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Order-to-cash business process improvement by Lean Six Sigma tools

Study of a case company

School of Technology and Innovations
Master's thesis in Industrial Management

Vaasa 2020

UNIVERSITY OF VAASA
School of Technology and Innovations
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Title of the Thesis: Order-to-cash business process improvement by Lean Six Sigma tools : Study of a case company
Degree: Master of Science in Economics and Business Administration
Programme: Industrial Management
Supervisor: Ahm Shamsuzzoha
Year: 2020 **Pages:** 79

ABSTRACT:
Worldwide competition drives businesses to focus on superior operational excellence activities along with creating value for the stakeholders. The purpose of this master's thesis was to analyze the case company's current state of the order-to-cash (O2C) process as well as identifying the areas of development by the means of Lean Six Sigma tools. The study was conducted as a mix of quantitative and qualitative analysis. Based on the data, a value stream mapping workshop was conducted to analyze the current state of the O2C process of the case company. The O2C process is the most visible process to the customer and therefore its punctual and fluent order management is vital. To ensure that the O2C process is operating as desired, suitable process performance metrics need to be aligned and followed. The results gathered from the data, interviews and workshop all highlighted that the high degree of manual work cause mistakes, delays and rework in the process. The manual work is mainly caused by the Allegro system functionality that is unreliable and requires manual controlling and checking. The results found that excessive manual work was highly connected to inadequate or incorrect data in pricing and invoicing activities which resulted in cancelled invoices. Cancelled invoices are visible to the customer and have a negative impact on the customer experience. Additionally, as the current process is split into different process phases which are interdependent of each other, the importance of communication is crucial for a well-functioning process. To analyze and improve the current O2C process, some Lean Six Sigma tools could be utilized for further actions. These tools are process mining, root cause analysis and daily continuous improvement activities. Additionally, key process performance metrics such as, touchless rate, credit invoice rate and the amount of manual field changes could be created in the process mining tool system, Celonis, in order to understand the real-time O2C process performance. Ensuring strong performance and enhancing continuous improvement leads to operational excellence and commercial competitiveness. By improving the performance of activities and communication with internal and external stakeholders, the whole O2C process can perform more effectively and provide better customer value.

KEYWORDS: Order-to-cash, business process improvement, Lean Six Sigma, process performance metrics, value stream mapping, case study

VAASAN YLIOPISTO
Tekniikan ja innovaatiojohtamisen yksikkö
Tekijä: Emilia Tuukkanen
Tutkielman nimi: Tilaus-toimitusprosessin kehittäminen Lean Six Sigma -työkaluilla
Tutkinto: Kauppatieteiden maisteri
Oppiaine: Tuotantotalous
Työn ohjaaja: Ahm Shamsuzzoha
Valmistumisvuosi: 2020 **Sivumäärä:** 79

TIIVISTELMÄ:
Globaali kilpailu edellyttää yrityksiltä ammattitaitoista operatiivista toimintaa, joka luo lisäarvoa sidosryhmille. Tämän lopputyön tavoitteena oli analysoida case-yrityksen tilaus-toimitusprosessin nykytilaa, sekä tunnistaa sen kehitysalueet Lean Six Sigma –työkalujen avulla. Tutkimus perustuu sekä kvantitatiiviseen että kvalitatiiviseen analyysiin. Analyyseista saatuihin tietoihin perustuen laadittiin arvovirtakuvaus, jolla kartoitettiin tilaus-toimitusprosessin tuottavuus case–yrityksen toiminnoissa. Asiakkaalle tilaus-toimitusprosessi on yksi näkyvimmistä, jonka vuoksi on tärkeää, että se toimii täsmällisesti ja sujuvasti. Tilaus-toimitusprosessille on asetettava oikeat suorituskykymittarit, joita seuraamalla voidaan varmistaa prosessin toimivuus odotetulla tavalla. Kvantitatiivisen ja kvalitatiivisen analyysin tuloksista ja laaditusta arvovirtakuvauksesta saadut tulokset osoittavat, että manuaalisen työn osuus on huomattava aiheuttaen virheitä, viivästyksiä ja ylimääräistä työtä. Manuaalisen työn tarve johtuu ensisijaisesti Allegro järjestelmän toiminnan epäluotettavuudesta. Saatujen tulosten mukaisesti puutteellisista tai virheellisistä tiedoista johtuen manuaalista työtä esiintyy eniten hinnoittelussa ja laskutuksessa johtaen hyvityslaskujen tarpeeseen. Hyvityslaskut ovat näkyvin osa prosessia asiakkaalle ja ne vaikuttavat negatiivisesti asiakaskokemukseen. Case-yrityksellä käytössä oleva nykyprosessi on jaettu eri vaiheisiin, jotka ovat toisistaan riippuvaisia. Viestinnän merkitys on kriittinen toimivan prosessin kannalta. Prosessia on mahdollista analysoida ja kehittää Lean Six Sigma –työkalujen avulla. Keskeisiä työkaluja ovat esimerkiksi prosessin louhinta, juurisyiden analysointi ja jatkuva parantaminen. Prosessilouhinnan järjestelmä, Celonis, mahdollistaa prosessin suorituskykymittareiden luomisen. Mittareita voivat olla esimerkiksi automaatioaste, hyvityslaskujen osuus ja manuaalisten muutosten määrä. Näiden avulla on mahdollista tarkastella tilaus-toimitusprosessin tehokkuutta. Hyvä prosessin toimivuus ja sen jatkuva parantaminen ovat operatiivisen toiminnan ja taloudellisen kilpailukyvyn menestystekijöitä. Myös toimiva viestintä sisäisille ja ulkoisille sidosryhmille mahdollistaa prosessin toimivuuden ja parantaa asiakaskokemusta.

AVAINSANAT: tilaus-toimitusprosessi, prosessin kehittäminen, Lean Six Sigma, prosessin suorituskykymittarit, arvovirtakuvaus, case-tutkimus

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Abbreviations

BPM Business Process Management

CIF Cost, Insurance, Freight

ERP Enterprise Resource Planning

KPI Key Performance Indicator

O2C Order-to-Cash

RCA Root cause analysis

TQM Total quality management

VSM Value stream map

1 Introduction

This master's thesis studies the improvement of the *order-to-cash* (O2C) business process through the implementation of *Lean Six Sigma tools*. O2C means handling and processing a customer order and this is described in more detail in section 2.1. The study was conducted for a Finnish energy and environment company. The aim was to find solutions to improve the overall process performance, in addition to providing value for the stakeholders. Additionally, this thesis studies the bottlenecks and defects of the current O2C process. It provides a comprehensive study on how the O2C process is currently operating and which parts of the process could be streamlined. The information used in this thesis has been based on data and other relevant materials regarding the sales operations of the case company. This study was conducted for the case company to provide additional value for their *operational excellence* activities.

1.1 Description of the case company

The case company operates in the field of energy and environment sector and is a leading corporation in sustainable business (Case Company, 2020). The company's operations are global thus, the offices and production sites are located worldwide. However, its strongest presence is in the Baltic Sea area. The case company's business environment is mainly focused on the energy production and creating solutions for transportation by road, sea, air and pipeline.

The strategy and vision of the case company is to operate responsibly and to offer sustainable solutions for consumer and corporate consumption (Case Company, 2020). Their solutions are constantly developing new ways to cut down on carbon emissions and to circulate and reuse its products. The case company's mission is to do business responsibly, innovatively as well as with excellence and these values are respected in

their actions. Thus, the company has an operational excellence team that promotes unified ways of working in accordance with the company strategy in order to ensure growth and competitiveness. Furthermore, this thesis supports its activities and future development projects.

1.2 Background

The case company has an ongoing development project of assessing the current business processes and their maturity, thus O2C is one of these processes that needs to be developed. In order to develop the process, a comprehensive study and assessment of the current process is required and the aim of this study is to support the case company to achieve that goal. Manual work and large number of changes throughout the process are recognized issues but their effect on the process performance is unknown. Currently, there are limited performance metrics for the O2C process and the company has identified a need to gain further understanding whether the process is efficient. It would be beneficial for the company to understand the amount of waste, its effect on the customer and the real-time process performance.

1.3 Purpose

The O2C process is the most visible process for the customer. Therefore, it is a vital business process to be managed. By optimizing the O2C process activities there is more time left for additional sales activities and thus incoming revenue. This master's thesis is focusing on the methods to improve the O2C business process by the means of Lean Six Sigma tools. The research questions of this study are the following:

- *What is Lean Six Sigma and its tools?*

- *What are the challenges of the current order-to-cash process and what methods can be used to improve the process performance?*
- *What are the best metrics to measure the order-to-cash process performance to provide value for the relevant stakeholders?*

This thesis studies the current state of the O2C process in order to gain understanding of the challenges and root causes of the arising problems. The theoretical frameworks and findings from data provide comprehensive knowledge in order to determine recommendations for the case company.

1.4 Method

This study has been conducted as a mix of quantitative and qualitative analysis. The quantitative analysis was based on data provided by the company's *enterprise resource planning* (ERP) system. The analysis has been conducted by finding the bottlenecks and defects of the process following with a comparison to the ideal process flow. Additionally, the qualitative analysis was reflected on the bottlenecks and defects in order to understand the reason the process is currently functioning in this specific way. A value stream mapping (VSM) workshop was also conducted as a part of the study. In the workshop, a selected team mapped the current state of the O2C process and determined the main areas of development.

1.5 Delimitations

The scope of the thesis is limited to the Baltic Sea area operations and surplus sales done as *spot sales* (unplanned sales). The O2C process was analyzed through vessel deliveries operated by Finland's and Europe's sales operations. This study takes into consideration the CIF delivery incoterms, only. The vessel deliveries were chosen because they are

business critical as global operations enable a larger market. These deliveries highlight the importance of cooperation between different stakeholders as several departments take part in the process.

The main aim of this thesis was to study and analyze the current order-to-cash process and give recommendations for the case company to act on. The implementation of the recommendations will be done after the publication of this thesis. The data has been classified company confidential as well as other company specific information has not been released.

1.6 Structure of the thesis

This thesis has been conducted scientifically and follows a scientific structure. The first chapter introduces the thesis topic, background and purpose. The second chapter covers the following theoretical frameworks:

- Order-to-Cash process,
- Business Process Management,
- Key Performance Indicators and Metrics and
- Lean Six Sigma.

The third chapter, reviews the methodology's and describes the implementation of the empirical study. The fourth chapter explains the data gathered, analyses the data and the workshop and finally discusses their results. The last chapter summarizes the results that are reflected to recommendations for the case company followed by the final conclusions.

2 Theoretical Framework

Worldwide competition is growing rapidly, and in order to receive competitive advantage businesses should develop a suitable strategy. The traditional competitive strategies are based on differentiation by costs or products (Martin, 2015). Consequently, companies that have gained recognized competitive advantage in their industries have succeeded by delivering exceptional customer value (Treacy & Wiersema, 1993). Treacy and Wiersema (1993) state that in order to succeed one of the following disciplines should be followed: operational excellence, customer intimacy or product leadership.

In this context, operational excellence means providing reliable goods with competitive pricing and with no inconvenience whereas, customer intimacy means targeting the markets and providing tailored solutions to match the customer needs (Treacy & Wiersema, 1993). Companies that succeed in matching customer needs, have good market intelligence and operational flexibility to rapidly respond to the market needs (Treacy & Wiersema, 1993). Leading in product leadership means possessing a product with the best characteristics which in turn attracts customers to use that product and any other products the company produces (Treacy & Wiersema, 1993). Consequently, such organizations tend to have solid customer loyalty. As the O2C process is the most visible to customer, focusing on providing value for the customer is a key activity to keep in mind in order to maintain customer satisfaction and loyalty.

The case company (2020) has created a Commercial Excellence Management System in order to track and manage common goals and interests of all business actions. In the case company, commercial excellence is carried out by focusing on customers and by optimizing the operations. As presented in Figure 1, the commercial excellence activities are divided into the following categories: “Create Markets and Manage Customers”, “Optimize Supply Chain” and “Deliver and Fulfill Customer Promise”.

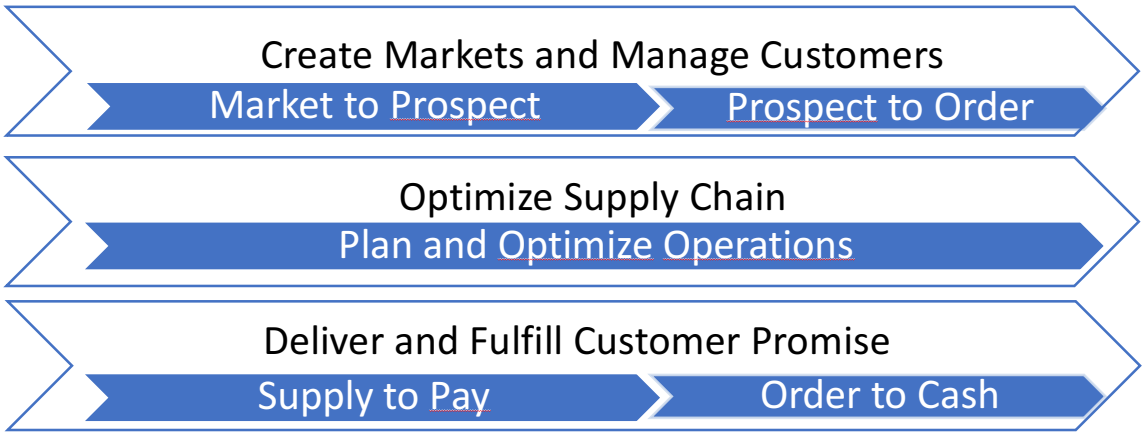

Figure 1. Case company's Commercial Excellence Management System (Case Company, 2020).

The purpose of the top level phase "Create Markets and Manage Customers" is to create a market to prospect following with an implementation of prospect to order activities (Case Company, 2020). Creating a market to prospect is building a competitive marketplace allowing to find the potential customers. Thus, prospect to order handles forecasting demand, developing sales and supply plans, managing key accounts, negotiating seller/buyer contracts and managing suppliers.

The meaning of the second level "Optimize Supply Chain" includes the commercial excellence activities built on planning and optimizing the operations (Case Company, 2020). These activities include sustainability and compliance, scheduling supply chain operations, managing supply chain performance, managing inventories and price risks.

On the third level, "Deliver and Fulfill Customer Promise", the team members ensure that customer promises are delivered and fulfilled, on both supply to pay and order to cash processes (Case Company, 2020). "Supply to Pay" operations make sure that the order is executed, logistics is planned and loading, transportation and unloading of the

product are executed. Consequently, the O2C process manages and executes sales orders and deals, organizes logistics as well as makes sure that loading, transportation and unloading are executed.

2.1 Order-to-Cash

Managing the O2C process is relevant for an organization's success (Shapiro, Rangan & Sviokla 2004). By analyzing the order management process, managers are able to understand the process performance and the customer perspective in order processing (Shapiro, Rangan & Sviokla 2004). The order processing is performed by critical people working with joint effort to fulfill the customer order (Shapiro, Rangan & Sviokla 2004). The O2C process is the handling of a customer order and it includes the activities starting from order to the stage of finally receiving the money from the sale (Parravicini, 2015). Parravicini (2015) states that the O2C process's key features are to collect customer orders, deliver the goods to customer's desired place on time and finally to receive the payment from the customer. In addition to delivering the goods, the quality of goods must be up as agreed and the relevant delivery documentation must be provided. The O2C process has a strong link to the company's reputation and customer relationship as errors affect customer satisfaction levels directly (Parravicini, 2015). The more improved and the optimized the O2C process is, the more time there will be available for the seller's activities to acquire new sales.

