Paper deliveries in Stora Enso, Swedish mills – challenges and risks during the logistics cycle. How can the the delivery model be improved?

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Abstract:
The aim of this thesis was to analyse the distribution and delivery process of Stora Enso's fine paper products from mills in Sweden. The purpose was to detect the main deficiencies in the supply chain and inefficiencies in the logistics process. The production process of paper was not included in the study. The interplay between the mill order planners, dispatcher, coordinator and the outsourced hauliers was examined. Flaws and challenges in the logistics process were identified and ways to improve the process were introduced. The thesis is built on logistics theory and research. The method of the thesis is a literature study combined with a qualitative case study. The approach of conducting the study is a case study with data collection method through participant observation during an internship at Stora Enso Kvarnsveden Mill in Sweden and interviews made in the form of an e-mail interview. The e-mail interview questions were sent to a mill order planner, coordinator and dispatcher working in the logistics process of Stora Enso. The e-mail interview attempted to analyse variables considered during the logistics cycle from the ready-made paper at the mill to the delivery of the paper rolls to the customer covering IT-systems, communication, accuracy, customer satisfaction, quality of product, automatization and risks. The outcome of the thesis shows that the logistics process is a well-established, standardised and integrated process. There are however, important issues in the process. The findings based on data collection show that the key challenges are bad communication within the process, slow response within the different functions of the logistics cycle, last minute changes to orders that require a lot of manual work to correct, information systems

that do not support the process or identify the weights and shapes of the paper reels and rolls in the planning. It was discovered that manual steps should be automated and digitalised as much as possible. Information systems should be upgraded and more integrated. All participants in the logistics cycle should have access to the same real-time database to enable more efficient flow of information. Orders following the same pattern on a regular basis should be planned as ALPs (Automated Load Plan).

Keywords:	Logistics, supply chain, paper delivery, dispatch, qualitative research, case-study, participant observation, Stora Enso
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TABLE OF CONTENTS

FIGURES

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For the great paper machines PM 10 and PM 12 in Kvarnsveden Mill producing more than 500 000 t of paper per year for the global markets.

Helsingfors, May 3rd 2020

ABBREVIATIONS

LSC	Logistical Service Center
ALP	Automated Load Plan
MOP	Mill Order Planner
FTL	Full Truck Load
LTL	Less than Truck Load
ERP	Enterprise Resource Planning
EKAER	(Hungarian: *Elektronikus közúti áruforgalom-ellenőrző rendszer)* Hungarian Electronic Trade and Transport Control System

1 INTRODUCTION

1.1 Background and problem statement

Stora Enso is one of the largest and oldest paper and forestry companies in the world. Its heritage is in the mill and mining industry in Sweden stemming back to the 14th century. Stora Enso of today was established in 1998 through the merger between the Finnish company Enso Oyj and the Swedish company Stora Kopparbergs Bergslag Ab. Stora Enso produces paper, pulp and other forestry products and secondary products such as biomass and Faluröd paint. Stora Enso has a global presence with operations in more than thirty countries.

In Sweden Stora Enso Paper Ab has three operating mills; Kvarnsvedens pappersbruk, Nymölla and Hylte bruk. These mills produce fine paper for the global markets. The paper division sells paper for commercial printing and office use. Fine paper is used for magazines, newspapers, catalogues and marketing materials. The sales by the paper division was 3,004 million euro in 2018 (Stora Enso, 2019). The paper division stands for approximately 20 % of Stora Enso's sales. The main exporting markets for Stora Enso's fine paper products is US, Europe and Asia. The distribution cycle of fine paper begins at the mill's loading point of manufactured paper, goes on to the loading of the truck with a final goal to transport the product to the end-customer, to a terminal or wholesale warehouse. The paper rolls, reels and pallets are delivered to the markets according to a delivery model supported by an IT-system at Stora Enso. The main players in the process are the mill order planners, the dispatchers, the coordinators and loaders. The transportation is undertaken by subcontractor forwarding agents.

The logistics process is a key component of Stora Enso's business model for fine paper. A well functioning logistics operation is a prerequisite for an efficient paper distribution process. Logistics should also ensure customer satisfaction; the customer expects the paper to be delivered on time and as agreed. Fine paper production is exposed to fierce international competition; the contribution margins are extremely thin, and costs have to be kept as low as possible. This leads to higher demand for efficient logistics operations. To contribute to the competitiveness of Stora Enso paper mill deliveries this thesis will

explore the logistics process at Stora Enso Mills in Sweden, establish which areas of the logistics process that can be improved and demonstrate means to increase the efficiency and smoothness of the logistics cycle of paper deliveries.

1.2 Aim

The aim of the thesis is to analyse the logistics and delivery process of Stora Enso's fine paper products from mills in Sweden. The purpose is to detect the main deficiencies in the supply chain and inefficiencies in the logistics process. The interplay between the mill order planners, dispatcher, coordinator and the hauliers will be examined. Flaws and challenges in the logistics process will be identified and ways to improve the process will be introduced.

1.3 Relevancy

This area has not been researched before, limiting only to paper deliveries from the ready product to the customer. Economics of Nordic paper mill (Hämäläinen & Tapaninen, 2010; Bell, 1987) covers improvements on Finnish mills and how the variables price, cost and logistics correlate with profits and contribution margins.

The relevancy to research of this topic is the challenges of the pulp and paper industry. Due to digitalization the demand for paper fine paper has plummeted. The pulp and paper market is global and highly competitive and paper companies have seen strong downward pressure on margins and profitability. Consequently, all measures to improve the competitive advantage of the companies are of essential importance. One of the key success factors is effective logistics and deliveries.

1.4 Research questions

RQ 1: How does Stora Enso, Sweden deliver its paper reels, rolls and pallets to the European market and what are the inefficiencies, risks and challenges in the logistics cycle?
RQ 2: What is the role and the interplay of the mill order planner, dispatcher and coordinator in the logistics process?

RQ3: What measures should be taken to improve the efficiency and smoothness of the delivery model?

The study will focus solely on the logistics process of fine paper products by Stora Enso mills in Sweden. The logistics process will cover the unloading and distribution of manufactured paper at the mill to the delivery of paper products to the end-customer. The production process of paper will not be studied.

The results of this study will pinpoint which phases and methods of the logistics process that can be improved to increase the smoothness, efficiency and minimize the defects of the logistics cycle of fine paper.

1.5 Method

The method of the thesis is a literature study combined with a qualitative case study. The literature study will cover logistics theory and transportation; the main phases of the distribution cycle of industrially produced fine paper. The case study will focus on the logistics process of fine paper produced by Stora Enso's mills in Sweden. The research method is qualitative. The findings from the operational logistics process will be gauged against the results of the literature study and improvements detected.

2 THEORY – LOGISTICS AND SUPPLY CHAIN MANAGEMENT

2.1 What is logistics?

Logistics as a phenomenon is not new. Throughout the history of mankind logistics has played a major role in trade and in wars. Many functions of logistics stem from a military context. Wars have been won or lost through logistics strengths and capabilities – or the lack of them. During the second world war logistics processes became more complex and critical. After the war businesses found themselves in a changed a new operating environment which forced them to recognize the vital impact that logistics can have in the achievement of competitive advantage. (Christopher, 2011, p. 1)

Logistics is a wide concept containing many different functions and activities. The definition of logistics typically centres around the term material flow. The flow of materials encompasses all the activities that ascertain that the right goods are transported to the right place at the right time. The most established and popular definition of logistics is based on the seven R's: "Activities that have to do with receiving the *right* goods or services, in the *right* quantity, in the *right* shape or form, on the *right* spot, at the *right* time, to the *right* customer, to the *right* cost. (Storhagen, 2003, p. 17)

Christopher defines logistics with an updated and wider scope as "the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory through the organizations and its marketing channels in such a way that current and future profitability are maximized through the cost-effective fulfilment of orders". (Christopher, 2011, p. 2)

Ritvanen et al define logistics as: "Logistics is the product or services and associated information and money management to satisfy customer demand". (Ritvanen, et al., 2011, p. 20). Logistics can be divided into inbound-, inhouse- and outbound logistics to describe materials and products flowing through the company. The first steps of inbound logistics are procurement or production. Inbound logistics comprises receipt of goods/raw materials, control and warehousing. Inbound logistics comprises the handling of materials and goods within the organization. Gathering goods from the warehouse, packaging and distribution and transportation from the loading platform is part of the outbound logistics. (Ritvanen, et al., 2011, pp. 20-22)

The customer need in relation to logistics is based on two main factors; to receive the goods as cost efficiently as possible and to receive the delivery of goods on time and to the right place. To achieve high customer satisfaction the company needs to have functioning and coordinated supply of materials, production and distribution. The work should be process based rather than functions based. Logistics is about planning and executing but also about controlling that the result is achieved. Logistics is focused on storing and moving materials; starting from raw materials to the transportation of goods to the end-customer. To be successful with this, the company needs different sources of data and

other information. The company needs to work with, develop and distribute the information based on the data as part of logistics. (Aronsson, et al., 2003, pp. 15-19)

Logistics undergoes constant change. The traditional customer-supplier relationship, where the logistics activities focus on the internal operations of the company, is replaced by close relationships with the customer and the supplier and a constant interaction between customers and the internal functions and departments. The interaction is directed from an outbound perspective and into the company by the customer in an updated logistics approach illustrated by Figure 1. (Storhagen, 2003, p. 55).

