜNLEŞİK LOJİSTİK UYGULAMALARI

ÖZ

KOBİ'ler ekonominin bel kemiğidir, ancak yeni müşteri beklentilerine ayak uydurma çabalarında zorluklarla karşılaşmaktadırlar. Öte yandan, büyük işletmeler kaynaklarını kullanmakta, maliyetleri azaltmak ve rekabet avantajı elde etmek için tedarik zinciri yönetimi uygulamalarına yatırım yapar. Bu fırsatlara sahip olmayan KOBİler, tedarik zincirlerini yönetirken yalnızca bireysel faydalara odaklanabilirler. Lojistik faaliyetler tedarik zinciri maliyetinin büyük bir bölümünü oluşturduğundan, şirketler çoğunlukla bunları yönetme konusunda çaba sarf etmektedir. Entegre lojistik uygulamaları ve tedarikçi sözleşmeleri, akış koordinasyonu ve bilişim teknolojisi gibi çeşitli tedarik zinciri koordinasyon mekanizmaları bu konuya çözüm olarak önerilmektedir. Bu araştırma, büyük bir gıda ambalajı üreticisi olan bir firmanın, müşterileri ve lojistik ortakları arasındaki mevcut lojistik süreç haritasını (Ulaştırma Değer Akış Haritalaması yoluyla) ve koordinasyon seviyesini ortaya çıkarmak için bir keşif vaka çalışması olarak hizmet etmektedir. Çalışmanın amacı, gerçek dünyada mümkün olan en iyi koşullarda bile meydana gelen koordinasyon problemlerini anlamak (odak firması, menşe ülkesindeki gıda ambalaj sektörünün liderleri arasında olduğu için) ve KOBİ'leirin de faydalanabileceği çözümler önermektir. Çalışma, sorunlara karşı 2 koordineli ve bütünleşik lojistik çözüm çerçevesinin kullanılmasını önermektedir. Bu sorunlar yarı yapılandırılmış görüşmeler, toplantılar, atölyeler ve şirket tarafından sağlanan verilerle belirlenmiştir. Bununla birlikte, zaman sınırları ve veri toplama zorlukları nedeniyle, öneriler tam ağ tasarımı ve maliyetler açısından detaysız kalmıştır. Şirketin yönetici pozisyonlarındaki çalışanlar, anketlerle çözümlerin uygulanabilirliği konusundaki görüşlerini paylaşmıştır. Sonuçlar analiz edilip, lojistik ve depolama çözüm ortaklarının verilerinin dahil edilmesiyle ortak optimizasyonun kullanılmasının önemi vurgulanmıştır.

Anahtar kelimeler: Küresel tedarik zinciri eşgüdümü, bütünleşik lojistik, Ulaştırma Değer Akış Haritalaması, ihracat

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CHAPTER ONE
INTRODUCTION

Today small and medium-sized enterprises (SMEs) are considered as the backbone of most economies. In emerging markets 60% of total employment is created only by formal SMEs and the ratio becomes significantly higher if informal SMEs were to be included. They also make up the biggest percent of exports share in top 10 economies of the world (United Nations Conference on Trade and Development, 2010). However, these companies are still among the most vulnerable when it comes to managing their costs and service levels. Because they are a part of larger and more complex systems called supply chains (SCs)". Most SCs have channel captains which make the critical decisions in the SC environment. These are mostly large retail companies, brands, and supermarkets within the food industry. They can have a decisive effect over SCs and set the product standards without even taking part in the production process or its associated logistics (Humphrey, 2003; Gereffi, 1999). This situation has negative effects on SMEs' competitiveness, growth and independence in short and long terms.

In developing countries such as Turkey, the problems reach beyond, especially while doing exports. Turkey's 2018-2020 E-exports Strategy and Action Plan (Ekonomi Bakanlığı, 2018) states that major obstacles which Turkish SMEs face while doing exports are, high logistics costs, complex exports procedures and regulations, low technology utilization and lack of accessing financial sources.

Consequently, the foreign countries hesitate while purchasing goods from Turkish SMEs. In a research conducted by Paypal and Ipsos (2016), logistics costs, risks in delivery of goods coming from an unknown market, customs taxes and procedures, delivery durations, false descriptions of products and complex returns operations are determined as main causes of low demand (Kantarcı et al., 2017).

Many enterprises have developed supply chain management (SCM) strategies to cope with these obstacles. For example, companies decided to use distribution centers (DCs) to reduce transportation cost and lead time. Others made deals with freight forwarders to manage documents and procedures or purchased a management software. However, as the number of parties and solution partners involved increases,

"supply chain coordination (SCC)" and its cost become an issue. Big enterprises can cover the risks with their resource and capabilities (such as labor force, negotiation advantage, economies of scale etc.), while SMEs struggle to stay focused on main value-adding points due to lack of these. Two good questions to ask at this point might be, what does it cost to benefit from multiple logistics solution partners while maintaining the coordination and how can we provide these for SMEs?

1.1 Objective

This research serves as an exploratory case study to discover coordination practices and level between manufacturing firms, their global supply chain logistics partners and customers. The main objective after determining SCC level, is to find out how a large company with opportunities that SMEs do not have, is able to utilize suggested solution frameworks without the help of integrated logistics. Therefore, functions that must be provided by an integrated logistics solution which targets SMEs are expected to be discovered. The first step is understanding the current nature of their relationship to be able to reveal key interactions of the global supply chain logistics (GSCL) system and to determine the main quantitative characteristics of the system. Several frameworks will be suggested in accordance with observed problems, and company's ability of implementing these solutions will be evaluated by company executives via Likert scale questionnaires.

1.2 Motivation

The writer's personal experience, gained during her short 8 months of assistance to Honorary Consul of The Gambia, caused the interest of SCC to emerge. During export attempts by different businesses, several problems were observed. These problems eventually caused the cancellation of some transactions. First of all, because of 3 hours difference between The Gambia and Turkey, only 4 working hours (launch breaks are excluded) were remained which intermediaries of both countries could be simultaneously available for communication. Thus, inefficient communication caused longer process delays than it would in a domestic trade environment. Secondly,

because of the uncertainty of the supply in Gambia, order sizes, order specifications, minimum order quantities and shipment dates changed several times. A slightest change in any step led to a sequential data exchange, resulting in increased order confirmation duration. Due to these coordination failures many business transactions between Gambian and Turkish SMEs were subject to cancellation. Finally, while finding trusted intermediaries and local carriers in The Gambia was an issue, absence of a single up-to-date source of truth also caused doubts on importing goods from The Gambia.

This study is planned on the idea that, Turkish SMEs could be in a similar position for countries with more standardized trade practices.

1.3 Scope

The scope of this study consists of a food packaging manufacturer's (since original company name cannot be shared because of data privacy agreement, let us call it X Co) exports logistics activities from Turkey to destinations Europe. The players involved are the company itself, its customers in Europe (EU) and its contracted 3PL providers which offer transportation and other logistics services for these destinations. With its remarkable export activity of averagely 483 pallets/week just to EU, X Co is familiar with technology and has a modern website, however, does not use e-export

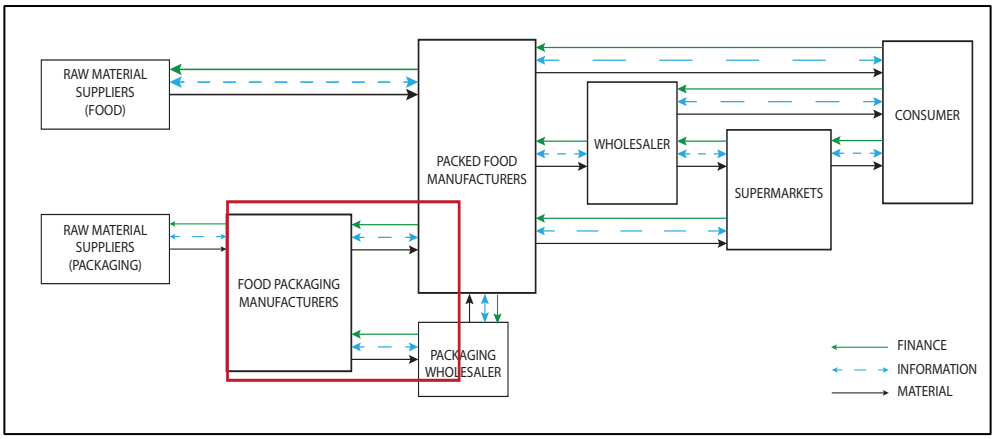

Figure 1.1 Study scope within the packed food SC

channels. Intracompany data flows through the SAP system since April 2018, e-mails and excel sheets were used before. Intercompany data is currently transmitted via e-mails with different contexts (mainly plain text, excel sheets and XML documents). Company does not own a fleet, so all logistics activities are outsourced, and land transportation is considered as the main cost item, since X Co rarely uses marine transportation mode. Only 8 export destinations in EU which make the A group in Pareto analysis was studied in this dissertation. Downstream logistics activities related to export operations starting from receiving the order until the bill of delivery is signed, are observed and some data are extracted from past operation records. In Figure 1.1 above the scope of study within the whole SC of packed food industry is presented.

The study includes exploring costs, service levels, delays and other wastes caused by focal parties, external players' effects are handled deterministically.

1.4 Outline

This paper 9 main chapters. This sub-chapter is the end of Chapter One.

Chapter Two reviews the literature on the effects of company size on export performance, supply chain logistics management, supply chain coordination, coordination mechanisms, integrated logistics in depth. Limitations and challenges of SCM for SMEs are also described in this chapter. Chapter Three explains the relationships of GSCL players in the case study, explicit descriptions of processes, responsibilities and their objectives. This chapter also sets detailed limits to the areas of focus, states research questions and propositions. Chapter Four explains data collection and analysis process. Tools used to visualize current processes, and logic behind data analysis are explained in detail. Chapter Five reveals the suggested solution frameworks. Chapter Six explains the framework evaluation questionnaires and their outcomes. Chapter Seven discusses the outcomes and possible future focus points. Chapter Eight concludes the thesis, summarizing inputs and outputs. Chapter Nine presents the references included to this thesis dissertation. References are sorted in alphabetical order.

CHAPTER TWO
LITERATURE RESEARCH

2.1 Export Performance and Company Size

A SME is defined as "a company, or companies considered as a group, that are neither very small nor very large" by Cambridge Dictionary (Cambridgedictionary, n.d.). As World Trade Organization's 2016 trade report mentions, in every country's population of firms, most are SMEs (including micro enterprises, excluding non-employers and informal firms) which account for over 95% of all enterprises in developing countries. They also account for 99% of enterprises in non-high income, LDCs. There is also evidence on the relationship of the firm size and worker income, in developing countries: Even the workers have same qualifications, as firm size increases, salaries increase too. This is the opposite in developed countries since it is known micro enterprises pay higher wages than small firms. Another finding about companies with different sizes is SMEs are on average less productive than large companies, which causes less unstable jobs and less training (World Trade Organization, 2016). All these differences have their effects on the export performance of a firm.

Table 2.1 Sectoral distribution of MSMEs (%) (World Trade Organization, 2016)

	Manufacturing	**Trade**	**Services**	**Agriculture/other**
Share of micro enterprises				
Developed	8.0	35.0	56.0	1.0
Developing	11.05	44.3	38.9	5.3
G20 developing	14.0	33.0	40.0	14.0
Other developing	10.0	46.0	40.0	3.0
LDCs	15.0	45.0	31.0	9.0
Total	11.0	43.0	42.0	5.0
Share of small and medium-sized enterprises				
Developed	22.0	25.0	52.0	1.0
Developing	19.9	30.6	41.0	8.5
G20 developing	21.0	31.0	44.0	3.0
Other developing	18.0	32.0	41.0	8.0
LDCs	24.0	23.0	37.0	16.0
Total	20.0	30.0	42.0	8.0

A survey study conducted by World Bank Enterprise which covers more than 25,000 SMEs in developing countries reveals some statistics on exports activity of developing countries. First of all, Africa has the lowest export share of exports (3%) among developing regions. In manufacturing sector, only 7.6% of total sales is exports in SMEs while this almost doubles (14.1%) in large enterprises (World Trade Organization, 2016). Also, as shown in Table 2.1 above, the smallest share belongs to the agriculture/other and manufacturing SMEs (World Trade Organization, 2016).

Nowadays, use of e-commerce channel in exports is a trending way to boost export activity. Governments and commerce chambers support efficient use of this channel and are aware that e-commerce creates opportunity for a better global market presence which is fundamental to reliability and for an expanded target customer reach (World Trade Organization, 2016). USA government puts a good example of how governments can take part in this movement. 72% of SMEs in United States have e-commerce activity and US government made a deal with eBay, in order to provide necessary digital opportunities to widen the customer portfolio of these SMEs to global from local (Ekonomi Bakanlığı, 2018). However, this also creates a certain customer expectation which require the efficient management of e-commerce channel and online presence by firms. Unfortunately, despite all promises of e-commerce, SMEs continue to be less well represented online than larger enterprises. SMEs fall behind large enterprises in actions such as establishment of a website. It is known that less than 25% of formally registered SMEs in developing regions have a website, while this increases to 85% for large companies (World Trade Organization, 2016).

2.1.1 Barriers and Opportunities

Many trade barriers are especially challenging for SMEs. Finding and solving these is important because even small companies have smaller chance to survive in exports market, when they do, they grow faster. Also, they are key to new exports since they can rapidly respond to new markets (World Trade Organization, 2016).

In a survey study conducted by Fugate and colleagues (2006), when asked how they defined a supplier's performance, buyer and supplier participants listed the quality, low cost, timeliness, and potential growth in the customer's business, consistent orders respectively, while both parties had visibility and efficient order discrepancy handling as common criteria. (Fugate et al., 2006). So, what are the obstacles that hold SMEs back from creating high performance global business relationships and what opportunities do they have to tackle these?

In the comprehensive literature review about export barriers of SMEs by Tesfom and Lutz (2006), it was found out that procedural barriers are among the most cited barriers of export and, especially SMEs, have concerns about time and paperwork required for exporting. Often the documents are not properly completed, causing delays in export process and payments. In his paper Tesfom and Lutz (2006) suggest that this is related to the cumbersomeness of the paperwork and lack of time (Tesfom & Lutz, 2006). World Trade Organization (2016) also states that finding the correct information about opportunities and legal issues of international markets is expensive, especially for small firms. Another barrier is handling logistics functions. Since SME's have a small weight of shipment, they cannot leverage discounts of economies of scale nor utilize critical distribution networks (World Trade Organization, 2016).