The O2C process has a clear cycle consisting of several key activities:

- preparation,
- customer order and its implementation,
- delivery of the goods,
- invoicing the customer and
- getting the payment of the order (Parravicini, 2015).

The preparation activities ensure that customer datasets are correctly entered into the systems, the goods are available and the pricing is correct (Parravicini, 2015). Once all the necessary information has been set in the database and ERP systems, the seller receives the customer order. Prior to confirming the customer order, the availability of the goods and customer credit must be checked. Finally, when everything has been put in place the sales team confirms the order to the customer and sets up the outbound delivery to the ERP system in order to book a transport mode and time. In the ERP system the sales team, logistics and the supply chain planners plan the cargo movements.

Once the upcoming delivery has been finalized, the order fulfillment activities includes the order picking, loading, transporting and discharging to the customer (Parravicini, 2015). Throughout the whole order fulfillment process the activities of transportation shall be documented (e.g. Bill of Lading, loading and discharge reports, inspector analysis on quality of good). The act of delivering the goods initiates the actual transportation of the goods making sure that the product is in the correct quantity and quality and in addition, at time agreed. If errors occur during the transportation, they need to be noted and documented. After the delivery, the invoice will be sent to the customer according to the agreed billing type and terms. Based on the billing type, the invoice will be created and sent to the customer. After handling the possible delivery returns the payment from the customer finalizes the activity. If the payment is received on time, the O2C process is complete. If for some reason the payment is outstanding or a partial payment, the customer will be sent a reminder. In case the customer refuses to pay, the most extreme form is to block deliveries and take legal actions.

If the O2C process is efficient and the activities of the process have been accomplished correctly, providing good customer service will be a competitive advantage for the company (Parravicini, 2015). To ensure that the O2C process is performing in the best way possible, it is crucial to make sure that in the preparation stage of the process everything is available in the database and the ERP system correctly in order to avoid mistakes. In addition to having a strong performance of these actions, Parravicini (2015) highlights

that having a clear customer communication is important. Moreover, any errors in the process should lead to corrective actions. A strong relationship with customers who regularly provide feedback of the organization's actions can also lead to O2C improvements. In order to improve the O2C process, all team members must be committed to participate in the process (sales team, customer care, pricing, master data, logistics, etc.) (Parravicini, 2015). There might be many actions in different teams that could be improved to make the whole process perform better.

2.1.1 Why is O2C important?

Shapiro, Rangan and Sviokla (2004) state that the O2C process is the most visible process to the customer and therefore the order management is vital. Every order can be referred to as a customer, and their management is the way the customer is treated (e.g. an uncared order is an uncared customer). The O2C process consists of multiple phases and order processors which are the critical people managing the order (Shapiro et al., 2004). By tracking an order phase by phase, the O2C process will reveal what effect changes have on the customer. Consequently, by analyzing and improving the order management process, organizations can create a competitive advantage.

As an O2C process requires cooperation across different teams there tends to be interactive and possibly even overlapping activities (Shapiro et al., 2004). Thus, it is critical to make sure that the customer is handled throughout the process with high quality and customer service. It cannot just be each process performer focusing on their own responsibility. The core of a well-functioning O2C process is to fill orders effectively and to match customer expectations (Shapiro et al., 2004). In addition, a well-functioning process minimizes internal conflicts and overlapping work, as well as increases the financial performance by increasing sales and reducing waste. To ensure that the process is well-functioning, suitable process performance metrics need to be aligned as these metrics will reveal if the process is operating as desired (Shapiro et al., 2004).

2.1.2 Delivery incoterms

International Chamber of Commerce's Incoterms are globally agreed terms for the sale of goods (ICC, 2020a). The delivery incoterm rules are included in sales contracts and followed by importers, exporters, transporters and insurers. The CIF incoterm represents Cost, Insurance and Freight (ICC, 2020a). The CIF incoterm is applied for sea and inland transportation. In Image 1, it has been shown to what degree the CIF incoterm works in practice as the cargo delivery moves from the seller to the buyer.

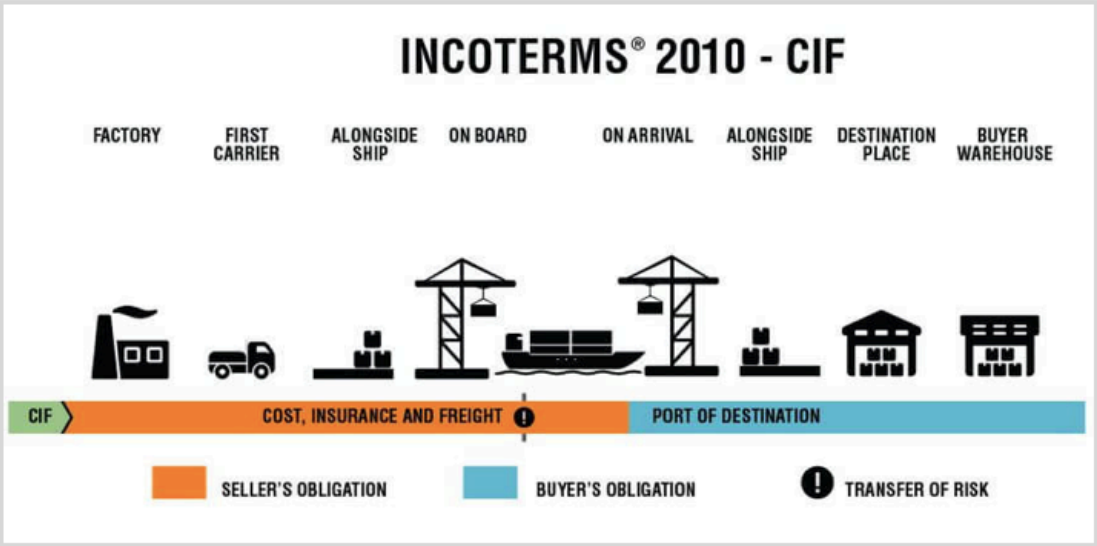

Image 1. The CIF Incoterm (Bansar, 2020).

Under CIF incoterms, the seller has to pay for the carriage and arrange the transportation (ICC, 2020b). However, the seller is not responsible for the risk of loss or damage of goods or any additional cost due to events occurring after the shipment (ICC, 2020b). In addition, the seller is obliged to have insurance which has minimum coverage (ICC, 2020b). The CIF incoterm is one scope of this study as it was the most common delivery incoterm of the dataset.

2.2 Business Process Management

Business process management (BPM) enables processes to be executed and changed on the spot in order to match the needs of the market (Ould, 2005). One of the key activities of BPM is to manage processes in a way in which they can be monitored and controlled while running and distributing throughout the organization (Ould, 2005). The core idea of BPM is to optimize the business process throughout its lifespan in order to increase profitability (Khan, 2004). To achieve this common goal, business process management requires the contribution of all participants and an understanding of the business and organization of the company (Ould, 2005). A business process can be, for instance, an order or any systematic process performed by the joint effort of different teams (Khan, 2004).

Khan (2014) states that a business process should function well to be profitable and a well operating business process is usually measured by the speed of response and the clarity of decision making. To ensure the flow of goods and information, a business process should be a monitored sequence of activities, along with a mutual understanding of roles and responsibilities of people and systems (Khan, 2004). Glykas (2013) states that business process modeling is one key activity of BPM. Business process modeling takes into account various perspectives such as the behavioral, organizational, functional, goal-oriented and object-oriented factors (Khan, 2004). The different perspectives of business process modeling identify and analyze the current state of the processes and indicates the way they should be operated. Zabjek, Kovacic and Stemberger (2009) argue that BPM should be a vital element while managing business change.

2.2.1 Business Process Improvement

Hammer (2007) argues that a common business process improvement approach is redesigning. By redesigning organizations have achieved improved performance, increased customer value and increased profits for shareholders. These improvements of quality,

cost, agility and profitability were achieved by analyzing and measuring internal and external customer processes. In addition to redesigning and arranging work, business process improvement requires redefining roles and responsibilities, training personnel, enhancing organizational culture and improving information flow to enable cross-functional processes between different departments (Hammer, 2007).

A well-functioning business processes possess two characteristics: process enablers and organization wide capabilities (Hammer, 2007). The process enablers define the degree of effectiveness of the process functions. The enablers are distinguished by the scope of the redesigning, competences of personnel operating the process and the metrics by which the process performance is measured. To be able to put these process enablers in place, organizations need important capabilities. These are managerial support and employee's who value customers and cooperation. The employees also have competences of redesigning processes and problem solving. Better process performance is achieved by good process enablers and organizational capabilities (Hammer, 2007).

Davenport and Spanyi (2019) claim that there are two main challenges when improving a business process. Firstly, a crucial activity is to analyze the current state of the process and understand where performance problems arise. The degree of variation is an important parameter to understand why the process is not performing in a certain way. In addition, a significant challenge is that the ERP systems and business processes require integrated connections between each other. For example (1), the SAP system is process-oriented that supports the O2C process but does not reveal the way information flow runs in the process. In order to understand the system process, different technologies (e.g. Microsoft's Visio or Software AG's Aris) are used to support the understanding of the process design (Davenport & Spanyi, 2019).

In order to better comprehend the process performance a process mining software, such as Celonis, can be put into service (Davenport & Spanyi, 2019). Celonis provides detailed information from SAP transactions to reveal the process performance (Davenport &

Spanyi, 2019). It generates event actions for each phase of the process identifying the person performing the activity, the duration of the activity and the variation of the activities. Celonis also enables the defining of key performance indicators. Process mining provides a data-based view of process performance which enables management to recognize performance problems and to make decisions based on the data (Davenport & Spanyi, 2019).

2.2.2 Process owners

The redesigning process and process management has created a new aspect for process enterprises, where operational excellence is crucial (Hammer & Stanton, 1999). In a process enterprise, the control is separated from the management level to the people performing the work. In a process enterprise, a process owner is hired for a certain process to ensure that the process improvement is implemented across all functions. A process owner is responsible and authorized to design and to develop the current process, to measure its performance and to ensure that all the individuals involved have the required training (Hammer & Stanton, 1999). In addition, process owners should understand the way the customer values the company and their services. Thus, they must be certain that the key processes are continuously creating competitive advantage for the company (Power, 2011a). Power (2011a) argues that by making sure the relevant metrics measure the process performance, the more value it provides for the top management on how the business is performing.

As the changing market and business environment requires the business process to change too. The role of the process owner is important in guiding the development of the process (Hammer & Stanton, 1999). Consequently, a process owner's role should be permanent and integrated to performance management (Power, 2011b). As the process owner is responsible for the whole process improvement and change management, they are also responsible for taking action when the process performance is not desired. By

involving the process owner in management level meetings (e.g. budgeting, monthly reporting), it can provide organizational and businesswise understanding of the process performance (Power, 2011b). Finally, a good process owner possesses leadership skills and encourages cooperation across different teams (Power, 2011b).

2.2.3 Business Process Leadership at the case company

Operational excellence is a key driver in the case company's actions and processes (Case Company, 2020). In order to enable operational excellence activities, the case company focuses on four key activities: "focus", "speed", "simplicity" and "discipline". "Focus" refers to identifying and prioritizing actions that have the highest business impact and support the strategic priorities. "Speed" refers to the waste-free processes that create customer value along with "simplicity" of actions that minimize impacts and complexity. "Discipline" refers to relevant key performance metrics that support the strategic objectives of the organization. These core activities pursue operational excellence in the organization.

In practice, operational excellence means unified ways of working, comprehensive education and documentation of functions (Case Company, 2020). The core processes, functions and systems are described in detail to guarantee that the correct process phases and protocol are followed. By unified ways of working and comprehensive knowledge of operations, the purpose of operational excellence is to ensure high quality and efficient activities in the deliveries of goods.

For 2020, the case company has defined some key activities in order to have clear targets for the development processes (Case Company, 2020). So far, hiring a process owner for the O2C process has been done. The main tasks of the process owner are (a) participating in the overall accountability of End-to-End (all stages of a process) processes and (b) leading process related activities. The responsibilities of a process owner are carrying

out management reporting as well as creating and monitoring process performance metrics. Thus, one of the key targets is to implement a real-time process performance metric for the O2C process by the end of the year.

2.3 Key Performance Indicators and metrics

Measuring performance is an important factor in motivating and guiding team members' actions that support the organizational goals (Trent, 2008). Usually, the chosen performance metrics indicate the key activities which are seen important for the organization. Consequently, those metrics are defined as the *key performance indicators* (KPI's). A KPI could be, for example (2), accomplishing tasks without errors (Trent, 2008). In addition, performance metrics showcase process areas in which improving actions are needed. Performance metrics allows managers to objectively make decisions based on the data and to create target metrics for continual improvement (Trent, 2008).

Performance measurements tend to form around four different aspects (Trent, 2008). The first aspect is deciding on the parameter the measurement will concern, for example (3) lead time, quality or customer satisfaction. The second aspect is the performance target which might be rather external than internal. The third component is the awareness of the actual performance level. This information should flow from the ERP systems database. Lastly, it is important to create an improvement plan that defines the way the common target will be reached on both an individual and team level.

Measuring performance and creating good and transparent metrics and KPIs should be aligned with the lean objectives (Trent, 2008). Good metrics have to be in accordance with the corporate strategy and mission. Additionally, as managers make decisions based on the process performance they benefit of figures presenting financial performance (Trent, 2008). These figures show the increase in return on assets (ROA) or cash flow. Good performance metrics enhance the cross-functional cooperation in the organization

and provide data that is transparent and visible to everyone (Trent, 2008). As the measurements relate to the customer requirements and organizational goals, the targets should be reassessed and adapted from time to time to ensure the alignment of the actual and targeted performance.

A sales strategy can be reflected in the corporate strategy and mission (Parravicini, 2015). The sales strategy and performance needs to be measurable to be able to monitor development (Parravicini, 2015). To measure sales activities, the right KPI's should be selected to set targets for the team. The chosen KPI's should enhance the process, mission and continuous improvement of the company. For example (4), the chosen KPI's could be related to financial performance (e.g. turnover), good customer service (e.g. grading the experience from 1-10), perfect order rate and good business planning (Parravicini, 2015). The challenge for setting good KPI's is to find relevant measures and a way to measure them (Parravicini, 2015).

Trent (2008) suggests that some possible performance measurements could be as follows:

- the perfect customer order rate,
- order fill rates,
- unplanned backorders,
- order-to-cash cycle time,
- conformance to delivery dates,
- travel distances and distribution quality and
- cost indicators.

These measurements are defined in Table 1.

Table 1. Process performance measurements (Trent, 2008).

MEASURES	COMMENTS
Perfect customer order rate	The % of orders shipped to customers without errors.
Order fill rates	Rate of unfilled orders due to lack of stock. These create waste, costs and loss of sales.
Unplanned backorders	Orders with no physical stock which affect costs and customer service.
Order-to-cash cycle time	A common measure used to estimate the cooperation of different teams.
Conformance to customer-driven delivery dates	Measures the on-time delivery at the customer's location.
Average distance travelled between internal material movements	Reveals a major source of supply chain waste.
Total miles traveled	An important measure for customer delivery networks.
Distribution quality indicators	Provides information of wrong goods, wrong quantities, missed deliveries and damage.
Total distribution cost % of total product costs/sales	A common cost-related measure for management.

From the measurements presented in Table 1, the most relevant performance metrics for the O2C process are (a) the perfect customer rate, (b) the cycle time of the process, (c) the order fill rate, (d) the conformance to delivery dates and (e) the quality and cost indicators. These performance measurements provide the most crucial information in accordance with the process performance.

As the O2C process is usually measured by efficiency, a common supply chain metric for the performance is the perfect order index (POI) (Parravicini, 2015). The perfect order index has three perspectives OT-IF-NIE as following:

- the order to be delivered on time (OT),
- in the full form (IF) and

- with no invoice errors (NIE) (Parravicini, 2015).