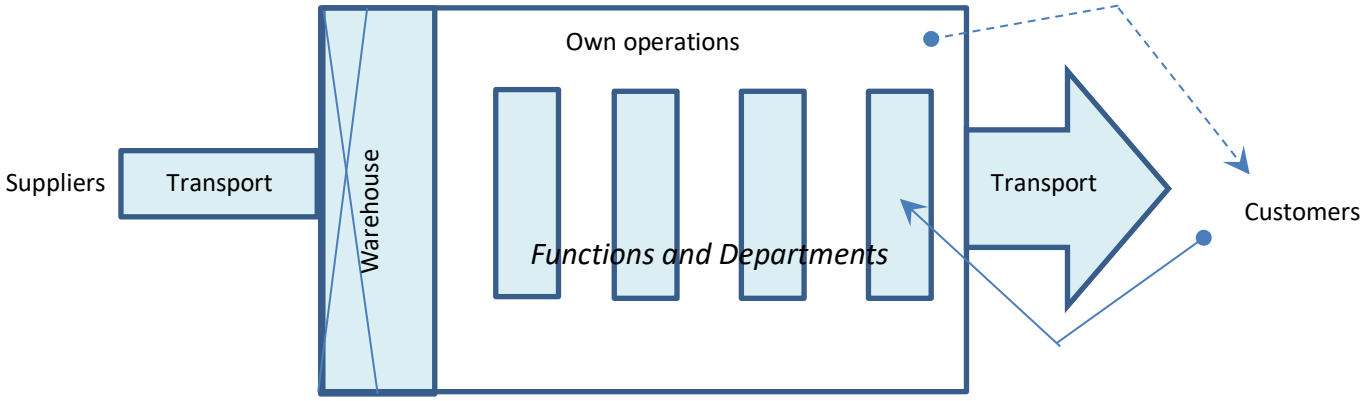

Figure 1 The different steps of the logistics process. (Storhagen, 2011, p.55)

2.2 The need for logistics

Logistics is one of the oldest and most essential functions to the society. Logistics is an important driver of economic growth and development. The importance of logistics stems from the need to move people and goods.

Lumsden identifies several reasons for the need for and origin of logistics. Logistics arises from the fact that different raw materials can be found in different places of the earth (heterogeneity of the surface of earth). Another important factor is that production is

based on specialization and that companies need raw materials from deliverers from different parts of the world. Efficient logistics is an enabler for economics of scale. Logistics has a political, social and cultural function (Lumsden, 1995, pp. 33-34).

2.2.1 Functions of logistics

In practice logistics has two major functions; transportation and warehousing. Transportation management involves the planning and executing of the complex process of moving goods in the air, at ocean, over rails and roads. It also involves optimizing shipment loads and routes, order management, freight auditing and payment. Carrier management is an important factor of the process since the price, availability and capacity of transportation can vary widely and has a direct impact on efficiency and productivity of the process. Warehousing includes inventory, order fulfilment as well as infrastructure and process management. (Essex, 2019)

2.3 Logistics activities

Logistics activities flow refers to the network structure from sourcing from raw materials to customer delivery including several activities such as warehousing, transportation, materials handling and packaging, that all impact the logistics process and the related costs.

Customer service has been defined as a customer-oriented philosophy that integrates and manages all elements of the customer interfce within a predetermined optimum cost-service mix. Each component of the logistics system can affect whether a customer receives the right product, at the right place, in the right condition, to the right price and at the right time. (Stock & Lambert, 2001, p. 20)

Transportation is the most typical logistics activity. It encompasses logistics decisions about planning, executing and monitoring of transports (Björnland, et al., 2003). This activity is about moving a product from raw materials to consumption. Transportation cerates value or place utility. Transportation determines how fast and how consistently products mov from one point to another. If products are not available at the precise time they are needed, there may be expensive repercussion, such as lost sales, when there is

demand, it can lead to adverse consequences such as sales losses, customer dissatisfaction and production downtime. (Stock & Lambert, 2001, p. 313)

Warehousing is an integral part of every logistics system. It plays a vital role in providing a desired level of customer service at the lowest possible total cost. Warehousing is used for the storage of inventories during all phases of the logstics process; from raw materials to finished goods. (Stock & Lambert, 2001, pp. 390-391)

Materials handling is concerned with every aspect of the movement or flow of raw materials, in-process inventory, and finished goods within a plant or warehouse. Materials handling is part of warehousing and encompasses unloading, re-loading of goods, control of goods, warehousing, re-warehousing, gathering and dispatching. The objectives of materials handling are to minimize travel distance and work-in-process, provide flow free of bottlenecks and mimimize losses. A firm incurs cost every time an item is handled. (Stock & Lambert, 2001, p. 22)

Packaging has two functions for the logistics activity. First the package protects the product from damage while it is being stored or transported. Second, proper packaging can make it easier to store and move products, thereby reducing materials handling costs. (Stock & Lambert, 2001, p. 23)

Forecasting is about defining the amount of goods that the customer will need in the foreseeable future. Forecasting is usually based on sales forecasts and -plans but for product flow steering forecasts need to be on a more specified level. This makes forecasting and warehousing closely interrelated. (Björnland, et al., 2003)

The order process is a logistics activity that starts with the customer placing the order. The order process includes operational elements such as change of order, preparation of order, order picking, dispatching of order and invoicing. Another element of the order process is of communicative nature and includes order modification, order status inquiry, tracking, compensation for divergence from order plan. The order process is of key importance for customer interaction with the company and therefore has strong impact on customer satisfaction. (Stock & Lambert, 2001, pp. 146-151)

Effective and efficient logistics organizations are vital elements f supply chian management. The problems that and challenges that companies face do not lie primarily in the area of strategic decision making but in systems, structure, mission, people, corporate culture and reward structure. (Stock & Lambert, 2001, pp. 582-583)

The information flow facility structure is key. The kind of information passed among supply chain members and its timeliness have a strong influence on the efficiency of the supply chain. (Stock & Lambert, 2001, p. 76).

2.4 Logistics costs

Logistics activities give rise to logistics costs. In case of international trade the cost of logistics plays an important role in the pricing of the goods. Logistics costs can stand for a considerable amount of a company's operating costs. Logistics cost will vary by company and by industry (Christopher, 2011, p. 57).

Logistics costs are costs directly related to the company's logistics activities. Jonsson et al. define total logistics costs as costs relating to transportation- and handling, packaging, warehousing, administration, order planning, capacity, shortage or delay and environment (Jonsson & Mattson, 2005, pp. 138-139). For this study the most relevant logistics costs are related to transportation costs.

2.4.1 Transportation costs

The main transportation costs for external transportation come from loading, moving, reloading and unloading of goods. Transports take place between the company's own plants but also to and from third-party providers and customers.

Jonsson & Mattson describe the pricing of transportation as a function of the current state of play in the market and the costs incurred from the transportation. If the same transportation occurs repeatedly the price is usually based on a freight tariff. The freight tariff varies according to the distance of the transportation, the volume and density of the goods,

the physical shape of the goods, the risk exposure of the goods and demand and supply of transportation. (Jonsson & Mattson, 2005, pp. 415-419)

It is essential that the amount of goods is calculated correctly to ensure a full load truck, that the goods are appropriately packed and that the package is well calibrated for the pallet. The price of the transportation is usually based on pallet meter, m^3 or kg.

2.4.2 Benefits and costs for transport outsourcing

Many companies outsource transportation and other logistics functions to third-party providers. Transportation management requires handling a multitude of relationships with different stakeholders in the delivery cycle. Outsourcing transportation and transportation management to a third-party provider has several core benefits.

By outsourcing transportation management companies free up their teams to focus on other aspects of the business. Outsourcing transportation to professionals should generate better results of the service provided. The requirements for outsourcing transportation to professional transporters should be that they use the most up to date and effective transport technology, are trained to identify and mitigate risks of transportation, report and analyse the transportation activities are accountable for the results. (Robinson, 2019)

Outsourced transport costs are the costs internally assumed by the providers of transport services. They come as fixed (infrastructure) and variable (operating) costs depending on a variety of conditions related to geography, infrastructure, administrative barriers, energy and how freight is carried. (Rodrique & Notteboom, 2019)

2.5 Supply chain management -definition

Supply chain is a network of organization cooperating to deliver flows of materials and services through an engineered flow of information, cash and physical distribution (Ritvanen, et al., 2011, p. 9). Supply chain management encompasses the planning and management of all logistics management activities. It also includes coordination and col-

laboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. Supply chain management integrates supply and demand management within and across companies (CSCMP, 2020).

