



Expertise  
and insight  
for the future

Iryna Musiienko

# Evaluation of Information Technologies in Modern Supply Chain Systems

Metropolia University of Applied Sciences

Bachelor of Business Administration

International Business and Logistics

Bachelor's Thesis

2.12.2020

Author Title	Iryna Musiienko Evaluation of Information Technologies in Modern Supply Chain Systems
Number of Pages Date	45 pages + 1 appendix 02 December 2020
Degree	Bachelor of Business Administration
Degree Programme	International Business and Logistics
Instructor/Tutor	Suvi Moll, Head of the IBL Degree Program
<p>This bachelor's thesis gives evaluation of information technologies being used in modern supply chain systems. The case company, Company X, presents itself as such one company that plays a key role in sea freight consolidation and sea transportation in the Nordic region. Company X uses, innovative IT solutions in its daily operations but still looking forward to developing in this direction. This fact gives Company X the possibility to update operations and build a foundation for future development in this area.</p> <p>Qualitative case analysis was the research tool used in this study. The export / import operations handling system of the case company was analyzed and evaluated using related literature review and qualitative analysis method. The literature survey covered topics related to Information Technology innovations in supply chain systems. Qualitative research included data method of direct participating observation. Direct participating observation was conducted in case company's export and import unit where the processing of shipments appears. This work defines various IT used in supply chain systems, discuss the impact, benefits and challenges organizations face during implementing information technologies and proposes an evaluation and optimization considerations that will help companies in general and Company X to eliminate present barriers as well as improve internal operational correctness and performance. The purpose of the evaluation and optimization plan is to reduce holes in the existing structure of shipment handling system.</p>	
Keywords	SCM, IT, Blockchain, IoT, Big Data, EDI, ERP

## Contents

### Glossary

1	Introduction	1
1.1	General Importance of Topic	1
1.2	Background of the Study and Statement of the Problem	2
1.3	Research Objectives	3
1.4	Research Questions	4
1.5	Case Company Background	4
1.6	Structure of the Thesis	5
2	Literature Review	7
2.1	Introduction to SCM	7
2.2	Information Flow in SCM	9
2.3	Existing IT Tools and Applications in SCM	11
2.4	Emerging Information Technology Solutions for SCM	12
2.5	Objectives and Role IT in SCM	15
2.6	Benefits of IT application in Supply Chain Management	18
2.7	Challenges in Implementing IT Technologies in SCM	19
3	Method and Material	22
3.1	Exploratory research	23
3.2	Qualitative research	24
3.3	Data Collection Method (Method of Direct Observation)	25
3.4	Reliability and Objectivity	26
3.5	Research Material	26
4	Results and Analysis	27
5	Conclusions and further considerations	33
6	References	38
	Appendix 1. Observational journal	

## List of Figures and Tables

Figure 1 Types of flow in supply chain management (TutorialsPoint, 2020).....	3
Figure 2 Research design.....	6
Figure 3 Traditional Supply Chain (SlideModel, 2019) .....	8
Figure 4 Integrated Modern Supply Chain Model (Prashant R.Nair, 2020).....	8
Figure 5 Traditional and Integrated Supply Chain System (SlideModel, 2019).....	9
Figure 6 Shipment Handling Process.....	30
Figure 7 Proposed Shipment Handling Process.....	36
Table 1 Schedule / route / delay enquires from Clients .....	31
Table 2 SWOT Analysis.....	32

## Glossary

SCM	Supply chain management. The wide range of activities required in the most economical way possible to plan, manage and execute a product's flow from materials to production to distribution (A Knowledge Hut, 2020).
SCM SYTEMS	Interorganizational programs that allow firms to manage the stream of products effectively from sellers to consumers (What are SCM Systems?, 2020).
IT	Information technology. A collection of devices, methods and procedures and related hardware/software used to capture, manage and produce information (BusinessDictionary, 2020).
RFID	Radio-frequency identification. Uses electromagnetic fields to classify and automatically monitor tags attached to objects (RETAILINNOVATION, 2020).
EDI	Electronic data interchange. The idea of electronically transmitting information from companies that has historically been transmitted on paper, for example, purchase orders and invoices (WIKIPEDIA, 2020).
ERP	Enterprise resource planning. Software that allows to use an integrated app system to manage the company and computerize several infrastructure, facilities and human resources related back office functions (ABASERP, 2020).

# 1 Introduction

## 1.1 General Importance of Topic

This thesis focuses on evaluation of Information Technologies in modern supply chain systems. Topic is important to study as IT technologies are providing companies visible advantages and benefits such as increased productivity, minimized costs and errors. These technologies make possible to manage the shipment on its whole life-cycle way, from the point of planning a shipment and to the moment of release to the cargo to the end customer (in case we take into consideration logistics service providing companies). Some IT technologies are widely used by companies nowadays while the others are totally new and underestimated. Topic is relevant as IT innovations are pushing the boundaries and changing how the world does business. The case Company X is representing itself as that one that uses innovative IT solutions although it has not implemented the latest innovations yet. This thesis work gives evaluation on benefits, challenges, and possible negative influence in case of use IT technologies in SCM.

According to Emmanson's Blog (2012) IT innovations have given companies extraordinary chances to gain competitive advantage. As a result, investment in IT technologies is the crucial target for each company in order to keep in the flow.

Intelex Blog highlights (2015) that nowadays the difference between remaining afloat and sinking means providing a modern and agile supply chain. Companies that use modern supply chain systems are flexible and show better results in the long run. Innovations are fundamental to business advancement and supply chain management is no exclusion. Because of global competition, companies constantly have to maximize the efficiency of their supply network to face rapidly changing consumer demands. It can help to promote processes, minimize costs, enhance consumer satisfaction, and give better control over the supply chain by leveraging new technology.

Intelex Blog (2015) reports that organizations that know how to build and implement a philosophy of quality improvement are often able to find ways to distinguish themselves from other rivals. Inadequate communication and collaboration within the network are one of the most widespread risks in developing a solid supply chain. A disconnected supply chain leads to longer procurement periods, a decrease in quality, and rise in prices and ultimately affects consumers satisfaction.

Hau L. Lee and Seungjin Whang (2001) state that competitive organizations aim to achieve greater cooperation and alignment between all partners and stakeholders inside a common supply chain. This goal is called the "integration of the supply chain" in which information technology plays a central role in advancing their objectives.

Parshant R. Nair in his article (2020) emphasises companies who wish to succeed will realize that their current integration of the supply chain will have to be stretched beyond their limits and integrate all stakeholders. For such results, the support and use of information technology is important.

## 1.2 Background of the Study and Statement of the Problem

The topic of this thesis work is "Evaluation of IT innovations in modern supply chain systems". In this thesis work I will explore what kind of innovations are used in SCM nowadays and the impact (both positive and negative) of information technology (IT) innovations on the supply chain.

According the article published in The Blog of Logistics at MGEPS at UPV (2017) the principle of SCM involves data flow as one of the two key flow elements of the supply chain. The need to exchange data through the several supply chain stakeholders is of outstanding importance. Information operates as a link between the different stages of the supply chain, helping them to coordinate their activities and bear many of the benefits of increasing the profitability of the overall supply chain.

As supply chains include physical flow of goods, information flow and money flow (as it shown in Figure 1), the research and first of all observational results and key findings in this thesis concern only information flow in supply chains.

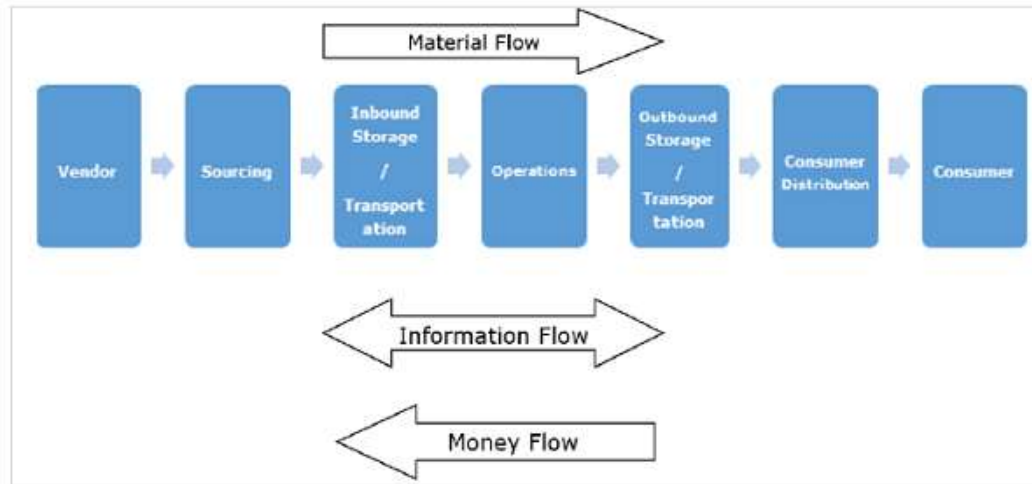


Figure 1 Types of flow in supply chain management (TutorialsPoint, 2020)

Continuous emerging technology growth, increasing worldwide rivalry, and bigger consumer demands are pushing companies to rethink how they can take benefit of information flow advances in information technology to produce competitive advantages, boost company efficiency, and manage their supply chains.

### 1.3 Research Objectives

Research objectives mentioned below describe what this thesis work is trying to achieve, they sum up the accomplishments that are going to be achieved through the project and give direction to the further study.

The research objectives:

- To determine the various IT used SCM for Information Flow.
- To discuss the impact (both positive and negative) of IT on SCM.



- To discuss challenges organisation face during implementing IT

#### 1.4 Research Questions

The aim of this thesis work is to evaluate and to analyse the use of IT innovations in modern supply chain systems, to find out what kind of solutions these IT innovations can offer to modern supply chain systems. The purpose of this research is to figure out evaluation and optimization considerations for the case company through the implementation of new informational technologies and to explore how new technologies can improve supply chains. The goal is to recommend adequate and up to date recommendations for Company X. Although solution in this thesis work is less important than analysis of causes and implications.