The no invoice errors (NIE) aspect can be measured by the percentage of invoices that need manual collections (Parravicini, 2015). In addition to these aspects, one can also measure whether the good was delivered without any damage and with the correct documentation (Parravicini, 2015). The implementation of touchless order activities has enabled corporations to streamline their operations and decrease any manual work and rework (Parravicini, 2015). Touchless order activities are process phases that flow automatically without any manual work after being entered into the system.

Hall and Johnson (2009) state that business processes tend to be standardized and cut down to clear routines. Yet, not all processes are scientific nor can they be measured statistically, such as customer satisfaction and feedback (Hall & Johnson, 2009). Work that varies and has divergence are artistic processes (e.g. customer service). They should be performed in accordance with the changing environment and customer demands. These kinds of artistic processes enable innovative goods that cannot be copied. The combination of standardized and artistic processes creates strong business process performance (Hall & Johnson, 2009). Both performance measures should be determined and evaluated accordingly to the process (Hall & Johnson, 2009).

2.4 Lean Six Sigma

Lean thinking and management is a method first introduced by the Japanese car industry, especially Toyota (Oakland, 2014). The principle of lean thinking is to focus on the operational and quality features of processes and improve them (Oakland, 2014). The car industries implemented lean manufacturing by reducing waste and reassuring quality in every operation in production. One key method of lean is the Just-In-Time (JIT) method, in which the production materials are ordered and received just when they are needed in the process (Oakland, 2014). The JIT method reduces waste of cost and inventories.

The concept of lean is agile and can be implemented to other industries such as in the service environment.

Plenert (2012) argues that lean management concentrates on cutting down on all activities that are not necessary when delivering a product or service, whilst maintaining the quality, punctuality in delivery and low cost of the product, to the customer. The core activity of lean business process management is to identify the value for the customer and to identify the waste of resources, cost and time in the process (Plenert, 2012). By identifying waste, the bottlenecks of the process can be resolved by improving the process. A lean process should react to the initiative from the customer (e.g. a sales forecast or a customer order) (Plenert, 2012). In order to sustain lean business process management, a strategic plan that supports the goals of the company and aims for continuous improvement should be created (Plenert, 2012). By updating this plan, management is able to determine, influence and oversee strategic areas of improvement.

2.4.1 Six Sigma

The *Six Sigma* methodology was formed around the quality aspect of operations and the value provided to the customer (Oakland, 2014). As competitiveness rises, businesses need to focus on correct activities along with high quality management (Oakland, 2014). The manufacturing industry was the first to introduce Six Sigma as maintaining a high standard of quality was a crucial element for survival in the industry (Oakland, 2014). This was the starting point of total quality management (TQM). To succeed in Six Sigma, quality management systems have to be implemented to all systems. The adoption of quality tools and methods along with the improvement and involvement of the team, will result in improved business process performance and better business planning (Oakland, 2014). Lean methodology systematically eliminates waste and Six Sigma decreases variation in activities (Oakland, 2014). By combining these two, *Lean Six Sigma* provides a continuous improvement approach to enhance performance.

The Six Sigma model consists of five steps when it is used as a tool to improve performance: Define, Measure, Analyze, Improve and Control (DMAIC) (Oakland, 2014). This model can be implemented to Deming's original continuous improvement Plan, Do, Check and Act model (PDCA). The PDCA model presents a framework for improving team members' actions and process performance. The PDCA cycle helps teams to test improvement ideas and their solutions in a controlled scale before implementing it throughout the processes (Oakland, 2014). Figure 2. shows the PDCA cycle and DMAIC improvement model (Kanbanize, 2020).

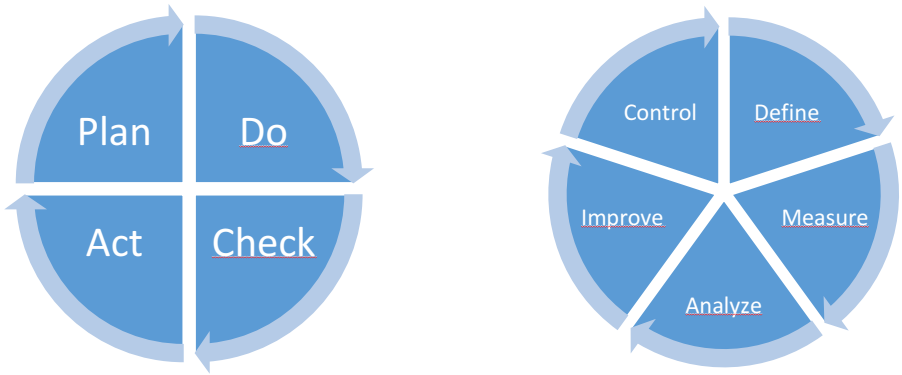

Figure 2. The PDCA cycle and the DMAIC improvement model (Kanbanize, 2020).

The "Plan" phase of the PDCA cycle carries out a comprehensive plan of actions that need to be done in the scope of the project (Kanbanize, 2020). This stage answers questions regarding the resources needed and possessed and the main issues need to be solved. When the plan is ready, the planned actions are implemented (the "Do" phase). As errors or unexpected situations may arise, it is important to implement the project in a controlled scale and environment. After implementing the plan, the results are checked and analyzed (the "Check" phase). This is the most important stage in order to avoid mistakes in the future by correcting them before implementing the new process to the whole business model. Once everything is tested and checked and the

outcome is as desired, the plan can be put into practice (the “Act” phase). The PDCA cycle is a great tool for solving problems and testing possible outcomes as many times as needed (Kanbanize, 2020).

Oakland (2014) argues that the PDCA cycle provides a great framework for the Six Sigma DMAIC improvement model. The DMAIC step “Define” is the “Plan” phase, “Measure” is the “Do” phase, “Analyze” and “Improve” are the “Check” phase and “Control” is the “Act” phase. In the “Define” phase of the DMAIC cycle, the resources, scope and goals of the project are defined. In the “Measure” phase, the process performance is analyzed along with its short- and long-term capability. The “Analyze” phase focuses on checking for any possible mistakes and tracing the root causes of any arising problems. Furthermore, “Improve” phase focuses on finding solutions to these problems in order to be able to reach the desired outcome. Finally, the “Control” phase is about implementing the improved process into the organization. In addition to this process implementation, it is standardized accordingly to meet the ISO 9000 quality standards of performance (Oakland, 2014). With all these phases improvement models can be planned to any level of organization (Oakland, 2014).

2.4.2 Lean Operations

Although lean management is strongly detected in the manufacturing industry it can be applied to all industries and service models (Trent, 2008). An effective supply chain has a continuous flow of actions where each step runs smoothly to another without any disruptions (Trent, 2008). If disruptions or errors arise, they affect the capacity and throughput time of the whole cycle. This model can also be utilized in a process cycle. The activities of a process should be organized as a clear step-by-step flow rate that matches the demand from the customer (Trent, 2008). A supply chain that reacts to the customer’s pull demand operates better since no production happens unless the customer forecasts sales or requests an offer (Trent, 2008).

As Trent (2008) suggests, a key activity to lean operations is to identify the throughput and lead times of operations and to find solutions to reduce time. In addition, the process layout and information flow should be taken into consideration. It is crucial that information flows from the ERP and support systems easily for the users and that the information is accurate and reliable (Trent, 2008).

2.4.3 Lean tools and approaches

To enhance process improvement across organization and individuals, the employees should have knowledge and access to improvement supporting lean tools and approaches (Trent, 2008). The most common lean tool is kaizen, which translates to continuous improvement (Trent, 2008). The main action of kaizen is to focus on small changes in the process. By doing little improvements from time to time, the improvement actions are reviewed and accessed continuously in order to perform better. The kaizen process has three steps, the first of which is to analyze and prepare material for the actions that need to be improved (Trent, 2008). After preparation, the kaizen event is performed and the action plans are decided on within the team. To follow up, the improvement model is tested and checked to see if the changes made worked and can be implemented permanently.

Tools related to process design are *value stream mapping* (VSM), process mapping and the use of a RACI matrix (Trent, 2008). Value stream mapping (VSM) was first developed for Toyota by Taiichi Ohno (Trent, 2008). The idea of VSM is to help understand the flow of material or information by visualizing it (Rother & Shook, 2009). VSM helps to identify waste and the sources causing waste (Rother & Shook, 2009). VSM provides a coherent framework and identifies areas of development (Trent, 2008). Similar to VSM is process mapping and modeling which presents the process as a flowchart (Trent, 2008). Flowcharts define activities and their sequence in the process with the use of different symbols and lines which are standardized to represent a certain action. The standardized

symbols follow the American National Standards Institute (ANSI) symbols which are the most recognized. These symbols are shown in Figure 3.

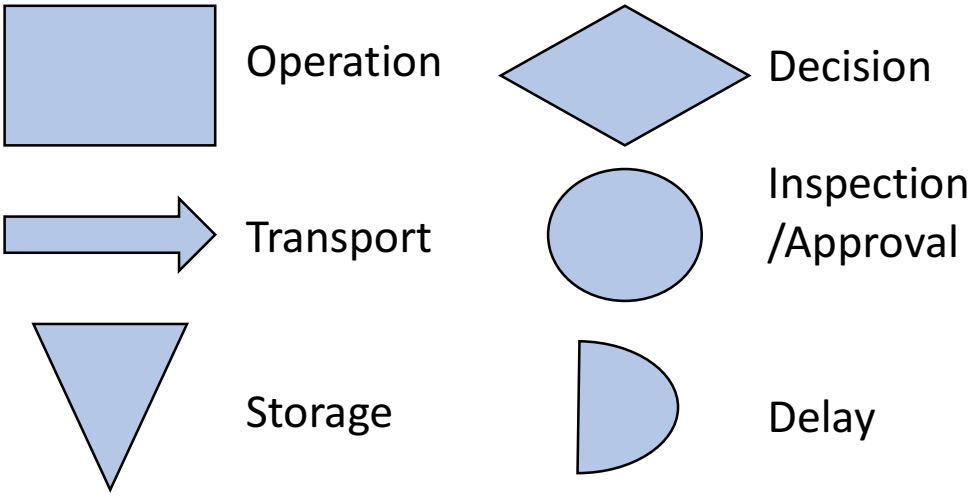

Figure 3. The ANSI symbols (Trent, 2008).

Trent (2008) argues that it is crucial for organizations to be able to model processes, to identify what processes they depend on and what processes have the most potential for improvement. Process mapping offers a good framework to identify the business process showing the parts of it that should be improved (Trent, 2008). Process mapping can also be done with a swimlane diagram. A swimlane diagram presents the same VSM activities by inserting the process phases in the correct department lane defining the person performing the process (Wedgwood, 2016). To clarify the scope of process mapping a SIPOC model is a generally used tool to identify the suppliers, inputs, process, outputs and customers of the process on a high-level (Taghizadegan, 2013). A SIPOC model helps in clarifying the key process actions and measures that provide value for the stakeholders (Taghizadegan, 2013).

In addition to VSM and process mapping, a RACI matrix also reveals the process and identifies the roles and responsibilities of individuals and teams (Trent, 2008). RACI

stands for Responsible, Accountable, Consult and Inform. Responsible defines the person performing the action and Accountable describes the person responsible for getting the work done on time (CI Toolkit, 2020). The Consulted person is a mentor guiding the work whilst the Informed refers to the person who needs the information on the decision since the rest of the work depends on the informer's actions (CI Toolkit, 2020).

Root cause analysis (RCA) identifies the core reason causing problems and tries to find solutions and approaches to solving it (Tableau, 2020). By analyzing root causes and finding the right solutions, RCA tries to systematically prevent future problems. The RCA principles focus on the reasons problems arise and it has several techniques, from which the most common are cause-and-effect chart and the 5 Whys (Tableau, 2020).

Andersen (2007) states that the cause-and-effect chart is a classic tool of TQM that identifies the possible causes to an effect. The cause-and-effect chart can be displayed as a fishbone chart or a process chart (Andersen, 2007). The fishbone chart presents the main categories of possible causes such as people, processes, work environment, machines and methods. The main issues are identified under the main categories and at the end of the 'fishbone', is the problem that needs to be solved. The fishbone chart is presented in Figure 4.

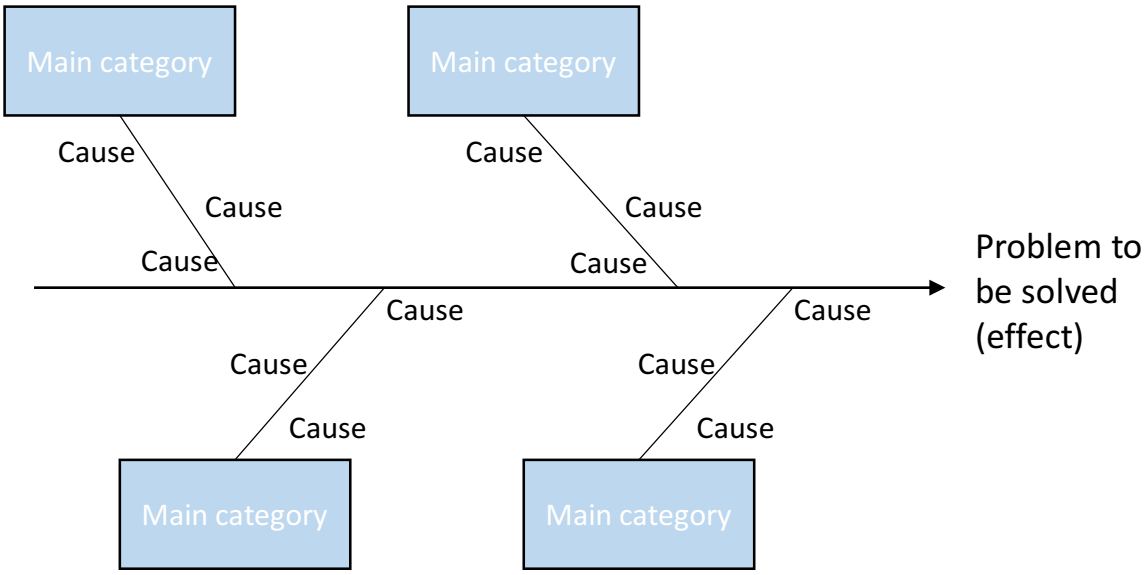

Figure 4. Fishbone chart (Andersen, 2007).

A fishbone chart is similar to a process chart except that the process chart aims to improve the business process rather than looking for cause and effects (Andersen, 2007). Process charts identify problems and low performance levels by highlighting them (Andersen, 2007). A process chart can be similar to a fishbone chart but it presents problems instead of causes.

The 5 Whys approach focuses on finding detailed and concise responses to questions (Andersen, 2007). To conduct a 5 Whys analysis, a problem that needs solving must first be detected (Andersen, 2007). Answering the first Why, identifies a cause for the problem. The answer of the first Why creates a new question as long as no new answers are provided. Figure 5 presents 5 Whys analysis.

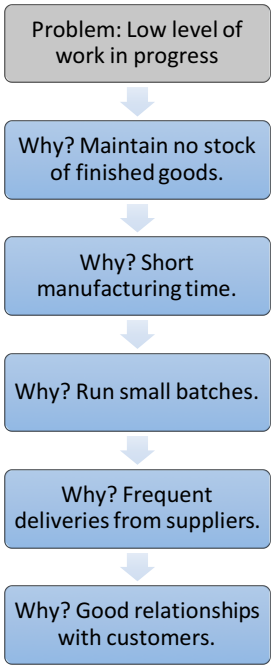

Figure 5. The 5 Whys analysis (Andersen, 2007).