A paper by Handayani et al. (2018) states that, digital transformation and adopting efficient logistics practices are the biggest opportunities for SMEs. E-commerce availability and third-party logistics (3PL) performance (timeliness of service, price factor, quality of delivery) directly and proportionally affects exports performance of SMEs (Handayani et al., 2018). Unfortunately, with current conditions seizing these opportunities is not possible. A research made by Sapio Research for 'Digital Transformation and B2B E-Commerce Report 2017-18' of Sana Commerce reveals that, over 75% of respondents indicated serious obstacles on their road to digital transformation include: getting right and complete clients data in one system, product information not being available in a single system and lack of real-time inventory information and more than 60% of businesses mention that having a single source of truth is at least somewhat serious issue in digital transformation of businesses regarding B2B e-commerce (Sana Commerce, 2017). Preventing data duplication minimizes management efforts and increases the accuracy of business information.

However, setting up a single source of truth is easier said than done, and this was confirmed in responses to surveys (Sana Commerce, 2017). In fact, due to non-standard information flow between many parties, most firms' exporting procedures are actually a complex work-systems on their own, which can easily become hard to manage. In their book, 'Process Mastering: How to Establish and Document the Best Known Way to Do a Job?', Wilson and Harsin (2002) presents that lack of standardization in a complex work-system brings many challenges, such as confusion, unnecessary costs, variation in workflow, longer training times, higher error rates, longer cycle times and less supervisory control (Wilson & Harsin, 2002). Therefore, the starting point of any proposal to improve coordination must be setting standards and maintaining the integrity and uniqueness of the data.

2.2 GSC Logistics Management and Coordination

In this particular study, the term "global supply chain logistics" is referred as all logistics activities through a global supply chain. Normally, logistics is considered as non-value-added activity, however with this point of view value can be defined as timeliness and completeness of delivered order which also known as OTIF or Customer Service Level (CSL). Recently customers became more conscious and expectations reached beyond just delivering on a certain date and in full. Customers now want environment-friendly practices, deliveries on a certain time of a certain day, exporters want real-time tracking and long-term contracts and so on. Therefore, any company involved in a global supply chain logistics network is obligated to work on continuously improving in order to satisfy their customers evolving needs.

2.2.1 SCM practices

Managing logistics is a crucial part of SCM, therefore we must first understand the definition, objective and importance of managing this complex environment. Characteristics of a supply chain environment can be named as internationalization, high customer responsiveness, integration of channels and utilization of information

and communication technologies (ICT) (Moenga, 2016). Many papers describe SCM as a function that covers and synchronizes all business activities between vertically linked entities (e.g. manufacturers, wholesalers, distributors and retailers, consumers) of the SC in order to gain competitive advantage in this supply chain environment (Moenga, 2016; Bask, 2001; Lambert, 1998). In their study, Li and colleagues (2005), also defined the goal of SCM as creating sourcing, making and delivery processes and logistics functions seamlessly within organizations and across the supply chain as a long term effective competitive weapon (Li et al., 2005). Hugo et al. (2004) states that SCM is an extended version of logistics as it includes the supply base management (Hugo et al., 2004). Mentzer and colleagues (2001) define it as "The systemic, strategic coordination of the traditional business functions and tactics across these businesses functions within a particular organization and across businesses within the supply chain…" (Mentzer et al., 2001).

Li and colleagues (2005) categorized the key performance indicators of the SCM practices as; strategic supplier partnership, customer relationship, information sharing, information quality (criteria: adequate, timely, accurate, complete, reliable), internal lean practices and postponement (Li et al., 2005).

SCM practices are also known for achieving increased agility and customer satisfaction (Fayezi et al., 2016; Omoruyi, 2016). In their literature review Fayezi and colleagues (2016), stated quickness, proactiveness, responsiveness, adaptiveness, cooperation, flexibility and information systems as dimensions of organizational agility (Fayezi et al., 2016).

According to La Londe and Powers (1993) SCM is focused on product flows (from supplier to customer) and information flows (both directions), through the supply chain and the concern of supply chain re-engineering essentially is changing the business to the flow of information rather than material (La Londe & Powers, 1993). Another important flow to be considered is "value" flow, which inherently represents a customer-oriented perspective, since the customer defines what is valuable.

Like every other management method, SCM practices also come with several challenges, generally more visible to SMEs of developing countries (Moenga, 2016). Tanco and Jurburg (2012) conducted an exploratory survey to find out whether

Uruguayan SMEs (retail & manufacturing) recognize the importance of SCM and the difficulties which have the most impact on their SCM practices. Results showed, that very little (%30) of Uruguayan SMEs use SC improvement methods and the major problems can be categorized as: economic & political environment, workforce, sourcing & distribution flows (logistics), ITs & warehousing and SC integration (Tanco & Jurburg, 2012). Koh and colleagues (2007), found out that SCM practices of Turkish SMEs have positive effects on operational performance such as flexibility, cost reduction, resource planning; however, no impact on organizational performance such as coordination within company or with suppliers and customers (Koh et al., 2007). Another study about SMEs in OECD countries focuses on SCM practices and its effect on export activities of tea producers in Kenya uncovered that one of the main challenges is lack of information flows in SC systems (Moenga, 2016).

This thesis dissertation also focuses on information sharing and information quality, especially in exports logistics of firms, beginning from order placement until final delivery. The study also considers information technologies as fundamental enablers for the development of this area. Moenga's (2016) study on Kenyan tea exporting SMEs, summarizes the ideal conditions of information flow as availability of data at any time to be used by all companies and complete utilization of the available data. The research also shows that, especially Internet applications greatly reduces costs and states, not only technology but information utilization and strategic planning are also key factors of improvement (Moenga, 2016).

2.2.2 SC Coordination

"SCM is important for modern businesses because it coordinates and synchronizes activities of partner businesses, giving higher efficiency." (Moenga, 2016, p. 82).

Even there is no standard definition of coordination, many research papers adopt Malone and Crowston's (1994) perspective, which presents coordination as a tool to manage dependencies of different entities. To achieve this, different types of dependencies must be identified for the coordination processes to be used accordingly

(Sallnäs, 2016). According to McCann and Galbraith (1981) coordination strategies are based on three dimensions: formality regarding the meetings, level of control and whether the decision making mechanism is centralized or decentralized, while two attributes that associate with various coordination structures: information structure consisting of how parties interact with the information and decision function consisting of the decision making behavior. (McCann et al., 1981; Malone, 1987). In this thesis dissertation we will mostly focus on the information and material flows rather than decision function.

When we take a look at the research direction of previous study on this subject, there are mainly three categories: Dependencies (of the players and activities), coordination mechanisms (for decision making, coordination mechanism effects on SC performance) and methodologic research (mathematical modeling, statistical modeling, simulation and case study) (Handayati et al., 2015). This research falls into second category.

On the topic of dependencies, according to Sallnäs (2016),

> ...if one actor is highly dependent on another, who in turn has a low dependence on the first, the first actor can be said to be dependent on the second. If both actors were to be dependent on each other, they would instead be interdependent… Given that various types of dependencies require different types of coordination, it is vital to understand the variety of ways in which coordination can be accomplished… (Sallnäs, 2016, p. 318).

Effects of coordination on SC performance is also a highly studied topic. As Thomas and Griffin (1996) state, independent management of players in a supply chain can bring poor overall performance and behavior (Thomas & Griffin, 1996). Thomas and Griffin (1996) define three categories of operational coordination: Buyer-Vendor coordination (can be solved via strategic investments or joint optimal order quantity), Production-Distribution coordination (very hard to solve due to complex characteristics of the field) and Inventory-Distribution coordination (multi-echelon inventory systems) (Thomas & Griffin, 1996). Huo and Zhang (2015) made a qualitative research on many different sectors and company sizes to answer these three

research questions which are emerged from the combined perspective of socio-technical system theory and configuration theory:

> … (1) How do IT for suppliers/customers and relationship commitment to suppliers/customers jointly influence supply chain coordination with suppliers/customers? (2) How does supply chain coordination with suppliers and customers jointly influence supply chain performance? (3) What are the patterns of supply chain coordination and their resource and performance characteristics? … (Huo, Zhang & Chao, 2015, p. 729).

The results of their study reveal that both customer side and supplier side coordination can create value for the chain by turning resources into value. When a firm is closely coordinated with its customers, benefits are the accuracy of demand information, reducing the firm's design and production time, responding to customer's needs/changes quickly, reduced costs and enhanced value; while supplier side coordination benefits are, improved understanding and anticipation of the firm's needs to better meet its changing requirements. Also sharing information on products, processes, and capabilities helps achieving better CSL (Huo & Zhang, 2015). Other outcomes are that, when firms have a committed relationship, they are more likely to coordinate and when proper intercessors are combined, it is easier to understand the effect of IT and relational resources on the performance (Huo & Zhang, 2015). The study also explored a critical mechanism for SCC which is resource synergy, indicating that purchasing and marketing functions of the firm must work together to develop SCC. Also, upstream-downstream IT and commitments must carry on with

Table 2.2 Advantages and disadvantages of vehicle co-loading (Olsson, 2015)

Pros	**Cons**
Higher utilization in the truck	Longer routes
Lower total transportation costs	Coordination of pick-up points
Higher transportation frequency	Deeper planning
Lower inventory	Longer lead time

same synergy (Huo & Zhang, 2015). Additionally, Huo and Zhang's findings reveal that both commitment and IT play an important role in the development of supply chain coordination capability, however, it is more important to manage customer relationships rather than supplier, especially in Chinese firms (Huo & Zhang, 2015).

On the supplier side coordination, especially coordination of transports is becoming an attractive topic. This means reducing the logistics costs via coordinating transports between suppliers. A study on this topic presents advantages of supplier logistics coordination and co-loading as higher utilization in the truck, lower total transportation costs, higher transportation frequency, lower inventory while, longer routes, coordination of pick-up points, deeper planning and longer lead times are presented as disadvantages (see Table 2.2) (Olsson, 2015). Gruchmann and colleagues (2019) studied the key elements of creating sustainable local food chains and their logistics coordination. Study proves that sharing financial risks and coevolving of the firms bring competitive advantage in terms of financial coordination. Also, a significant level of coordination creates opportunity to utilize more innovative distribution channels (Gruchmann et al., 2019).

Coordination mechanism decision matrix below (see Table 2.3) shows that, flow coordination and information technology mechanisms are suitable for solving coordination issues (regarding logistics) with 3PL and customers, integrating the logistics activity to a global scale supply chain, while information sharing mechanism can improve coordination of general inventory management (order quantity, timing of order, replenishment time and forecasting). The matrix also states performance measures for logistics (delivery speed, order status, accuracy of info, invoicing on delivery, accurate invoicing, transportation cost, warehousing costs, inventory levels, ordering cost, stock-outs, order cycle time, on time deliveries etc.) and inventory (customer service level, holding costs, purchasing costs, product availability, system wide cost etc.) (Arshinder et al., 2008). Vendor Managed Inventory (VMI), Quick Response (QR), Efficient Customer Response (ECR), Collaborative Planning Forecasting and Replenishment (CPFR) and postponement are currently used flow coordination mechanisms (Luo, 2013) and captured many researchers' attention

(Brown & Bukovinsky, 2001; Cannon, Achrol & Gundlach, 2000; McCarthy & Golicic, 2001) and finally, started to be utilized by practitioners. Three dimensions of flow coordination mechanisms were identified by Fugate and colleagues: multi-functional involvement (multiple individuals from buyer and supplier firms being involved in the design and implementation of flow coordination mechanisms), standardization (definitions and descriptions, how you manage what, what you really mean by in transit inventory level and such), and complexity (detailed, and sophisticated interchangeably) (Fugate et al., 2006). Mechanisms in the other suitable

Table 2.3 Coordination mechanism decision matrix (Arshinder et al., 2008)

	Coordination mechanism				
	Supply chain contracts	Information technology	Information sharing	Joint decision making	Performance measures
Logistics					
Coordination issues in 3PL provider and customer		x		x	Speed of delivery, status of order, accuracy of information, invoicing on delivery, cash-flow improvements, accurate invoicing, transportation costs, warehousing costs, inventory levels, ordering costs, stock-outs, order cycle time, order cycle variance, on time deliveries
Integrating the logistics activity in geographically dispersed network/supply chain	x	x	x		
Inventory					
Coordinated order quantity	x		x	x	Inventory levels, ordering costs, customer service level, holding costs, product variety, purchasing costs, product availability, unacceptable delivery, system wide costs
Coordinated timing of the order	x		x	x	
Coordinated timing of replenishment				x	
Inventory management in a network		x	x		
Forecasting			x	x	Bullwhip effect, holding cost, system wide cost
Integrated production-distribution					
Joint consideration of cost				x	Supply chain system wide cost
Supply chain network		x	x	x	
Integrated procurement-production	x			x	Supply chain system wide cost

category, which is named as “IT-enabled coordination mechanisms” by Lou (2013) are; Electronic Data Exchange (EDI), Enterprise Resource Planning (ERP), Business Process Management (BPM), Enterprise Application Integration (EAI) and Electronic Fund Transfer (EFT) which is also used for personal purposes (Lou, 2013). Among them EDI attracts companies the most. Hill and Schudder (2002) revealed that types of EDI transactions are mostly the purchase orders, invoices and warehouse orders

(Hill & Schudder, 2002). The results of the study show that there is not a significant difference (P = 0.658) between the two groups on the coordination variable for customers, which means there is not a difference in coordination with customers between EDI users and non-users of EDI. On the other hand, about the coordination with suppliers, the statistical test gave a significant (P = 0.033) result showing there is a difference in coordination between EDI users and non-users of EDI, EDI users having a higher coordination level. The study also points out that, each firm is actually a supplier to another firm. Therefore, for it to be more efficient, customers need to force EDI usage onto supplier firm, rather than vice versa (Hill & Schudder, 2002).