The study is focusing on four main research problems and questions:

- What IT innovations are used/can be used for information flow in SCM?
- What are challenges in implementing IT technologies in SCM
- What are advantages of using of IT innovations in modern SCM?
- What are the negative influences of information technology on supply chain performance?

#### 1.5 Case Company Background

The case company used in this research plays a key role in sea freight consolidation and sea transportation in the Nordic region. Today the company consists of 60 enthusiastic staff members in the 4 offices. With offices in Sweden, Norway, Finland and Denmark, Company X is a neutral consolidation company in the Nordic region. (Company X, 2020)

Company X also provides FCL-full container load and a variety of other transport services on land, rail and air, in addition to the basic business of LCL-less than container load and attention on direct consolidation services The company coordinates

freight consolidation to more than 500 export destinations and from more than 300 worldwide import places (Company X, 2020).

Highly qualified personnel, quality operating systems, creative IT technologies and financial strength offer the stability needed to meet today's market demands and potential expectations (Company X, 2020).

Company cares about health and wellbeing of its employees – it offers modern office in Helsinki, healthy working atmosphere inside the team, wellbeing package and work conditions according to Finnish laws and restrictions. (Company X, 2020)

## 1.6 Structure of the Thesis

The thesis contains of 5 chapters. The first chapter includes introduction of the topic. This chapter covers such questions as importance of the topic, background of the study and statement of the problem, research objectives and questions. This chapter tells also about case company background and illustrates structure of the thesis. The scope of this part is to present a background of the topic.

In the second part the literature review is presented. The purpose of the second part is to compare, understand and evaluate significant theories and points of view contributed to the topic. Empirical studies are applied in this chapter. According to article “Better Thesis, Your Online support” (2020) empirical studies are the collecting and review of primary data based on direct observation or field experience.

According to Sadcheva J.K. (2008, p. 46) in the literature review section, recent (or historically significant) research studies, company data and industry reports operating as the basis for the proposed study are reviewed.

The third chapter reflects the methodology of research used in this thesis and the data collection method. When carrying out this research, the qualitative research method was used. Primary information was collected by methods of observation and direct communication with respondents. Secondary data were gathered from books, journals, websites.

Figure 1 explains how the study was performed. To get an response to research questions, a comprehensive literature review of IT Innovations, their negative and positive influences took place. This theoretical framework for the thesis was established by these three major literature topics.

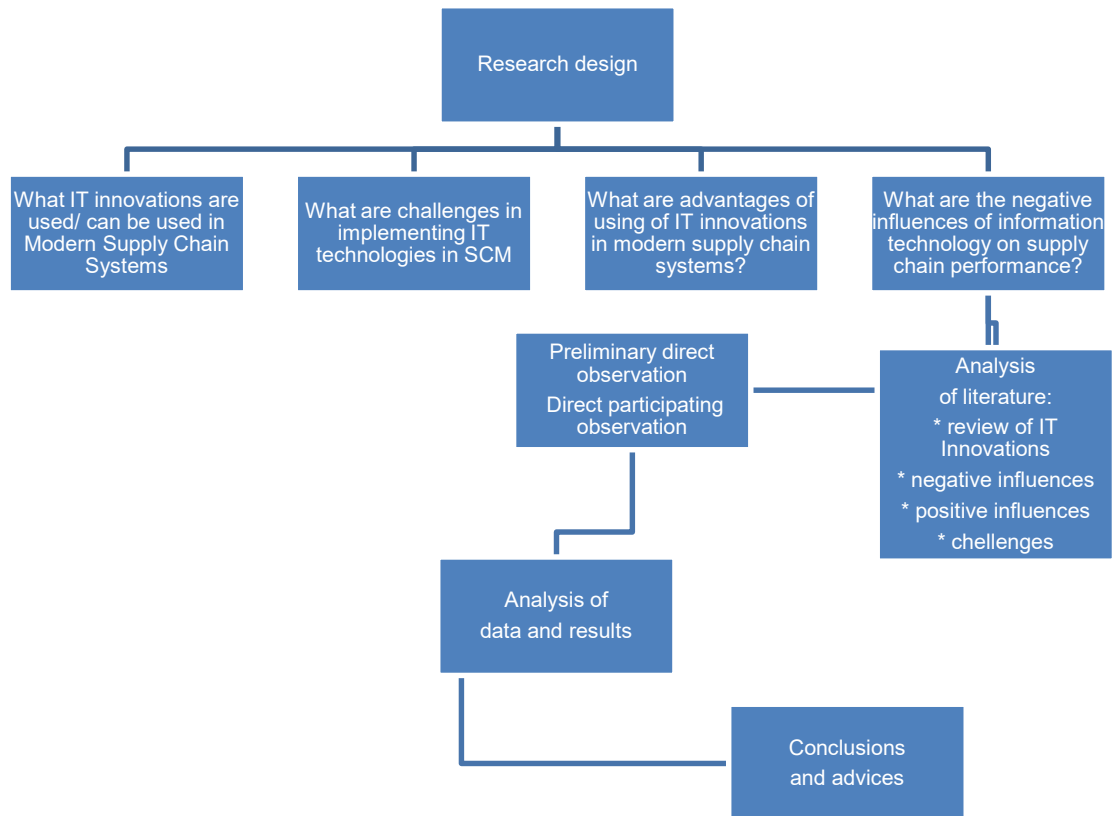


Figure 2 Research design

The result section gives a concise presentation of main and most important findings about IT innovations received trough examining literature and through direct observation method. The analyses is also done in this part and it summarizes and interprets collected data using qualitative analysis method.

The conclusion section's content includes recommendations and improvement considerations for the case company. The recommendations were developed based on both direct observation and study of literature.

## 2 Literature Review

### 2.1 Introduction to SCM

To understand how it is possible to improve the company's performance through improved information flow and implementing modern IT systems, it is important to know the definition of supply chain and supply chain systems and the differences between modern and traditional supply chains.

The article *What are SCM Systems?* (2020) explains that SCM systems are interorganizational systems that allow companies to successfully control the flow of products from suppliers to consumers. A supply chain is a network of companies and services that turns raw materials into goods shipped to consumers. The operations of the supply chain include everything from product development, procurement, manufacturing and logistics to the information systems used to manage these operations.

Same article (*What are SCM Systems?*, 2020) emphasises that organizations within one supply chain are "connected" by physical flows and flows of information. Physical flow includes the transformation, transfer and storing of products and material. These processes form the supply chain's most noticeable part. But information flows are just as important. Information flows allow the different stakeholders in the supply chain to organize their long-term strategies and monitor the regular flow of products and material up and down the supply chain.

According to Badenhorst J.A. (2013: 1) different organisations inside one supply chain are reliant on each other. The dependence lays in the supply of goods, facilities, and knowledge for optimal supply chain efficiency. In order to work properly, effective,

unrestricted information flow is required in supply chains. Information flow is therefore a part of the supply chain that requires to be controlled.

The source SlideModel (2019) states that traditional supply chains (as pictured below) are linear for all processes that run from left to right within a given product flow chain. And there are several various business processes and operations going on before a raw commodity becomes an actual good and meets the purchaser.



Figure 3 Traditional Supply Chain (SlideModel, 2019)

The bidirectional arrow reflects the accommodation of reverse information feedback flows in the integrated (modern) supply chain model ( Figure 4). (SlideModel, 2019)

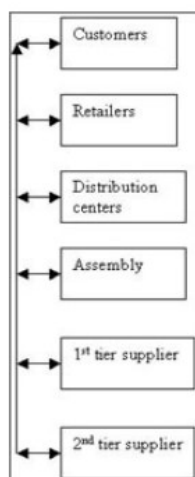


Figure 4 Integrated Modern Supply Chain Model (Prashant R.Nair, 2020)

The objective of modern supply chain is to connect all the processes of supply chain into one fully integrated global supply chain as shown in Figure 5. It also shows a good example how traditional supply chain differs from modern supply chain.

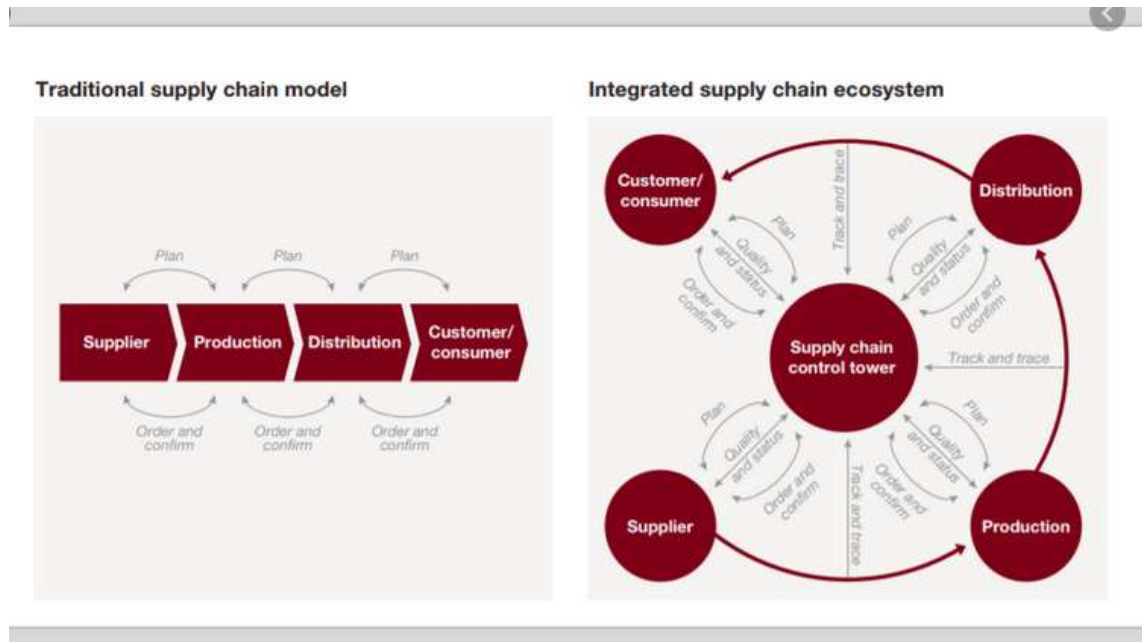


Figure 5 Traditional and Integrated Supply Chain System (SlideModel, 2019)

As we can see in the Figure 5 (SlideModel, 2019) modern supply chains are more transparent, there is better communication and collaboration between stakeholders, Data is automatically communicated to the whole network regarding any changes in the supply chain, decisions can be taken based on real-time activities, any change in end-customer requirements can be handled by the supplier automatically.