The 5 Whys approach can be combined with cause-and-effect analysis to diagnose each factor and to determine the root cause for that issue (Andersen, 2007). To find the real root cause, it usually requires at least five whys (Andersen, 2007). A SIPOC model, a swimlane diagram and a VSM matrix will be implemented in the results chapter to analyze the current state of the process and to define the most important areas of improvement.

3 Methodology

The scope of this research were spot sales (unplanned surplus from production), which were delivered by vessel and operated from the Finland and Europe office with the use of the CIF incoterms within the timeframe of May 2018 to September 2019. This scope was chosen because the majority of the deliveries are transported overseas by vessels which can carry large quantities at once. Additionally, the CIF incoterms was chosen since from the surplus sales the CIF sales represented 76 % of all spot vessel deliveries.

The research was conducted as a mix of quantitative and qualitative methods in order to gain a more comprehensive overview. Based on the data collected through the dataset and interviews, the reasons for certain bottlenecks or errors occurring in the process could be discovered. The quantitative analysis was based on data received from the case company's ERP system during the timeline of the research. Consequently, whatever the quantitative data highlighted as a bottleneck, was then examined with methods of qualitative analysis. As the process was split into trader's actions, operator's action, pricing specialist, accounting specialist's actions and harbor specialist's actions, the interviews were conducted separately with each department involved in the process. In addition to the quantitative and qualitative data, a VSM workshop was conducted, in which the current state of the process was assessed and improvement areas were identified.

3.1 Quantitative data

The quantitative dataset consisted of all data entered to the company's ERP system within the timeframe of the project. The case company uses SAP, Allegro and a process mining tool called Celonis, which visualizes their business processes and performance. By limiting the dataset to all spot sales delivered by vessel with the CIF incoterms, the dataset consisted of 249 cases. The time range of the data was from the 1st of April 2018 to the 30th of September 2019.

The aim of the quantitative research was to analyze the current process flow and what defects arise from the data. The defects and bottlenecks were analyzed by assessing long lead times and repeating activities that lead to rework or additional work. The main challenges found from the data were assessed in closer detail and brought up during the interviews.

3.2 Qualitative interviews

The qualitative part of the study was conducted by interviews with the specialists operating in different teams and phases of the O2C process. The interviews were conducted by dividing the process into six phases and responsibilities: trader responsibilities, operations specialist responsibilities, pricing specialist responsibilities, logistics specialist responsibilities, harbor specialist responsibilities and invoicing specialist responsibilities. From each process phase, between one or two specialists were interviewed. The interviews were conducted in Finnish as it was the native language of all interviewees. The interviews were one-to-one and two-to-one as well as conducted either face to face or by a meeting call.

The reason why the process was divided to six different phases was that according to the quantitative data the major bottlenecks are in the area of pricing billing blocks, logistics ticketing and invoices that need cancelling. The aim of the interviews was to focus on these activities and comprehensively investigate the effectiveness of the process in different teams.

The interview questions focused on identifying the bottlenecks of the process. Furthermore, they investigated the causes for the defects or rework in the O2C process in order to understand their impact on the process. The aim of the interview questions was to find explanations that clarify the bottlenecks identified in the data. The questionnaire was the following and they are also attached to Appendix 1.:

- *What are the challenges (bottlenecks and defects) of the current process? What causes these?*

- *How are the defects handled and resolved?*

- *Are there any extra features or rework that increase or affect your workload?*

- *Are there any activities in your job that require guidance / information / permission from a colleague before you can get started? If yes, who/whom are contacted for further information?*

- *What would you change/develop in the current process?*

The interviews were executed in an irregular order to gain as much information as possible. The interview results were used along with the quantitative data to understand the challenges of the current O2C process. Moreover, the knowledge gathered from the quantitative and qualitative study provided a viewpoint for the issues to be discussed in the VSM workshop.

3.3 Workshop

The workshop consisted of the current process assessment and analysis. The O2C process was gone through from start to finish by value stream mapping all of the actions in accordance to the scope of the thesis. The people participating in the workshop had knowledge of the O2C process as a whole and some participants were experts in a certain process area (e.g. operations specialist). The aim of the workshop was to map all activities of the process from the viewpoint of lead time and rework. Consequently, the aim was to locate issues affecting long lead times and rework as well as discovering areas of improvement in the process.

Prior to the workshop, the qualitative data was analyzed along with the interview results which provided additional information for the workshop. In order to measure the activities and improvement areas in the workshop some metrics were needed. The chosen metrics were the lead time of activities and information flow (doing things right the first time and avoiding rework).

Since there were various improvement areas, only the most important ones were highlighted and prioritized. As this workshop focused only on the current state of the process, the improvement areas were chosen for a future implementation plan that can be initiated once this thesis has been published.

4 Results

This section reviews the current O2C process management in the case company and the results of the study conducted. Moreover, the quantitative, qualitative and workshop results are assessed and discussed. The quantitative and qualitative data focused on analyzing the bottlenecks and defects of the O2C process. Consequently, the VSM workshop was conducted based on the theoretical framework and the aim of the method was to map the current state of the process and to showcase the root causes of the problems. Based on the discussion some recommendations are provided for the case company.

4.1 Current O2C process management

The O2C process management in the case company follows the steps as presented in figure 6 (Case Company, 2020):

1. The trader negotiates a sale with a customer and a sales contract is agreed on.
2. The contract team forms the aforementioned sales contract according to the sale agreed. The trader, the legal department, the operation specialist and the customer comment on the contract until it is accepted by all parties.
3. Once the sale is agreed on, the trader inserts the sale to the Allegro system and the compliance team checks the sales.
4. When the compliance check is done, the operator starts working with the sale and adds information to the SAP system. The operator creates a contract and a sales order for the deal and asks the logistics specialist to create a nomination for the deal.
5. Once the nomination is created, the operator checks it and adds additional information such as demurrages and inspector information.
6. The operations specialist informs the pricing team about the deal and the pricing. Then they ensure that the pricing is in accordance to the contract.
7. When all data is correct in SAP, the operator informs the internal and external stakeholders about the deal.

8. The operations specialist creates a nomination for the customer which confirms what product(s) will be delivered, in what quantity, where and when.
9. Additionally, an inspector is appointed to make sure the quantity and quality of the good is as agreed.
10. The operation specialist creates instructions for loading related activities. The harbor operators' and the vessel operators' are informed about the product to be delivered, how much, where, when and the inspectors actions. These instructions have to be sent prior to loading in order to assure that everyone knows what to do.
11. Once the nominations and instructions are completed, sent and confirmed, the sales order is ready for loading.
12. Loading is handled by the harbor specialists and they take care of the paperwork, practical arrangements and supervise the loadings.
13. Once the loading is done, the harbor specialist actualizes a ticket into SAP informing that loading is complete.
14. Once the ticket actualization is entered into SAP, the system automatically creates actions such as "Create delivery item" and "Post goods issue" to inform that the ownership of the goods has been transferred and the goods are released from the inventory.
15. The harbor specialist sends the original cargo documents to the operations specialist.
16. Depending on the sale, the order might have a billing block in order to avoid incorrect invoices sent to the customer. Depending on the billing block type, the operations specialist and pricing specialist check that the pricing, quantities, and data are correct before releasing the billing block.
17. Once the billing block has been released the order is ready to be invoiced. The invoice is created automatically and sent to the customer.
18. Once the customer pays the invoice, the accounting document is matched and cleared and the O2C cycle is complete.

Figure 6. The O2C process phases and the flow of actions in the SAP system (Adapted from Case Company, 2020).

Figure 6 presents the O2C process phases and the flow of actions in the SAP system. In addition to the system steps, other parts of the process are; sale negotiations between the trader and customer, addition of possible new customer information into the Master Data system, compliance checks, contract creation and instructing the loading activities

are part of the process. Table 2 presents the O2C process performers and their main responsibilities in more detail.

Table 2. The O2C process performers and their responsibilities (Adapted from personal communications with interviewees, February, 2020).

Team/Individual performing the process	Main responsibilities
Trader	Receives information about product surplus and when it could be delivered. Cooperates with the supply chain planners and shipping department. Based on that information, the trader negotiates the sale with the customer.
Compliance	Monitors operational and financial risk, makes sure the legal regulations are followed.
Contract team	Creates a contract and sends it for comments from the trader, legal department, operations specialist and customer.
Operations specialist	An operations specialist is a connection between the external and internal stakeholders and ensures that the sale is carried out as planned. The operations specialist should be aware of all the activities throughout the process. The operations specialist enters data into SAP and instructs the stakeholders on how to operate with the sales.
Pricing team	Enter the pricing data into SAP, monitor the prices on sales and make sure they are fulfilled.
Logistics/Supply Chain Management	Creates the nomination item into SAP and plans the cargo movements.
Harbor	Takes care of the practical arrangements and paperwork in the harbor. Daily planning and monitoring of the loadings. Creates a ticket into SAP, which includes the loaded quantity, date and time, after the loading is done.
Invoicing	Manages daily invoicing activities, conducts error investigations, handles cancellations and re-invoicing, takes care of checking invoice details and manages accurate filing.
Accounts Receivables	Checks that the invoice is paid, matches it to the invoice item and clears the document.

The O2C process has a clear step-by-step design that all cases should follow. However, the design is not always clear and rework or errors occur in the process. For example (5), common errors that the case company faces are errors in data. Errors in data can cause misunderstandings in the harbor and the loading might not go as planned or incorrect invoices are sent that need to be cancelled. Figure 7 presents an example of a case where a variety of O2C process problems can be seen.

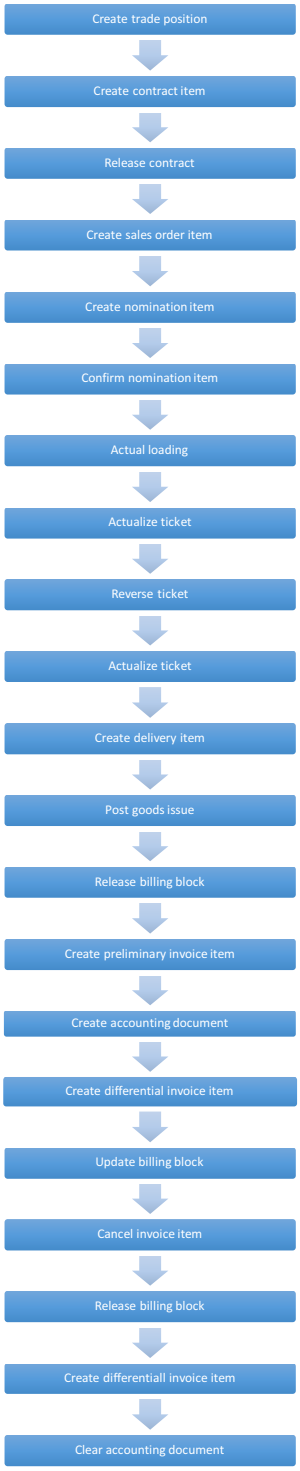

Figure 7. An example of the O2C process (Case Company, 2020).

This example showcases several areas in which rework occurs. Once the loading activity is complete, the actualized ticket has inadequate data and it needs to be reversed and

actualized again. After the preliminary invoice is generated and cleared, the differential invoice is generated and the billing block is updated. However, there is still inadequate data as the differential invoice is cancelled. Later the billing block is released and a new differential invoice is generated and finally cleared. In this case, rework was presented in ticket actualization, billing block updating, canceling invoices and re-invoicing activities.

4.2 Quantitative results

The dataset consists of 249 sales cases. These cases include 30 different customers and 38 different products transported to 71 different locations. From the 30 customers, the majority of the deliveries, with all covering over 10% of the deliveries, was between three customers by 22%, 11% and 10%. From all of the products there were three main product types which constituted the majority of deliveries with 19%, 12% and 8% of the total respectively. From all of the locations the majority of deliveries have been delivered to the ARA region (Amsterdam-Rotterdam-Antwerpen) and the Baltic Sea area. These locations were the busiest during the time period.

The dataset reveals that areas of rework and extra activities were the following:

1. manual field changes to sales orders,
2. cancelled invoices debited by credit invoices,
3. releasing and updating the billing block and
4. reverse ticketing.

The following figures will show these actions in more detail.

Activity count

Figure 8 shows the activity count of each process phase within the 249 cases. Figure 8 shows the different activities on the x-axis and the amount of the activities made on the y-axis. The letters in the brackets refer to possible preliminary or differential invoice items.

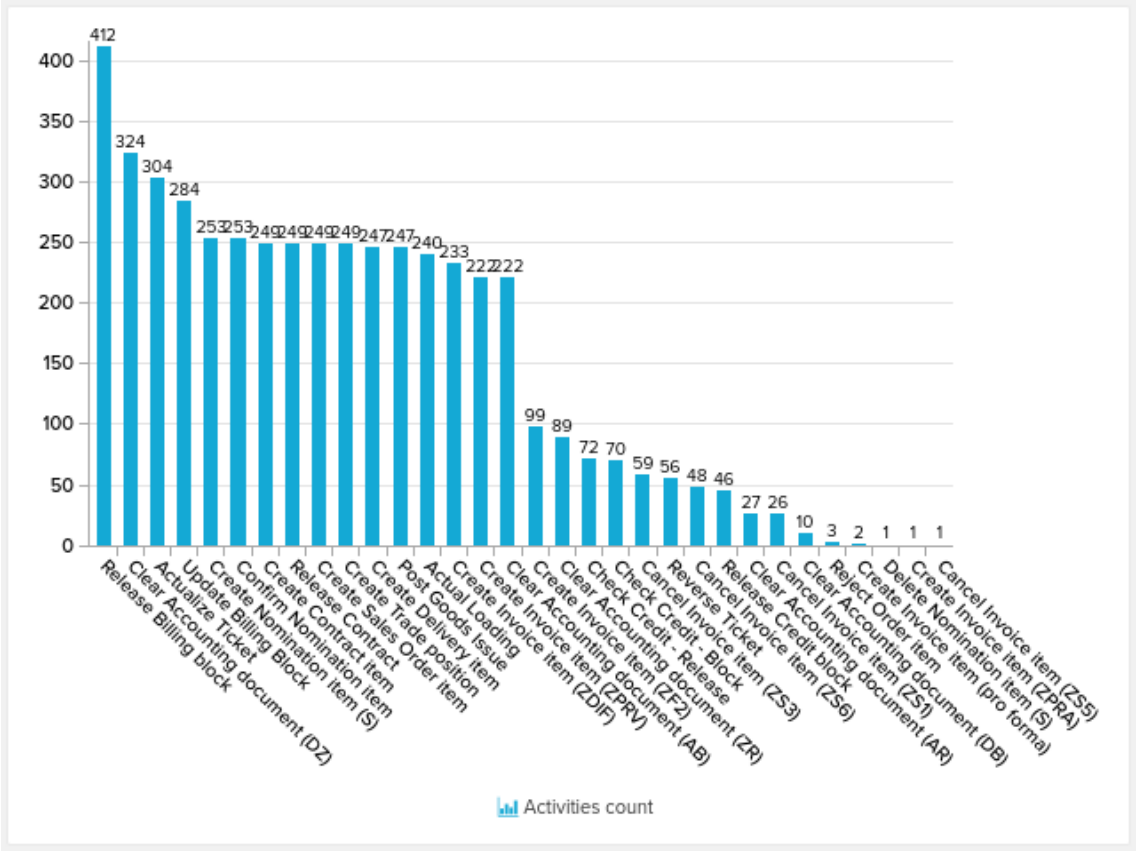

Figure 8. Activity count of each process phase (Case Company, 2020).