A study by Xu and Beamon (2006), gives insights on the effect of various dimensions of SCC strategies on risk cost, coordination cost and material costs. The study shows that, risk cost increases when level of control is low and risk/reward allocation is unfair, vice versa. Low resource sharing also increases risk cost while it decreases material costs. On the other hand, coordination cost increases when level of control is high and decreases when decision style is centralized because there is less communication and negotiation (Xu & Beamon, 2006). Sotz (2018) focuses on operational challenges which emerge from the importance of forming good connections. The study states that it is vital to provide proper and standard communication within the chain to establish sufficient coordination mechanisms and information flow (Sotz, 2018).

2.3 Integrated Supply Chain Logistics

Globalization is enforcing supply chains to become more sophisticated and international. The competition now carries on at the chain level instead of company level therefore, SCs which respond to the customer demand quickly and deliver products on time through the support of a logistics system have a higher chance to survive. However, since logistics costs make up a big part of SC costs, it seemed that reducing cost and delivery duration at the same time is not possible (Zhang & Okoroafo, 2015). Research shows that, integrated supply chain and logistics management can be a way cope with this situation. Integrated logistics within the context of integrated supply chain is defined as managing the logistics of a supply

chain as a single whole instead of managing each activity separately (Businessdictionary, n.d.). We must note that the word "integration" implies creating a new system by combining different functions of logistics. A paper stated that supply chain processes must be viewed as value chains and from a systemic perspective, while managing both internal (production processes) and external processes (logistics and supply chain) of firms' operations in an integrated manner must be the main objective. Thus, a firm is likely to obtain superior performance when achieving high levels of internal and external process efficiency (Prajogo, 2016). Research on dimensions of this integration states that, it is conducted of strategic alliance, information sharing, and working together. Working together involves the coordination of related activities and focuses on the operational level, emphasizing human aspects of operations; whereas strategic alliance focuses on strategic-level activities and information sharing emphasizes the technological aspects of operations (Huo, 2015; Zhao et al., 2011). On the benefits of this integration, Prajogo (2016) suggest that supply logistics integration creates an environment with a highly connected material and information flow and high visibility of internal and external processes. This environment provides ideal conditions for improving the inbound supply performance by eliminating or reducing incidences of late or wrong deliveries, thus, positively impacting competitive performance (Prajogo, 2016).

Literature search on this subject for this study was limited with papers published after 2015 since technology, a major enabler in this field, rapidly improves. Snowball literature review method was used and initiated with keywords "integrated logistics". 4640 related results were found on Google Scholar. The research are mostly focused on effects of integrated logistics practices on supply chain's performance and other qualities (Mandal, 2016; Mandal, 2015; Prajogo, 2016) or enabling integrated logistics via developing frameworks (Ganesh & Gajanang, 2018; McFarlane et al., 2016; Zhang & Okoroafo, 2015) and IT solutions (Santos et al., 2016; An et al., 2016; Cimino, 2015; Fanti et al., 2017).

Research on the relationship between integrated logistics and various levels of supply chain performance revealed interesting results. Prajogo (2016), tested if

logistics integration has a positive relationship with competitive performance and found out that integration is not a direct predictor of competitive performance (Prajogo, 2016).

Many researches' results revealed that integration of logistics activities of a supply chain has positive outcomes for development of logistics outsourcing and operational performance of the chain. In a highly integrated environment, information sharing, coordination, and joint planning are common. Mutual information exchange between a vendor and its client about demand, supply, operational processes, capabilities, and plans, creates a better understanding of client needs and service designs, while helps reducing resource and capability waste, ultimately leading to a more agile process flow. Coordination and joint planning enable vendor firms to deliver services on time and give both sides strategic flexibility. Such logistics connection facilitates customers to reduce their order cycle and inventory level, leading to improved operational performance and finally to improved financial performance (Flynn et al., 2010; Prajogo, 2016; Schonberger, 2007; Yang & Zhao, 2016; Wong et al., 2011; Swink & Nair, 2007).

A common way that companies adopt integrated logistics practices is outsourcing via utilizing third-party logistics (3PL) services. Many researches prove that 3PL companies are becoming more and more integrated with supply chains, while providing scale, know-how, search ability and IT skills, they also help managing logistics activities of the entire chain (Zhang & Okoroafo, 2015; Jayaram & Tan, 2010; Tezuka, 2011; Chu & Wang, 2012). In their study, Zhang & Okoroafo (2015) state

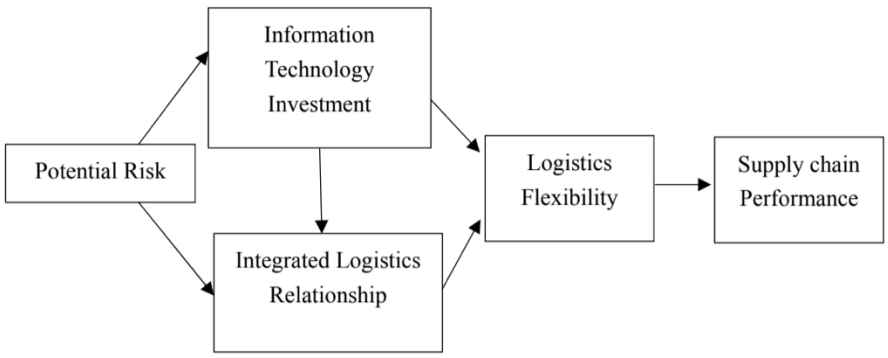

Figure 2.1 Suggested framework by Zhang and Okoroafo (2015)

that, 3PL is a remarkable development in the global supply chain network which helps solving the problem of achieving cost reduction and short delivery lead times simultaneously. This development allows companies to achieve cost reduction and on-time delivery by outsourcing logistics services with 3PL providers. As indicated by researchers, volatile demand means that the volume, type, and requirement of the client's logistics demands change frequently and only if firms coordinate and share information, they can regain control of relationship efficiency in this environment (McIvor, 2009; Lee, 2002; Yang & Zhao, 2016).

A framework proposed by Zhang and Okoroafo (2015) to examine the relationship between 3PL and supply chain performance is presented below (see Figure 2.1). They suggest that 3PL companies are more likely to invest in information technology while building integrated relationships with other supply chain members. This investment is expected to help information sharing among all the players, thus helps improving integrated logistics relationship. This will lead to more flexible logistics, which will eventually increase the supply chain performance (Zhang & Okoroafo, 2015).

Table 2.4 Suggested framework for CTM planning by Sitadewi and colleagues (2018)

Level	**Description**
Strategic Level	**Front-end Agreement**: The process starts on the Front-end agreement stage, which is necessary for all the agents involved in the collaboration as an assurance of collaboration per the agreement to bring equal benefit.
	Network Planning: In this stage, the agents established pricing, distribution strategy and visibility of information to bring benefit to the collaboration.
Tactical Level	**Shipment Forecasting**: At this stage, the collaborating agents would forecast the volume of shipment based on customer demand and match them with the existing capacity and availability of trucking resources.
	Order Assignment: After the shipment forecasting, the collaborating agents will decide the assignment for the deliveries.
Operational Level	**Scheduling**: This stage is necessary to ensure the goods are available and ready to be delivered on time.

Another framework is presented by Sitadewi (2018) as collaborative transport management (CTM), and the case contains three agents: Carrier A, Carrier Band and Neutral Party. Key enablers to the human side of CTM are defined as common interest, openness, prioritization, clear expectation, leadership, cooperation not punishment and trust. Internal planning stages of CTM are stated as front-end agreement and network planning on strategic level, shipment forecasting and order assignment on tactical level and order processing, routing and scheduling on the operational level. Definitions are presented in Table 2.4 (Sitadewi et al., 2018).

A more integrated version of 3PL is called fourth-party logistics (4PL). CEO of American Global Logistics describe 4PL as a one-stop supply chain management (Hochfelder, 2018). While a 3PL can be a warehouse or a carrier firm and thus a company can work with different 3PL firms, a 4PL firm manages all these different functions as a unified whole. For example, van Heeswijk and colleagues (2016) conducted a case study where a 4PL provider matches customer orders' volume, pickup location and delivery window with contracted carriers (van Heeswijk et al., 2016).

On the matters that effect integration negatively, Yang and Zhao analyzed 264 such relationships suggests that supply and demand volatility, technology uncertainty and legal un-enforceability reduces integration between firms (Yang & Zhao, 2016). Further on this matter, researches state that, high environmental uncertainty also has negative effects on integration via increasing costs related to bargaining, partner monitoring and mal-adaption. More complex inter-firm exchanges, difficulty of gathering complete and accurate information to assess market conditions, predict market changes, evaluate partner qualifications and capabilities, also the need to spend more resources on negotiation, monitoring partners' behavior to guarantee their fulfillment of obligations, and making remedies when communication and coordination failures emerge are the fundamental reasons behind this negative effect (Krishnan et al., 2006; Dahlstrom & Nygaard, 1999; Luo, 2006; Zhang & Okoroafo, 2015).

CHAPTER THREE
PROBLEM DEFINITION

In this chapter clear definitions of players, their responsibilities in GSCL activities, their goals are given in detail. Project Charter prepared by X Co employees sets clear boundaries of company's problems and deliverables. According to these, research questions and KPI are determined. Limitations to this study are also stated in this section.

3.1 Players

3.1.1 Company: X Co

X Co is a food packaging manufacturer in Turkey, classified as a large enterprise. It purchases raw material from suppliers and manufactures customized packaging on order (MTO, lead time average: 8 weeks for new orders, 6 weeks for repeated orders, average transit time being 2 weeks to EU) through processes of printing, layering and cutting. After, products are packed as rolls or bags. Packs are palletized and moved to outbound warehouse (OW) which is next to the production plant. X Co also has a warehouse in The Netherlands which is used as a DC for several customers. Since the production line setup is complex and cost is high, batch production is preferred when possible, thus some pallets can stay in the warehouse up to 3 months. Logistics activities are arranged by Exports Department and vehicles are pre-booked from contracted carrier firms. Pallets are moved to loading area from OW according to weekly shipment schedule, then loaded when the vehicle arrives. Product's nature requires special vehicle and transportation conditions, so carrier reliability is key for X Co. The company prices products per kg. Thus, freight cost is also added as per kg while billing the customer. X Co's responsibilities in the GSCL are booking vehicles (parameters: ZIP code, number of pallets, kg/pallet, required delivery date), ensuring that delivery window is met (carrier selection) and providing order status information for customers. We can say that, mainly X Co organizes the logistics activity of the

system. X Co's goals are reducing logistics costs, improving information flow efficiency, lowering transit times and ultimately, increasing customer satisfaction.

3.1.2 Customers

Most of X Co's customers are located in Europe. Top 8 destination countries are Belgium (BE), France (FR), The Netherlands (NL), Germany (DE), United Kingdom (UK), Ireland (IE), Italy (IT) and Sweden (SE). X Co works with its customers under various conditions. Some customers place orders on spot while others are contracted, which means they are legally bound to order a certain amount of product over a certain time period. A customer's responsibilities in GSCL can be defined as triggering actions and defining value, for this study. The goals are receiving order in full and on time while expecting rapid response and feedback when an action is triggered.

3.1.3 Carriers

Logistics service providers are referred as carriers in this thesis and are considered as the suppliers of GSCL. X Co works with 6 contracted land transportation providers for its top 8 destinations and only contacts other providers if these cannot fulfill the demand in terms of delivery time or vehicle capacity. Responsibilities of the carrier is to supply vehicles, deliver goods in promised duration, sustain obligatory transportation conditions and to provide the company with shipment status information. Carrier party does not have a goal other than satisfying X Co's demand in this context, because it mainly serves as an enabler.

3.2 Project Charter

The project charter prepared by X Co's executive level employees, clearly defines goals and deliverables for its customers and itself. Optimizing logistics costs, accurate delivery date estimation, CSL improvement of 10%, standardization of information flow and carrier evaluation are main goals which are anticipated to provide benefits to both X Co and its customers. Deliverables are stated as destination-based logistics

activity models, cost and duration comparisons of current and proposed logistics network designs.

3.3 Limitations

The study is limited with downstream players of X Co's GSCL activities. As explained before in details, focal players are company itself, destinations of their A group customers and the carriers used for these destinations. Company's considered internal operations are order management and logistics arrangements rather than the production process, since it is very complex in packaging industry and creates risk for depth of the research. Other players such as ship and railway owners, port operators and customs points are only considered as external players which are basically points of waiting for either legal confirmations or vehicles. Time was another limitation of the study.

3.4 Research Questions

As mentioned previously, the study aims to explore the current coordination practices of an exporting company in order to suggest integrated logistics solutions to achieve cost-efficiency and IT utilization.

-Q1: What are the current processes in export logistics activities of X Co, their characteristics and problems?

The first research question aims to map the current process flow of X Co, its customers and carriers. On the customer side destinations, weekly order amounts and delivery windows are selected as characteristics to be determined. On the company side, main activities to be examined are defined as order processing, freight booking and shipment scheduling. On the carrier side, promised delivery durations for each country and utilized routes are determined as focal subjects. Other parameters to be determined are freight costs, X Co's customer service levels (%) for each destination and carriers' customer service levels (%).

Proposition 1: A solution framework conducted of carriers, company and clients can be suggested to reduce chain-wide logistics costs and delivery lead times.

Proposition 2: A logistics solution framework conducted of a distribution center, company and clients can be suggested to reduce chain-wide logistics costs and delivery lead times.

- *Q2: How coordinated is X Co's GSCL activity?*

The second research question is about measuring the firm's current level of coordination. The dimensions of this level are determined to be communication, partnership, information technology and performance monitoring.

- *Q3: Does the focal company need to utilize integrated logistics to successfully implement solutions given in Proposition 1 and Proposition 2?*

Next question of this research focuses on the ability of the focal firm to manage increasing number of players and changing conditions as described in Propositions 1 and 2, without the help of integrated logistics practices.

- *Q4: Which GSCL functions need to be covered by an integrated logistics solution in order to provide SMEs with the necessary coordination level and other opportunities that large enterprises have?*

It is known that in order to create space for improvement one needs to increase complexity. Increased complexity means more players, especially in a global supply chain environment. The last question of the study aims to reveal the fundamental functions that an integrated logistics solution needs to cover in order to provide SMEs with the ability to manage increased complexity, which emerges when improvements in logistics cost or delivery durations are planned.