## 2.2 Information Flow in SCM

Prashant R.Nair in his study (2020) states that prior to the 1980s the information flow between different organizations, inside the companies and between different supply chain members was paper based. Transactions and correspondence on paper were slow. Information was often ignored as a key strategic resource, because its importance to supply chain participants was not clearly understood. Later importance of information was reconsidered. Satisfying customer needs has become something of a

corporate obsession. It has become important to serve the consumer in the safest, most efficient and effective manner. Information is a key factor in the ability of admin staff to reduce the demand for inventory and human resources to a competitive level. The flow of information plays a critical role in strategic planning.

In “Information flow is social” Wu Fang (2005) declares that it would be difficult to exchange information without efficient information flows. Information distribution is in fact needed to occur on a real-time basis, to minimize confusion among supply chain participants and to contribute to smoother and more effective supply chain functioning and integration. The flow of information in business organizations and in supply chains in particular influences efficiency and creativity because it determines how easily individuals can act and organize future activities.

According to Himanshu S. (2020) IT must ensure that information moves seamlessly through divisions and should direct organizations to pursue business practices that are most viable. At this stage, IT ensures that information flows smoothly through the various departments and establishes and manages a company-wide database. This database would remove the need for current, and in each department, isolated data islands and make the data of the company available across departmental boundaries. This enterprise-wide sharing has many advantages, such as process automation, high-quality information accessibility for better decision-making, and quicker response times.

In the same article in Himanshu’s (2020: 748) states that a core idea of information systems for the creation and management of effective supply chain is the need for practically seamless connections within and between organizations. In other words, the target of information technologies is to allow the transmission of seamless information internally between marketing , sales, purchasing , finance, production , distribution and transport, as well as inter-organizationally – between consumers, vendors and carriers across the supply chain. Effective information flow can maximize customer service satisfying rates, improve predictability, decrease overall inventory and save on the company's transportation costs. After all, incorrect or incorrect data from one end of the supply chain to the other may lead to enormous inefficiencies, such as wasteful spending on inventory, poor customer service, lost revenues, incorrect capacity plans, inefficient transport and incorrect manufacture timetables. This is called bullwhip effect,

which is widely seen in the consumer goods industries. Appropriate innovations, such as bar coding and scanning, have been created and used to sections of the supply chain to minimize mistakes.

### 2.3 Existing IT Tools and Applications in SCM

#### Electronic Data Interchange (EDI)

According to Prashant R.Nair (2020) EDI technology was launched in the 1970s and spread in the 1980s, and was frequently used by companies in supply chains to simplify transactions and information exchanges. EDI is characterized as the exchange of structured data from computers to computers for automatic processing. The supply chain partners use EDI to share vital information required for the efficient operation of their companies. Typically, these institutional ties are developed between organizations which have a long-term mutual relationship. The key benefits of using EDI are that the computer system only needs information once, and then it can speed up transactions and reduce costs and error rates. EDI's other advantages are fast information collection, better customer service, decreased paperwork, enhanced productivity, improved tracing and expediting, cost savings and improved billing.

#### Bar Coding and Scanner

In the same article named "Overview of Information Technology tools for supply chain Management" Prashant (2020) informs that bar codes are the representation in a form proper for reading by machines of a number or message. Bar codes are commonly used in the supply chain to identify and track products at all stages of the process. Bar codes are a set of separate lines of width that can be viewed in a horizontal order, called orientation of the ladder, or a vertical order, called orientation of the picket fence. For example, the warehouse management system can recognize goods received in a warehouse and add them to stock kept in the store. The bar code is used when placed away to connect the storage position with the bar-coded stock, and the stock record is updated upon dispatch. Using bar codes will greatly speed up the operations. On the other hand, if bar codes are incurred or labels fall off in transit, the problems will arise.



To extend this equipment's long-life span, the maintenance management must be implemented.

#### Enterprise Resource Planning (ERP)

ERP is described in the same article "Overview of Information Technology tools for supply chain management" by Prashant R. Nair (2020) as transaction-based information systems that are applied across the organization. Practically, they allow data collection for the entire company in a single computer program, which provides a single source for all main operations, such as customer orders, stock and financial data.

#### Radio Frequency Identification (RFID)

The author defines (Prashant R.Nair, 2020) that the bar code was intended to increase retail space efficiencies, but the bar code cannot recognize individual objects individually, such as when products are manufactured, the lot of products were created and when the items would expire. RFID was able to look after these problems. Indeed, both RFID and bar codes are very similar, both of which are auto-ID technologies which are intended to identify products. The primary difference is that the items read data. The reading device scans a printed label using optical laser or imaging technology in bar coding and RFID; the reading device uses radio frequency signals to scan a tag.

### 2.4 Emerging Information Technology Solutions for SCM

Emerging information technology solutions are those which are in the early phases of growth and create enthusiasm and increased investment. Although they are not yet commonly used, in the next three to five years, new technologies will likely bring major benefits to communities and economies. Ideally more than one company should be designing the technology. Finally, new technologies disrupt or change industries and have evolved ways of doing stuff (CSCMPI'S SUPPLY CHAIN, 2020).

Organizations that are offering and developing new solutions and technologies single out three technologies that are impacting supply chains the most. These are blockchain, IoT and Big Data. When combined with more conventional supply chain management systems and business network activities, the combination of IoT, AI and blockchain can drive new levels of innovation and efficiency (Opentext, 2020).

#### Artificial Intelligence (AI) and Machine Learning

Loo Saw Khuan & Santhiram R. Raman in their work (2018) state that purchasing professionals might use artificial intelligence to source, classify and match the products with the required suppliers. It can also be used to alert consumers to possible price spikes and product shortages. Furthermore, artificial intelligence may be used to warn contract renewal and administration of suppliers.

#### Blockchain

Blockchain is defined by McDaniel and Nordberg (2019) as a modern way of communicating and recording the info. It is a decentralized digital ledger where users can safely exchange information without a third party being needed. Users and their computers are referred to as "nodes" and can make transactions with others, such as exchanging money. Each transaction is confirmed by consensus, meaning no one may make alterations on their own. All information is added to a block after the transaction is checked on the network. Then a new cell block is put in to the blockchain, where several copies of the same data are stored at various locations. It is almost difficult to make any changes after that because each block forms a complicated chain, making it very safe for its users.

Kshetri (2018: 80) argues that the supply chain is likely to be changed by blockchain. Among the trends that will impact SCM is a growing emphasis on the use of Internet-of-things (IoT) applications. Using IoT, RFID, GPS and chips shipments and containers can be monitored at each stage. This enables better, real-time control of items. The first of the direct advantages of blockchain is that it offers a potential identity management solution. Blockchain can be used to know who is doing what in a supply chain. In addition, the time and place of the activities can be defined. Koetsier (2017)

declares that blockchain allows the valid and efficient evaluation of outcomes and key SCM process results. When the data are in a blockchain database, they are permanent. Other suppliers can also monitor orders, deliveries and progress in the chain. Blockchain generates trust among suppliers in this way. Quality can be enhanced by removing intermediate auditors, and costs can be minimized. On Kshetri's opinion (2018) blockchain also offers an efficient way to calculate the consistency of a commodity during transportation. For example, by analyzing travel path and period data, all members of a supply chain may know if the product was in the wrong place or if it stayed at a location for too long.

Blockchain offers several benefits to its users as Mougayar states (2016). One of the benefits is reduced prices, which is possible because the need for third parties is removed. With no central authority, the transactions in blockchain technology are considerably faster. Privacy is improved, and since all transactions are checked, such accountability was never possible before. Faster procedures and lower error rates contribute to increased productivity and higher results, enabling better profits to be made and company to expand.

The article "Using blockchain to drive supply chain transparency" (Deloitte, 2020) states that new technologies are posing exciting possibilities for supply chain. The use of blockchain can increase efficiency and traceability inside the supply chain, as well as reduce managerial costs. Blockchain allow participants to record prices, date, location, quality, certification and other important information to manage the supply chain more effectively. The availability of this information inside blockchain will increase traceability of the supply chain, reduce losses from the grey market, enhance visibility and enforcement over outsourced contract manufacturing and potentially improve the role of a company as a leader in responsible manufacturing. Challenges: Technology is still in early supply chain trials; industry is still learning about safety, costs, and consequences; continued difficulty connecting blockchain to physical objects; uncertainty persuading blockchain to be accepted by all stakeholders.

## IoT

Ranger S. in the article “What is the IoT?” (2020) says, that the Internet of Things, or IoT, means the billions of physical devices currently connected to the internet around the world, all gathering and exchanging information. Thanks to the launch of super-cheap computer chips and the ubiquity of wireless networks, everything can be converted into a part of the IoT, from anything as small as a pill to anything as huge as an aircraft. Connecting and attaching sensors to all these various items brings a degree of artificial intelligence to devices that would otherwise be stupid, enabling them in real time to share information without involving a human being. The Internet of Things is making the world around us smarter and more adaptive, linking the physical and digital worlds.

## Big Data

Big data is a concept that explains the massive amount of information that inundates a company on a regular basis, both structured and unstructured. But it is not the quantity of information that is relevant. It is what companies do with the information that matters. Big data can be examined for perceptions leading to better business decisions and strategic steps (SAS, 2020).

### 2.5 Objectives and Role IT in SCM

The objectives of IT in SCM are (Simchi-Levi, D. at al., 2003):

- offering information accessibility and visibility,
- allowing a separate point of contact for data;
- allowing making decisions on total supply chain information; and
- enabling collaboration with partners

Ketchen (2008) mentioned that emerging technologies, global competition, and expanded consumer demands force companies to rethink how they can benefit from IT's capacity to better control their supply chains. Marinagi (2014) noted that by incorporating both internal and external business functions, IT practices and techniques are used to allow knowledge distributing across supply chain partners. In addition, IT goals and priorities can be matched with strategic SCM to boost efficiency, competitiveness and profitability.