The figure reveals that the billing block was released 412 times, meaning that there are lots of cases where the billing block was released more than once. It can be concluded that releasing billing block, clearing accounting document and actualizing ticket were the most frequent activities. Figure 9 states the amount of activities done in accordance to sales orders made that month.

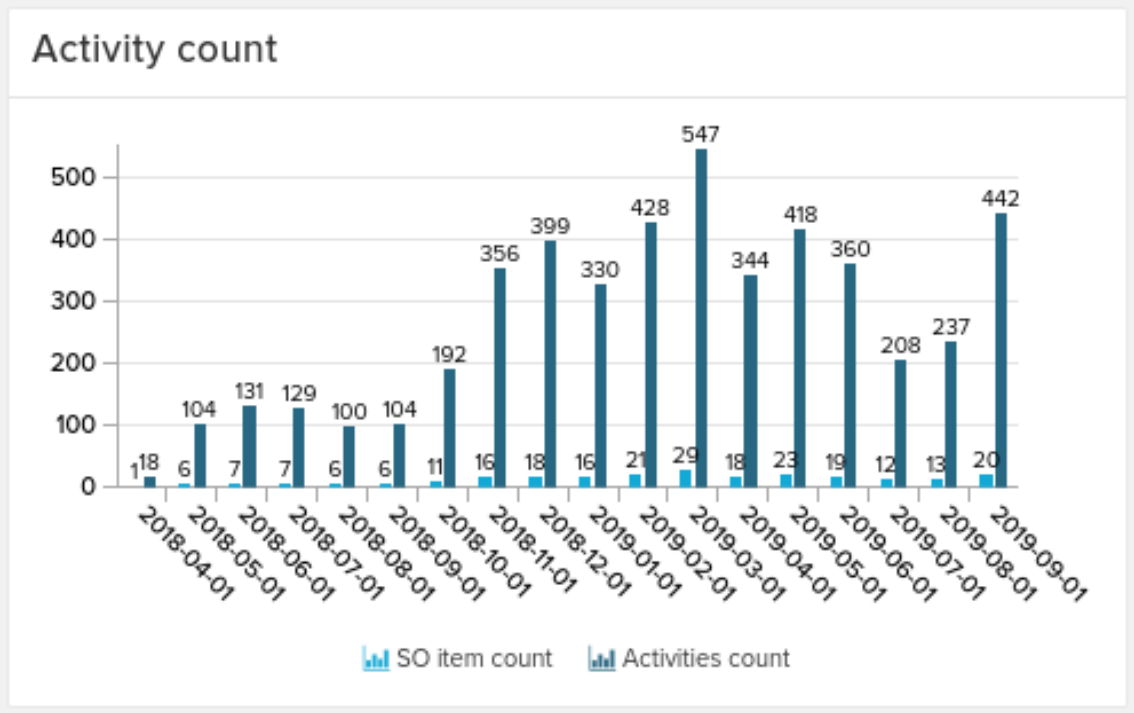

Figure 9. Activity count in accordance to sales orders per month (Case Company, 2020).

In September 2019, there were 20 sales orders done and 442 activities were executed for them. The activities counted included all the different categories (e.g. create sales order, create nomination item) and the number of times it was performed. As the normal system process flow has 13 activities (Figure 6), 20 sales order items would have 260 activities (20 sales orders x 13 activities = 260 activities all together). It can be seen that comparing the 260 activities to 442 activities, there are 182 additional activities.

Changes made to the sales order items

The dataset reveals that in most cases the data is not initially correct or reliable when it is inserted into the systems. Figures 10 and 11 show statistics on the manual field changes made to the sales orders. A change was counted whenever a modification was made and saved to the sales order. In total, 3000 changes were made in the 249 cases analyzed. An average manual change for one sales order was 12 changes. Figure 10 describes the amount of changes in sales orders within the limits provided.

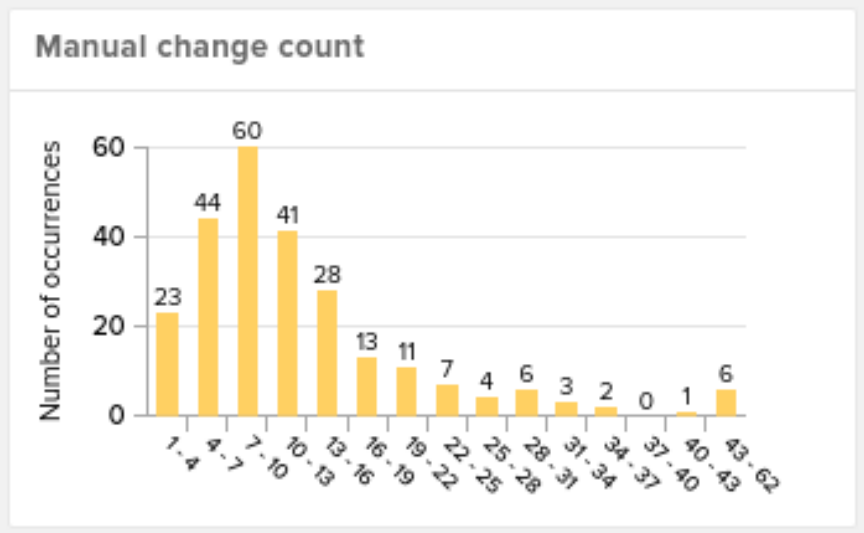

Figure 10. Manual change count occurrences (Case Company, 2020).

For the majority of the cases, sales orders were changed between 1-16 times. Only 23 sales orders had 1-4 changes made, and 60 sales orders were changed 7-10 times. However, some changes are necessary and need to be made. For example (6), the price needs to be updated in the system once the operations specialist has created the contract and sales order. Thus, that counts as a manual field change. Figure 11 states monthly the amount of manual changes done to the sales orders.

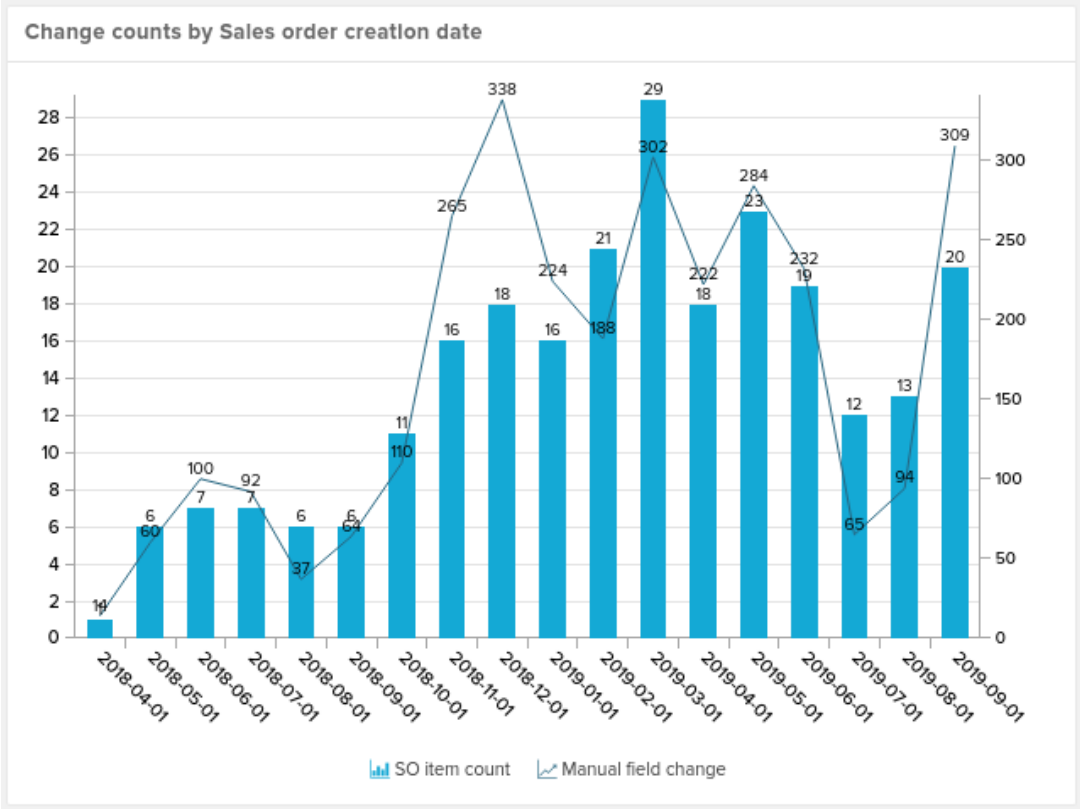

Figure 11. Amount of manual field changes in accordance to the sales order amount (Case Company, 2020).

Figure 11 showcases the count of sales orders on the left axis and the count of manual field changes on the right axis. As the manual field change curve shows, all sales orders are changed. During November 2018, December 2018 and September 2019 the change count was the highest. Figure 12 shows the trend of manual field changes per sales orders.

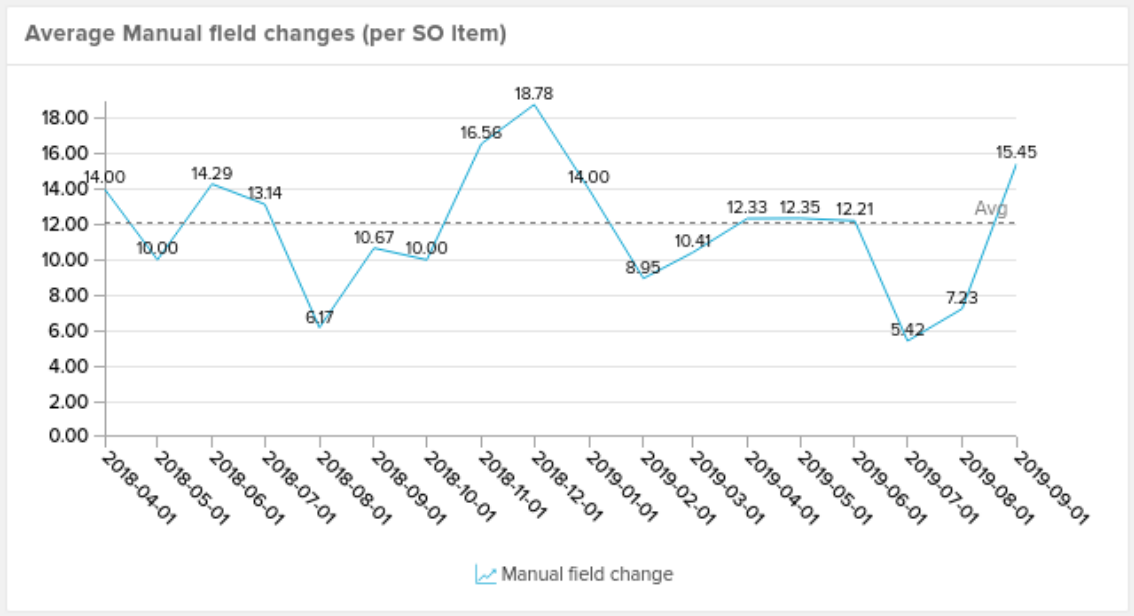

Figure 12. Manual changes made per sales order (Case Company, 2020).

According to Figure 12, in September 2019, on average 15.45 manual changes were done per one sales case. The manual field change curves in Figure 11 and Figure 12 clearly show that in those time periods when there have been a lot of manual changes, the business model has changed by expanded operations. According to the case company (2020), in October 2018 the operations were unified with Europe's office operations by creating a mutual process altogether, except that operations specialists are still separate in both locations: in Finland and in Europe. Starting from October 2019, a new product category operation was also unified and the rising amount of changes reflects the change which occurred in the business model.

Billing block rates

According to the data, the billing block rate in all of the cases was 97 % meaning that only 3 % of the cases did not have a billing block. The following figures present billing block rates and counts. The billing block rate of all the cases is shown in Figure 13, the rate was under 100% for a few months, only.

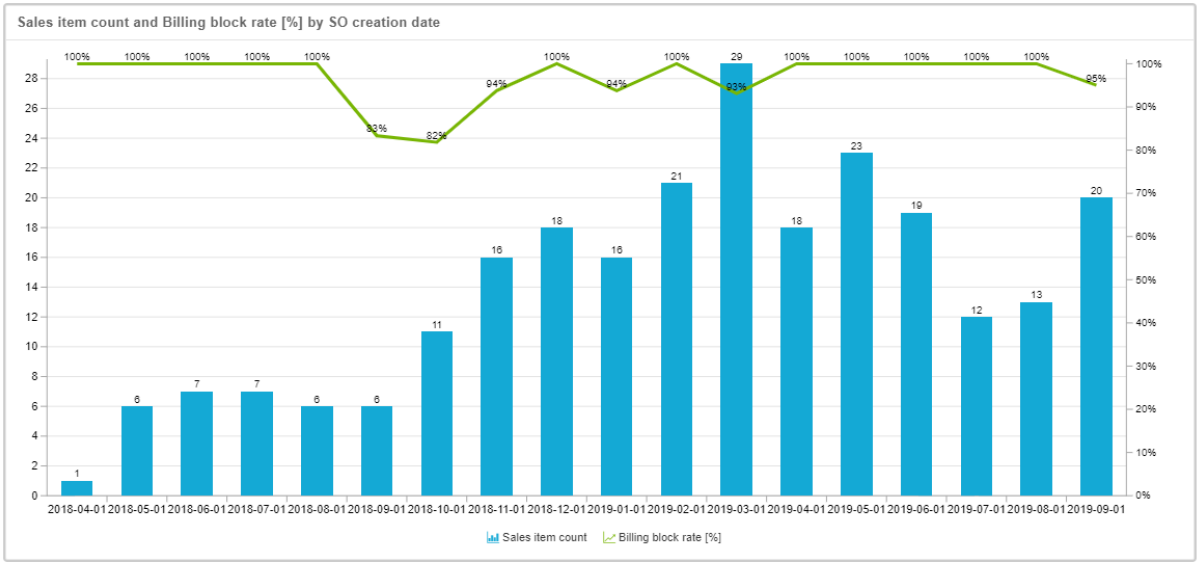

Figure 13. Billing block rate (Case Company, 2020).

As Figure 13 shows, the billing block rate was under 100% in September 2018, October 2018, November 2018, January 2019, March 2019 and September 2019. The next figure shows the number of the billing block activities done on average each month. For instance, in April 2018 there was one sales order and its billing block was updated four times. On average there were 2.8 billing block updates made per one sales order.

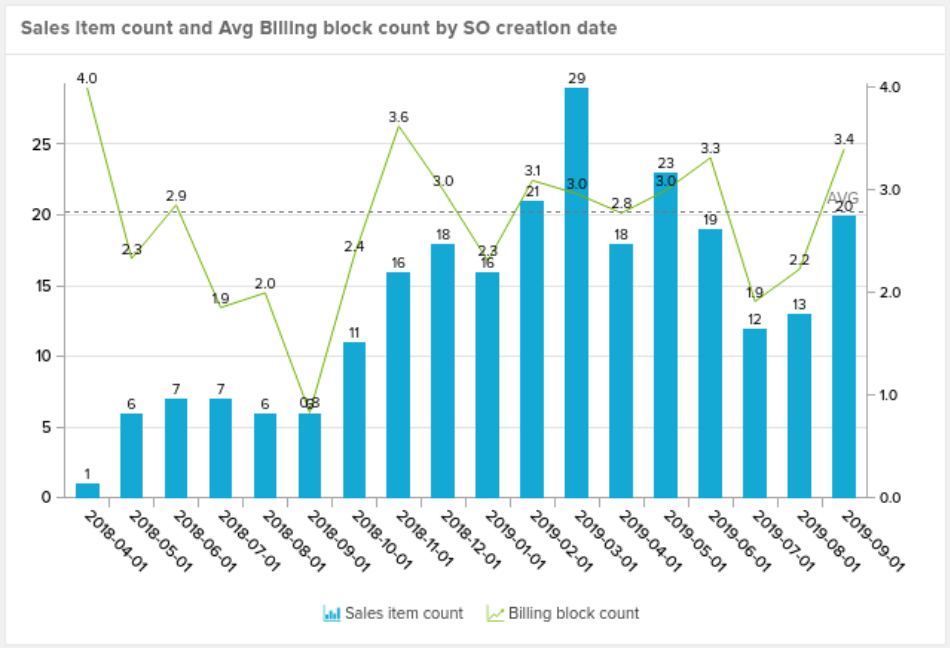

Figure 14. Average billing block count (Case Company, 2020).