CHAPTER FOUR
METHODOLOGY

4.1 Data Collection

Data on export procedure, information and material flow of X Co, which is a food packaging manufacturer in Turkey, were collected by several meetings and two TVSM workshop involving different players (such as executive level employees from sales, exports and logistics, production, supply chain departments of X Co, freight forwarders, academic staff and students of DEU Logistics Department), held at the company. First meeting was on general introduction of company and brainstorming on issues of its export activities. After deciding to focus on EU region, another meeting was held in order to understand the nature and details of EU operations, customer behaviors and needs, regulations and such. Transportation value stream mapping (TVSM) is used to analyze current states of logistics activity and information flow, in a more standardized and data centric manner, also to detect the common error points. Two TVSM workshop sessions were done within 2 weeks (photographs from the workshops are presented in Appendix 1) to create the current state map. At the first workshop, destination countries of EU region were divided into four groups according to the transportation routes used. After, all maps were combined to form a comprehensive map of top 8 destinations in EU. The second workshop was held to complete missing data in order to calculate the current metrics of the system. Future state map was not developed in this study, however focal improvement points were determined.

During the meetings with X Co, staff members also revealed some very interesting aspects about their processes on coordination, their goals and how they are testing a VMI system, which is a flow coordination mechanism, with some of their customers. Research shows that same kind of behavior was observed in other companies too (Fugate et al., 2006). In the paper, Fugate and colleagues (2006) stated that, many times company executives expressed excitement over the use of, or desire to implement, various flow coordination mechanisms (Fugate et al., 2006). However,

since this subject needs a detailed research on its own, also because of the time and data constraints are considered, was only included as a customer order placement behavior to this study.

4.2 Data Analysis

The data collected during this study is analyzed via descriptive statistics. It is known that X Co's GSC activity starts with a customer order. X Co's customers in Europe (number of customers and shipment frequency for each destination are given in Table 4.1 and Figure 4.1 respectively) have different characteristics based on their ordering behavior. These are: Warehoused/Non-warehoused, VMI/contracted/spot. Also, they differ according to the customs processes (customs trough NL/not necessary) however this is only effective for a single destination country thus was not considered. Communication behavior also differs between all these different groups.

Table 4.1 Number of X Co's customers in 2016, 2017 and 2018 at target destination countries

NUMBER OF CUSTOMERS	**2016**	**2017**	**2018**
Germany	23	20	19
Belgium	14	15	18
United Kingdom	15	13	11
Ireland	4	4	4
Italy	13	10	7
Sweden	6	6	6
France	17	20	12
The Netherlands	13	14	11

Most of X Co's European customers use e-mails to place their orders, while contents of these e-mails vary. The rest use mobile texting applications and direct phone calls. Customers that use VMI send XML files which can be directly uploaded to company's SAP system, contracted and warehoused customers send plain text which includes SKU type(s), amount and requested delivery date. Since the company operate in food packaging manufacturing industry which is almost entirely based on everchanging design and sizes (which makes accurate order information more critical), company's order fulfillment strategy is make-to-order. Each SKU of X Co is created from a super BOM that has almost 1700 characteristics. X Co's sales representatives

receive these e-mails and they have to manually enter them into SAP in 24 hours. Then SAP schedules a production and delivery date for each order, sends these to sales representative and sends production line setup parameters to production department. As stated earlier, production process itself is not included in this study. Next thing after

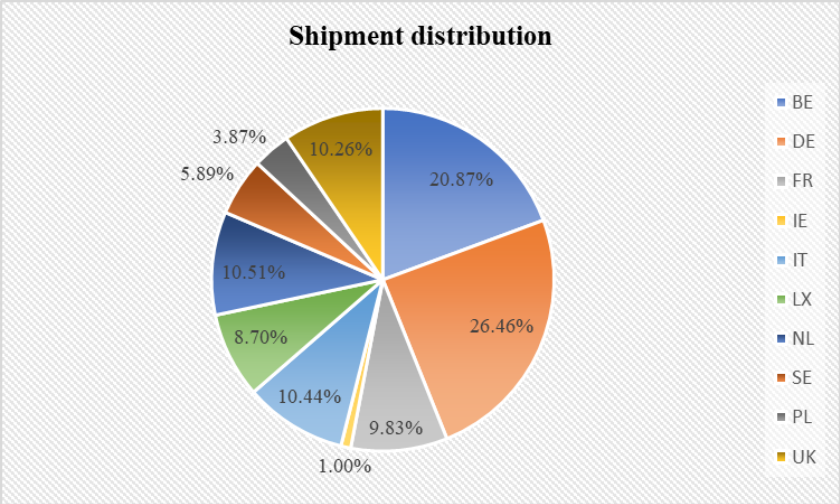

Figure 4.1 Shipment distribution of X Co according to locations

an order is produced and packed is palletizing. Most of X Co's pallets are standard EU-pallets (80 cm x 120 cm) with an average height of 110 centimeters and weight of 460 kgs. Maximum of 2 pallets can be stacked, however in some cases customers demand no stacking at all. Palletized orders are moved to a racked outbound warehouse (OW) with capacity to hold up to 3000 standard EU-pallets. Each pallet has a special label that contains an SSCC code, production date, buyers name and delivery

Table 4.2 Carrier distribution of X Co. according to locations

DESTINATION	# of contracted carriers
Germany	3
Belgium	3
United Kingdom, Ireland, Sweden	1
Poland	1
Italy	1
France	1
The Netherlands	3

address. Pallets are placed and picked manually with a Vector forklift according to SSCC codes, however there is no WMS. Once a pallet is placed on a shelf it stays there until the shipping day. It is observed that some orders to be shipped in May were produced back in February. This shows us that inventory can be held for 3 months in X Co's OW.

00X Co delivers all of the orders to EU as DAP and mostly with land transport. Ro-Ro ships and rail transport is used also in some routes. X Co has several contracted carriers for destinations in Europe (see Table 4.2), however, does not have a standard carrier performance evaluation policy. While for some destinations they have multiple choices, sometimes for several locations they have only one carrier option. With its contracted carriers, X Co has annual deals and freight price lists, so the context of the communication is only based on vehicle booking and receiving the pick-up date information. If the contracted carriers cannot supply trucks, then X Co starts to communicate with spot carriers, which means including also a freight quote request (FQR) and freight quote (FQ) confirmation process. During the meetings, one employee said "… we talk with them [carriers] on the phone for hours...", mentioning spot carriers, agreeing with the difficulty of managing the information flow manually. As loading dates are confirmed, the shipping list is created by Export and Logistics departments weekly, then sent to shipping department and OW. Most of export orders are loaded on Fridays and Wednesdays (see Table 4.3 for details).

Table 4.3 Shipment frequencies and average transit time according to days of the week

	Mon		Tue		Wed		Thu		Fri		Sat		Sun	
	requenc	Agv transit	Frequency	Agv transit time (days)	Frequency	Agv transit time (days)	Frequency	Agv transit time (days)	Frequency	Agv transit time (days)	Frequency	Agv transit time (days)	Frequency	Agv transit time (days)
BE	0.0029	12	0.0243	11	0.2795	10	0.0779	11	0.6144	11	0.0010	11	0.0000	*
DE	0.0049	13	0.3126	12	0.0282	11	0.0867	11	0.5677	11	0.0000	*	0.0000	*
FR	0.0017	12	0.0379	13	0.2909	13	0.1463	14	0.5215	14	0.0017	10	0.0000	*
IE	0.0233	17	0.0233	17	0.0698	16	0.1163	17	0.7674	17	0.0000	*	0.0000	*
IT	0.0102	10	0.0560	8	0.3905	8	0.0917	8	0.4516	8	0.0000	*	0.0000	*
NL	0.0000	*	0.0370	11	0.2504	10	0.0706	11	0.6387	11	0.0017	12	0.0017	12
SE	0.0000	*	0.0139	12	0.0627	14	0.0801	13	0.8397	14	0.0035	13	0.0000	*
UK	0.0039	12	0.0414	13	0.0592	14	0.0730	14	0.8225	13	0.0000	*	0.0000	*

Pallets are picked from OW racks (in averagely 4 minutes) and placed near to the loading ramps. When the carrier truck arrives, it is first checked according to the vehicle hygiene protocol and only if every condition is satisfied, the order is loaded to the truck. This process takes about 5 minutes if the vehicle is in good condition. Otherwise, X Co contacts with the carrier and requests another vehicle, which is not a common problem and can be represented via Poisson (2).

X Co ships 93% of its EU orders in LTL and 7% in FTL. According to this data, most of the time trucks pick up other goods or the order may be transferred to another vehicle after they leave the company which creates a risk since now X Co has to trust the carrier about maintaining the hygiene conditions. This situation also elongates the transit time, by adding more delay nodes to the network. Company executives stated that they are aware of FTL delivery's advantages, thus consolidation of orders is a preferred option, however there are some obstacles such as volatile order amounts and interarrivals.

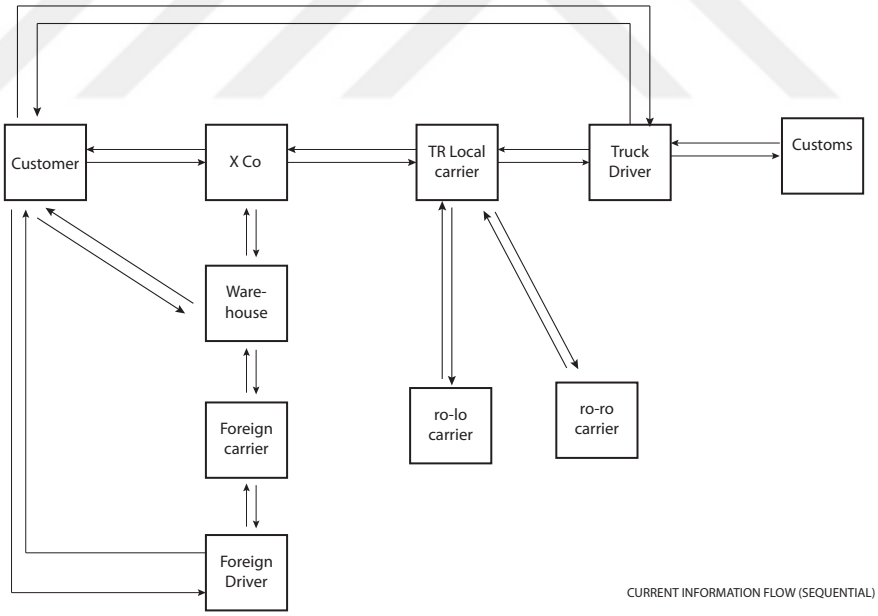

Figure 4.2 Current information flow of X Co with number of entities N=1

X Co's carriers use many different routes while delivering to EU however, since evaluating the efficiency of routes is not a focus point in this study, the as-is TVSM

created by workshops is used only to reveal which destinations' orders can possibly be consolidated. Still, order frequencies remain a SCC problem to be solved.

One thing that is fundamental for this study is how and with whom the company communicates after the truck leaves. According the company employees, drivers communicate with carrier daily and each carrier sends an e-mail to X Co. Import/Export department with an Excel file attachment of daily shipping status information. Then, this information is sent to Customer Management department which shares it with the customer when requested. This is a good example of a sequential information exchange and error notification, which lower the efficiency and agility of the communication network. Unfortunately, there are conditions that prevent X Co's network from communicating directly. Language, changing vehicles thus responsible parties, way of communication and privacy are some of the reasons. Figure 4.2 shows current external information flow of X Co. Please note that, we need multiply number of arcs with number of entities in each group if there is more than 1 entity. For example, if there are N TR local carriers and M truck drivers belonging to each carrier, number of arcs is 2xN between carriers and X Co and 2xMxN between carriers and drivers.

Export logistics activity data of X Co. between Jan 2016 and Dec 2018 is shared as an Excel sheet by the company. Customer name, country, ZIP code, order amount (in kgs), number of pallets and delivery type (FTL, LTL), B/L date (same with loading date), freight costs (per shipment and per kg) data was used for the analysis in order to form realistic solutions. In addition, INCOTERMS was set to DAP (Delivered At Place) for all deliveries so X Co. is responsible for delivering the goods to the import customs clearance destination (procedures and fees handled by buyer party), and to the unloading place afterwards.

The shared data was problematic, therefore had to be cleaned before analysis. First, cells containing the value #N/A were deleted. The histogram below is created from the original data table (Figure 4.3). We can see that there are lot of outlaying numbers. To further examine the problems, deliveries were separated as FTL and LTL, because pickup dates and calculation of freight price also change according to this criterion.

For FTL deliveries (Figure 4.4: Original and Figure 4.5 Cleaned) 41 rows were deleted according to abnormal pallet number entry. Since the maximum capacity of FTL is assumed to be 66 EU-pallets, a single row containing 89 pallets was deleted also.

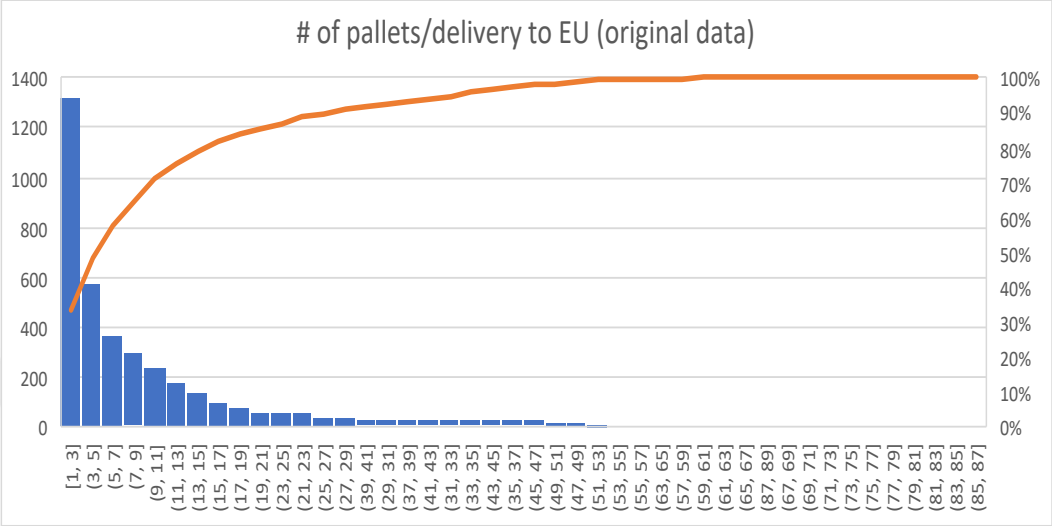

Figure 4.3 Number of pallets per LTL delivery (2016-2018) to EU customers, from original data sheet

For LTL, minimum number of pallets per order was calculated assuming each pallet has maximum load capacity of 660 kgs. Cells containing numbers lower than (ORDER AMOUNT/660) ratio were deleted (Figure 4.6 and Figure 4.7). Also, the cells which contain bigger numbers compared to (ORDER AMOUNT/100) was deleted, assuming each pallet is loaded at least 100 kgs. Remaining number of orders to be analyzed were 5169 in LTL and 409 in FTL, from 8 destinations in EU over the course of Jan 2016 to Dec 2018.