In the past 25 years, information and communication technologies (ICTs) have played a key role in driving logistics transformation, but ICT includes a range of different technologies, ranging from transport planning and scheduling applications to RFID and telematics applications (Mena & et al., 2007). IT plays an important role in the success of companies in the market world. It provides knowledge flow that allows the supply chain stronger and more robust without compromising its effectiveness.

In previous years, most companies are gradually implementing IT systems in supply chain management (SCM) practice to boost their functioning in competitive global markets (Bayraktar & et al., 2009).

Mazur I. (2018) states that company processes need to be digitized in all fields including logistics. Given the close relationship with IT services, their growth patterns need to be monitored. Since businesses are aware of the intensity of the logistics service industry, they are increasingly working to optimize work processes, depending especially on the optimization of information flows between parties and parties.

On Rajiv's opinion (2020) technology is a tool for increasing the productivity and output of the supply chain by improving the overall productivity and reliability of the logistics system. It is therefore very important for any organization to choose the right technology for different logistics operations or sub-processes to gain a competitive edge in today's competitive market.

Krstev in the article (2011) states that everyone recognizes that successful management of the supply chain will be a significant source of competitive advantage. Accordingly, the task of a supply chain manager must be to connect the end users, distribution networks, manufacturing processes and procurement activities in such a

way that the requirements of customer service are met and at a lower overall cost than the competition. The successful use of information technology (IT) is one of the enabling factors for achieving this purpose.

Bayraktar (2009) adds Information technology ( IT ) plays an essential role in the success of corporations in the market world. It provides knowledge flow that allows the supply chain stronger and more robust without compromising its effectiveness.

Dominika C. and Branimir Z. (2017) report that companies that implement agile modern supply chain practices show better result in the long run. Innovation is essential to improving the business and supply chain management is no exception. Organizations must continuously maximize the efficiency of their supply network due to global competition to satisfy ever-changing customer demands. Leveraging new technology can help automate processes, minimize costs, enhance customer satisfaction, and give the supply chain greater control. Investment in information and communication technology and their use in logistics processes will lead to the fulfillment of individual users' needs, efficient execution of business operations, improvement of the quality of service by creating conditions for better customer service, maximizing the time needed for service delivery, reliability of delivery times, guaranteeing and protecting the products, while also enhancing the company's picture.

On the basis of intelligent systems support staff can focus on creative value-added activities and be exempt from routine tasks. Given the upcoming shortage of skilled workers as possible, thus the productivity of older workers to keep for a longer working life. Flexible work organization allows employees to better combine work and family life, and to combine it with better training and improve Work-Life Balance (balance of life). (Demirova S., 2017)

According to Vijayarajan (2018) the logistics sector is experiencing a phase of rapid and unparalleled transformation. With innovation and technology, the future of logistics is paved. Today, to provide quicker, cheaper, more efficient and sustainable delivery, the industry is rapidly adopting these technologies.

## 2.6 Benefits of IT application in Supply Chain Management

According to Unicsoft (2019) too many companies are still using outdated methods in their supply chain, particularly when it comes to the flow of paper documents and people-based production and transport processes. The main disadvantages of such regressive policies include:

- Inaccurate paper records: easy to lose or to mix, easy to fake or substitute, storage space required.
- Slow access to the necessary data: it is difficult to quickly find a paper-based information when needed; it takes a lot of time to search for information within the database.
- Lack of transparency: in the manufacture and distribution of products to the various players in the chain and to the regulatory authorities.
- Monitoring difficulties: production of goods and automatic control of revenue forecasts, inventory management and procurement.

Emmanson`s Blog (2012) points on the following benefits of IT application in SCM:

- Streamlining - more effective cooperation with suppliers worldwide.
- Connecting - connection between customers´ wants and suppliers´ offers
- Analysing - analysing supply chain and production options and selecting a strategy that makes best use of assets
- Synchronizing- synchronizing the flow of batch production by managing the capacity of vessels, tanks, and lines-and the flow between them.
- Communicating - improvement of communication and collaboration with suppliers worldwide.

- Designing- creation the optimal supply chain network and adaption the network to keep pace with changes in business.
- Transforming- transforming the processes inside the warehouse and across the supply chain to meet demands for new efficiencies.
- Understanding - get a better understanding of warehouse labour activities and implementation the needed changes to optimize worker performance.
- Maximizing - maximizing warehouse profits by using advanced costing, billing, and invoicing capabilities.
- Optimizing - optimization day-to-day fleet performance to reduce costs and improve customer satisfaction.

## 2.7 Challenges in Implementing IT Technologies in SCM

The efficient use and implementation of IT in supply chain systems gives a lot of advantages to the companies but on the other hand the companies that are using IT technologies in their daily work are facing also some challenges and unwanted results. Despite the significant advantages, there are also disadvantages that should be considered before implementing new IT solutions.

- Security issues - One of the biggest problems and not only in supply chain but rather for all companies that rely on Information Technologies in their daily work is Security Issues. Company's sensitive data like bank records, intellectual property can be achieved by hackers.
- Lack of harmonization - When creating information space for support of logistics operations in the supply chain it is important to manage decisions on the selection of a particular set of information and communication resources, otherwise, lack of harmonization does not allow participants of product distribution to recognize the information. It should be noted that the market of



information and communication technologies is very diverse, which in turn determines the high demands of the abilities and skills of IT-managers, both in design and development of information solutions, as well as when they are used in business practice. (Pustynnikova E.V. & Baklushinskii V.V. , 2016)

- Lack of time for team - member training and restructuring - adding a new system into a functioning supply chain is challenging and frequently needs restructuring and team-member preparation. This method must involve thorough preparation and consistent, substantive communication, or might result in costly mistakes and unnecessary turnover of employees. (Carter Logistics, 2020)
- Implementation expenses - the integration of a new information system into a company's process requires high costs including expenses for software, hardware and people. According to Dominika C. & Branimir Z. (2017) inappropriate logistic solutions can lead to high costs being incurred directly by the customer, missed deadlines, business failures or similar business problems.
- Maintenance and upgrade expenses - technology is continuously being changed, requiring frequent and expensive improvements. Each upgrade involves employee preparation, taking time out of the working process. The loss of productivity, combined with the cost of software and implementation, will reduce overall profitability. Each update can also decrease morale as workers struggle to learn new technologies and meet new performance standards. (Nestor-Harper M., 2019)
- Breakdown of a system - breakdown of a system can halt the entire supply chain and lead to crucial cost and reputation losses.

Organizations need to work together in order to build a perfect supply chain and to maximize their market share. More significant and progressive changes in individual business performance can only be reached with this support for the holistic chain concept (Prashant R.Nair, 2020). It was found that the technology and services required to fulfill market demand are not available to a single company and

that all supply chain organizations have a crucial role to play in adding value and fully understanding and meeting customer requirements. As a consequence, the member organizations of the supply chain began to organize and incorporate their planning, key business processes and technologies across corporate borders. (Lambert, D.M., 2008: 1-3). Further developments in information technology help companies to share information that has been described as one of the most significant factors in the growth of integrated supply chains. (Salo, J. & Karjaluoto, H, 2006: 20).

Supply chain management includes continuous decision-making individually and collectively by each of the supply chain participants in five separate areas: manufacturing, inventory, location, transport and information (Hugos, M., 2006: 4-6). The sum of these choices will decide the supply chain 's capability and productivity. In order to organize everyday activities relating to the functioning and planning of the other four key areas, information is mainly required. The information collected at different points in the supply chain must flow efficiently between the departments of a company and the supply chain member companies (Hugos, M., 2006: 16). However, efficient information flow, precision, reliability and comprehensiveness are directly associated with efficient interoperability between the various supply chain partners' handling and use of this information. Interoperability means a smoother flow of data and an effective method of decision-making (Tyrinopoulos, 2004: 101). The failure to deliver information correctly to where and when needed would have an impact on decision-making in the four main areas and thus on the effectiveness of the entire supply chain.(Badenhorst, J. A., Maurer, C. & Brevis-Landsberg, , 2013: 1).

Any company that wishes to use and apply the concept of an integrated supply chain management strategy with the use of IT tools, knows that one of the biggest challenges it will face is the change internal culture that is needed to make the supply chain restructure effective. Re-conditioning people to support change, especially in organizations where a certain mentality has existed for many years, is not a simple thing. Change can be done successfully if led by a powerful and knowledgeable leader who understands the tools available to make meaningful improvements, as well as their role in the implementation and maintenance of those changes. It may also be a challenge to incorporate new apps with existing and legacy systems.(Prashant R.Nair, 2020).

With the growing use of integrated information systems and enabling technology, it has now become possible to build streamlined supply chains that connect sellers to consumers to reduce weak supplier productivity, unpredictable consumer demands, and uncertain market environments. (Bayraktar & et al., 2009). However, the investment needed for the adoption of new IT is often not desired, whereas cooperation might generate a unique benefit that cannot be individually accomplished by a single entity. (Dutta, A., Lee, H.L., Whang, S., 2007: 646).

### 3 Method and Material

According to Kothari C.R. (2004) Research is an information quest. Research may once also be described as a scientific and systematic search for knowledge on a particular subject. Research is simply an art of scientific research.

The methodology of research is the basic methods or techniques used to detect, pick, process and analyse information on a topic. The research paper helps the reader to assess the overall validity and reliability of a report in a critical manner (Research Support: Research Methodology, 2020). Kothari C.R. (2004) identifies research methodology as a method to systematically solve the research problem. It may be identified as a science of studying how research is done scientifically.

In this section are described various steps that are used in studying above mentioned research problem and questions. This thesis presents itself the explanatory problem-centered research, which announces the subject to the reader; it does not declare a stance which needs an argument to defend. This explanatory thesis is evident, it does not contain personal opinions or make claims that are unsupported by evidence. Instead, it tells precisely what the topic will be and touches on the major points that will be explored. Solution in this case is less important than analysis of causes and implications.