Figure 15 presents the billing block occurrences of the sales orders. It showcases that the majority of cases were only once held in billing block but also updating the billing block three times was common for one case. Only eight sales orders were not held at billing block at all.

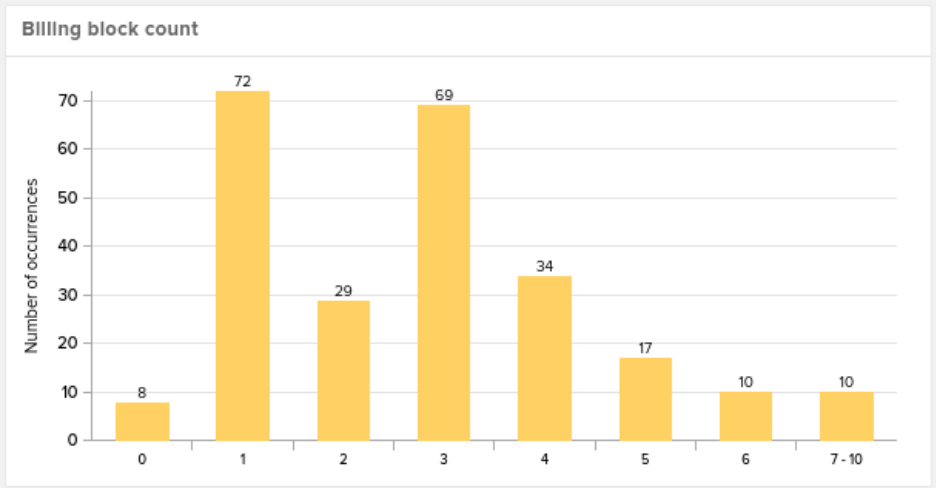

Figure 15. Billing block count occurrences (Case Company, 2020).

The billing block figures state that this is certainly one bottleneck of the process. Almost all cases are held in the billing block having a need to be manually released before the invoicing can be executed automatically. Billing blocks were one of the aspects in the interviews with pricing specialists. The aim was to find out the reason for sales orders needed to be held in blocks manually which evidently slows down their work processes.

Reverse ticket count

A reverse ticketing activity is done if the actualized ticket has inadequate data which needs to be corrected. Reverse ticketing means that the ticket is revoked and a new one is created. According to the data, in most cases no reverse ticket was needed (202 cases), but in some cases the ticket was reversed once (38 cases) or twice (9 cases). This is shown in Figure 16.

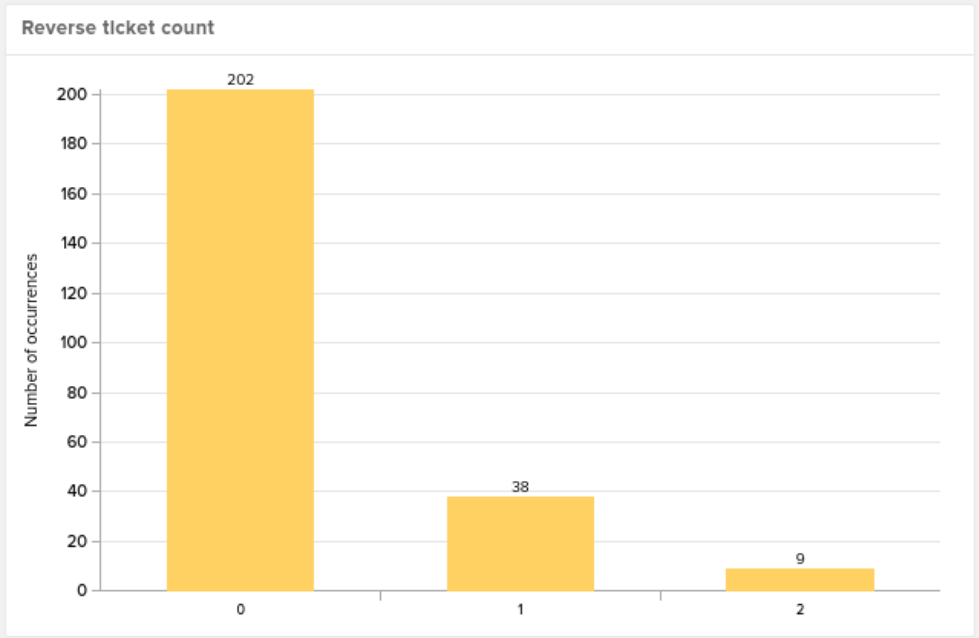

Figure 16. Reverse ticketing times (Case Company, 2020).

Figure 17 shows the number of reverse ticket activities made monthly. The count of reverse tickets is an average. In April 2018, there was one sales case in which there was one process of reverse ticketing.

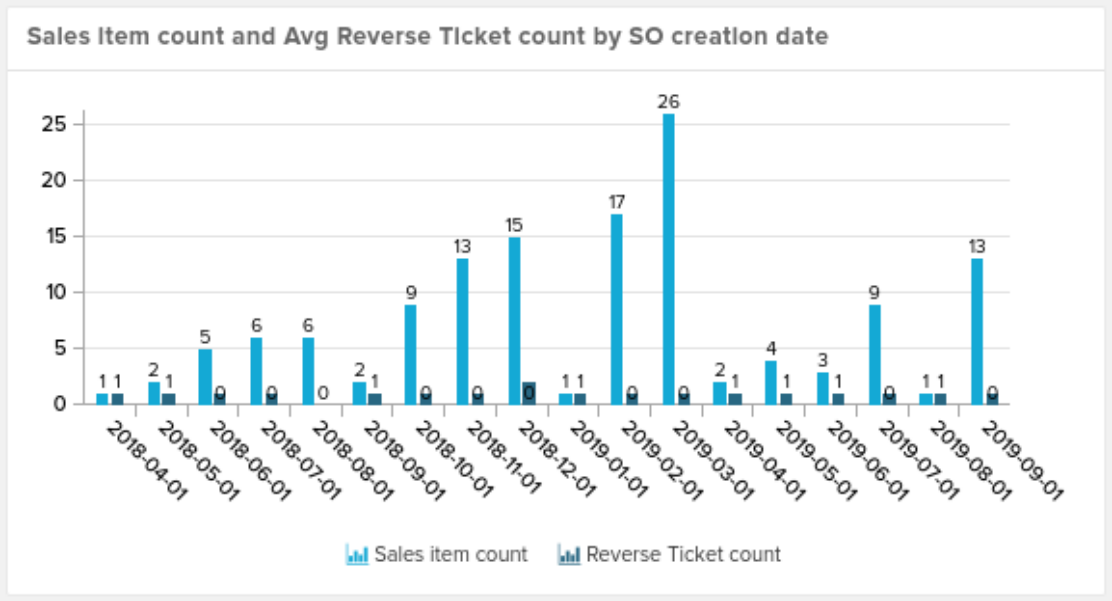

Figure 17. Average reverse ticketing monthly (Case Company, 2020).

It can be seen that from all of the cases, reverse ticketing activities were done for 23 % of cases and mostly once. These reasons will be discussed in the section 4.3. as the other information collected from the interviews are addressed.

Credit invoice rate

Credit invoice is an incorrect invoice which needs to be cancelled. From all of the 249 cases there were 600 invoice items created and all in all, the credit invoice rate of the cases was 46 %. Figure 18 shows the amount of sales orders per month and the number of those sales order invoices credited.

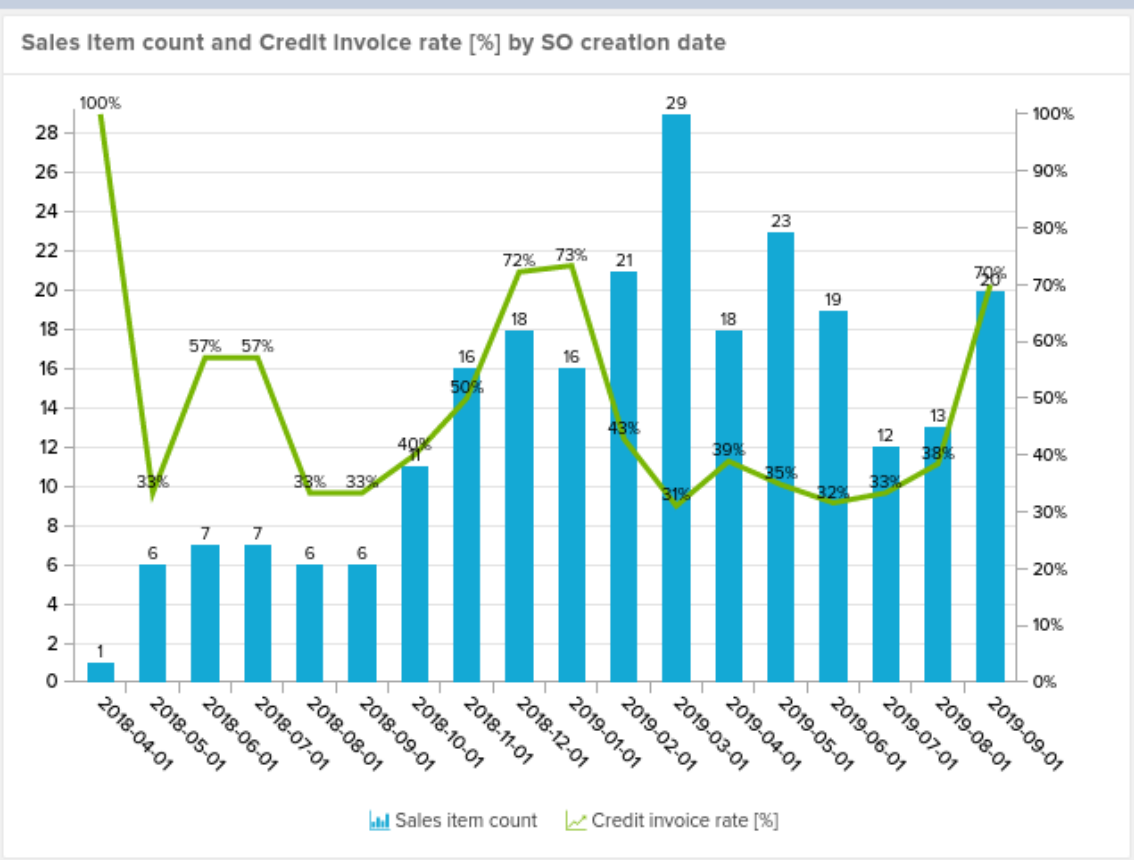

Figure 18. Credit invoice rate of the sales cases (Case Company, 2020).

In September 2019, there were 20 sales cases from which 70 % were cancelled with a credit invoice (14 credit invoiced cases). This data also shows well the timeframe the operating business has been changed by the introduction of a new sales office or a new product category. One explanation for the high amount of credited invoices could be the new operations which are being executed first time leading to errors occurring more often than usual. The issue of the amount of credit invoices was addressed in the interviews.

4.3 Qualitative results

The interviews were conducted face-to-face or by a meeting call with specialists operating in different responsibilities in the O2C process. As a summary, nine specialists were interviewed and they were held either as one-to-one or two-to-one personal communications. The interviews were carried out after studying the qualitative data in order to understand what were the areas of rework and challenges. The aim of the questionnaire was to find explanations describing the bottlenecks identified in the data. Furthermore, the interview questions studied the current challenges of the process giving guidance in the way ahead for the development of the process.

The Trader

Trader cooperates with the supply chain planners and shipping department to receive information about the surplus product. Once the trader has enough information about the product, the sales is negotiated with the customer. The trader stated that one of the biggest challenges is that as these spot sales are rapid and need to be sold quickly, one might not even know the exact quality of the product. This can lead to lost revenue, since the value of the product increases depending on the quality. Another issue is the Allegro system process. The Allegro system gathers the data of the deal and integrates it to SAP. The trader enters the deal to Allegro and all the information should flow to SAP: to the contract, sales order and nomination. For unexplained system reasons Allegro is not working properly and the information is not flowing. (Trader, personal communication, February 13, 2020)

The trader highlighted that as an area of development, the operations specialists could take part in commercial activities by doing some kind of a market research of the potential customers. It was also mentioned that the physical capacity of the harbor is limited as only a few vessels can carry certain products to certain areas. Furthermore, the tanks in the harbor area are also limited and products cannot be stored for prolonged periods of time. By having more operating vessels and tanks the sales would not have to be done rapidly. Lastly, the trader also underlined that the information flow throughout the

whole process should also be improved. (Trader, personal communication, February 13, 2020)

The Operations specialists

The operations specialists cooperate cross-functionally with internal and external stakeholders as well as ensure that the sale is carried out as planned. The operations specialists argued that the compliance team has a crucial role in the process. Spot sales are rapid and the loadings can even occur on the same day, the faster compliance approves the deal, the faster the operations specialists get everything under control. Eventually, the ticketing can cause challenges if the harbor cannot enter the loading details to the system and the operator needs to resolve the issue and do the ticketing. Consequently, this causes delays in the process. Additionally, if there is incorrect data in SAP, the invoicing will not be accurate meaning that the operations specialist has to have the sales on the billing block in order to check the data before the invoice is created. However, sometimes the invoice still needs to be cancelled and re-invoiced and the operations specialist is in charge of managing these actions with the pricing and invoicing team. (The Operations specialists, personal communication, February 11, 2020)

The operations specialists highlighted that they would like to see development in areas of roles and responsibilities, faster decision making in compliance and flexibility in actions. Due to the fact that currently everything needs to happen at the precise moment the case drops to the operations specialist's desk. Additionally, the operations specialists felt that they could benefit from increased visibility in invoicing actions as they need to be aware if an invoice is cancelled and get information of the price of the invoice. (The operations specialists, personal communication, February 11, 2020)

The Pricing specialists

The pricing specialists ensure and monitor that the pricing data is correct in the systems. The pricing specialists highlighted that Allegro system causes them extra work since it is not functioning properly. Therefore, they need to manually add the pricing data, monitor

and check on a daily basis that the prices are set accordingly. Still some invoices need to be cancelled and the prices fixed for the re-invoicing. They argued that if the Allegro system would work as intended, their major challenges would be resolved. (The Pricing specialists, personal communication, February 12, 2020)

The Logistics specialist

The logistics specialist creates the nomination key and participates in the overall planning of the cargo movements and prioritization of the cargoes. The daily operations are mainly focused on managing operational planning and the creation of nominations. If changes arise, the nomination is updated accordingly. However, the logistics specialist underlines that the physical capacity of the harbor is crucial which affects arising bottlenecks in the process. The piers and tanks are limited, thus having an effect on rapid spot on sales when the timeframe of action is so limited (1-2 days) to sell and load the cargo. (The Logistics specialist, personal communication, February 19, 2020)

The logistics specialist highlighted that one key development area is the physical capacity of the harbor. Additionally, it was stated that improving the system and giving visibility to other activities in the system would also improve the current way of working. (The Logistics specialist, personal communication, February 19, 2020)

The Harbor specialist

The harbor specialist takes care of all the practical arrangements and paper work in the harbor. The harbor specialist indicated that the main challenge within the daily operations is that the information differs between the system, instructions and inspector's actions. To be sure what to do, the harbor specialist needs to contact the operations specialist. In addition, also the capacity and equipment of the vessels create challenges as there are only a few different sized piers and the harbor is very busy at certain times. The limited physical capacity might cause delays in the whole process. (The Harbor specialist, personal communication, February 14, 2020)

The harbor specialist highlighted the fact that rework happens mainly due to inadequate and inaccurate information. Also due to SAP system errors, the process of actualizing the ticket might not go through and in that case, the operation specialist resolves the issue and does the ticketing which also causes delays. The harbor specialist suggested that some development areas could be improving the physical capacity of the harbor (number of piers, vessels and tanks) and improving the information flow of the process. (The Harbor specialist, personal communication, February 14, 2020)

The Invoicing specialists

The invoicing specialists ensure daily invoicing activities such as, checking invoices, cancellations and re-invoicing. The invoicing specialists underlined the fact that nearly half of the spot vessel sales invoices are cancelled and that is a major work task for the team. Also, in the case of deals having a prepayment model, this means more manual work for the team. The invoicing team highlights that inadequate and incorrect data causes cancelled invoices. Additionally, the excessive amount of manual processes and the dependency of other actions are the bottlenecks for the team. (The Invoicing specialists, personal communication, February 11, 2020)

The invoicing specialists stated that they would like to have improved communication between different teams and more automated processes. Additionally, an overall improvement in the process by doing things right the first time with the right information was brought up. They also felt that they are very dependent on others in their work and that is the reason for a need to improve communication. (The Invoicing specialists, personal communication, February 11, 2020)

The interviews revealed that the main challenges of the current process were the system errors (Allegro system does not function as it should), the physical capacity limitations of the harbor, incorrect information and limited visibility to actions performed by others. The interviews highlighted that these challenges cause additional manual work. It was

underlined that better communication and understanding of roles and responsibilities would improve the process.