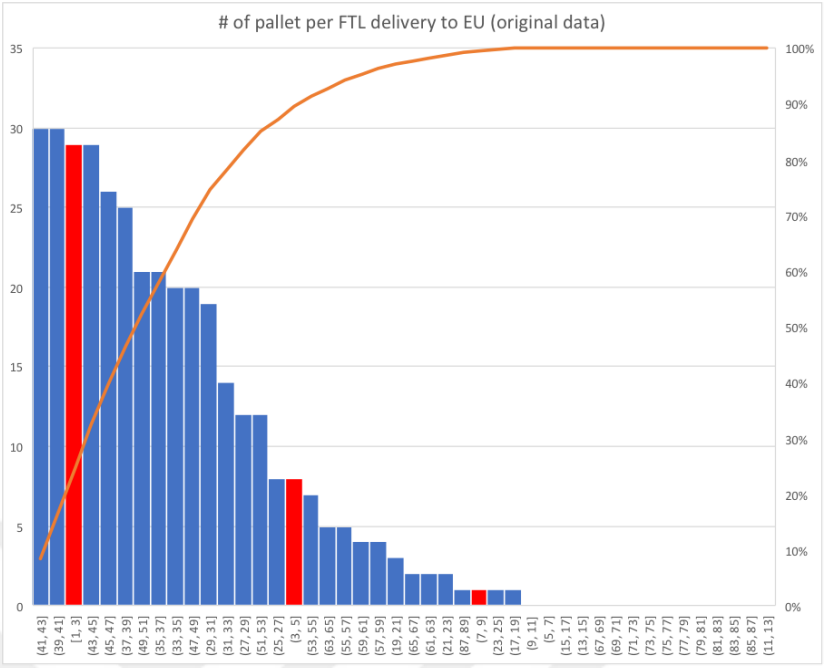

Figure 4.4 Number of pallets per FTL delivery (2016-2018) to EU customers, from original data sheet

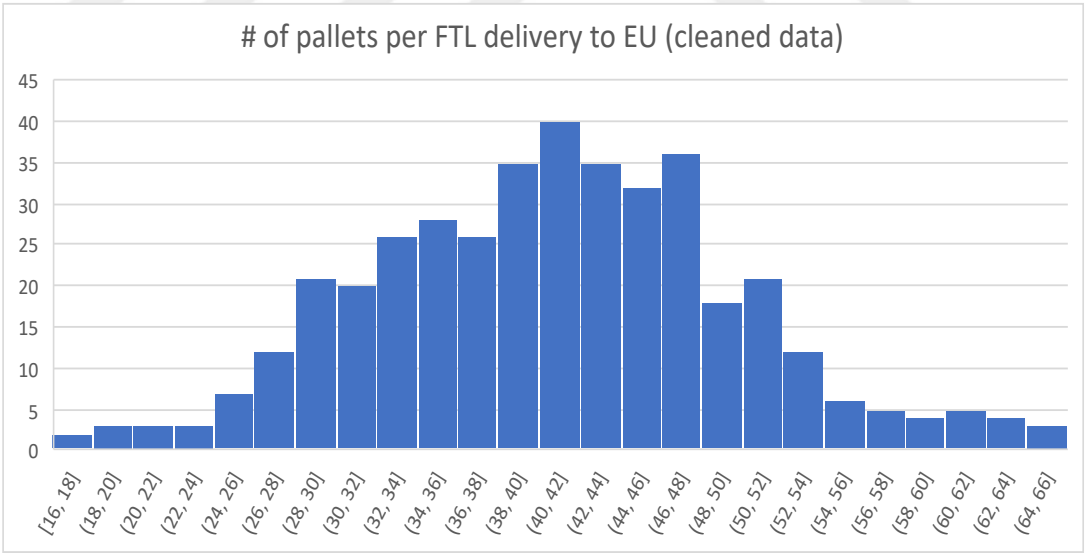

Figure 4.5 Number of pallets per FTL delivery (2016-2018) to EU customers, from cleaned data sheet

After the data was cleaned, average weight of a pallet is calculated. For FTL orders a pallet weights 452 kgs while for LTL the average is 384 kgs for EU in general (see

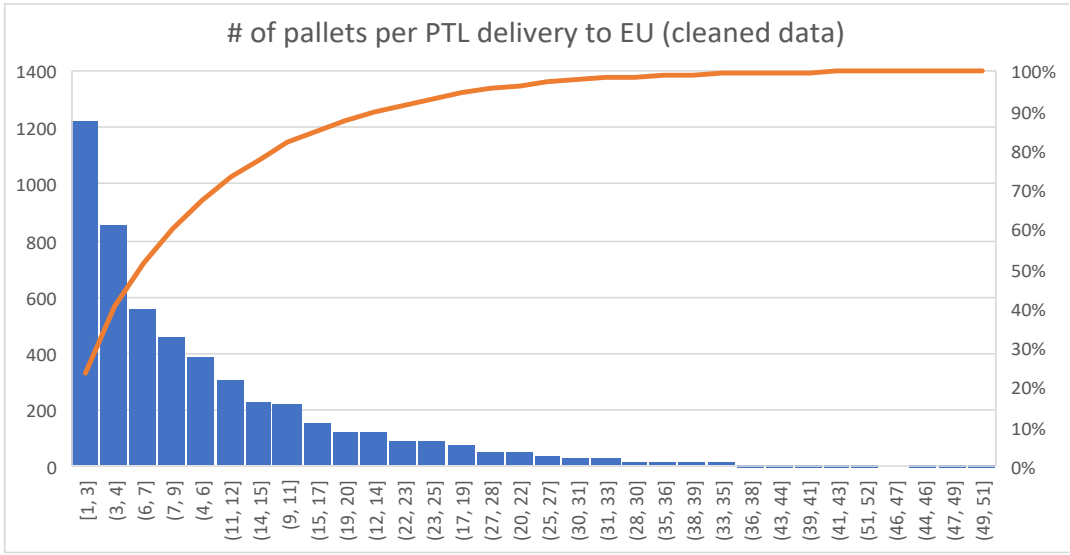

Figure 4.6 Number of pallets per LTL delivery (cleaned data)

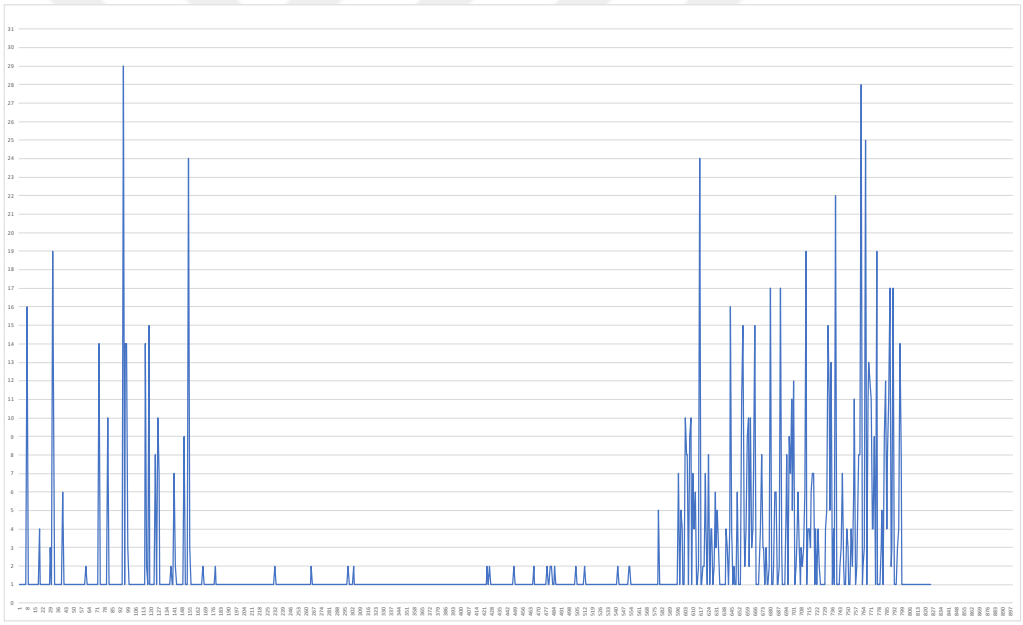

Figure 4.7 Calculated number of pallets per LTL delivery to EU which are entered as 1 pallet by X Co to data table

Figures 4.8 and 4.9 for distributions). Number of pallets per order is also examined. It is found that number of pallets is randomly distributed for LTL orders.

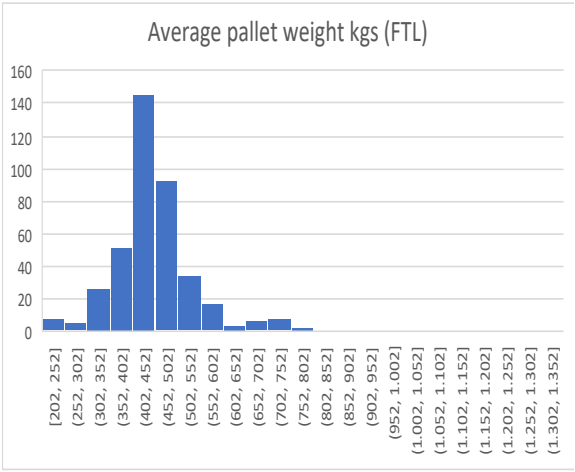

Figure 4.8 Weight (kg)/pallet for FTL deliveries

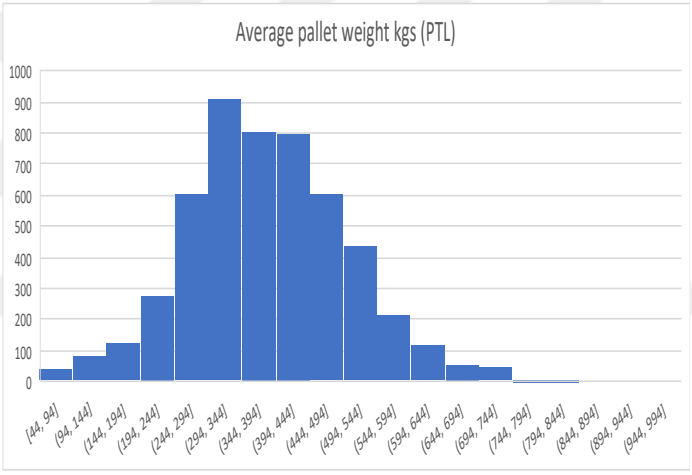

Figure 4.9 Weight (kg)/pallet for LTL deliveries

Most of the transportation is done by road and freight cost per pallet of LTL deliveries is represented in units of per kg, for each distinct destination country. On the other hand, for FTL, freight cost is independent from number of pallets so, it is estimated as per vehicle for each distinct destination, however there are fluctuations due to many external factors.

Tables 4.4 and 4.5 show the changes in shipment parameters according to destination countries and shipment type. When we take a detailed look at Table 7, the data shows that average weekly shipments of X Co to BE, UK and DE are over 40 pallets each, which is the average number of pallets sent when shipping in FTL. In the same table we also see that the price per kg greatly fluctuates when delivering LTL to

any destination. Additionally, customer service level is calculated and the lowest CSL was found as 18% (Ireland) while the highest is 80% (Sweden) in LTL shipments. On the other hand, Table 8 shows that X Co ships weekly FTL only to two destination countries which are BE and DE. When we compare the price fluctuations, we can see price per kg is far more stable in FTL shipments. This is because X Co's carriers charge per vehicle when delivery type is FTL. When the average vehicle utilization is calculated assuming a vehicle can be loaded with maximum of 66 EU-pallets, shipments to FR and SE have the highest vehicle utilization with almost 77% while IE FTL shipments has the lowest vehicle utilization (46%). Finally, it is revealed that if all the shipments were made in FTL between 2016 and 2018, logistics cost would decrease at least 24000 Euros per year for each of 8 countries (see Table 4.5 for details.).