### 3.1 Exploratory research

Research method used in this study is exploratory. Exploratory research is the initial research into a conceptual or theoretical concept. This type of research is not about making final decisions, but rather gathering general information about a subject (Study.com, 2020). In order to determine the essence of a problem, exploratory research is performed. The aim of this research is not to provide final and definitive solutions but to explore research questions. Exploratory research allows scientists to understand the issue better, but exploratory research findings are generally not useful for decision-making alone. Exploratory research may offer useful understanding into a given scenario, as the aim is to collect initial data to help identify problems and propose theories (DeFranzo, 2014). The researchers use exploratory research as a starting step when a challenge is complex and not clearly specified. Exploratory research is a valuable way of recognizing what is going on; finding new insights; asking questions and analysing phenomena in a new light (Yin R.K., 1994). The aim of exploratory research is to formulate issues, explain concepts, gather interpretations, gain perspective, remove unrealistic ideas and shape hypotheses more specifically. To perform exploratory research, literature research, surveys, focus groups and case studies are typically used. Hypotheses may be created through exploratory testing, but it does not aim to test them (Bholanath D., 2009).

Advantages of Exploratory Research are as follows:

- Flexibility and adaptability to change
- Exploratory research is effective in laying the base that will lead to future studies.
- Exploratory studies can potentially save time and other resources by defining at the earlier stages the types of research that are worth pursuing (Research Methodology, 2020)

### 3.2 Qualitative research

Based on the study of Guba and Lincoln (1994) Two approaches or research methods are available, i.e. The quantitative and qualitative tools available to scientists. The use of numbers and percentages is the most important distinction between the two methods. Naturally, the choice of research approach depends on the specified research problems and the data necessary to solve these issues.

In terms of quantity, quantity, intensity or frequency, the qualitative approach emphasizes processes and meanings that are not measured. The qualitative approach gives a deeper understanding of the phenomenon in the scope (Guba, E. G., & Lincoln, Y. S., 1994)

To obtain an understanding of the underlying causes, beliefs, and motives, a qualitative approach is used. It offers insights into the issue or helps to generate ideas for future quantitative analysis or theories. Qualitative analysis is often used to expose patterns in thinking and beliefs and dig deeper into the problem. Using unstructured or semi-structured techniques, qualitative data collection approaches differ. Focus groups (group discussions), individual interviews, and participation / observations are several common approaches. Usually, the sample size is limited, and respondents are chosen to fulfil a given quota.. (DeFranzo S., 2011)

Qualitative analysis is the primary data collection approach that focuses on revealing motives, beliefs, and underlying facts. Qualitative analysis in a case study could be carried out by qualitative interviews and direct observations based on the collection of quality data. (Swanson, R. A., Holton E. F., 2005).

According to Gillham (2000), qualitative research in a case study allows to:

- Study subject despite the lack of information available
- Analyse subject in detail and get underneath of it
- Explore the case from the perspective of involved people

### 3.3 Data Collection Method (Method of Direct Observation)

Observation is a method of gathering data through observing, as the name suggests. The method of gathering observation data is known as a participatory study since, when taking notes and/or documenting, the researcher has to immerse herself in the area where her respondents are. Observation may be structured or unstructured as a form of data collection. Data collection is carried out using particular variables in organized or systematic observation and according to a pre-defined schedule. On the other hand, unstructured observation is performed in a transparent and freeway in the sense that there are no pre-determined variables or targets (Research Methodology, 2020).

In addition to visually gathering information, observation includes listening, reading, smelling and touching. According to Sachdeva J.K. (2008) The advantage of the observational approach is that at the moment they occur, we can obtain the original data.

As pointed out by Gillham (Gillham, B., 2000), In order to resolve these difficulties, the researcher must maintain a continuous and on-time updated observation journal and cultivate an ability to look from the side at the subject investigated, attempting to refer to all possible aspects of the situation. To be accurate, the observation journal should contain the following:

- First impressions
- Ideas about the subject
- Things to remember and to check later
- Analytical notes

### 3.4 Reliability and Objectivity

As highlighted by Scholz and Tietje (2002) in order to enhance the reliability and objectivity of the work, the case study should include comprehensive research process information. Subsequent behavior should also be incorporated to achieve a high degree of reliability and objectivity.

- The research question should be clearly expressed
- The design of the analysis should be adequately focused on research questions.
- Primary data should be regularly obtained.
- Information should be systematically analyzed

In addition, this study includes an observational journal in the appendix section of the research work, taking into account the research process.

### 3.5 Research Material

The primary objective of direct participating observation was the compilation of primary data on IT technologies that has been already used in case company and related problems/challenges and benefits in import and export operational department in actual environment. Case company's team consists of 15 employees including author of this thesis.

This thesis observation data is based on:

- Observation of this thesis author's and colleagues' daily export and import operations workflow

- Observation of internal communication related to IT and further development of IT in the company
- Observation of improvements during almost 1,5 year of work in case company
- Observation of IT being already used in case company.

Direct observation was carried out in two steps:

- The purpose of step one was to write the first experiences of the author before evaluating literature in order to collect data that was not influenced by theory.
- After the literature review, the second stage of direct observation was carried out. It should also be noted that the author gathered data during the second process about IT Technologies and innovations being already used in the company.

#### **4 Results and Analysis**

The key results from the direct observation of the work environment of the case company are seen in this study section. The interpretation of this knowledge is also discussed in this section. It is possible to find the data source in Appendix 1.

Company X offers to authorised clients several IT solutions available online. It uses also modern communicational solutions and software/hardware technologies (Company X, 2020). Existing IT Technology Tools and Applications, their advantages and possible disadvantages of each offered solution from the perspective of direct observation are as described below.

Electronic Data Interchange (EDI)

EDI - is an important communication tool between all supply chain members.

Information via EDI is sent quickly and safe to a necessary partner. The Company X



uses this for the data transmission to suppliers, agents and other members. EDI is used for sending Waybills, bookings, loading lists, manifest container lists to agents, warehouse and other divisions of company. The possibility to send documents via EDI is integrated into ERP system. It saves time and resources but at the same time is still on the implementation stage and requires time, high implementing costs and training-sessions for staff. EDI is fast and convenient – only one klick is needed to transfer a huge volume of information to supply chain stakeholders. Unfortunately, not all stakeholders in company's supply chain network are using EDI technology, still 90% of documents transmissions are done by email. Another one big gap in using EDI technology is breakdown of system. It is very dependent on hardware/software issues and internet connection. At this point of implementing EDI to the daily shipping handling process it is worth to have an additional or alternative way for sharing information to avoid unsuspected problems due to system breakdown.

#### Bar Coding and Scanner

Is used by warehouse to recognize the shipment. It is very important tool in case of consolidated cargo.

#### Enterprise Resource Planning (ERP)

Company X has in its use convenient and secure ERP program which idea is to connect warehouse, three offices and agents and to gather and save all information available. It shows all needed information starting from the moment when booking is made by client and up to moment when somebody wants to see statistical data.

Besides this Company X has very convenient and smart tools on its website: These are fore example:

- Rate and emission calculator – freight rates and emission calculator are available online for company's partners and clients. First advantage is that it saves time and resources in case of rate calculator, from the other hand it is only basic tool and does not include all features and rates (like overweight or long colli etc.). Emission calculator is a good toll for environmentally responsible

company. Company X is defined as an environmentally friendly distribution partner. The organization continuously enhances the organization's environmental work and reduces the environmental impact of its transport from a technological and financial point of view, as long as it is viable. It follows up on its chosen subcontractors to decrease their CO2 levels and ideally be an ISO 14001 business or at least operate in compliance with the same standard. (Company X, 2020).

- Booking online –is a good tool for a company that cooperate with a Company X on a permanent way and place a lot of similar orders to same destination countries. This tool saves time for shipment bookings.
- Domestic trucking and emission calculator - allows to get actual freight rate for road domestic transportation including emission and impact on the environmental.
- Local charges at destination and origin calculator – good tool to understand what includes in your freight rate.

Emerging IT Technologies such as blockchain, IoT and Big Data are not used and probably will not be used in recent years due to that fact that the company acts efficiently nowadays. The simplified shipment handling process at Company X export operational department from the point of view of direct observation can be presented as following:

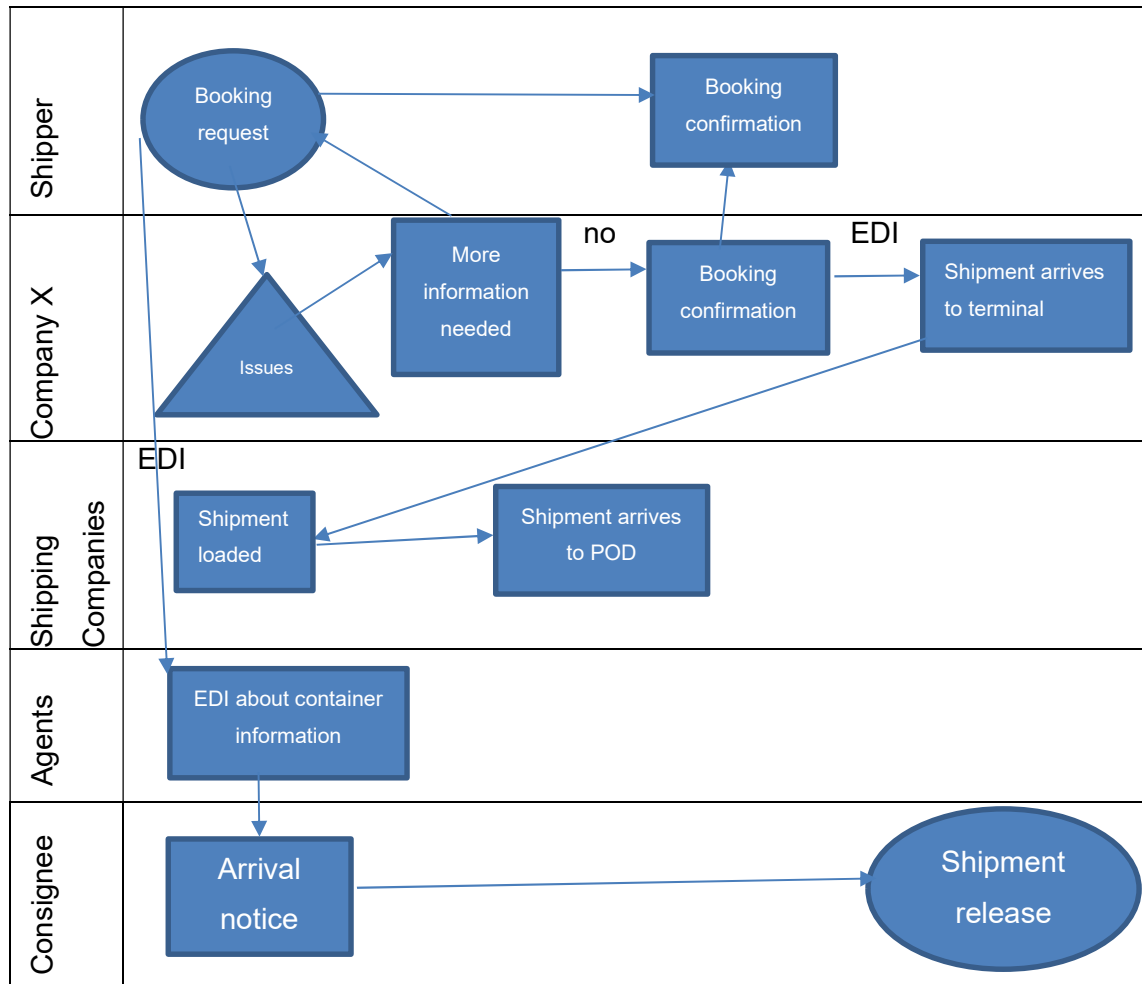


Figure 6 Shipment Handling Proces

From the figure above it is clear that stakeholders are not connected with each other on every step of shipment handling process. Shipper and agents get information about actual situation with shipment (schedule/route changes and delay) only from Company X. Consignee can get information about the ordered goods only from Shipper. To receive the correct information Consignee sends request to Shipper, Shipper sends

request to Company X, which sends request to Shipping Company or Agents, then information in the same way goes to the Consignee.

Table shows the quantity of schedule / route / delay enquires from clients during one month.

Table 1 Schedule / route / delay enquires from Clients

	Schedule / route / delay enquires per week
Week 23	10
Week 24	15
Week 27	8
Week 30	7

As it shown in Figure 6, the whole process starting from the order received from client and up to release to consignee is organized well and works without any problem a lot of years. Although a big gap is in sharing information between shipping lines, Company X, agent and customer (actually, between all stakeholders of supply chain) once shipment has left the port of loading. To know about all schedule changes and other transport related issues it is always needed to contact shipping line. Sometimes clients check the schedule information by themself on the shipping line webpage with help of tracking tool. Nevertheless, a lot of questions and mails are coming every day to export department concerning delivery date (Table 1), delay info, container details and other sailing schedule relating issues. As we can see from shipment handling process figure, this problem could be solved in case of implementing newest IT solutions to the supply chain. Further developing and implementing of EDI technology and upgrading of ERP system would allow to share information in a quicker and more reliable way. Another one way to resolve this issue could be IT innovations like blockchain. Implementing and use of emerging technologies such as blockchain would resolve the problem.

The problem is that fulfilling of emerge technologies is time consuming and needs cooperation and readiness to changes from the side of other stakeholders of the supply chain. Nowadays supply chain members are not ready to such extreme changes and

investments. Some shipping companies (for example Maersk) have implemented in their practice this technology already due to the same issues that Company X faces nowadays.

Key research findings can be interpreted in the form of SWOT analysis, summarizing the findings of direct observation.

Table 2 SWOT Analysis

<p><b>Strengths:</b></p> <p>Well-designed and smooth running in general export/import shipment handling model;</p> <p>User-friendly and generally efficient ERP;</p>	<p><b>Weakness:</b></p> <p>High dependence on workflow and employee personal skills;</p> <p>Manual labor;</p> <p>Lack of transparency</p> <p>Difficulties in monitoring shipments for all stakeholders</p>
<p><b>Opportunities:</b></p> <p>Opportunity to fasten the workflow by automatization of Waybill/BLs issuing and synchronized shipment tracking software</p>	<p><b>Threats:</b></p> <p>Stagnation in case no new IT solutions will be implemented</p>

In this way, it can be assumed that, thanks to IT solutions and applications that the organization already uses, the general shipment handling model at Company X presents itself as a strong one. Although the case company should resolve its IT implementation key challenges in order to boost the efficiency of the entire company. In order to get a complete analytical image of the shipment handling mechanism of the case company, its weaknesses were evaluated on the basis of the literature review.

It was stated during the direct participation observation that case company avoids unnecessary paperwork as much as possible and tries to make all processes faster through implementing innovative software and IT. Although the processes in the company are performing relatively efficiently, following challenges were figured out.

One of the most widely encountered difficulties is technological problems. In extreme instances, emails or internal systems do not function due to server issues (once a month at most). This is affecting the whole workflow process. Another one problem is related to time that is needed for employees to change the working process. It is always a little of stress in case of systems breakdowns or implementing new IT solutions. EDI is used at some steps of information transmission but even this technology results in challenges for the Company X such as high implementing costs, unreadiness of a staff and other members of a supply chain to implement/use new technologies and to change the usual way of doing things.

One big challenge for the whole company was during the lockdown. The whole company needed quickly to reorganize work to be able to serve the whole shipping handling process from home. The whole process was managed to organize very quickly, approximately during one week but a lot of stressful situations came during that time related to software/hardware and other IT solutions that directly influence the work of the whole company very much.

Company tries also to reduce paperwork and paper consumption by reducing unneeded printing of documents. A big help in this task is such technology as EDI. From the time the author of this thesis has started to work in the company and until the time this thesis was finished (that took approximately 1,5 years) the paper consumption was reduced at 80 %. All documents, pictures and emails started to be saved in internal program. The access to this program (to some of its features) also have clients, agents and terminal.

Breakdown of system is the biggest threat for the whole company. All processes stop at least one per month in case of software/internet or ERP system breakdown or updates.

## **5 Conclusions and further considerations**

For more detailed research, the field of IT being used in SCM systems appeared to be too broad in this thesis framework. Although this topic requires a separate examination

because IT are developing too fast and that companies that are open for innovations are more likely to get better performance in long-run, to get bigger market share and to gain better customer satisfaction. This thesis offered a fundamental understanding of key developments, related challenges, benefits and influences (both positive and negative) in IT in SCM systems for information flow field. Nevertheless, there should be done more comprehensive review of the theme and its value.

This analysis was adapted to the case research study. It must be noted that a model of action research could be implemented where optimization techniques could be evaluated in a real-life environment. While this approach has been declined due to time constraints and making it impossible to perform experiments. The probability of action research for the next researchers on a similar subject should be considered.

On their website, the leading sea freight transport and consolidation company in the Baltic region shows that they not only have the most competitive selection of services, but also that they dominate both IT solutions and customer service. Company X (2020) states that one of the company's core principles and a focus area for the Company X community is IT innovation. It always focuses on added value for clients and internal productivity and quality when Company X designs IT solutions. They always listen to the needs and demands of their customers in order to provide the best IT solutions. They learn from that and actively strive to strengthen their systems.

Case Company could consider the experience of other companies that have already tried new technologies. For example, such company as Maersk, the Danish shipping company Maersk is the world's largest container carrier and accounts for 18% to 20% of the market (Groenfeldt T., 2017). Maersk has been a high-profile example of a corporation that has successfully evaluated the international logistics use of blockchain applications. Maersk uses the solution to monitor its shipping containers with characteristics such as GPS position, temperature, and other conditions around the world. (Jackson B., 2017). Maersk has been searching for a better way to trace the items it ships around the world for many years. For Maersk, the main issue with each container was the "mountains of paperwork" required. For example, on the coast of Kenya, Maersk's storage room at the Mombasa office was confirmed to have shelves and paper record shelves dating back to 2014 (Popper N., Lohr S., 2017). In 2014, to

understand the physical processes and documentation of cross-border trade, Maersk tracked a shipment of avocados and roses from East Africa to Europe (Baipai P., 2017). The containers can be loaded onto a ship in a few minutes in most cases. However, owing to a lack of documentation, it can be kept up in port for several days. The study found that stamps and approvals for up to 30 individuals, such as customs, tax and health officials, were needed for a single container for easy shipping of refrigerated goods from East Africa to Europe. This includes more than 200 individual interactions and connections between them. (Groenfeldt T., 2017).

The movement of goods can be fast only under the condition that the information flow behind all logistics operations is also fast. Efficient information flow is the opposite of paperwork that is causing a lot of unwanted costs and mistakes. If information flow is inefficient and slow it always leads to lack of satisfaction, transparency, and trust between all members among the supply chain. An effective use of IT technologies can increase a company's profitability, lead to higher supply chain efficiency and sustainable operations on daily basis.

As implementation of modern IT would demand significant amount of financial resources and, extreme system improvements are not suggested or considered for the case company. However, new technologies can improve supply chains in Company X in case it would decide to reorganize the whole shipment handling process with help of IT innovations.