Supply chain management builds on the framework of logistics but is a wider concept. A definition of supply chain management is the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole. The focus of supply chain management is upon the management of relationships in order to achieve cost efficiency for all parties in the chain. (Christopher, 2011, p. 3) The purpose of supply chain management is to achieve linkage and co-ordination between the processes of other entities in the pipeline, i.e. suppliers and customers, and the organization itself (Christopher, 2011, pp. 2-3).

Supply chain management is important because it increases competitiveness and customer satisfaction. Supply chains allows the producer to efficiently deliver the products to the customer. A supply chain is a network of connected and interdependent organizations mutually and co-operatively working together to control, manage and improve the flow of materials and information from suppliers to end users. (Aitken, 1998)

The figure illustrates the idea of the company being at the centre of a network of suppliers and customers (Christopher, 2011, p. 3).

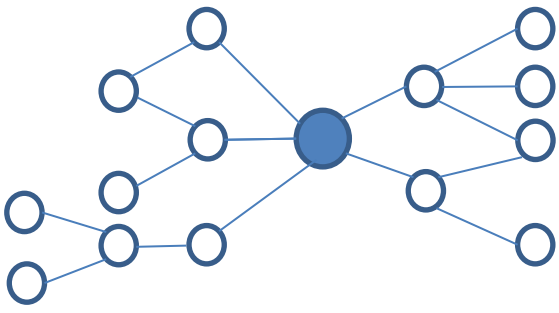

Figure 2 The supply chain network (Christopher, 2005, p.3)

To create and develop the structure of the chain is of the essence in supply chain management. Time, confidence and transparency are the key building blocks of supply chain management as well as the cooperation between the different counterparts in the chain. Critical success factors for supply chain management are constant development of the company's competitiveness, profitability and efficiency. Equally important is the problem-solving capacity, measurement and reporting of the activities as well concentrating on the essential functions and communicating internally and externally. (Ritvanen, et al., 2011)

2.6 Logistics risk management

Risk management is a dynamic process and not a one-time static event. Risk management as a process includes activities risk identification, systematization of risk types, risk measurement and risk analysis. The outcome of risk analysis is the foundation for the necessary risk control. (Wolke, 2017, pp. 4-5)

Risk events in logistics cause delays and disruptions in matching supply of products with demand from customer. Risks in logistics include operational risks and interruptions. Operational risks involve faults, mistakes and uncertainties in order planning, transports and deliveries. Interruptions can come from production stops, accidents in transports and natural disasters.

2.6.1 Risks and uncertainties in supply chains

The basic definition of supply chain risks is the probability of occurrence of any undesired event caused due to external and internal vulnerabilities which can be avoided by using preventive actions (Sharma, 2016).

Modern supply chains are very complex with physical, financial and information flows occurring simultaneously in order to ensure that products are delivered in the right quantities, to the right place in a cost-effective manner. Maintaining uninterrupted supply chain flows is a prerequisite for the success of a supply chain in the marketplace (Nishat, 2009, p. 41).

Vulnerability of supply chains to disturbance or disruption has increased (Christopher, 2011, p. 189). Transportation delays, theft, natural disasters, inclement weather and cyber-attacks can disrupt the logistics process. Not all risks to supply chain continuity are external. Supply chains are also exposed to operational risks and unexpected quality issues (Resilience360, 2019). Risks in the supply chain must be understood, identified and managed. A supply chain contnuity team should be established and procedures improved (Christopher, 2011, p. 198).

2.7 Key performance indicators of logistics and supply chain management

The main target for logistics and supply chain management is to keep the total costs as low as possible. Using indicators and measures is a useful way to set targets and measure the costs and efficiency of the logistics function of a company. The scope of the measures should be kept as wide as possible, prioritize indirect effects before direct effects and involve customer value. Measures such as availability, delivery time and accuracy, and other quality indicators are useful components to measure customer satisfaction (Storhagen, 2003, pp. 286-287, 291).

The performance of logistics and supply chains are measured through key performance indicators. The indicators can be financial and non-financial, strategic, tactic and operational as well as external and internal. The key performance indicators should capture the reliability of deliveries (% of complete deliveries), lead times (delivery time), agility (reaction to changes in volume, costs (total costs) and capital costs (warehousing). (Ritvanen, et al., 2011, pp. 101-102)

2.8 International logistics of forestry products

International logistics has a higher degree of complexity. Global activity extends the supply chains and thus increases the risk of faults and errors in the delivery process. The main sources of the increase complexities are due to i.e. longer lead times, delays, differences in national transport systems and cultural differences in communication within distribution channels. (Storhagen, 2003, p. 153)

The forestry industry is a significant buyer of international transport services and logistics play a major role in the sector's competitiveness. Cost effectiveness, security, flexible and frequent transport solutions are crucial factors for logistics of forestry products. The operating environment of transports is impacted by geographical location, climatic conditions, location of production unit and infrastructure. International agreements and national laws regulate the international transports (Forestindustries, 2020).

2.9 Challenges and forces of today's logistics

Logistics is in constant evolution. Traditionally the driving forces behind logistics have been improving cost efficiency. Developing internal flows and processes have been in the forefront of logistics efficiency. Smooth transports from the point of view of the production unit to the customer have been another important component in logistics efficiency. With new demands from customers the logistics approach has changed. Higher efficiency of the logistics flow, shorter lead times, added value for the customers have challenged traditional values in logistics. (Storhagen, 2003, pp. 316-319) New trends such as outsourcing, the use of new technologies, environmental considerations drive structural change of logistics (Fredholm, 2006, pp. 30-34). Digitalization and the use of artificial intelligence bring new dimensions to logistics and is changing the transport sector. Autonomous vehicles and tracking of transportation problems are innovative components of future logistics. Artificial intelligence brings great benefits to road transport but also poses challenges such as cybersecurity risks (European Commission, 2019).

2.9.1 Logistics and information technology

The logistics information system (ICT) is usually the most critical element for the competitiveness of logistics. One of the most important functions of ICT in logistics is the interface towards other systems. (Fredholm, 2006, p. 68) It works as a link connecting the logistics activities in an integrated process, combining hardware and software to manage, coordinate, communicate, measure and monitor logistics operations. Information technologies are used by participants in the logistics processes; in storage, restoration, transfor-

mation, dissemination and integration of data and information in an organization, improving the efficiency and effectiveness of the processes as a whole (Varella & Gonçalves, 2013).

The use of ICT allows all participants in the logistics cycle to reduce lead time and paperwork. Part of an organization's ability to use logistics as a competitive advantage is the ability to monitor customer demands and inventory levels as they occur, to act in a timely manner to prevent stockouts, and to communicate potential problems to customers. This requires excellent, integrated logistics information systems. (Grant, et al., 2006, p. 26)

There has been a major technological development in areas that support logistics. Artificial intelligence (AI) is in the spotlight as one of the emerging fields transforming the transport sector. AI is helping to make all transport modes safer, cleaner and smarter. AI can be applied in vehicles, infrastructure for drivers and to the way in which these interact to deliver a transport service. The most ground-breaking applications are exploring AI technologies to develop automated vehicles. Such vehicles are based on a variety of sensors, control units and software. (European Parliament, 2019).

2.9.2 Outsourcing transports

Outsourcing is defined as the strategic use of external specialised service providers to execute and manage activities that are normally seen as non-core to the business (Rushton & Walker, 2007, p. 4). Outsourcing offers opportunity for organizations to concentrate on their core-competencies, strengthen its competitive position and use the most efficient service providers to carry out logistics services. The whole logistics process or part of it can be outsourced (Fredholm, 2006, p. 32). The logistics operations that can be outsourced are 1) physical logistics and delivery, 2) non-physical logistics (information) and 3) reverse-logistics (Rushton & Walker, 2007, p. 105).

Logistics outsourcing is a global trend and an area of fast change and growth. Supply chains extended over several continents are significantly more complex and involve sea,

air, rail and raod movements. (Rushton & Walker, 2007, p. 1). The outsourcing can entail different levels of logistics providers; starting from outsourcing to hauliers, forwarders expanding to third-party logistics providers adding new logistics capabilities all the way to fourth (network integrator) and fifth party (supply chain manager) logistics providers. By outsourcing logistics activities such as transports, companies can save on capital investments. The drawbacks are that it is not easy to establish a reliable and cost-effective partnership between the company and the service provider; the selection process is of key importance. Maintaining a reliable relationship including information sharing and constructing a clear risk sharing scheme between the company and eg. haulier will result in more efficient logistics activity. (Vasiliauska & Jakubauskas, 2007, p. 70)

2.9.3 Sustainable logistics

Sustainable logistics is about transforming logistics more environmentally friendly, increasing the eco-efficiency of all parts of the supply chain. The goal of sustainable logistics is to improve profitability and reduce environmental impact for long-term performance. The framework for a sustainable logistics system combines sustainable development with the elements typically included in the traditional logistics system. The sustainable logistics system considers three aspects; economics, the environment, and social that are essential for a logistics system. By implementing a sustainable logistics system a company can positively impact its long-term performance objectives, maximize its profitability, minimize its environmental impact and improving the community's quality of life (Wichaisri & Sopadang, 2014, p. 3).