Table 4.4 Parameter estimations of LTL deliveries to destinations in EU

	Jan 2016 - Dec 2018 (156 weeks)		LTL						
Destination	**Total shipped kg**	**Total number of shipments**	**(%)**	**Shipment rate**	**Freight cost/kg (eur) (min, max, most, avg)**	**Avg pallets/ shipment**	**Avg transit time (days)**	**Expected transit time (days)**	**CSL (Delivered in o expected transit time/total deliveries)**
BELGIUM (BE)	7.640.594	1242	83%	7/week	0.02, 2.15, 0.15, 0.24	9	11	8 to 12	66%
GERMANY (DE)	5.919.543	1379	94%	9/week	0.05, 2.67, 0.14, 0.22	9	11	8 to 12	61%
UNITED KINGDOM (UK)	2.844.345	543	94%	4/week	0.01, 2.53, 0.21, 0.35	10	13	8 to 12	61%
SWEDEN (SE)	2.162.229	321	89%	2/week	0.06, 2.17, 0.18, 0.30	14	14	8 to 12	44%
ITALY (IT)	2.047.663	590	99%	4/week	0.03, 2.36, 0.11, 0.21	8	8	8 to 12	70%
THE NETHERLANDS (NL)	1.835.153	617	97%	4/week	0.01, 2.52, 0.13, 0.28	7	11	8 to 12	58%
FRANCE (FR)	1.196.938	586	99%	4/week	0.07, 1.76, 0.31, 0.35	5	14	8 to 12	37%
IRELAND (IE)	272.390	49	90%	2/month	0.27, 2.42, 0.29, 0.66	10	17	8 to 12	12%

Table 4.5 Parameter estimations of FTL deliveries to destinations in EU

	FTL									
Destination	(%)	Shipment rate	Freight cost/kg (eur) (min, max, most, avg)	Avg pallets/ shipment	Average vehicle utilization (%)	Avg transit time (days)	Expected transit time (days)	CSL (Delivered in expected transit time/total deliveries)	Average vehicle cost in 2018 (eur)	ANNUAL SAVINGS IF ALL SHIPMENT WAS FTL (eur)
BELGIUM (BE)	17%	2/week	0.13, 0.45, 0.14, 0.17	42	63.64%	9	7 to 10	72%	2.828	€ 89.383
GERMANY (DE)	6%	1/week	0.11, 0.30, 0.12, 0.16	39	59.09%	9	7 to 10	49%	2.730	€ 87.260
UNITED KINGDOM (UK)	6%	1/month	0.24	35	53.03%	12	7 to 10	25%	4.660	€ 136.364
SWEDEN (SE)	11%	1/month	0.19	50	765.76%	14	7 to 10	21%	3.750	€ 54.602
ITALY (IT)	1%	3/year	0.09	41	62.12%	7	7 to 10	38%	2.000	€ 75.943
THE NETHERLANDS (NL)	3%	8/year	0.21	40	60.61%	10	7 to 10	23%	2.900	€ 35.410
FRANCE (FR)	1%	1/year	0.20	50	75.76%	9	7 to 10	75%	3.350	€ 56.570
IRELAND (IE)	10%	2/year	0.24	30	45.45%	15	7 to 10	0%	4.800	€ 24.241

4.3 Process As-Is

In order to map the current exports logistics processes of X Co, Transportation value Stream Mapping (TVSM) method was used. TVSM is a variation of Value Stream Mapping (VSM). VSM is a method generally used for capturing a birds-eye view of the production process and determine problematic points. VSM is significantly utilized by lean practitioners and researchers. TVSM on the other hand, focuses on logistics activities. The goal is to create a better version of the system in both methods, which is called the future state map. However, in this study only as-is map was created. As in VSM, the most important rule in TVSM is to be customer oriented and all enhancements must focus on increasing the customer's benefit. Another important point is that methods provide a macro view. Also, contribution of all the players is very important for the reliability of the map. Last but not least, the map must reflect the reality not the ideals.

A TVSM workshop is run (almost same as a VSM workshop) and proceeds as follows:

1. Select the process / route to focus on

2. A sponsor is selected to guarantee the implementation of the improvements.

3. A charter is prepared in which scope, problem definition, objectives and performance criteria are determined.

4. Materials and equipment are prepared: Sticky notes, whiteboard, flipchart, A2 papers, pencils and erasers.

5. Requested delivery times are determined

6. Process outline is determined in 5 steps

7. Customer box is drawn in the upper right corner and details are written (Demand and delivery window)

8. Then the process is followed backwards (focusing first on the material flow) and subprocesses are placed on the map. Here, providing detailed data for each process, the effect of the method will strengthen.

9. When the sub-processes are completed, transit and waiting times between two consecutive processes are added.

10. The next step is to draw the logistics control box and map the inter-company and intra-company information flow.

11. A timeline is drawn at the bottom of the paper. In this line, the durations of sub-processes are calculated according to being value-added time (the time the product is moving to its destination) or non-value-added time (the product is waiting).

Birds flight view of X Co's export logistics operations (for LTL shipments) is given in the comprehensive TVSM (see Appendix B). The map allows us to discover that there is a certain level of complexity in some areas such as order placement, carrier selection and routes. Still, we need to keep in mind that X Co is a big company, leveraging economies of scale in terms of freight pricing and service level, also has a significant amount of labor resource which makes it possible to manage this complexity. On the other hand, suggested improvements might require decisions at the strategic level because of the organizational structure of the company.

Customers' (based on destination country) demand rate (in pallets/week), average transit times and CSL are given in Figure 4.10. Carriers' estimated transit lead times (in days) for LTL deliveries are given in Figure 4.11. Additionally, routes used for

different destination are mapped (see Figure 4.12). Solution frameworks are built according to this map.

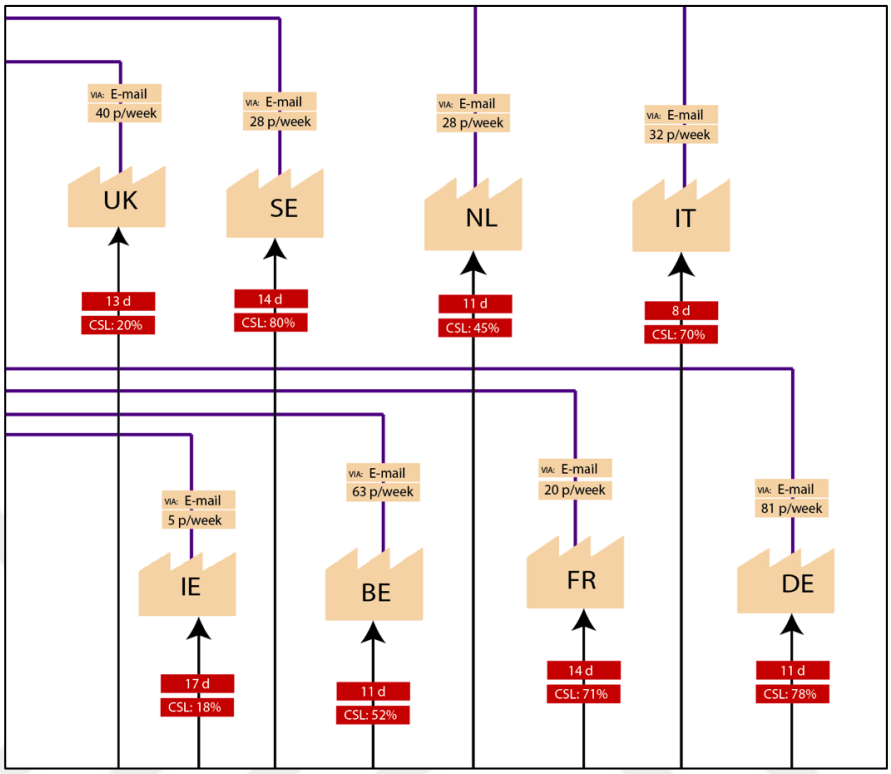

Figure 4.10 TVSM close up: Demand and Delivery

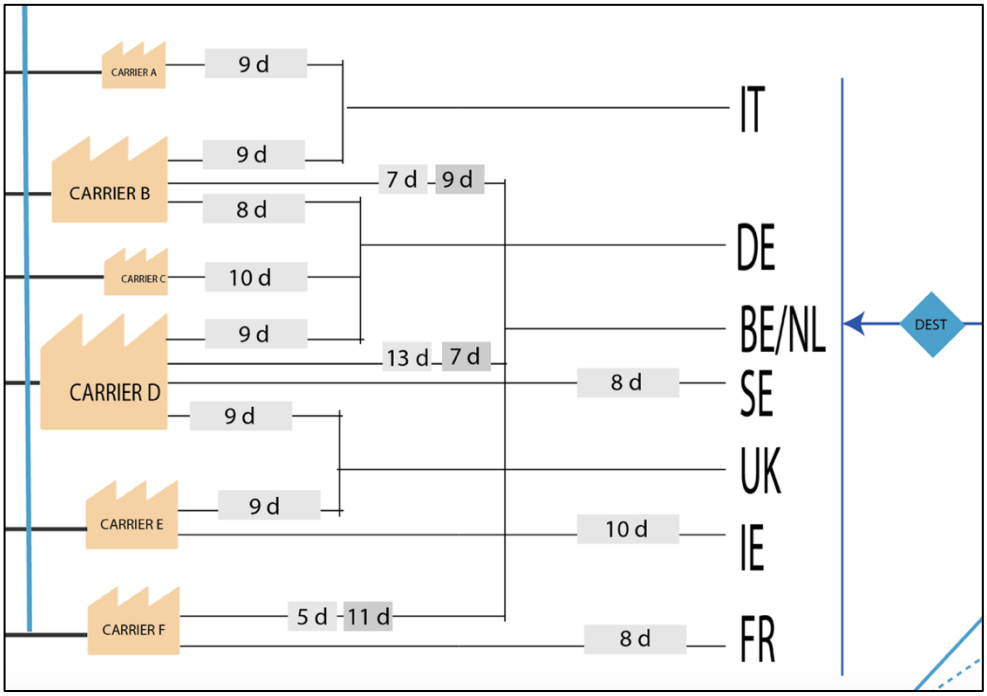

Figure 4.11 TVSM close up: Transit times given by carriers for each destination

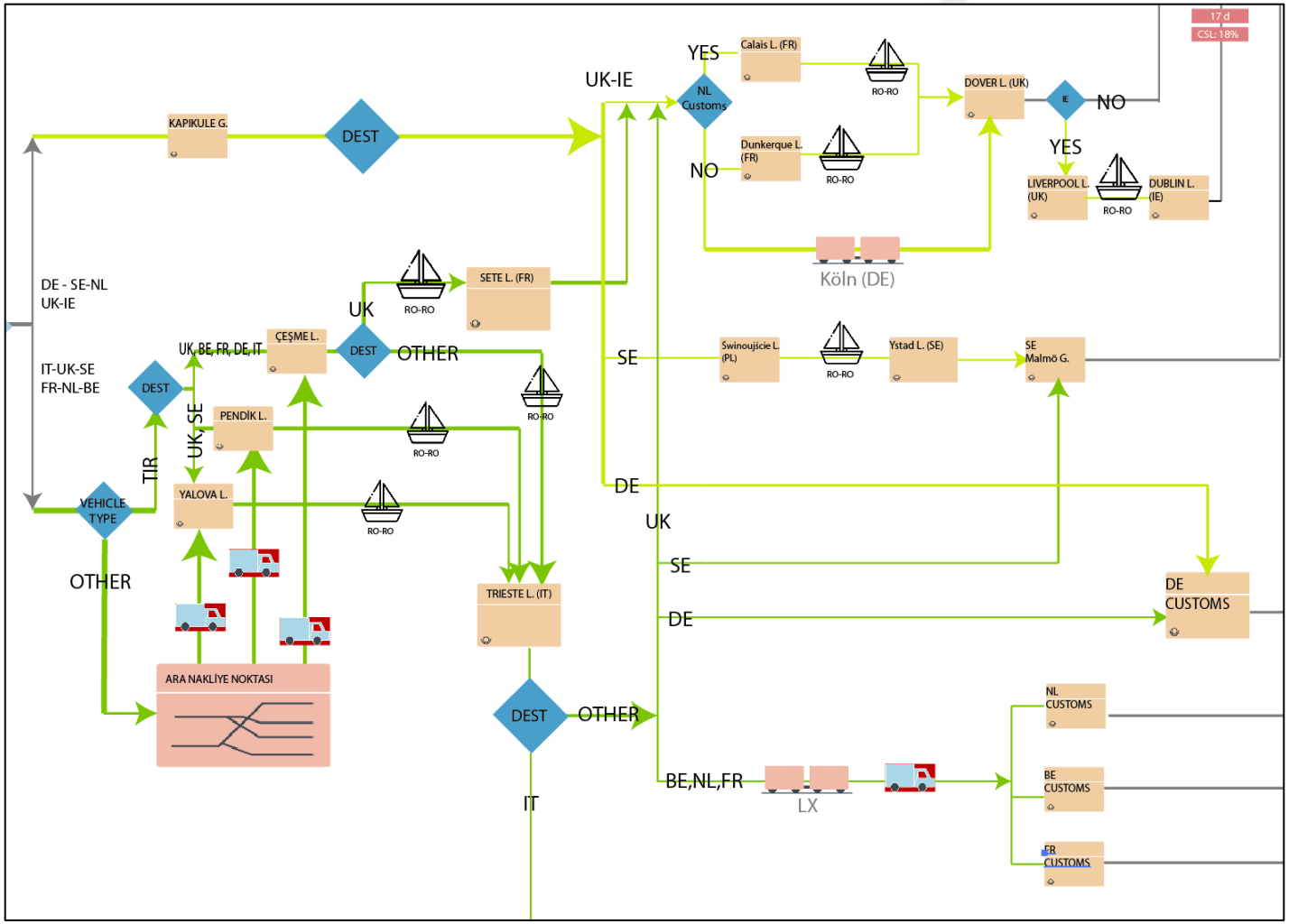

Figure 4.12 TVSM close up: Routes

CHAPTER FIVE
SOLUTION FRAMEWORKS

According to the results of data analysis, several solution scenarios were created. These can be summarized as consolidating orders to partly leverage FTL delivery advantages, using X Co's contracted warehouse as a distribution center to increase CSL and redesigning information flow via help of IT. Details of each framework are given in following subsections: 5.1, 5.2 and 5.3.

5.1 X Co – Carrier Coordination: Order Consolidating

In accordance with data provided by X Co, currently volumes of weekly shipments to BE, DE and UK are found sufficient for using FTL shipment and multi-stop distribution in the destination country (framework is given in Figure 5). Main problem is however fluctuations in the ordering policies. Standardizing the ordering policies and clustering the customers accordingly is important in for implementation of this solution since these are expected to help better shipment planning.

The exact outcomes and planning of this solutions can be revealed by using optimization however more detailed data is needed, such as freight pricing policies and ordering behaviors of each customer. Further, coordinated optimization between client, company and carrier party is greatly recommended to benefit chain wide cost reduction and service improvement.