4.4 Workshop

The workshop was held in order to map the value stream of the current state of the O2C process. The process was mapped from the moment the trader sells a surplus sale to the point when the customer pays the invoice. The workshop was conducted with the use of online workshop tool Jamboard which made it possible for all participants to join and add sticky notes to the canvas. The participants of the workshop were as followed:

- a O2C process owner,
- an operational excellence manager,
- a development manager,
- an operations specialist,
- a pricing specialist and
- an invoicing specialist.

The participants consisted of the operational excellence team and the some of the key performers of the O2C process (e.g. operations specialist, pricing specialist and invoicing specialist). The workshop had very good participation and all of the aspects of the process were covered. The workshop was started by presenting the SIPOC model of the O2C process following with the validation of the scope of the VSM. The SIPOC model is shown in Figure 19 (attached also to Appendix 2.).

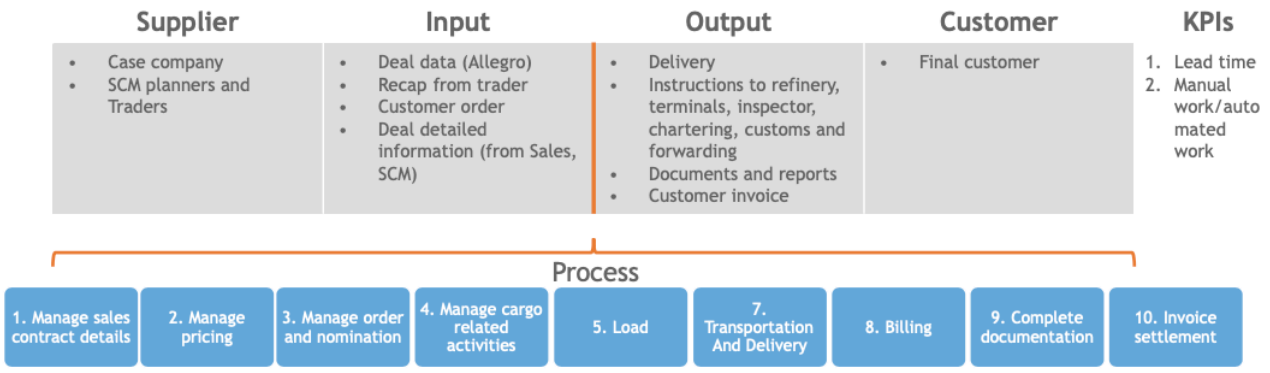

Figure 19. A SIPOC model of the O2C process.

The SIPOC model describes the O2C process scope by appointing (a) the case company, (b) the supply chain management planners and (c) the traders as the suppliers of the process. The inputs of the process are (a) the deal data and the recap provided by the trader, (b) the deal detailed information provided by the SCM planners and (c) the customer order. The process phases are the actions to manage sales and cargo related activities until the invoice is settled. Consequently, (a) the delivery, (b) all instructions and documentation, as well as (c) the customer invoice are the outputs of the process. The customer of the process is the final customer receiving the goods. After agreeing on the process scope made with the SIPOC model, the process actions were discussed with the swimlane diagram which presented the responsibilities of each action of the operation. It also contained the order of the actions following each other. The swimlane diagram of the O2C process is shown in Figure 20 (attached also to Appendix 3.).

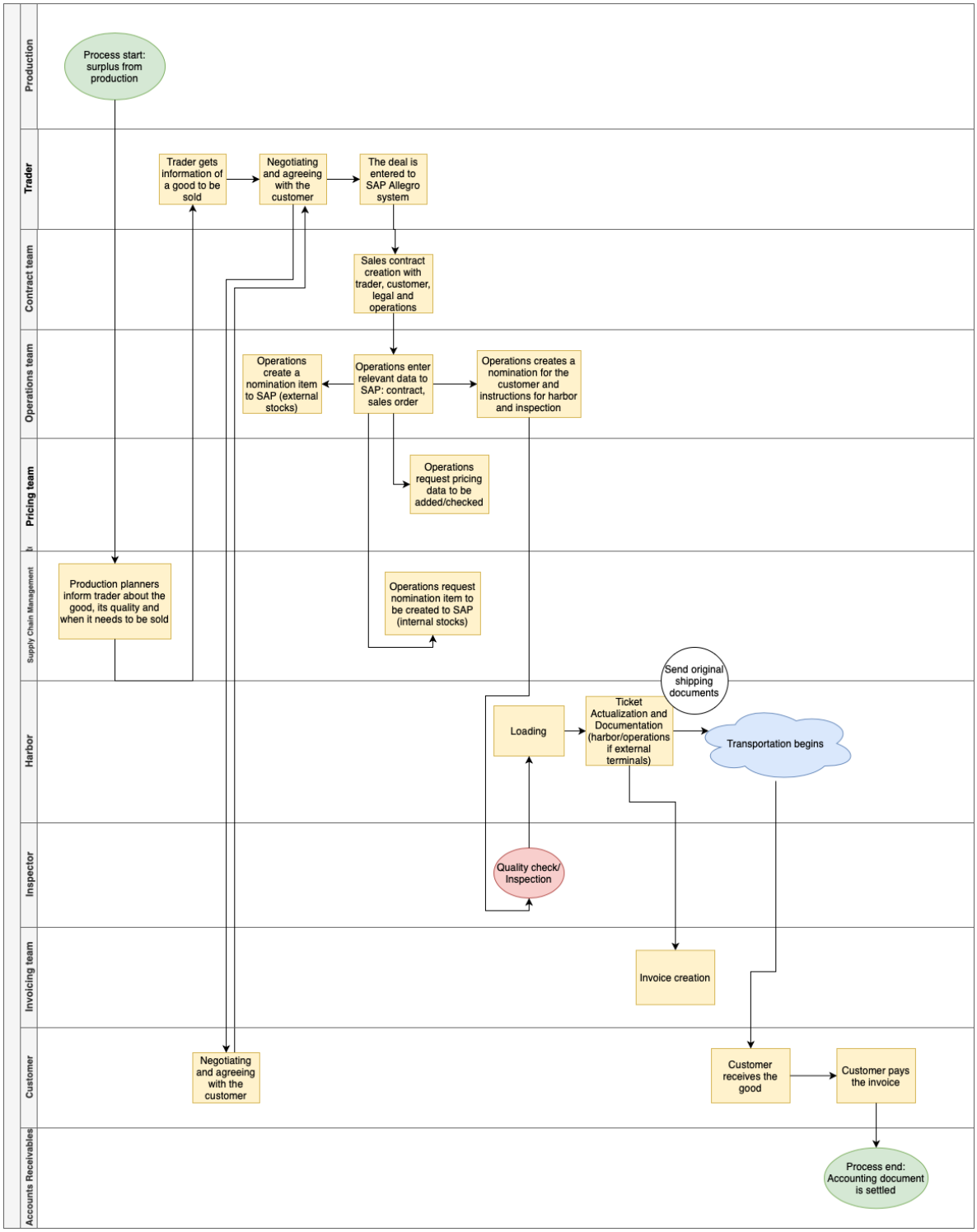

Figure 20. A swimlane diagram of the O2C process.

The swimlane diagram presents the process actions by the performer. The rows show the performer providing also information of the process flows between different performers and which actions follow each other. The process is divided to the following process performing departments:

- Production,
- Trader,
- Contract team,
- Pricing team,
- Supply Chain Management,
- Harbor,
- Inspector,
- Invoicing team,
- Customer and
- Accounts Receivables.

The swimlane diagram showcases the process starting from the production by surplus product and the production planners informing the trader about the product. Once the sale has been negotiated, prepared and managed, the swimlane diagram ends when the customer has paid the invoice and the Accounts Receivables team settles the accounting document. Once the workshop participants agreed that the swimlane diagram was correct, the next task was to initiate mapping the current state of the process. The output of the workshop is shown in the following Figure 21.

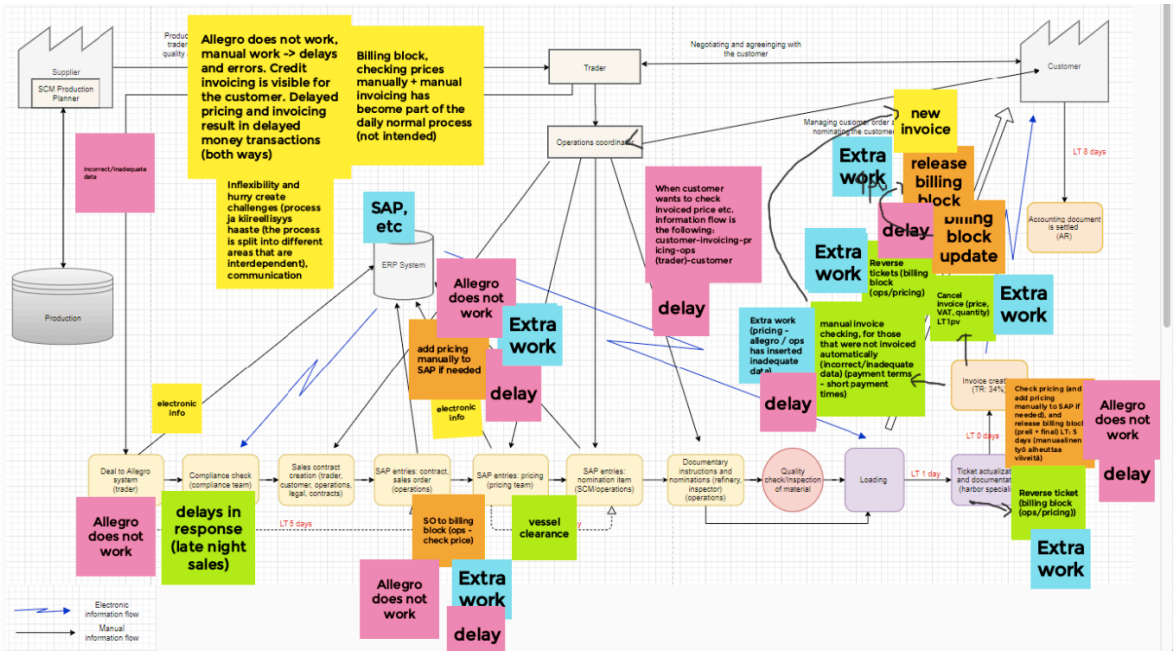

Figure 21. VSM workshop output.

The value stream mapping of the current state was conducted by starting from the beginning of the process and discussing all the process phases, information flow, manual/automation rate and the possible challenges of the phases. A rough process flow of the basic phases was mapped beforehand accordingly:

1. surplus from production,
2. trader negotiating the sale with the customer,
3. deal to Allegro system,
4. compliance check,
5. contract creation,
6. data to SAP (contract, sales order, pricing, nomination),
7. documentary instructions and nominations,
8. quality check at the harbor,
9. loading,
10. ticket actualization and documentation,
11. invoice creation and
12. settling of the accounting document.

During the mapping of the process a lot of issues came up and these issues were highlighted next to the activity by describing the problem and the effects of the issue. The discussion was fruitful and provided new insights to the process. Lastly, the main issue areas were highlighted together. Figure 22 shows the VSM chart which was transcribed after the workshop (attached also to Appendix 4.).

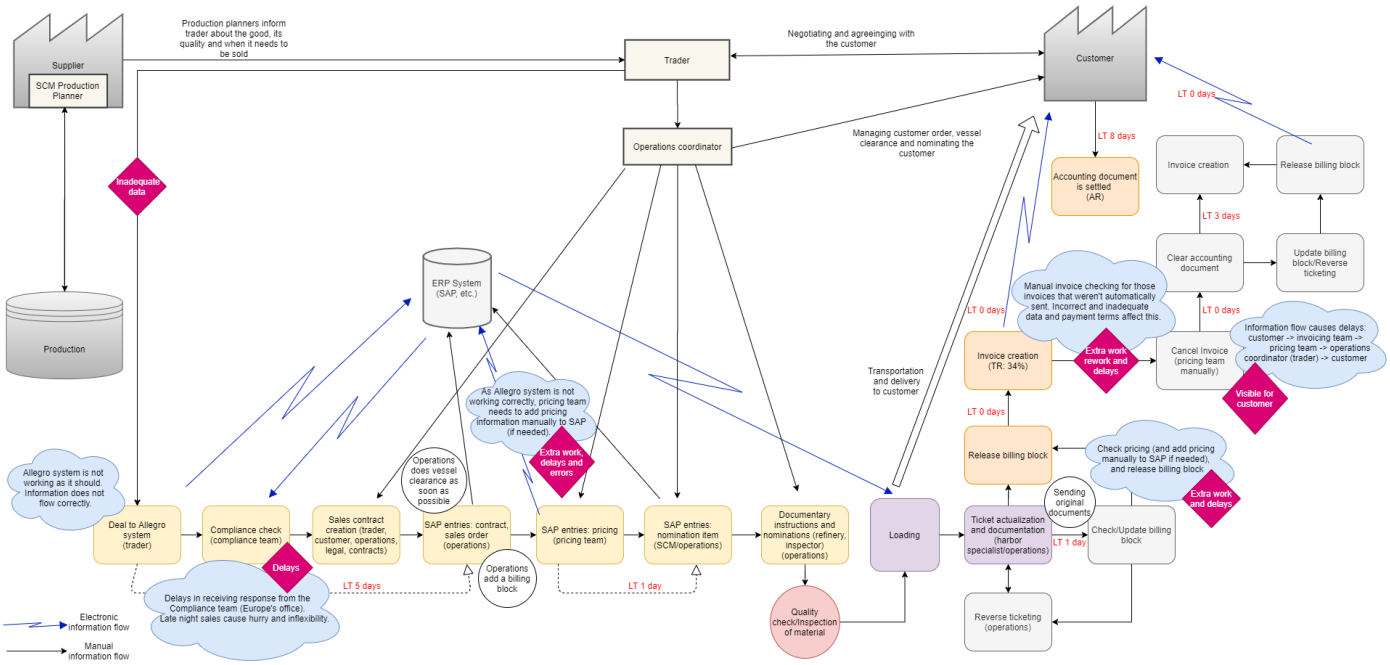

Figure 22. VSM of the O2C process.