Increased awareness of environmental effects and stricter environmental laws are impacting all parts of the logistics cycle. Road transport represent almost a quarter of Europe's greenhouse gas emissions and is a main cause of air pollution (European Commission, 2016). In 2016 road transport was responsible for 72 % of total greenhouse gas emission from transport. Heavy-duty vehicles, i. a. used for the paper reel transport, are responsible for 27 % of road transport carbon dioxide emissions in the EU and new truck registrations are expected to increase by 46 % by 2030 (European Environment Agency, 2018).

Commercial road transportations play an important part in the transition towards a low carbon economy. Road transport is still mainly operated with fossil fuels. Diesel motors are widely used and pollute more than motors run with petrol. Environmental effect of tyres comes from fuel consumption during use, but also from the production of rubber tyres. Transport by railway is a more environmentally friendly way of transport. Trains are more energy efficient, but the overall Renewable energy is growing as a share of total amount of energy used by the transport sector but the share still remains low at 8 % in 2018 (European Environment Agency, 2018).

3 METHODOLOGY

3.1 Introduction

Methodology is about the fundamental way of conducting research for the study. The choice of method sets the framework and principles for the work. A suitable method or a combination of different methods have to be selected. Based on the selected method a detailed plan is outlined for the research (Höst, et al., 2006, pp. 29-30).

The most important question for the choice of research method is not ”Which method is the most appropriate for the research?” but ”What do I need to know and why?” (Bell, 1987, p. 87).

3.2 Qualitative research

3.2.1 Concepts of qualitative research

The chosen method for this study is qualitative research. Qualitative research emphasizes words rather than quantification in the collection and analysis of data. Qualitative research seeks to explore a certain phenomenon, describes variation, provides the point of view of participants, is flexible, open-ended and iterative in research design (Bryman & Bell, 2011, p. 386). Qualitative data generates non-numerical data. Qualitative data often takes

the form of field notes, audio recordings and transcripts (Bryman & Bell, 2011, pp. 446, 447, 480).

Qualitative research as method is used to understand people's beliefs, experiences, attitudes, behaviour and interactions. Qualitative research focuses on the "why" rather than on the "what". Qualitative research takes into consideration the inner reality of humans, i.e. feelings, opinions and experience (Starrin & Svensson, 2004, p. 11).

The aim of qualitative research is to explore how people interpret their social reality. This is done by observing what people do and what they say with their own words (Jacobsen, 2002, p. 39).

3.2.2 Definition of the case study as a research method

The essence of case study is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result (Schramm, 1971).
A case study is an empirical inquiry that investigates a contemporary phenomenon (the "case") in depth and within its real-world context especially when the boundaries between phenomenon and context may not be clearly evident (Yin, 2018, p. 15).

Yin shows that the case study as research method is a linear but iterative process that requires a clear methodological part. There are six elements of the case study research plan. It starts with a planning phase by defining the "how" or "why" research question that would be the rationale for the case study. Research design of the case study is the next phase and is the logical sequence that connects the empirical data to the research question and its conclusion. Preparing to collect case study evidence should follow a given protocol and encompass e.g. screening of candidates, questions, case study report. Case study evidence can come from different sources, e.g. interviews, archives, direct observations and a database should be created as formal assembly of evidence. The final steps of case study research include analysing case study evidence and reporting and results. The analysis of data relies on analytic techniques such as using descriptive frame-

works, theoretical propositions. It is essential that the case study displays sufficient evidence is complete and considers alternative perspectives. Sharing the conclusions from case study means bringing its results and findings to closure.

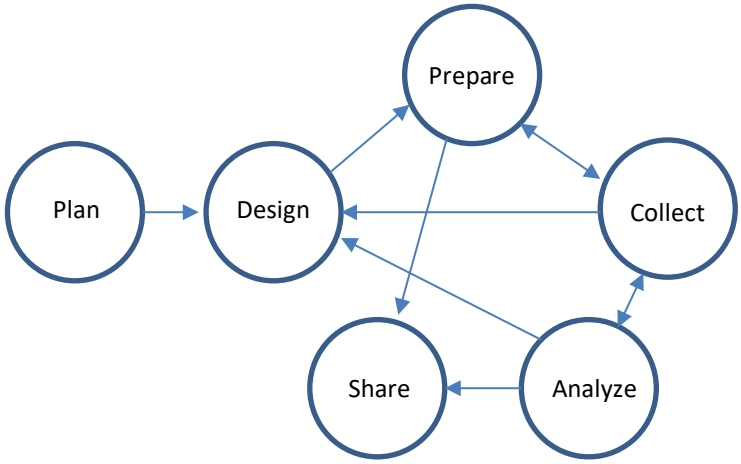

Figure 3. Doing case study research is a linear but iterative process (Yin, 2018, p.2)

Yin's method is a comprehensive and systematic outline for undertaking design and conduct of a case study. It links theory and practice and is highly applicable to this research. Single case-studies are a common design for doing case study research and is justifiable where the case represents a critical test of existing theory and common case (Yin, 2018, p. 53), in this case the logistics cycle at Stora Enso.

3.2.3 Data collecting methods

3.2.3.1 Interviewing in qualitative research

The interview is the most widely employed method in qualitative research. The research interview is a prominent data collection strategy which aims at eliciting of information by the interviewer from the interviewee and operates rules of varying degree of formality or explicitness concerning the conduct of the interview (Bryman & Bell, 2011, p. 202). One of the most important sources of case study evidence is the interview. The strength

of interviewing is that it can be targeted and focus directly on case study topics. Interviews can also be insightful; provide explanations as well as personal views. Weaknesses of interviewing is response bias and bias due to poorly articulated questions (Yin, 2018, p. 114). A standardized interview aims to give all interviewees exactly the same context of questioning (Bryman & Bell, 2011, pp. 203-205). The goal is to enable aggregation of data.

Qualitative interviews can be unstructured, flexible and adjustable. In qualitative interviews there is much greater interest in the interviewee's point of view. In qualitative interviewing the researcher wants rich detailed answers and the interviewer is not bound by a schedule (Bryman & Bell, 2011, pp. 466-467).

One of the most important sources of case study evidence is the interview (Yin, 2018, p. 118). Therefore interview, as a method, is chosen to describe and analyse the process and logistics cycle of Stora Enso in Sweden. The purpose of the interview is to assess the logistics cycle by verbalising the current process through human perception of the co-workers and evaluate and improve the quality of the current process based on observation and findings. The knowledge and expertise of co-workers are key to establishing the state-of -play of the process. The interview approach taken in this study is an e-mail interview. Specific topics, often referred to as an interview guide will be covered (Bryman & Bell, 2011, p. 467). An interview combined with participant observation as described in 2.3 are powerful tools for this research.

Interviewing involves issues of ethical principles in research and confidentiality. The ethical concern in this research relates to harm to participants and lack of informed consent. According to MRS's Code of Conduct the researcher must take all reasonable precautions to ensure respondents are in no way harmed or adversely affected as a result of participating in a research project (Market Research Society, 2019). The principle of informed research means that prospective research participants should be given as much information as might be needed to make an informed decision about whether or not they wish to participate in a study (Bryman & Bell, 2011, p. 133). This research study will protect the anonymity of the participants and seek consent of the interviewees who agree to take

part in the study. To maintain the confidentiality of the interviewees, the respondents will be referred to by their professional titles.

3.2.3.2 Participant observation

Qualitative research gives voice to participants in the study. Participant observation is research based on observing behaviour, listening to what is said in conversations and asking questions. Participant observations typically include interviews with key informants and fieldworkers and the studying of documents (Bryman & Bell, 2011, p. 717).

Participant observation is chosen as method to capture the observations made by the researcher in a three-month long summer traineeship at Stora Enso Kvarnsveden Mill in 2019. In this study participation observation is based on engaging with personnel from Stora Enso's mill in Kvarnsveden for an extended period of time (3 months). Particular emphasis is given on using and observing the functionality of the in-house IT-system of the logistics process at Stora Enso and analyzing and drawing conclusions from the interplay between mill order planners, coordinators, dispatchers and freight forwarders.