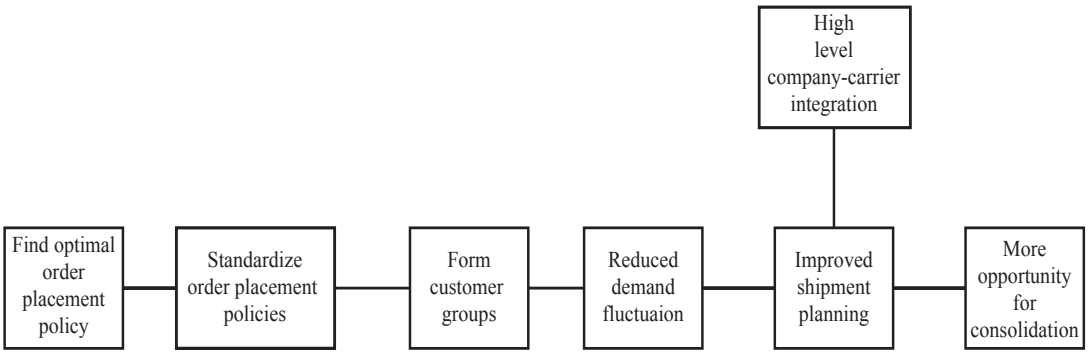

Figure 5.1 Proposed framework of solution 5.1

5.2 X Co – Customer Coordination: Distribution Centre

In accordance with data provided by X Co, it is revealed that, orders produced at least 20 days before their delivery date can be consolidated and shipped in containers to X Co's contracted warehouse in NL, through a suitable port (for example Port of Antwerp), while keeping 15 days inventory in the warehouse. One of SCC mechanisms which is supply chain contract is suitable for improving financial advantages of this solution. This contract is generally built on cost responsibilities of X Co and its customers which will be fulfilled from mentioned warehouse. In return for more flexible order frequencies and reduced transit times, X Co is responsible for paying the holding and order processing costs while local transit cost from warehouse to door is covered by the client party. This solution also changes the delivery term from DAP to DAT.

The exact outcomes and planning of this solutions can be revealed by using optimization however more detailed data is needed, such as local freight pricing policies and warehousing costs. Further, coordinated optimization between client, company and warehouse provider is greatly recommended to benefit chain wide cost reduction and service improvement.

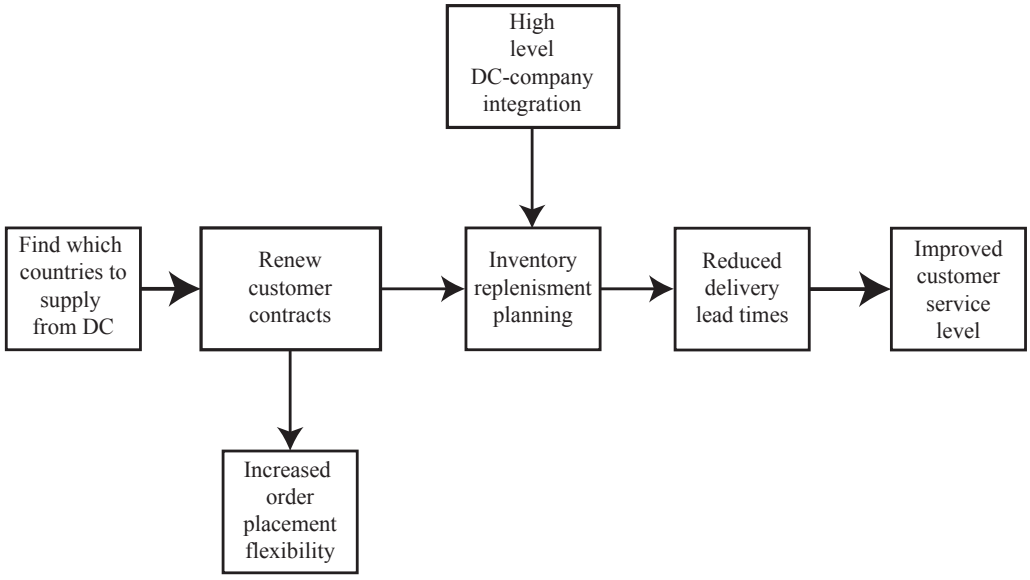

Figure 5.2 Proposed framework of solution 5.2

5.3 Information Flow Coordination: From Sequential to Central

Current information flow of X Co is sequential which means the information is transferred to the next party in the chain until it reaches its actual target. This situation causes reduced information quality, delays and thus a less effective flow. The proposed framework for the information flow is part-direct and part-central. This means some of the information is directly transferred to the target player and some information is shared via IT-based platform that provides ready to use and up to date information to authorized parties. It is expected that with reduced number of information transfer, efficiency, reliability and traceability of information in the system will increase. The platform also creates a single source of truth, which is critical in the global supply chain environment. Framework for the proposed solution is provided in

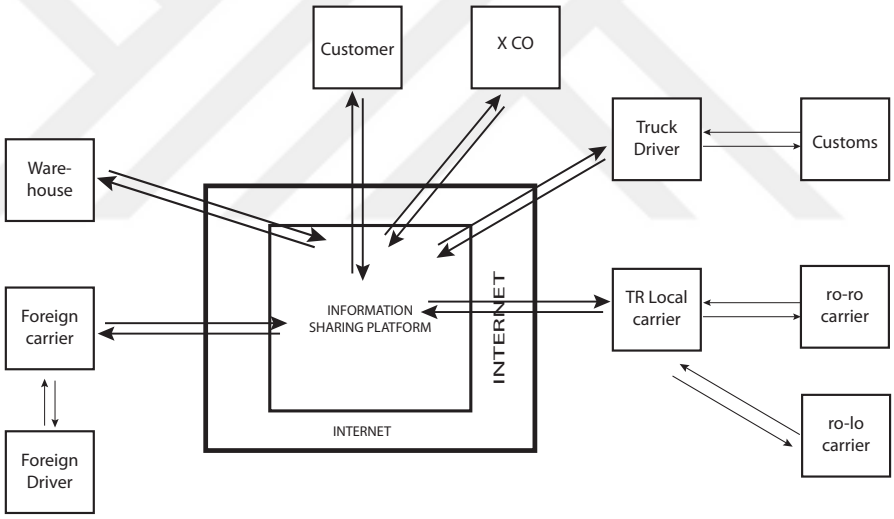

Figure 5.3 Proposed framework of solution 5.3

CHAPTER SIX
RESULTS

6.1 Coordination Level

X Co's level of GSCC is determined via a Likert scale questionnaire prepared by Stank and colleagues (1999), which has four parts: Communication (COMM) Information Technology (EDI), Partnership (PRTNR) and Performance Monitoring (PERF). The statements of this questionnaire are given below in Tables 6.1 to 6.4 (Stank, Crum and Arango, 1999). Statements in COMM, EDI and PRTNR sections are focused on client while PERF includes 3PLs that take part in the distribution process. Responses were gathered from 6 company executives. Average and standard deviations are calculated, and each statement is assumed to have the same weight (details are given in Tables 6.1 to 6.4).

Table 6.1 Survey results for COMM (1: always, 7: never)

	AVERAGE	STD DEV
Our company informs clients in advance about specific promotions.	6.83	0.41
Our company informs clients about price changes.	1.00	0.00
Our company informs clients about new goods (E.g. storage conditions etc.)	1.17	0.41
Our company informs clients about goods out of production .	1.17	0.41
Our company informs clients in advance about delivery problem.	2.00	0.00
Company informs clients inform each other about any conditions and / or changes may affect each side.	2.00	0.00
Our company informs clients about fluctuation of production may affect availability of goods.	1.17	0.41
Our company demands client's opinion while planning its logistic strategy.	3.75	0.50
Information flow between company and clients depend on needs, but not on predetermined regulation.	2.00	0.00
During trading, our company and clients share company's information if this information is useful for both parties.	3.00	0.00
In our relationship with client, company provides all information that might be helpful to counter party.	3.00	0.00

According to respondents, X Co always informs its customers on price changes. Company also almost always shares information about new products, out of production goods, delivery problems and production fluctuations. Additionally, most of the time company and clients share the information that might affect or be useful to the other party. However, it is discovered that X Co almost never informs customers

in advance about promotions. The overall communication coordination level between company and client is determined as 65%.

On the topic of information technology (EDI) use, responses reveal that customers never use EDI when placing orders, providing company with demand forecasts and POS demand information. This result matches with Stank and colleagues' (1999) findings (Stank, Crum and Arango, 1999). Additionally, company never utilizes EDI when sharing shipment tracking information. Therefore, level of coordination via IT-based solutions is 0% in X Co's case.

Table 6.2 Survey results for EDI (1: always, 7: never)

Our clients provide us with demand forecasting via EDI.	7.00	0.00
Our clients provide us with Point-Of-Sales demand information over EDI.	7.00	0.00
Our company shares cargo follow up information with clients over EDI	7.00	0.00
Our clients give order over EDI.	7.00	0.00

Next, on partnership, X Co always expects to have a long-term relationship with its clients. However according to the respondents, the company and its clients only sometimes put their efforts for the benefit of both parties and the relationship or try to solve problems collaboratively, instead of working on individual benefits. Still, X Co executives are satisfied with the existing level of partnership and collaboration with their clients, which is determined as 71%.

Table 6.3 Survey results for PRTNR (1: strongly agree, 7: strongly disagree)

We expect long lasting relationship with client who has chosen us.	1.00	0.00
Company and clients responsible not only one side but develop relationship that advantageous for both sides.	3.17	1.33
Not individually, but we collaboratively solve possible problems rise during trading.	2.50	0.55
Our company and clients do not hesitate to do favour to each other.	1.50	0.55
Generally, we are pleased to level of collaboration between our company and clients.	1.50	0.55
Both parties may expect to collaboratively alter the relationship to accommodate new conditions.	1.50	0.55
If any unexpected condition appears, our company and clients do not insist to follow original contract; instead, they put their effort to modify/change the contract.	3.17	0.41

Finally, on performance monitoring, executives agree that X Co has the ability to identify costs that affect their logistics activities, measure the relationships between these costs, measure customer service level for clients, measure the profit of different logistics services and can monitor the success of partnerships. On the other hand, executives only partly agree that X Co is able to follow the reason-effect relationships of its logistics costs.

Table 6.4 Survey results for PERF (1: strongly agree, 7: strongly disagree)

Our company is aware of accurate definition of function for each party in distribution process.	1.17	0.41
We have ability to follow reason-effect activities in our logistic costs.	2.67	0.52
We have ability to identify costs that directing our logistic activities.	1.50	0.55
We have ability to measure relationships between costs that directing our logistic activities.	2.00	0.00
We have ability to measure different level of logistic services for different clients.	1.50	0.55
We have ability to measure contribution / profit of different logistic services for different clients.	1.33	0.52
We have ability to determine whether different logistic service levels could be provided for different client's need.	1.83	0.41
We have ability to identify most profitable client by monitoring costs.	1.33	0.52
Our company can monitor success of partnership established by different parties.	2.00	0.89
Our company can offer services to clients planned for their needs.	1.33	0.52

6.2 Implementation Capability Evaluation

X Co's capabilities to implement suggested solution frameworks 5.1 and 5.2 are evaluated by X Co executives through Likert scale (1: Strongly Agree 7: Strongly Disagree) questionnaires. The statements in these questionnaires are given below. Company, Company and Carrier, Company and Customer, Customer and External Factors sections of both questionnaires are same. However, for solution 5.2 there are additional parts of Company and Warehouse, Warehouse and Client. The statements are as listed below.

Company

- Number of personnel in the corresponding department of the company is sufficient for applying proposed solution.
- Company's technology is sufficient for applying proposed solution.
- Organizational structure of the Company is suitable for applying proposed solution.
- Financial strength of the Company is sufficient for applying proposed solution.
- Competitive capacity of the company in the market is sufficient for applying proposed solution.
- Vision of the managers in the company is decisive for applying proposed solution.
- Financial advantage would be provided by this type of solution is decisive for applying proposed solution.
- Increased level of customer service quality by this solution is decisive for applying proposed solution.

According to the averages and standard deviations of answers given by 6 executives, company's financial power is certainly sufficient for solution 5.1 to be implemented. However, respondents are less certain about whether X Co has sufficient technology, organization level and competitive advantages to implement suggested solutions. The survey results also show that, vision of company managers, financial advantages and increase in the customer service level is decisive for implementation of both solutions (see Table 6.5 for details).

Table 6.5 Survey results for Company section (1: strongly agree, 7: strongly disagree)

	5.1		5.2	
COMPANY	AVERAGE	STD DEV	AVERAGE	STD DEV
Number of personnel in the corresponding department of the company is sufficient for applying proposed solution.	1.83	0.41	2.17	0.75
Company's technology is sufficient for applying proposed solution.	3.00	0.63	2.67	0.52
Organizational structure of the Company is suitable for applying proposed solution.	2.17	0.41	2.50	0.55
Financial strength of the Company is sufficient for applying proposed solution.	1.00	0.00	1.83	0.98
Competitive capacity of the company in the market is sufficient for applying proposed solution.	2.17	0.75	1.83	0.41
Vision of the managers in the Company is decisive for applying proposed solution.	1.33	0.52	1.00	0.00
Financial advantage would be provided by this type of solution is decisive for applying proposed solution.	1.00	0.00	1.33	0.52
Increased level of customer service quality by this solution is decisive for applying proposed solution.	1.33	0.52	1.33	0.52

Company and Carrier

- Despite to freelance carrier, working with contractor carrier positively affects the applicability of proposed solution.
- Service range of all contractor carriers is sufficient for applying this proposed solution.
- Level of transparency in sharing information by carriers with the company is sufficient for applying proposed solution.
- Compatibility between information shared by carriers and level of technology in the Company is sufficient for applying proposed solution.
- Usability / quality of the information the carrier shares with the company is sufficient for applying proposed solution.
- Speed of feedback / error correction between carrier and company is sufficient for applying proposed solution.
- Usability / quality of the information the company shares with the carrier is sufficient for applying proposed solution.
- Level of transparency in sharing information by the company with the carrier is sufficient for applying proposed solution.
- Bargaining power of the company against the carrier is sufficient for applying proposed solution.
- Level of technology used by the carrier is sufficient for applying proposed solution.

Results of this section reveals that company executives agree on the benefits of working with contracted carriers. On the other hand, technological compatibility of carrier firms is perceived somehow unreliable, when it comes to applying solution frameworks that need intense operational-level control, such as ours. Also, the averages are higher for solution 5.2 than 5.1. This is an expected outcome, because X Co is somehow unfamiliar with ocean transportation since, which is suggested in 5.2 (see Table 6.6 for details).

Company and Client

- Quality of demand forecasting data shared by client with the company is sufficient for applying proposed solution.
- Usability / quality of the information the company shares with the client is sufficient for applying proposed solution.
- Level of transparency in sharing information by the company with the client is sufficient for applying proposed solution.
- Level of transparency in sharing information by the client with the company is sufficient for applying proposed solution.

When we compare the answers given to this section of the questionnaire, we can see that executives find the quality of demand forecast data provided by the client less sufficient for solution 5.2 than 5.1 (see Table 6.7 for details). This might be due to level of planning which is tactical for solution 5.2 while operational for solution 5.1. Therefore, we can say that in order to implement solution 5.2 successfully company needs to extract higher quality forecast demand data from client.