Reviewing crucial moments, process could be introduced as a following figure

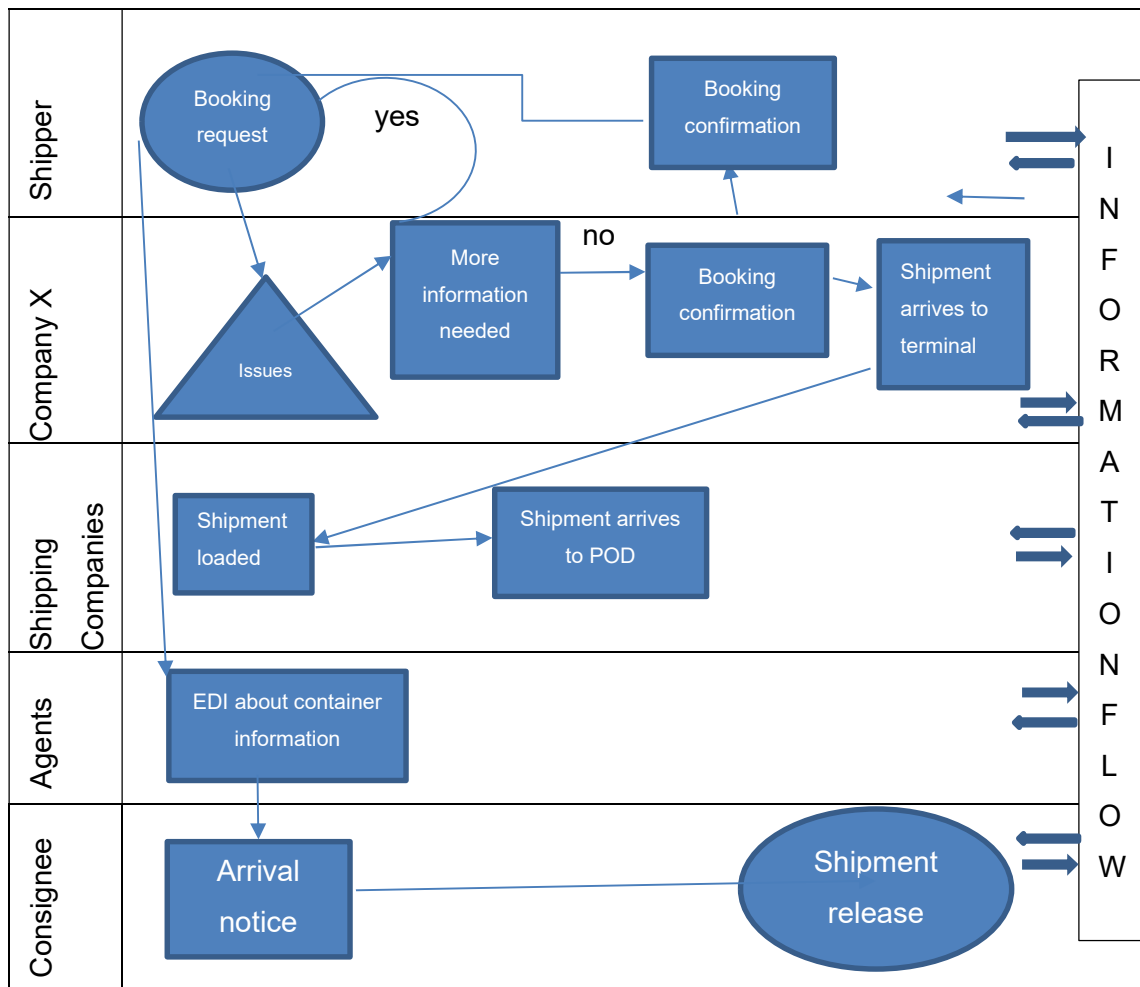


Figure 7 Proposed Shipment Handling Process

The process presented in the Figure 7 is reflecting integrated (modern) supply chain that is worth to implement in a case company. In the integrated (modern) supply chain model all the stakeholders are linked with each other and have the same access to the same information that allows improved communication and cooperation between stakeholders. Data in the supply chain gets transmitted to the entire network, decisions can be made based on real-time events, any change in end-customer demands can be immediately addressed by the supplier. The company's information flow is still more like traditional supply chain information flow, although EDI system is in use, as it is

shown in Picture 6. The difference between two these processes is exactly in linear and integrated information flow sharing process.

It is necessary to emphasize that in case company will decide to implement the model of integrated information flow, it must be ready to also face some of related challenges described in section 2.7 of this thesis work. The understanding of the challenges related to IT integration and implementation into supply chain will allow to reduce time, costs and resources. The model of integrated information flow can be achieved by developing and implementing EDI at all stages of supply chain. Another one technology that most likely will transform the operations of the supply chain is the blockchain. This emerging technology can link all members and allow equivalent and fast access to information for all members of the supply chain. The main threats and disadvantages of traditional supply chain such as slow access to information, lack of transparency, difficulties in monitoring and unreliable paperwork can be omitted through further developing and implementing of EDI technology and blockchain.

## 6 References

A Knowledge Hut, 2020. *Supply Chain Management*. [Online]

Available at: <https://www.knowledgehut.com/tutorials/project-management/supply-chain-management>

[Accessed 19 September 2020].

ABASERP, 2020. *ERP SOFTWARE*. [Online]

Available at: <https://abas-erp.com/en/faq-erp-software/what-enterprise-resource-planning-erp>

[Accessed 18 September 2020].

Badenhorst, J. A., Maurer, C. & Brevis-Landsberg, , 2013. Developing measures for the evaluation of information flow efficiency in supply chains.. *Journal of transport and supply chain management*, June, pp. 1-13.

Baipai P., 2017. *How IBM and maersk will use the blockchain to change the shipping industry*. [Online]

Available at: <http://www.nasdaq.com/article/how-ibm-and-maersk-will-use-the-blockchain-to-change-the-shipping-industry-cm756797>

[Accessed 07 September 2020].

Bayraktar, E. & et al., 2009. A causal analysis of the impact of information systems and supply chain management practices on operational performance: Evidence from manufacturing SMEs in Turkey.. *International Journal of Production Economics*, Vol. 122(1) November, p. 133.

Better Thesis, Y. O. s., 2020. *Better Thesis, Your Online support*. [Online]

Available at: <http://betterthesis.dk/research-methods/empirical-studies>

[Accessed 05 January 2020].

Bholanath D., 2009. *Entrepreneurs Management: Text and Cases*. 1st ed. New Delhi: Excel Books.

BusinessDictionary, 2020. *BusinessDictionary*. [Online]

Available at: <http://www.businessdictionary.com/definition/information-technology-IT.html>

[Accessed 18 September 2020].

Carter Logistics, 2020. *DISADVANTAGES OF POOR SUPPLY CHAIN MANAGEMENT*. [Online]

Available at: <https://carter-logistics.com/disadvantages-of-poor-supply-chain-management/>

[Accessed 30 March 2020].

Company X, 2020. *Company X*. [Online]

[Accessed 15 February 2020].

Corsten, D., Kumar, N., 2005. Do suppliers benefit from collaborative relationships with large retailer? An empirical investigation of efficient consumer response adoption..

*Journal of Marketing*, Volume 69, pp. 80-94.

CSCMPI'S SUPPLY CHAIN, 2020. *Which emerging technologies will help you meet your supply chain challenges?*. [Online]

Available at: <https://www.supplychainquarterly.com/articles/1932-which-emerging-technologies-will-help-you-meet-your-supply-chain-challenges#fn1>

[Accessed 21 June 2020].

DeFranzo S., 2011. *What's the difference between qualitative and quantitative research?*. [Online]

Available at: <https://www.snapsurveys.com/blog/qualitative-vs-quantitative-research/>

[Accessed 02 March 2020].

DeFranzo, S. E., 2014. *SnapSurveys*. [Online]

Available at: <https://www.snapsurveys.com/blog/benefit-3-types-survey-research/>

[Accessed 05 January 2020].

Deloitte, 2020. *Using blockchain to drive supply chain transparency*. [Online]  
Available at: <https://www2.deloitte.com/us/en/pages/operations/articles/blockchain-supply-chain-innovation.html>

[Accessed 13 June 2020].

Demirova S., 2017. INDUSTRIAL INFORMATION TECHNOLOGY – A REVOLUTIONARY FACTOR IN LOGISTICS. *INDUSTRIAL INFORMATION TECHNOLOGY – A REVOLUTIONARY FACTOR IN LOGISTICS*, 10(4), pp. 25-28.

Dominika C. & Branimir Z., 2017. TRENDS IN THE USE OF INFORMATION TECHNOLOGY IN LOGISTICS SYSTEMS MANAGEMENT. *Ekonomski Vjesnik*, 1(30), pp. 221-236.

Dutta, A., Lee, H.L., Whang, S., 2007. FID and operations management: Technology, value, and incentives. *Production and Operations Management*, 16(5), pp. 646-655.

Emmanson`s Blog, 2012. *Emmanson`s Blog*. [Online]

Available at: <https://emmansonme.wordpress.com/2012/03/12/the-role-of-information-technology-in-logistics-and-supply-chain-management/>

[Accessed 15 February 2020].

Gillham, B., 2000. *Case Study Research Methods*. 1 ed. England: Continuum.

Groenfeldt T., 2017. *IBM and maersk apply blockchain to container shipping*. [Online]

Available at: <https://www.forbes.com/sites/tomgroenfeldt/2017/03/05/ibm-and-maersk-apply-blockchain-to-container-shipping/>

[Accessed 9 7 2020].

Groenfeldt T., 2017. *IBM and maersk apply blockchain to container shipping*. [Online]

Available at: <https://www.forbes.com/sites/tomgroenfeldt/2017/03/05/ibm-and-maersk-apply-blockchain-to-container-shipping/>

[Accessed 07 September 2020].

Guba, E. G., & Lincoln, Y. S., 1994. Competing paradigms in qualitative research. In: I. N. K. D. & Y. S. L. (Eds.), ed. *Handbook of qualitative research*. In N. K. Denzin & Y. S. Lincoln (Eds.) ed. London: London: Sage, pp. 105-117.

Hau L. Lee and Seungjin Whang, 2001. *E-Business and Supply Chain Integration*, Stanford: Stanford University.

Himanshu S. Moharanu at al., 2020. IMPORTANCE OF INFORMATION TECHNOLOGY FOR EFFECTIVE SUPPLY CHAIN MANAGEMENT. *International Journal of Modern Engineering Research*, 1(2), pp. 747-751.

Hugos, M., 2006. *Essentials of supply chain management*. New Jersey: Wiley.

Intelex Blog, 2015. *3 Characteristics of The Modern Supply Chain*. [Online]  
Available at: <https://blog.intelex.com/2015/12/16/3-characteristics-of-the-modern-supply-chain-2/2+>  
[Accessed 15 March 2020].