3.2.3.3 Sampling in qualitative research

Participant observation research through e.g. fieldwork as data collection process will result in sampling of informants. The purpose of sampling is to gather data from the pool of potential respondents. The resulting data from the sample that is actually surveyed are assumed to reflect the entire pool. (Yin, 2018, p. 56)

The method used is purposive sampling. The goal of purposive sampling is to sample cases/participants in a strategic way, so that those sampled are relevant to the research question being posed, with certain research goals in mind. (Bryman & Bell, 2011, p. 442). In the case study purposive sampling will ascertain that sample members differ from each other in key characteristics; in this case based on their role and function in the logistics cycle.

Structured observation is a data collecting method for systematically observing the behaviour of individuals. It is a technique that comprises specific rules for the observation and recording of behaviour (Bryman & Bell, 2011, p. 272). Structured observation is beneficial for this research as it is systematic and secures a higher degree of objectivity. Each participant performing a specific task of the logistics cycle will be observed using certain conditions for observation.

3.3 Data analysis and evaluation

Based on collected data by applying different research methods as described above, the study is conducted in order to identify the logistics cycle improvement solutions for Stora Enso's mills in Sweden. The goal of the study is to understand the main challenges, risks and flaws of the logistics cycle and identify the improvement factors based on both theoretical and empirical findings.

To assess the quality of qualitative research the concepts of reliability and validity, together trustworthiness is introduced. Trustworthiness is made up of four criteria i) credibility, ii) transferability, iii) dependability and iv) conformability (Bryman & Bell, 2011, p. 395). Whereas complete objectivity is impossible in qualitative research, these criteria can be deployed to prove that the researcher has not allowed personal values to impact the research and findings derived from it.

3.3.1 Qualitative data analysis

Qualitative data analysis is the process whereby the collected data is interpreted and analysed to get insights from it. One of the main difficulties with qualitative data analysis is that it very rapidly generates a large, cumbersome data because of its reliance on e.g. field notes, interviews, documents (Bryman & Bell, 2011, p. 571).

There are different approaches to qualitative data analysis. Coding is the starting point for most qualitative data analysis. Coding is a process of indexing or categorizing a text in order to establish a framework of thematic ideas about it (Gibbs, 2007, p. chapter 4). The main steps of coding qualitative data include getting familiarized with the data, revisiting

the research objectives, structure and label the data and finally identify patterns and connections (Bhatia, 2018). One of the most commonly mentioned criticisms of the coding approach to qualitative data analysis is the possible problem of losing the context of what is said. A second criticism of cosing is that it results in fragemntation of data. (Bryman & Bell, 2011, p. 588)

Case study evidence can be analysed by examining, categorizing, testing or otherwise recombining evidence. Sharing the conclusions means bringing the results and findings of the case study to closure. However, the analytic procedures for case studies have not been well defined or codified (Yin, 2018, pp. 165-167).

The above described methods of analysing qualitative data are adequate for the research and evaluation of the different steps of the logistics cycle at Stora Enso. The target is to find out the unknown improvements with an emphasis on the variations, structures and processes of all the main phases of the logistics cycle.

3.4 Intervention and materials – case study Stora Enso Sweden fine paper mills

This thesis is based on a single case study of Stora Enso's mills in Sweden. According to Eisenhardt the case study typically combines data collection methods such as archives, interviews, questionnaire and observations. This strategy could be useful and optimized especially when examining "the dynamics within single settings" in order to reach different aims of description provision, theory testing or theory generation. (Eisenhardt, 1989, p. 534)

The aim of the research is to evaluate the efficiency and quality of Stora Enso's fine paper logistics cycle compared to logistics theory. The structure applied for the analysis and testing of the theory is a deduction or top-down method in which conclusion for a specific case is formulated based on general theory (Kananen, 2013).

Data collection method is interviews with and an e-mail interview with all the relevant participants. The sample will be evidence-based observations of and fieldwork in the current eco-system and logistics cycle of fine products at Stora Enso mills in Sweden.

4 CASE STUDY – IMPROVEMENTS AND GREATER EFFICIENCY IN THE LOGISTICS DELIVERY CYCLE OF STORA ENSO PAPER MILLS IN SWEDEN

4.1 Outline and method of case study

The approach of conducting the study is a case study with data collection method through participant observation during an internship at Stora Enso and interviews made in the form of an e-mail interview. Yin states that the case study allows to focus in-depth on a "case" and to retain a holistic and real-world perspective such as in studying small group beaviour or organizational processes (Yin, 2018, p. 5).

The case study presented in this thesis is the logistics cycle at the mills of Stora Enso Paper Sweden Ab illustrated, analysed and assessed. The logistics chain is restricted to the load planning, transport and delivery of the produced paper to the customer. The case study is conducted using qualitative data from the three mills in Sweden, Hylte Mill, Kvarnsveden Mill and Nymölla Mill. The transport of the paper at the mills is outsourced to third party logistics providers. The paper is both sold in Sweden, as wells as exported to the EU countries and overseas.

4.2 Subjects and participants

For this study the logistics cycle of the delivery of paper rolls from Stora Enso Paper Sweden AB mills in Kvarnsveden (Borlänge), Nymölla and Hylte was analysed. The tasks of the participants holding key roles in the logistics process were studied and the

interplay between them was analysed and assessed. The impact and functioning of outsourced functions were also considered.

4.3 Apparatus

Interviews were conducted through an e-mail interview, see appendix. The interview questions were sent out to all the participants representing different roles in the logistics cycle. The construction of the questionnaire was based on logistics theory and literature in Chapter 2 and participant observation during a three-month internship at the site of Stora Enso Kvarnsveden Mill. The e-mail interview attempts to analyse variables considered during the logistics cycle from the ready-made paper at the mill to the delivery of the paper rolls to the customer covering among other things IT-system, communication, accuracy, customer satisfaction, quality of product, automatization and risks. The case study seeks to detail the processes involved in the logistics cycle by identifying the main agents, their roles, their relations of cooperation, synergy between them, process requirements, the processes involved in the undertaking with freight forwarders and to detect the risks, challenges, inefficiencies of the process and which improvements that can be made.

4.4 Procedure

This study is characterized as a field research exploratory and is descriptive, with qualitative approach, developed through a case study using the method of participant observation and e-mail interviews with the employees with a specific duty in the logistics cycle of Stora Enso paper mills in Sweden; the mill-order planner, the dispatcher and the coordinators. The explanatory case study takes the following steps; i) explanation of the logistics cycle, ii) collection of evidence and documentation of primary data through direct observations at the internship on the site of Stora Enso Mill Kvarnsveden and e-mail interview as data collection source, iii) analysis of results and iv) discussion and conclusions.

4.5 Case study - collecting evidence and data of the logistics cycle of paper rolls and reels delivery from Stora Enso mills in Sweden

4.5.1 Overview of the logistics cycle of Stora Enso paper mills in Sweden

4.5.1.1 Stora Enso Paper Sweden AB paper production

Stora Enso Paper Sweden AB is the Swedish subsidiary of Stora Enso's paper division. It stands for 7,42 % of the total sales of Stora Enso, being the second largest paper manufacturer in Europe. The Stora Enso Multicopy-office paper is the most produced product at the mills in Sweden. Other typical paper products include newsprint, book paper, supercalenderised magazine paper, coated paper and office paper. Some plants also sell wood products and pulp. (Stora Enso, 2020)

4.5.1.2 The logistics flow of Stora Enso paper mills

The logistics organisation designs, procures and manages transport and distribution solutions for Stora Enso products. The aim of the logistics operations is to develop processes throughout the logistics chain and efficiently manage the information flows involved. The logistics operations at Stora Enso mills are carried out by different teams across Europe. There are four main roles in the logistics process; the dispatchers, the coordinators, the mill order planners. Logistics services are provided by approved and contracted suppliers worldwide, eg. road hauliers, rail- and shipping companies, port operators. The target of these duties is to ship the different paper products as efficiently and smoothly as possible to the customers across the globe (Stora Enso, 2020).

4.5.2 Roles, activities and interplay of actors in the logistics flow

4.5.2.1 Mill order planner

The mill order planners are responsible for how much paper the mill produces and align the production with the demand from customers. The demand of the customer is conveyed through the coordinator. A member of the mill order planner is responsible production planning of a paper machine line. The mill order planners are in daily contact with the coordinators and act as contact person with the production and the dispatchers. The mill order planners, with the input of customer demand of the coordinators, are in direct contact with the personnel at the mill.

4.5.2.2 Dispatcher

The dispatcher is responsible for the order planning and handling. A member of the dispatch team monitors current and upcoming orders and is in daily contact with hauliers. The dispatcher plans and executes the transport and delivery of the loads and inputs the order in the LSC (Logistics Service Center) -system. An important part of the dispatcher role is to carefully consider all the regulations related to the load, e.g. weights, national regulations, national holidays. The dispatcher takes actions to deviations and problems in the transport.