Table 6.6 Survey results for Company and Carrier section (1: strongly agree, 7: strongly disagree)

	5.1		5.2	
COMPANY AND CARRIER	AVERAGE	STD DEV	AVERAGE	STD DEV
Despite to freelance carrier, working with contractor carrier positively affects the applicability of proposed solution.	1.50	0.84	1.67	0.52
Service range of all contractor carriers is sufficient for applying this proposed solution.	2.33	0.52	3.00	0.00
Level of transparency in sharing information by carriers with the company is sufficient for applying proposed solution.	2.00	0.63	2.17	0.75
Compatibility between information shared by carriers and level of technology in the Company is sufficient for applying proposed solution.	2.83	0.75	2.33	0.52
Usability / quality of the information the carrier shares with the company is sufficient for applying proposed solution.	2.00	0.63	1.83	0.41
Speed of feedback / error correction between carrier and company is sufficient for applying proposed solution.	2.00	1.10	2.50	0.84
Usability / quality of the information the company shares with the carrier is sufficient for applying proposed solution.	1.83	0.41	2.50	1.22
Level of transparency in sharing information by the company with the carrier is sufficient for applying proposed solution.	2.17	0.75	2.17	0.75
Bargaining power of the company against the carrier is sufficient for applying proposed solution.	2.00	1.10	2.33	0.82
Level of technology used by the carrier is sufficient for applying proposed solution.	3.00	1.10	2.67	1.21

Table 6.7 Survey results for Company and Client section (1: strongly agree, 7: strongly disagree)

	5.1		5.2	
COMPANY AND CLIENT	AVERAGE	STD DEV	AVERAGE	STD DEV
Quality of demand forecasting data shared by client with the company is sufficient for applying proposed solution.	2.00	1.10	3.00	1.10
Usability / quality of the information the company shares with the client is sufficient for applying proposed solution.	2.67	0.82	2.67	0.82
Level of transparency in sharing information by the company with the client is sufficient for applying proposed solution.	2.33	0.82	2.33	0.82
Level of transparency in sharing information by the client with the company is sufficient for applying proposed solution.	2.33	0.82	2.67	0.82

Client

- Fluctuation of inventory replacement policy of the client negatively affects the applicability of proposed solution.
- Country-based similarity in demands of clients is decisive for applying proposed solution.

Table 6.8 Survey results for Client section (1: strongly agree, 7: strongly disagree)

	5.1		5.2	
CLIENT	AVERAGE	STD DEV	AVERAGE	STD DEV
Fluctuation of inventory replacement policy of the client negatively affects the applicability of proposed solution.	4.17	0.75	2.67	1.21
Country-based similarity in demands of clients is decisive for applying proposed solution.	3.17	0.75	2.83	0.41

External factors

- Legislative regulations in traded countries is decisive for applying proposed solution.

Table 6.9 Survey results for External factors section (1: strongly agree, 7: strongly disagree)

	5.1		5.2	
EXTERNAL FACTORS	AVERAGE	STD DEV	AVERAGE	STD DEV
Legislative regulations in traded countries is decisive for applying proposed solution.	2.17	0.75	2.17	0.75

In the last two common sections for both solutions, executives' responses show that they somehow disagree with the negative effect of fluctuations in order placement for solution 5.1 unlike solution 5.2. They also equally agree that regulations of the importing countries can be decisive for the implementation of both solutions (see Tables 6.8 and 6.9 for details).

Company and Warehouse

- Service range of warehouse is sufficient for applying proposed solution.
- Level of transparency in sharing information by the warehouse with the company is sufficient for applying proposed solution.
- Level of transparency in sharing information by the company with the warehouse is sufficient for applying proposed solution.
- Storing capacity of the warehouse is sufficient for applying proposed solution.
- Speed of feedback / error correction between the warehouse and the company is sufficient for applying proposed solution.
- Usability / quality of the information the warehouse shares with the company is sufficient for applying proposed solution.
- Level of technology used by the warehouse is sufficient for applying proposed solution.
- Bargaining power of the company against the warehouse is sufficient for applying proposed solution.

Table 6.10 Survey results for Company and Warehouse section (1: strongly agree, 7: strongly disagree)

COMPANY and WAREHOUSE	AVERAGE	STD DEV
Service range of warehouse is sufficient for applying proposed solution.	1.83	0.41
Level of transparency in sharing information by the warehouse with the company is sufficient for applying proposed solution.	1.67	1.03
Level of transparency in sharing information by the company with the warehouse is sufficient for applying proposed solution.	1.83	0.41
Storing capacity of the warehouse is sufficient for applying proposed solution.	1.33	0.52
Speed of feedback / error correction between the warehouse and the company is sufficient for applying proposed solution.	2.33	0.52
Usability / quality of the information the warehouse shares with the company is sufficient for applying proposed solution.	2.17	0.75
Level of technology used by the warehouse is sufficient for applying proposed solution.	1.67	0.52
Bargaining power of the company against the warehouse is sufficient for applying proposed solution.	2.33	0.82

Warehouse and Client

- Usability / quality of the information the warehouse shares with the client is sufficient for applying proposed solution.
- Level of transparency in sharing information by the warehouse with the client is sufficient for applying proposed solution.
- Speed of feedback / error correction between the warehouse and the client is sufficient for applying proposed solution.

Table 6.11 Survey results for Warehouse and Client section (1: strongly agree, 7: strongly disagree)

WAREHOUSE and CLIENT	AVERAGE	STD DEV
Usability / quality of the information the warehouse shares with the client is sufficient for applying proposed solution.	2.17	0.75
Level of transparency in sharing information by the warehouse with the client is sufficient for applying proposed solution.	2.17	0.75
Speed of feedback / error correction between the warehouse and the client is sufficient for applying proposed solution.	2.67	0.52

The two additional sections are only created for solution 5.2 since it includes an extra 3PL provider which is a warehouse. Therefore, company-warehouse and warehouse-client interactions must be also evaluated (see Tables 6.10 and 6.11).

According to answers of 6 executives, warehouse capacity and technology is sufficient for this solution. On the other hand, respondents are less certain about the sufficiency of X Co's bargaining power over the warehouse provider, quality and transparency of information flowing from warehouse to the client and speed of status feedback between parties. Finally, results reveal that, executives only partly agree that warehouse provider's level of transparency is sufficient for the successful implementation of solution framework 5.2.

CHAPTER SEVEN
DISCUSSION AND FUTURE WORK

In this section, findings are discussed and direction for future studies is explained. First of all, as expected, X Co leverages the benefits of being a large enterprise, gets the best possible service and offers from its solution partners, therefore in order to achieve further improvements, coordinated decision making is necessary. This includes carriers, clients and warehouse(s) to be used. However, X Co does not need any integrated logistics practice to manage the complexity, which is expected to increase since changes in the current processes and contracts are proposed. These outcomes reveal that, an integrated logistics solution to be used to help SMEs benefit from using coordinated decision making without the hesitation of increased complexity, must cover the IT compatibility, information quality, information transparency, demand forecast data, quick status feedback, quick error correction, fair negotiation, inventory planning and performance monitoring functions.

This study contributes to field of global supply chain logistics in terms of utilizing TVSM for a non-carrier firm's logistics process mapping and exploring the necessary functions of integrated logistics solutions that are expected to benefit SMEs.

The future work for this study is suggested as running joint optimization models to reveal optimal conditions and exact benefits of proposed solutions. Also, in the field of integrated supply chain logistics, conducting more detailed research on mentioned functions in order to successfully design an integrated logistics management platform with embedded joint decision-making mechanisms, is determined to be a fundamental. Proposed information flow framework (see subsection 5.3) is expected to be a good starting point for designing this platform.

CHAPTER EIGHT
CONCLUSION

Currently, increased globalization enforces companies to improve not only themselves but their whole global supply chain in order to satisfy changing customer needs faster and also in a cost-efficient manner in order to gain/preserve competitive advantage in the market. Since the big part of the supply chain cost is made of logistics costs, the first target of improvement efforts is, reducing these costs without increasing the delivery lead time. Outsourcing logistics activities via 3PL providers is a determined to be a suitable solution. However, as the number of 3PL firms involved increases, complexity and coordination cost increases. This situation creates challenges especially for SMEs since these companies lack the resources (such as personnel and financial assets) and advantages (such as economies of scale, bargaining power) that large enterprises have. Therefore, SMEs cannot deal with many players at the same time without the help of integrated logistics solutions. The study was conducted to explore large enterprises' capabilities used to manage complexity and coordination, and thus determine the fundamental functions that an integrated logistics solution must cover to create same advantages and level of coordination for a SME.

X Co, a large food packaging manufacturer in Turkey was selected as focal company. Its relationships with clients and 3PL providers are explored and logistics process flow is mapped via TVSM. After determining the main issues, two solution frameworks for order consolidation to increase FTL deliveries thus to reduce logistics costs and opening a DC to increase flexibility and reduce delivery times are suggested. Another solution framework was also proposed for improved information flow. Level of coordination and X Co's capabilities to successfully implement these solutions were evaluated by 6 company executives via Likert scale questionnaires. Results were analyzed and main functions to be provided by integrated logistics solution targeting SMEs are discovered.

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APPENDICES

APPENDIX-1: TVSM workshop photographs

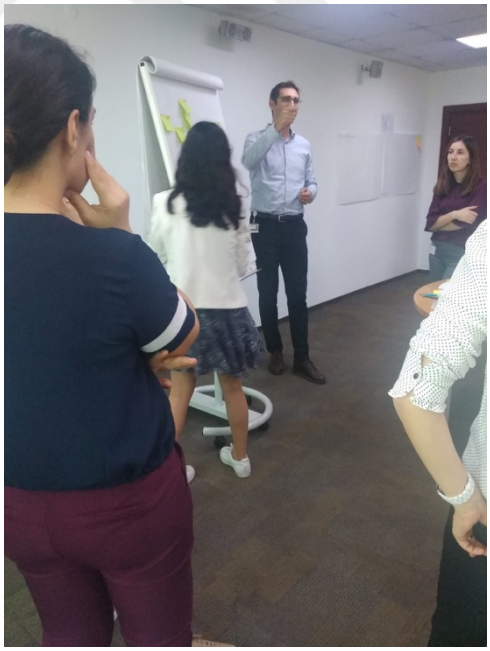

Figure 1 TVSM workshop photographs (personal archive)

APPENDIX-2: Complete TVSM

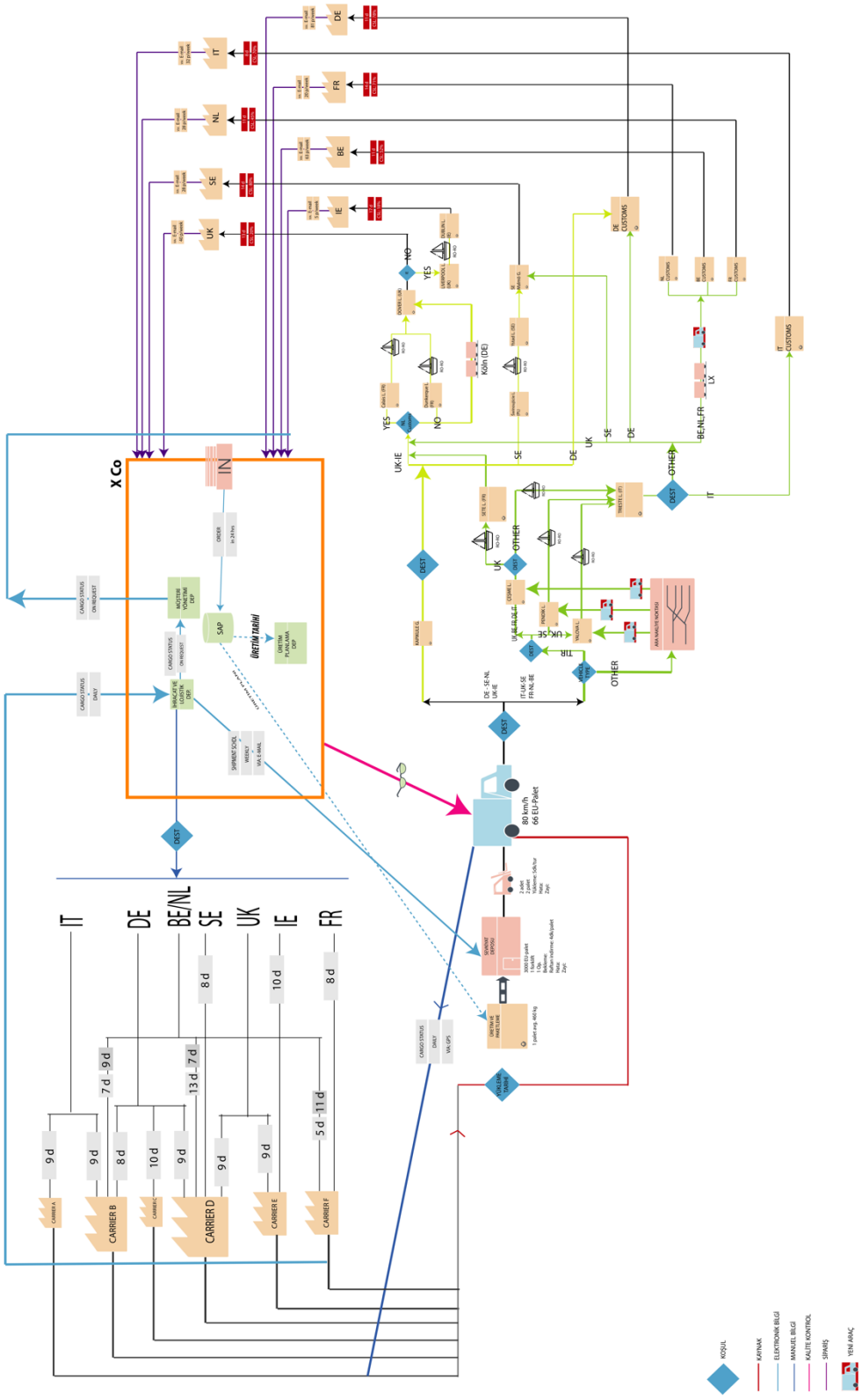

Figure 2 Complete Transportation Value Stream Map of X CO's EU export operations