Jackson B., 2017. *Canada's first commercial blockchain service could become the 'Interac' for digital transactions*. [Online]  
Available at: <http://www.itworldcanada.com/article/canadas-first-commercial-blockchain-service-could-become-the-interac-for-digital-transactions/391673>  
[Accessed 09 June 2020].

Ketchen, D. & et al., 2008. Best value supply chains: A key competitive weapon for the 21st century.. *Business Horizons*, May-June, 51, pp. 235-243.

Koetsier J., 2017. *Blockchain Beyond Bitcoin: How Blockchain Will Transform Business in 3–5 Years*. [Online]  
Available at: <https://www.inc.com/john-koetsier/how-blockchain-will-transform-business-in-3-to-5-years.html>  
[Accessed 7 June 2020].

Kothari C.R., 2004. *Research Methodology : Methods and Techniques*. s.l.:New Age International Ltd.

Krstev A., Jovanovski V. & Krstev B., 2011. INFORMATION TECHNOLOGY IN LOGISTICS: ADVANTAGES, CHALLENGES AND OPPORTUNITY FOR EFFICIENCY FROM PROBLEM DECISION IN DIFERENT ACTIVITIES. *International Multidisciplinary Scientific GeoConference : SGEM; Sofia*, Issue <https://search-proquest-com.ezproxy.metropolia.fi/docview/1285488889?accountid=11363>, pp. 533-537.

Kshetri, N., 2018. Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management*, Volume 39, pp. 80-89.

Lambert, D.M., 2008. *Supply chain management: Processes, partnerships, performance*. 3d edition ed. Florida: Supply Chain Management Institute.

Loo Saw Khuan & Santhiram R. Raman, 2018. *Emerging Technologies for Supply Chain Mangaement*, Penang: WOU Press.

Marinagi, C. & et al., 2014. The impact of Information Technology on the development of Supply Chain Competitive Advantage. *Procedia - Social and Behavioral Sciences*, 147, pp. 586-591.

Mazur I., Rakauskas F. & Rosa A., 2018. USE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN LOGISTICS OPERATIONS OF STORAGE: A CASE STUDY OF APPLICATION IN INDUSTRY OF TOYS. *Independent Journal of Management & Production, вкр. Special Edition IFLOG 2017*, 9(5), pp. 623-639.

McDaniel, C. Nordberg, H, 2019. *Can Blockchain Technology Facilitate International Trade?*, Arlington, Virginia: Mercatus Center at George Mason University.

Mena, C. & et al., 2007. *ResearchGate*. [Online]

Available at:

<https://www.researchgate.net/publication/228346497> Innovation in Logistics Services [Accessed 14 October 2019].

Mougayar, W., 2016. *The Business Blockchain*. s.l.: John Wiley & Sons.

Mystory, 2019. *7 Main Challenges in Supply Management and How You can Workaround It*. [Online]

Available at: [www.yourstory.com/mystory/7-main-challenges-in-supply-chain-management-and-how-to-work-around-it](http://www.yourstory.com/mystory/7-main-challenges-in-supply-chain-management-and-how-to-work-around-it)

[Accessed 16 March 2020].

Nestor-Harper M., 2019. *Chron*. [Online]

Available at: <https://smallbusiness.chron.com/disadvantages-technology-workplace-20157.html>

[Accessed 3 March 2020].

Opentext, 2020. *Power an intelligent supply chain*. [Online]

Available at: [https://www.opentext.com/info/ai-iot/connected-supply-chain?ldsrc=Marketing%20-%20Paid%20Inbound&elqcampaignid=40644&utm\\_source=google&utm\\_medium=ppc&utm\\_campaign=ai-iot-supply-chain-wp-mwd-ppc-textad&qclid=EAlaIqobChMlyb7Vgfqf6AIVxoGyCh276AarEAAYASAAEqJl](https://www.opentext.com/info/ai-iot/connected-supply-chain?ldsrc=Marketing%20-%20Paid%20Inbound&elqcampaignid=40644&utm_source=google&utm_medium=ppc&utm_campaign=ai-iot-supply-chain-wp-mwd-ppc-textad&qclid=EAlaIqobChMlyb7Vgfqf6AIVxoGyCh276AarEAAYASAAEqJl)

[Accessed 16 March 2020].

Popper N., Lohr S., 2017. *Blockchain: A better way to track pork chops, bonds, bad peanut butter?*. [Online]

Available at: <https://www.nytimes.com/2017/03/04/business/dealbook/blockchain-ibm-bitcoin.html>

[Accessed 09 July 2020].

Prashant R.Nair, 2020. *CITeseerX*. [Online]

Available at:

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.362.4524&rep=rep1&type=pdf>

[Accessed 13 July 2020].



Pustynnikova E.V. & Baklushinskii V.V. , 2016. Prospective directions of information and communication systems and technologies development in logistics.. *Proceedings of the Voronezh State University of Engineering Technologies.*, Issue 3, pp. 360-365.

Rajiv B., 2020. Impact of Technology on Logistics and Supply Chain. *IOSR Journal of Business and Management (IOSR-JBM)*, pp. 19-24.

Ranger S., 2020. *What is the IoT? Everything you need to know about the Internet of Things right now.* [Online]

Available at: <https://www.zdnet.com/article/what-is-the-internet-of-things-everything-you-need-to-know-about-the-iot-right-now/>

[Accessed 18 March 2020].

Research Methodology, 2020. *Research Methodology.* [Online]

Available at: <https://research-methodology.net/research-methodology/research-design/exploratory-research/>

[Accessed 23 February 2020].

Research Support: Research Methodology, 2020. *Research Support: Research Methodology.* [Online]

Available at: [Research Support: Research Methodology](#)

[Haettu 06 January 2020].

RETAILINNOVATION, 2020. *RFID (Radio Frequency Identification).* [Online]

Available at: <http://retail-innovation.com/rfid>

[Accessed 18 September 2020].

Sachdeva J.K, 2008. *Business Research Methodology.* 2009 ed. Mumbai: Himalaya Publishin House.

Salo, J. & Karjaluo, H, 2006. IT – enabled supply chain management. *Contemporary Management Research* , Volume 2(1), pp. 17-30.

SAS, 2020. *Big Data - What it is and why it matters*. [Online]

Available at: [https://www.sas.com/en\\_us/insights/big-data/what-is-big-data.html](https://www.sas.com/en_us/insights/big-data/what-is-big-data.html)

[Accessed 18 March 2020].

Scholz, R. W., Tietje, O., , 2002. *Embedded Case Study Methods*. 1 ed. California:

SAGE Publications Ltd.

Simchi-Levi, D. at al., 2003. *Managing The Supply Chain: The Definitive Guide For The Business Professional*. 12 ed. s.l.:McGraw-Hill.

SlideModel, 2019. *How to Start Digitizing Your Supply Chain Management*. [Online]

Available at: <https://slidemodel.com/how-to-start-digitizing-your-supply-chain-management/>

[Accessed 15 July 2020].

Study.com, 2020. *Study.com*. [Online]

Available at: <https://study.com/academy/lesson/overview-of-exploratory-descriptive-causal-research-in-marketing.html>

[Haettu 06 January 2020].

Swanson, R. A., Holton E. F., 2005. *Research in Organizations: Foundations and Methods of Inquiry*. 1 ed. California: Berrett-Koehler Publishers.

The Blog of Logistics at MGEPS at UPV, 2017. *The importance of information flow in Supply Chain Management*. [Online]

Available at: <https://logisticsmgepsupv.wordpress.com/2017/06/01/the-importance-of-information-flow-in-supply-chain-management/>

[Accessed 06 July 2020].

TutorialsPoint, 2020. *Supply Chain Management - Process Flow*. [Online]

Available at:

[https://www.tutorialspoint.com/supply\\_chain\\_management/supply\\_chain\\_management\\_process\\_flow.htm](https://www.tutorialspoint.com/supply_chain_management/supply_chain_management_process_flow.htm)

[Accessed 06 July 2020].

Tyrinopoulos, Y., 2004. A complete conceptual model for the integrated management. *Journal of Public Transportation*, Volume 7(4), pp. 101-120.

Unicsoft, 2019. *What is Modern Supply Chain Management?*. [Online]  
Available at: <https://unicsoft.com/blog/what-is-modern-supply-chain-management/>  
[Accessed 03 July 2020].

What are SCM Systems?, 2020. *What are SCM Systems?*. [Online]  
Available at: <https://sites.google.com/site/bus141wikisite/home/chapter-7-information-systems-for-competitive-advantage/what-are-scm-systems>  
[Accessed 04 July 2020].

Vijayarajan B., 2018. *The Impact of Information Technology on Logistics*. [Online]  
Available at: <https://www.linkedin.com/pulse/impact-information-technology-logistics-vijayarajan-balasubramanian>  
[Accessed 15 February 2020].

WIKIPEDIA, 2020. *WIKIPEDIA*. [Online]  
Available at: [https://en.wikipedia.org/wiki/Electronic\\_data\\_interchange](https://en.wikipedia.org/wiki/Electronic_data_interchange)  
[Accessed 18 September 2020].

Wu, F., Huberman, B.A., Adamic, L.A. & Tyler, J.R., 2005. *Information flow in social*. [Online]  
Available at: <https://arxiv.org/pdf/cond-mat/0305305.pdf>  
[Accessed 7 July 2020].

Yin R.K., 1994. *Case Study Research Design and Methods: Applied Social Research and Methods Series*. 2nd ed. s.l.:Thousand Oaks, CA: Sage Publications Inc..

## Appendix 1

## Observational journal

## First impressions:

All export/import operations are done very quickly

A lot of paper work

A lot of emails from all possible stakeholders

Small mistake in details can cause big problems

Efficiency is highly affected by work volumes

## Things to remember to check later:

Why so many emails?

How information is shared / channels?

How IT affects the whole workflow?

## Results of direct observation after literature review:

Paper work can be reduced

Manual checks of schedule and delays

No transparence

## Personal notes:

The most time consuming is preparing of Waybills and correcting. Also schedule checking in case of delays takes a lot of time.

ERP software is user-friendly.

Preliminary schedule checking is fast and easy and is easily found at company's website.

Amount of processing steps is definitely too big. Process does not seem to be streamlined.