4.5.2.3 Coordinator

The coordinator is responsible for the relationship with customers and is in direct contact with them. The coordinators negotiate and manage customer agreements and receive and confirm orders from customers. The coordinators also handle complaints and resolve conflicts with the customer. A member of the coordinators is in daily contact with the dispatch team and informs them about the order and gives instructions.

4.5.2.4 Haulier and road transportation

Logistics services of paper reels and pallets including transports, delivery, customs and clearance are provided by third party service providers. Outsourcing of the transportation

of paper reels from Stora Enso's mills in Sweden in based on long-term relationship and contracts with logistics service providers. The hauliers work closely with the dispatchers. Together, they plan and agree on how to transport and deliver the loads to the customer. The outsourced service providers are required to comply with Stora Enso's Code of Conduct which regulate the requirements concerning e.g. workers' rights and environmental impact.

4.5.3 The logistics IT-systems at Stora Enso

Stora Enso uses several IT-systems in its logistics process. IT-systems are used for coordinating, communicating and handling orders and deliveries of paper mill products. The current IT-architecture was established in 2001.

LSC, Logistical Service Center, is the main tool for order planning and order tracking. The dispatcher plans the orders, in accordance with the instructions from the coordinator and inputs the order in LSC.

LSC consists of two fields, the main grid and the planning grid. The unplanned orders are in the main grid, prior to the planning stage. The dispatcher's role is to plan and combine the orders of different weight, measures and shape (reels, rolls and pallets). Some orders are combined and planned automatically; these orders are known as ALPs (Automated Load Plan).

Fenix is an ERP-platform used mainly by the mill order planning -team and the coordinators. In Fenix, the mill order planner can plan the paper production with the mill and maintain real time figures about how much paper there is in stock. The coordinators put in info about how much paper the customer has ordered. The data from Fenix moves automatically via the internal network to LSC.

Transporeon is a modern web-based software used to book and keep track of all loads booked with the hauliers. It is the interface between the hauliers and the dispatch team. LSC is also connected with Transporeon. (Based on the author´s internship at Stora Enso Kvarnsveden Mill, 2020)

4.5.4 The logistics cycle – from loading platform to customer

Stora Enso uses a standardised set-up for the logistics process. It starts with a demand, a customer who contacts the coordinator, who in this case also acts as seller. The coordinators are in daily contact with the Mill Order Planners, MOP. The MOP-personnel is working closely with the production; the staff at the mills around Sweden. The MOP-team immediately checks availability with the mill. The coordinator teams work locally and are often located near the customers. The coordinator informs the dispatchers about the customers demand. In practice, this data is inserted in the Fenix program. The dispatchers again, see the customer demand as orders in the LSC-system. The dispatcher's role here is to combine and plan these individual orders to one full truck load. The dispatcher also caters for the transportation and the contact with the haulier. The dispatch team is divided so that that each member of the team is responsible for different markets. After the load plan stage, the dispatcher contacts the haulier and agrees on details with the freight company. This is done in LSC. Usually, there are pre-contracted hauliers for most of the transport routes, this also means that the freight prices are fixed. Therefore, it is important to strive to load the truck with the FTL -principle, in order to achieve economies of scale. (Based on the author´s internship at Stora Enso Kvarnsveden Mill, 2020)

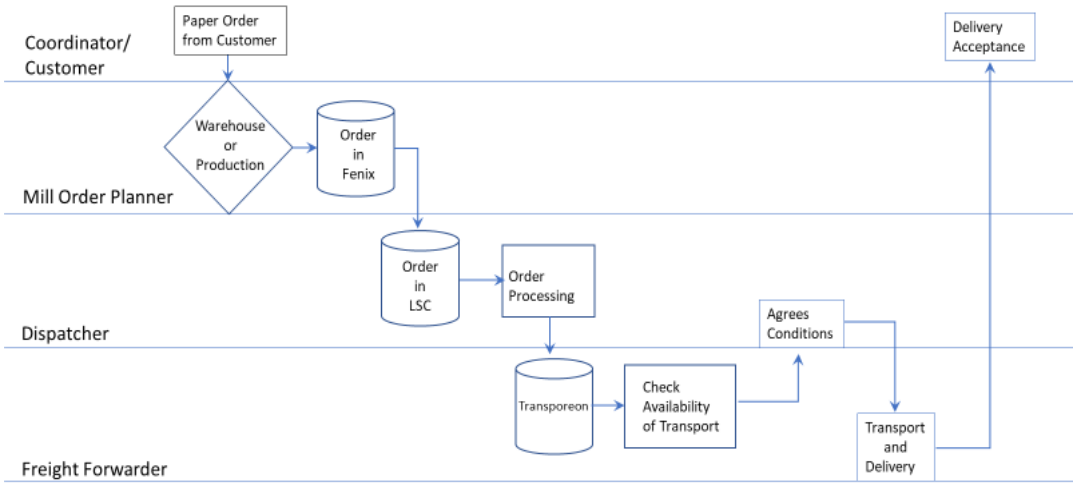

Figure 4. The logistics cycle at Stora Enso (von Knorring, 2020)

4.5.5 Data collection – e-mail interview

Interviews were conducted using an e-mail interview with ten pre-determined questions sent to the main participants in the logistics cycle at Stora Enso; the dispatcher, the mill order planning and the coordinator. All respondents insisted on staying anonymous and all were sent the same questions (Appendix). The questions were formed to match the research questions and enable the respondents to give their opinion on inefficiencies, risks and deficiencies in the delivery process and suggest ways to improve, make the delivery process smoother and more efficient. The first two questions deal with challenges and risks of the logistics cycle at Stora Enso paper mills. The next questions deal with how the logistics cycle can be improved, made more efficient and how risks can be managed. All the questions were open-ended questions to inhibit the respondents from answering yes or no. The respondents sent their answers back via e-mail.

E-mail interview data was analysed based on a step-by-step guide for qualitative analysis. First the data collected was analysed. The analysis started by labelling relevant words and phrases in all the answers -also called coding or indexing. The codes or indices were chosen on the basis of similar answers across respondent or the respondent explicitly stating that it is important or a statement that was repeated. The indices or codes were grouped in categories and compared to determine whether the data collected was consistent with underlying patterns across different participants representing different duties within the logistics cycle or contradictory. The findings in turn were interpreted and used to answer the research questions. (Qualitative analysis of interview data: A step-by-step guide for coding/indexing, 2013).

4.5.6 Data collection -participant observation

Data was collected through participant observation during a three-month internship at Stora Enso Kvarnsveveden Mill. The observations were made through the lens of a dispatcher. The working role provided not only a way to understand the strengths, weaknesses, challenges and threats of the logistics cycle at Stora Enso; but also, a method to study the collaboration, relationships and communication between the participants in the logistics cycle. The direct observation encompassed getting introduced to the work, per-

forming and engaging in the dispatch team, reading manuals, observing the surroundings and interplay between the members of the team, participating in meetings and social activities, observing non-verbal communication. The observations and notes and reflections of the interviews were registered in field notes and internship report.

4.6 Results and analysis

4.6.1 E-mail interview with participants in the logistics cycle

4.6.1.1 Dispatcher

A dispatcher working in the logistics team at Stora Enso was sent the interview question (Appendix) 18th March 2020 and responded by e-mail 19th March 2020. The dispatcher explained that using many different applications during the day is a bottleneck of the dispatch work. Another challenge is the combination of road and sea transports. Due to bad planning the road transports can be delayed which might lead to the truck missing the containership at the port. The containers are the left at the quay and the delivery is delayed. Due to humidity the paper quality can be affected which can lead to economic damage for Stora Enso. The main source of bad planning is lack of clear communication between the all four teams in the logistics cycle; mill order planners, coordinators, dispatch and freight forwarders. E-mails are answered too slowly and not accurately.

The dispatcher sees the following main risks in the logistics cycle; delays due to broken trucks, inappropriate and careless loading and unloading of the paper which can lead to damaged goods, the working hours of the drivers end in the middle of the delivery to customer which leads to delays.

The dispatcher thinks that the logistics process could be made more efficient by having all data in the same software with one interface, all the cases should have the same reference number series. Due to currently five different reference number series for each delivery case misunderstandings and mistakes occur. The current IT-systems are far from user friendly, only Transporeon and LSC communicate in the load booking stage. Some

national markets e.g. Hungary (EKAER-system), have their own control system and reference numbers for deliveries. These numbers should be generated digitally when the order comes in instead manual paperwork. Since many orders follow the same pattern time after time, more ALP:s (Automated Load Plans) could be in use.

Risks in the logistics cycle could be handled more efficiently if the communication between freight forwarders, drivers and dispatch team was more well-functioning; phone (instead of e-mails), quick messages could make the process smother. Timely reaction is of the essence.

The way of working could be improved by a more even division of duties among members of the dispatch team. Some national markets are more demanding (e.g. Germany, Hungary, Greece) to serve than others and this should be considered when allocating markets among dispatchers.