As Figure 22 shows, there were several issues that were brought up in the discussion. These are indicated with the blue clouds and their consequences with the red diamond shape. The main issues were:

1. The Allegro system is not functioning as it should. The information does not flow correctly from that system to SAP.
2. The compliance team is located at the European office and receiving quick responses might be challenging. The sales might be done late in the night which

causes delays, rush and inflexibility in the activities (especially those operations dealt from Finland's office).

3. The pricing needs to be manually checked and added for each sale as Allegro cannot be trusted. The pricing also needs to be checked when the billing block is released and ready for invoicing. Both of these phases cause extra work, delays and errors.
4. The invoicing team needs to go through manually all those invoice items that were not automatically created. Incorrect and inadequate data is the main reason for the errors. Additionally, some payment terms might cause errors in the invoicing process as the invoice is waiting for the payment term to be completed for invoicing. This causes delays and results in delayed money transactions both ways.
5. Also, the problems with information flow causes delays. In case a customer would receive an incorrect invoice and would like to check the pricing the information chain is complex, for example (7):

   the customer → the invoicing team → the pricing team → the operations specialist (sometimes even the trader) → the customer

The current state also indicated that some process activities which were never intended to become a part of the process are now common. Activities such as updating the billing block, manual price checks and manual invoicing have become a normal daily process. The billing block is updated in the majority of the sales because Allegro cannot be relied on and everything needs to be double-checked manually. These actions cause additional work or even rework and result mistakes and delays. The inflexibility and the challenge of the activities being interdependent was also brought up, since some sales are done in a rapid timeframe and all actions need to be performed by different process performers.

It must be highlighted that the main reasons for the issues are the system errors as the Allegro system does not work as intended. This causes delays and errors as manual work increases. A critical challenge is that credit invoicing is visible to the customer and causes

additional work for the customer. According to the data validated with the pricing specialist, approximately half of the sales cases were credit invoiced. The discussion brought up issues in which the extent of the problem was not previously known and the stakeholders became more aware of the current challenges in the process.

4.5 Discussion

As the aim of the study was to survey the current state of the O2C process and the improvement methods, it can be stated that with focusing on certain development areas the process can be improved to provide more value to the stakeholders. The current process revealed that the main challenges arise due to (a) incorrect and inadequate data, (b) manual work and (c) lack of communication and visibility to other functions of the process. The quantitative and qualitative results as well as the main conclusions from the workshop indicated that the current process has challenges in the areas of the Allegro systems functioning, compliance checking, pricing activities and invoicing activities.

The most crucial areas of development are the pricing and invoicing activities. When errors occur in prices and if it is unnoticed, incorrect invoices are sent to the customers. It is time and resources consuming and has a huge negative impact on the customer experience because credited invoices create work also for the customer as they need to contact the company about the issue and check that the new invoice corresponds to what was agreed on. One root cause for the manual work of the pricing and invoicing team is the Allegro system functionality that causes mistakes in pricing which end up to the invoices.

The interviews and workshop revealed that mainly all errors are caused by manual work which is due to system failures. Additionally, as the process is split into different phases that are interdependent, the importance of maintaining communication and accurate

data is crucial. The findings from the quantitative data supports all the results from the interviews and the workshop. All in all, the amount of changes done for one sales case affects the whole process chain by causing rush, delays, errors and/or possible gaps of information. All the changes and errors occurring in the process will appear in the invoicing phase with incorrect information. According to the data, the credit invoice rate was 46% of the datasets sales cases. This means that the crediting activity did not provide value for the stakeholders and the process did not perform as it should have.

4.6 Recommendations

The results of this thesis *Order-to-Cash business process improvement by Lean Six Sigma tools* supports the conclusions of the most important areas of improvement in the process and what kind of improvements should be made. The VSM matrix revealed three of the most critical areas of development:

1. Allegro system functionality,
2. manual pricing actions and
3. manual invoicing actions.

Allegro system functionality causes manual work for the pricing team as the information does not flow correctly. This is the reason that the pricing team needs to manually check and add pricing to each sales case. The amount of manual checking and adding causes incorrect invoices which need to be credited by invoicing team. It can be stated that this affects rework for the invoicing team. In addition to credit invoicing, the invoicing team needs to manually check all the invoice items that for some reason have not automatically invoiced. Usually, the main reason for this is the inadequate data missing from the systems. Repairing the Allegro system would solve most of the major issues for the pricing and invoicing teams because this will lead to the amount of human errors decreasing.

As the case company already utilizes the process mining tool, Celonis, some key performance indicators could be created to the system to visualize the process performance.

As KPI's should represent the areas of the improvement where actions are needed, they could be the following:

1. touchless rate,
2. credit invoice rate and
3. the amount of manual field changes per sales case.

The touchless rate of actions would show how many percent of invoice creation is done automatically as this should be the default. Additionally, the percentage of credit invoices could be shown as one metric and the amount of manual field changes done per sales case. Also, a financial indicator could be relevant for the management to showcase the amount of money the process is performing. By creating the KPI's to Celonis, it would show the real-time process performance to all the relevant stakeholders in the process.

Celonis could provide deeper insights from data to analyze arising challenges, such as credit invoicing. Celonis gathers all the data from SAP system, if an invoice is credited with an explanation code this would provide a reason for the action (whether it be due to: pricing, quantity, product name, etc.). The data along with the validation of the issue with the invoicing specialist would help finding root causes for the challenges and for instance, a fishbone model could be utilized for further analysis. As the current state of the process was mapped in the workshop, VSM could be used to map the ideal state of the process. In addition to RCA, DMAIC and PDCA cycle are continuous improvement tools that are suitable in managing daily operations. To ensure that the O2C process is performing in the best way possible, strong performance throughout the process, clear roles and responsibilities along with communication is important.

5 Conclusions

This master's thesis supported the ongoing development project of the O2C process alongside which this thesis focused on the current state and the challenges of the O2C process. The theoretical background provided deeper insight and understanding into the ways the O2C process should flow, how the business process should be managed in the organization and what different possibilities the setting of good KPI's and implementation of lean methodologies could provide at their best.

The research questions *What is Lean Six Sigma and its tools* was addressed in section 2.4. by describing the theoretical background of the concept and by presenting relevant methodologies of lean. The questions regarding the O2C business process improvement: *What are the challenges of the current order-to-cash process and what methods can be used to improve the process performance* and the question regarding the process performance metrics: *What are the best metrics to measure the order-to-cash process performance to provide value for the relevant stakeholders,* were addressed by identifying several areas of development and by providing some possible KPI suggestions to indicate the performance of the most crucial business actions. As the scope of the study was to analyze spot vessel deliveries with CIF incoterm, the conclusions and recommendations made concern this certain O2C process area.

The results of the dataset, interviews and workshop all highlight that large amounts of manual work causes mistakes, delays and rework. Manual pricing and invoicing actions have become a new normal for the process. However, this was never intended as the systems should be reliable. As the process is split into different functions that are interdependent, the importance of communication and accurate information is vital for a well-functioning value chain.

The current process creates waste internally and externally in the credit invoice actions. The credit invoice rate is at a high level of 46% meaning that this is a crucial area of improvement in increasing value for the stakeholders. Additionally, repairing the Allegro

system functionality would decrease the amount of manual work of the pricing and invoicing team.

To improve the O2C process, the use of Lean Six Sigma tools, such as RCA could be utilized for further actions. RCA together with data from Celonis could provide better understanding of the arising challenges. For daily management and continuous improvements, the case company could utilize the DMAIC and PDCA cycle. As the current state of the O2C process has been mapped with the VSM matrix, the case company could also map the ideal future state of the process next. In addition, KPI's such as touchless rate, credit invoice rate, the amount of manual field changes and a financial indicator could be created to Celonis in order to understand the real-time process performance.

By eliminating waste in the process and focusing on improving the value adding activities, the O2C cycle could provide more value for all of the stakeholders. Ensuring best in class performance and continuous improvement is a key driver towards operational excellence and commercial competitiveness. Thus, providing value for the stakeholders needs to be taken into account too. By the means of improved performance and communication with internal and external stakeholders, the whole O2C process can perform better and add customer value.

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Appendices

Appendix 1. The interview questions

- What are the challenges (bottlenecks and defects) of the current process? What causes these?

- How are the defects handled and resolved?

- Are there any extra features or rework that increase or affect your workload?

- Are there any activities in your job that require guidance / information / permission from a colleague before you can get started? If yes, who/whom are contacted for further information?

- What would you change/develop in the current process?

- Mitkä ovat nykyisen prosessin isoimmat haasteet? Mitkä niitä aiheuttavat?

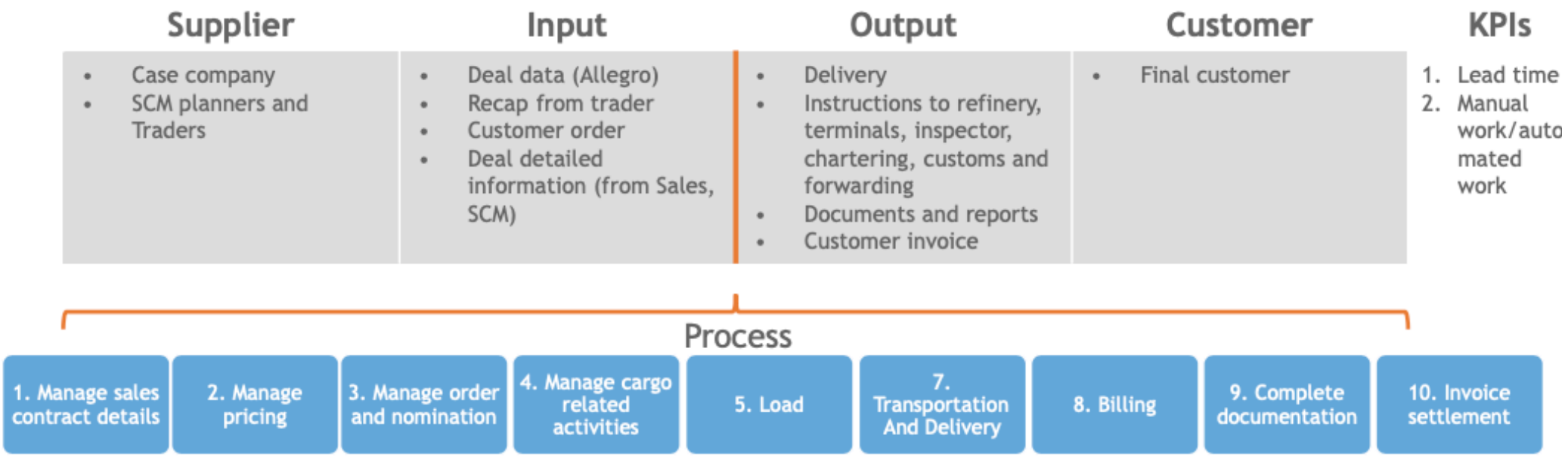
- Kuinka haasteet ratkaistaan?

- Onko työssäsi ylimääräisiä toimintoja, jotka aiheuttavat sinulle lisätyötä tai joudut tekemään kokonaan uudelleen? Millaisia?

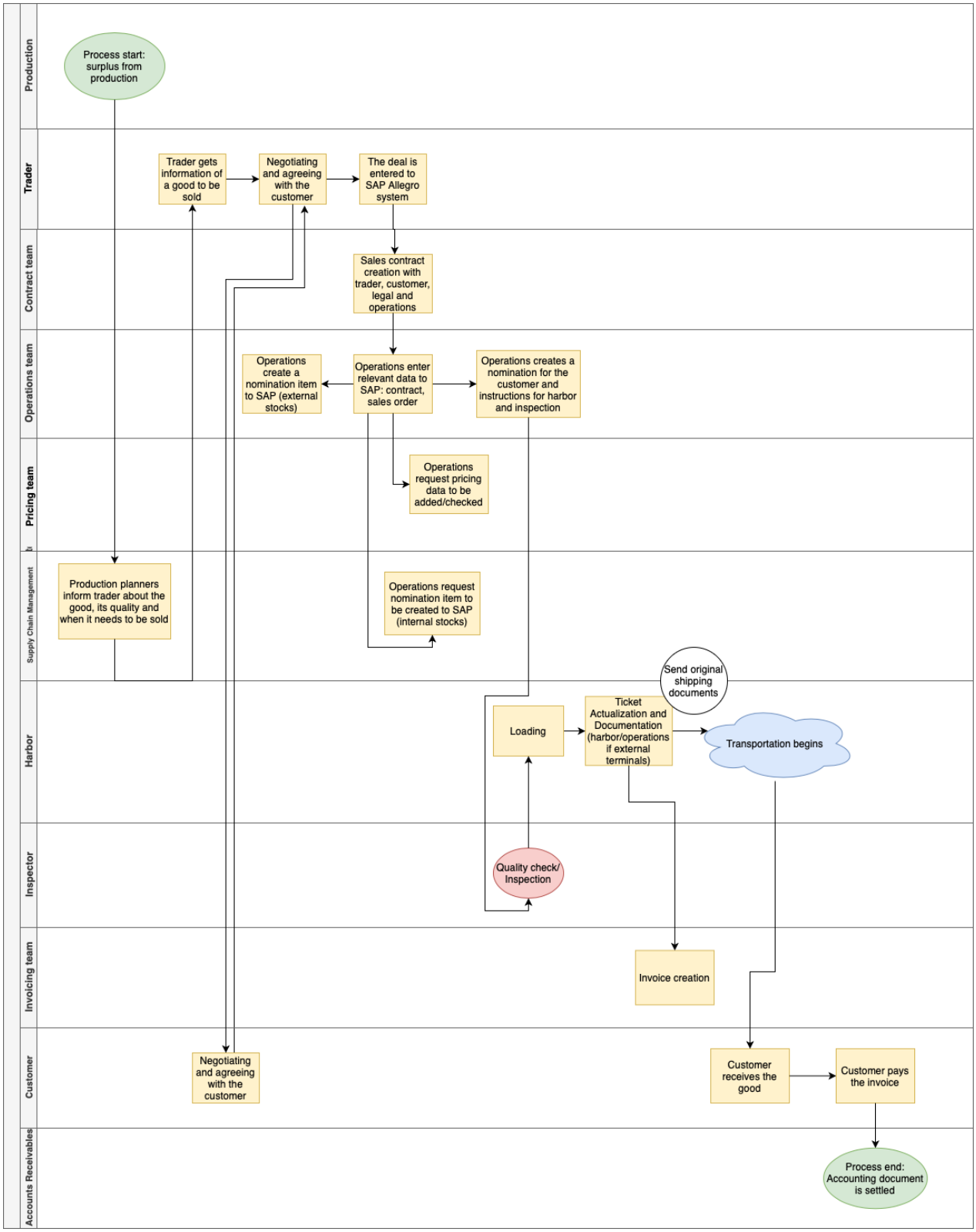
- Onko työssäsi toimintoja, jotka edellyttävät tietoa/lupaa/ohjeita joltain kollegalta ennen kuin voit aloittaa oman osuutesi? Ketä tavoittelet, jos tarvitset vahvistuksen tai lisätietoja? Kenellä on päätösvalta, mikäli ongelmia/haasteita ilmenee?

- Mitä muuttaisit/kehittäisit nykyprosessissa?

Appendix 2. The SIPOC model



Appendix 3. The swimlane diagram



Appendix 4. The VSM matrix