Transport could be made more climate smart by increasing the share of rail transportation. Sustainable transport is all about loading the trucks to a maximum, to strive for FTL and optimise truck usage, according to the dispatcher.

The dispatch work is occasionally very hectic; quick reactions and good concentration are needed. Knowledge about logistics, geography and good teamwork skills are key to success. The dispatcher needs to have clear communication skills.

4.6.1.2 Coordinator

A coordinator working in the logistics team at Stora Enso was sent the interview question (Appendix) 18th March 2020 and responded by e-mail 2nd April 2020. The coordinator believes that the main bottlenecks in the process are container packing and sea-freight. Delayed container packing often means missed feeder freight ship (smaller freight ships connecting to ro-ro ships in bigger ports). Communication with dispatch team and mill order planners located in different geographic areas is challenging. Time differences can lead to delayed deliveries and lower customer satisfaction and complaints. The risk shar-

ing of the delivery to customer is not straightforward from the point of view of the coordinator. Customer expectations have grown and in the case of problems, coordinator receives customer complaints for a delivery executed by dispatch, loading team and outsourced freight forwarder. Coordinator has little insight in the physical delivery and cannot see where exactly the delivery is on its way. When customer calls and makes inquiries about the delivery there are many steps to find out about it.

As a means to smoothen the logistics process the coordinator mentions improved container packing with more accuracy and more effective communication within the process. IT-systems are outdated but functioning. Marine policy paperwork, quality and quantity certificates could be digitalised and be integrated in the order planning system.

The coordinator sees improvements in loading and container packing as a way to minimise risks of damaged goods. Communications between loading and coordinators needs to be more effective. Loading needs to inform coordinator immediately in the case of delays, targets not met, lost paper rolls and reels so that coordinator can be in touch with customer. A technical innovation that would ease the workload for all involved in the logistics cycle would be the possibility to track loads in real time using GPS technology with maps.

Sustainability in transports can be achieved by a higher degree of railroad transportation, minimise small loads and use combined shipping.

A successful coordinator needs excellent organisational skills, attention to detail and accuracy, effective communication skills and ability to work with people in many different cultures.

4.6.1.3 Mill Order Planner

A mill order planner working in the logistics team at Stora Enso was sent the interview question (Appendix) 17th March 2020 and responded by e-mail 2nd April 2020. Imbalance between order fulfilment and production is the main bottleneck of the logistics cycle from the point of view of the mill order planner. Over- or underproduction lead to shortages or

delays. Overproduction fills up warehouses, goods can be damaged during storing or underproduction on the other hand leads to delays. Coordinators sometimes communicate customer demand late in the process which increases difficulty to achieve order fulfilment. The communication can be inaccurate regarding target quantities for the scheduled delivery. Another bottleneck is order splits. Depending on customer preferences, an order can be divided and delivered in multiple lots with the same order number reference. This can cause misunderstandings and additional work at the dispatching stage. Multiple lots should be avoided as much as possible. Potential bottlenecks should be dealt with in advance and dealt with systematically. A modern and fully integrated ERP-system could enhance the process with modules covering the entire supply chain; from production to the delivery of the final product. The most important is to get early information about precontracts and real time data about the current warehousing situation.

A major risk for the delivery is production stops and crippling machinery. This leads to a situation where at least parts of the planned quantities for the orders are not fulfilled.

4.6.1.4 Results of e-mail interviews

Based on the findings of the e-mail interview responses, three main categories of data observations were identified in the logistics cycle of Stora Enso mills in Sweden:

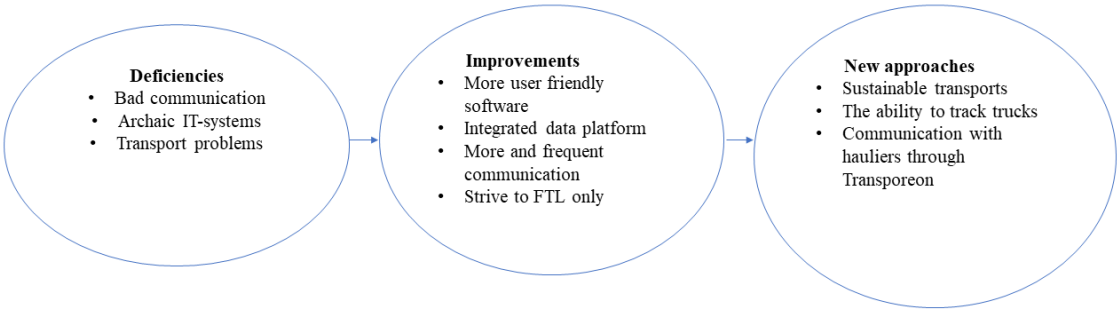

Figure 5. Categories created based on coding data of respondents' statements in e-mail interview

4.6.2 Participant observation of case study of the logistics cycle at Stora Enso Kvarnsveden mill

Dispatchers sit at the intersection of coordinators representing customers and mill order planners planning the production of paper. The roles are clearly defined, and the process is well standardised. Dispatch combines customer and production needs. The dispatching work consists of two principal stages; load planning and follow-up including problem solving.

The dispatch team at Stora Enso, Kvarnsveden Mill, consisting of 8-10 persons, is divided into teams catering for different international markets. A dispatch team can be responsible for up to three or even four markets (countries).

The load planning is the nerve centre of the dispatch work. A customer order from coordinator serves as the input that sets the logistics process in motion. The speed and accuracy of the information flow has direct impact on the success of load planning. This affects in its turn the costs and efficiency of the logistics cycle. Bad communication between the teams can lead to problems with orders and delays in transportation.

The first stage in the dispatch work is the load planning in the LSC-platform. The dispatchers receive new, unplanned orders in the main grid of the program. The task is to plan and combine the orders as efficiently as possible, always striving for FTL, depending on the weight limits in the markets (e.g. the limit in Sweden is 28 tonnes). Sometimes a full truck load is not possible as there are different measures on the reels, rolls and pallets and they have to be loaded so that they do not break. The dispatcher agrees with the team leader of the dispatch department if the loads are under 20 tonnes. The dispatcher is also obliged to ask for permission if the costs of the transport increase by 100 euro compared to the fixed price. The aim is to achieve the minimum cost of transportation flow.

There are three principal types of order planning. The first type is the automatically planned ALP:s . These loads are pre-planned by the LSC program, as they usually follow the same pattern; same weight, same destination and same customer. Nevertheless the dispatcher has to monitor the ALP:s as mistakes can occur, and the LSC program is not bullet proof. The dispatcher needs to make sure that the program has included and has planned all the reels, rolls or pallets that are mentioned in the order. Control and verification measures of ALP:s are time consuming and require manual monitoring.

The second type of load planning are the pre-given orders to terminals. The coordinator sends excel sheets per e-mail to dispatch when the orders are already planned. The dispatcher's task is to plan and execute the orders accordingly in LSC. These orders are often urgent, they have to be at the terminal one day prior to the following planning stage, when another dispatch team plans for oversea freight.

The third, and the last category are the "normal" orders. The normal orders consist of different shapes (reels, rolls and pallets) and are of different weight. Usually trucks are planned only with one shape. If a load consists of larger paper reels, there is usually no room for pallets. After the initial planning stage, the dispatcher looks for potential freight forwarders that possible could offer transportation to either a fixed price, or to a price based on bidding in Transporeon. For most markets, Stora Enso has pre-contracted hauliers that always deliver to a fixed pre-contracted price. For some newer markets, eg. countries in Eastern-Europe, the pricing of the paper deliveries are based on bidding. When a freight forwarder is elected, the load is visible in Transporeon. Some markets even require

booking of a slot time at the final destination. This is made in the Cargoclix program. The dispatcher books a slot at the customer's warehouse and puts in the details of the order in LSC.

Sometimes there are urgent changes in the already planned and booked loads. The MOP-team can face difficulties estimating how much paper the mill can produce. Changes in the already existing load plans can occur due to this. This means that the exact amount of paper is a moving target, even minutes before departure of the load from the mill. The dispatcher has to adjust an already existing load at a late stage which causes extra manual work and reconfirmations with the freight forwarder.

The availability of freight forwarders can sometimes be demanding for the dispatcher. If there are urgent orders coming up at the end of the day, the dispatchers might find it hard to find a haulier to transport the goods. This can lead to unwanted delays. The main risks with the outsourced service providers are connected with the selection of freight forwarders. Some freight forwarders provide better quality and reliability of transport services, e.g. faster reaction and reply, better know-how of delivery of paper reels and rolls, increased flexibility in services, transparency in costs, in-house fleet of transportation. Established and well-known hauliers deliver better transport services but at slightly higher prices.

The dispatch team has no contact with customer and has no way of controlling that the delivery has been successfully and timely delivered. There is no tracking of the loads and no delivery confirmation at final destination.

There were some deviations in the delivery process. Some trucks are not FTL and paper deliveries to some markets are only LTL (Less than truckload). These orders are usually urgent, and less than 10 tonnes. The dispatcher often needs to search for freight forwarders who can combine in the partial deliveries with an already existing truck going to the same destination. Since it is LTL the price is not fixed depending on a fully loaded truck, instead the dispatcher auctions the load to many hauliers in Transporeon and the haulier that is able to deliver in the fastest and most favourable way, wins the bidding.

The dispatch team handles huge amount of data. The information systems are designed to handle warehouse monitoring, load and delivery planning. However, there are numerous manual steps in the process. The IT-systems are not integrated and there are interfaces only between load planning and transport management systems. There is no automation and the load planning IT-system does not recognize weights and measures of paper rolls and reels. The dispatcher manually makes sure that the orders are correctly loaded.

Incident and quality defects in the process are registered and reported in Excel files. The report covers operational risks, exceeding costs, delivery errors. The incident report provides relevant information for incident investigation and quality improvement of the logistics cycle.

The socio-culture environment of the logistics process was well established with many co-workers having worked for Stora Enso more than 10 years. Logistics competence has been acquired through years of practice, but no team member had a degree in logistics. The dispatch team was dedicated to their work and there was a tight bond with the local mill. There was a strong sense of care and duty for the paper deliveries. The communication between team members was professional and straight-forward. Logistics executives were demanding, result driven and cost-awareness was high on the agenda. The balancing act was between customer satisfaction and cost-efficiency of the logistics process.

4.6.3 Results of participant observation

The findings from the participant observation of the case study is summarized in a SWOT analysis. A SWOT analysis is “a method of assessing a person, company or product by considering their Strengths, Weaknesses and external factors which may provide Opportunities or Threats to their development” (Fallon, 2018).

Strengths	Weaknesses
• Standardized and well-functioning logistics process • Well established haulier contacts • Competitive haulier bidding • Reporting and follow up of deviations • Clear division of duties	• Lack of data integration platform • LTL loads • Shortage of transport vehicles • Thin profit margins, and narrow mandates for dispatchers • Excessive manual paperwork • Software not user friendly
Opportunities	**Threats**
• Sustainable transports • Automatization of load planning • Improved communication between the parties in the logistics cycle • New ways of communicating, instead of e-mail	• Outdated IT-architecture • No tracking of deliveries • Hectic customer service work • Delays in the delivery process, especially to terminals • Damage of paper reels, rolls and pallets • Highway accidents • Last minute amendments by MOP • Quality problems with hauliers

Figure 6. SWOT-analysis of logistic cycle of Stora Enso Paper Sweden Ab

5 DISCUSSION AND CONCLUSIONS

Despite severe decline in demand for fine paper the paper and pulp industry is not disappearing, but it is going through a substantial transformation. Given the influence of technological change and resource concerns, the industry will have to find the next level of optimization (Berg & Lingqvist, 2019).

The aim of the thesis was to analyse the distribution and delivery model of Stora Enso's fine paper products from mills in Sweden to the European market, identify risks and inefficiencies and detect ways to improve the smoothness and efficiency in the logistics process. The focus was on evaluating the operational activities of the logistics cycle.

The first research question was to detect which inefficiencies, risks and challenges there are in the logistics cycle of paper deliveries from the mills of Stora Enso Sweden (RQ1). To explore this further, a second research question was added analysing the roles and interplay of the mill order planner, dispatcher and coordinator in the logistics process (RQ2). Based on the findings of RQ1 and RQ2 the third research question explored what measures should be taken to improve the efficiency and smoothness of the delivery model (RQ3). The findings of the study are based on qualitative data collection method through an e-mail interview with mill order planner, coordinator and dispatcher coupled with findings from participant observation of the Stora Enso Kvarnsveden Mill case study.

Logistics theory is the corner stone of this thesis. Logistics is the process of planning and executing orders, transportation and delivery of goods. The aim of logistics is to meet customer requirements in a timely and cost-effective manner. Demands for increased efficiency in the flow of information and goods, shorter lead times, higher delivery capacity has put logistics in the forefront of achieving the overall goals of companies (Mattson, 2002).

Logistics literature suggests that the logistics task is to meet the need for integration of material and information flows within and between organization (Storhagen, 2003, p. 31). This also holds true for the logistics process at Stora Enso Sweden. The logistics process is a well-established, standardised and partly integrated process.

There are, however, important issues in the process. In relation to RQ1 the results show that the key challenges of the logistics cycle are bad communication and sometimes slow response within the different functions of the logistics cycle, last minute changes to orders that require a lot of manual work to correct and information systems that do not support the process. The load planning main grid does not identify the volume; weights and shapes of the paper reels and rolls. This can lead to non-optimal loading that increases the risk of road accidents and damaged goods. There are no clearly defined environmental considerations of the logistics planning.

The findings based on data collected in relation to RQ2 suggest that the cooperation between the mill order planner, dispatcher and coordinator is generally good, but more resources should be focused on improved communication, better understanding and coordination of the different phases in the logistics cycle. Due to disintegrated IT-systems and bad communication no one in the logistics cycle has an oversight of the delivery process. There is not enough knowledge among the participants about the effect of a plan of action in the order planning cycle. The deliveries cannot be tracked during transportation. Problem solving is time consuming and involves many steps.

The results based on data collected show in response to RQ3 that communication and information sharing between the participants in the logistics cycle should be more frequent and efficient. Sharing information early in the order planning phase and making data available to all parties would increase the efficiency of the process. All manual steps should be automated and digitalised as much as possible. Information systems should be more integrated and all participants in the logistics cycle should have access to the same real-time database to enable more efficient flow of information. Orders following the same pattern on a regular basis should be standardised and planned as ALPs. Predictability of logistics flows will enable the use of artificial intelligence going forward and contribute to more efficient logistics. Tracking of transports would increase transparency of the delivery and improve problem solving capability of dispatch team. Findings in the incident report should be used more visibly and efficiently for quality improvement of the logistics cycle.

A better understanding of environmental issues of the logistics cycle are increasingly required. One first step would be to allow only FTLs. Transports could be more environmentally friendly by an increased used of train transportation instead of road transports. The aim of logistics activities, as described in literature, is often focused on minimising costs. This study has shown in relation to RQ3 that cost minimisation should not be the overriding objective of the logistics cycle of paper reels and rolls. Logistics is often outsourced to external service providers. Cost minimisation can lead to outsourcing of bad quality with delays, problems in the transportation and finally low customer satisfaction. In addition to costs, the selection process should include evaluation of the service provider's responsiveness, experience, quality of services and communication. The overall efficiency of the logistics cycle could be improved by always striving for FTL, more active communication within the logistics process, improved precision of the information, reliability in order planning, appropriate application of information technology.

Logistics play a key role in the economy (Grant, et al., 2006, p. 7) not least for the global paper industry. Due to digitalisation the industry is facing several challenges as the consumption of graphic paper is reducing. The global pulp and paper industry has contracted over the past decades mainly due to the transition to digital media and paperless communication. Especially the fine paper production business has gone through serious downsizing. The profit margins on fine paper products have been reduced as demand for fine paper in the global market has decreased (Bajpai, 2018). Theses challenges were visible also through the participant observations of the Stora Enso case study. Cost consciousness was high on the agenda and investments in integrated, user friendly software had been postponed to a future date.

Many opportunities and challenges will face the future logistics process of paper reels and rolls. The role of logistics grows and takes on greater importance in achieving the overall goals of the organization (Grant, et al., 2006, p. 21). The case study was important, as smoothness and efficiency in the logistics cycle of paper reels and rolls can help to improve the profitability, customer satisfaction and market share of Stora Enso in the global fine paper market. Organizing for effective and smooth logistics can strengthen the competitive position of Stora Enso in the global paper market.

The increased sustainability focus and stricter regulations will drive logistics and supply chain processes to bring solutions that lower the environmental footprint. This will also impact the logistics process of fine paper. Further research should focus on the identification of further opportunities to improve the smoothness of the logistics cycle of the paper industry. Improved and upgraded logistics information systems for more efficiency in the logistics process and a better understanding of the role of sustainable solutions and transports should be in the focus for continued research.

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APPENDIX

E-MAIL INTERVIEW QUESTIONS

1. What are the bottlenecks in the delivery process?

2. What are the three main risks and challenges in the delivery process?

3. How could the delivery process be more efficient?

4. How can the various applications be improved (LSC, Fenix, Transporeon)

5. Can some stage of the delivery process be automated?

6. How can risk management be improved?

7. How would you improve the communication between the coordinators, freight forwarders, MOPs and dispatchers?

8. What would you change in the way we work?

9. How would you make transports more efficient and sustainable?

10. What kind of education and knowledge does the work at CSC require to ensure smooth deliveries?