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Value gains from increased visibility in the supply chain

A case study on Volvo Penta's service market of spare parts

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Abstract

The complexity of supply chains worldwide has increased tremendously, with more global chains as well as increased demand for higher customer service levels. Technical enablers can to some extent ease this complexity and allow for better control throughout the supply chains. One aspect is the ability to better transfer information between peers involved in the supply chain which is discussed as something that can generate supply chain visibility. With better visibility, companies are able to follow their products as they travel through the chain, this in turn can improve and make their operations more reliable and efficient. However, many companies struggle to implement high levels of visibility in their supply chains. In this thesis, the authors have gotten the privilege to examine a part of the supply chain of Volvo Penta's service market concerning visibility in the supply chain and the benefits it can bring them. The purpose of this study is to identify the potential benefits of having increased visibility in the outbound flow of spare parts in Volvo Penta's supply chain, both for Penta and their dealers. In addition, measures that could be used to increase visibility will be investigated. The study is a qualitative case study where primary data was collected through interviews with Penta employees as well as three dealers to gain a solid view of how the operations are working today. Findings from the empirical data show that it is clear that Penta is lacking visibility in some stages in their supply chain, especially in the outbound transportation leg from the warehouse to the dealers and in the backorder process. Their order setup mainly includes three different order types that have a prioritization hierarchy between them. This hierarchy has implied that some dealers are misusing the setup to secure timely deliveries of parts, there was however a belief among the dealers that they likely would have behaved differently if they had better visibility. It was further evident that the lack of integrated IT systems complicated the information flow between departments within Penta as well as with the dealers. The empirical findings were later analyzed in relation to the already existing research on supply chain visibility and the main takeaway from this study is that if Penta would manage to increase the visibility, they would be able to increase the overall efficiency in both their own and their dealers' operations.

Keywords: Supply chain visibility, Visibility benefits, Information flow, Information quality, Technical enablers, Efficiency gains.

Table of content

Glossary

Below follows a glossary of all the abbreviations used in this thesis, and thereafter explanations on some of the terms used in this thesis which are quite specific to the case of Volvo Penta. These explanations will act as an introduction to the terminology for this case study.

ICT - Information and Communication Technologies

ISO - International Organization for Standardization

RFID - Radio Frequency Identification

AIDC - Automatic Identification and Data Capture

ERP - Enterprise Resource Planning

EDI - Electronic Data Interchange

IoT - Internet of Things

VOR - Vehicle Off-Road

VPIM - Volvo Penta Inventory Management

ETA - Estimated Time of Arrival

CDC - Central Distribution Center

RDC- Regional Distribution Centers

SDC - Support Distribution Centers

DFS - Dealer Facing System

TMS - Transport Management System

VPC - Volvo Penta Center

SML - Service Market Logistics

- **Volvo Penta Centers (VPC)** - Penta's business partners, the dealers, are located worldwide and sell Penta's parts as well as conduct repairs. Through their Volvo Penta Centers (VPC) program, Penta promotes some dealers with extended responsibility, for instance training other dealers. The VPCs are often the larger dealers in the network.

- **Service Market Logistics (SML)** - SML is the department within Volvo Group that is responsible for managing the aftermarket logistics operations. They are handling purchasing, warehousing, distribution channels, and consolidation of transported goods between all the group's brands in order to be more efficient, both in cost and environmental aspects. Hence, SML is handling the logistical matters for Penta. This thesis will mostly refer to Penta although it might be SML handling the specific process.

- **Dealer Facing System (DFS)** - The DFS is the order system used by the dealers, in which they place their orders whenever they require any parts. This is one of the platforms used by the dealers to send and receive information to and from Penta.

- **Backorders** - If a dealer places an order for a certain part that is not available in any of the warehouses within the organization, the order is listed as a backorder. This implies that the order cannot be fulfilled until Penta has received a delivery of that part from their suppliers. Once a backorder is created, it is handled as a separate case.

- **Estimated Time of Arrival (ETA)** - In this thesis, the ETA address indicates the estimated arrival time for spare parts to be back in stock in Penta's warehouse. Hence, not the arrival time at the dealer's location.

- **Customer** - In the context of Penta when discussing customers, it is referred to the dealer's customers and their perceived service level that Volvo Penta performs through their partnerships with the dealers.

1. Introduction

The following section will give an introduction to this thesis as well as present the case company that is investigated, both in general but also the issues they are facing which are to be further explored in this thesis. After the problem discussion, the purpose and research questions will be presented, followed by the delimitations made.

1.1 Background

The complexity of supply chains worldwide has escalated tremendously in the last decades as they are becoming increasingly global and products are shipped larger distances, both in the inbound- and outbound flows of companies' supply chains. At the same time, customers are demanding higher service levels and do often expect fast, on-time, deliveries when needed. The complexity has however also been somewhat eased by technical enablers present today, which allows for better control throughout the supply chains. One important aspect in which information and communication technologies (ICT) have played an important role is in the enabling of information sharing between different peers involved in a supply chain. Information shared between peers is often discussed as something that can create visibility in the supply chain, where shared information enables companies to follow their products throughout the supply chain, which in turn can improve and make operations more efficient (Barratt & Oke, 2007; Barratt & Barratt, 2011; Somapa et al., 2018). Although there are many benefits to be achieved from having a high level of visibility in the supply chain, many companies struggle to implement it properly (McKinney, et al., 2014). In some cases, parts of the supply chain might have a good information flow that creates visibility but there might be other parts in the chain where the information is lacking, which is creating uncertainties for companies and their customers. In this thesis, the authors have gotten the possibility to investigate a company case and examine the supply chain of Volvo Penta's service market concerning visibility in the supply chain and the benefit it can bring them, as well as the challenges they are facing in different steps of the chain.

1.2 Empirical Case - Volvo Penta

Volvo Penta is a part of the Volvo Group and dates to 1907 when they delivered their first engine. Volvo Penta (hereafter referred to as Penta) is mostly known for manufacturing marine engines for commercial purposes as well as for leisure boats. However, engines and power solutions for the industrial sector are just as important and stand for half of their business. Penta's stated vision, as presented by Evans (2022), is "To become the world leader in sustainable power solutions". In 2021, Penta stood for 4 percent of the Volvo Group's net sales, though with the remarkable amount of 14 billion SEK. Penta has contributed to many innovations within the marine industry and the most important one came in 2005, which was the IPS engine that was revolutionary for the industry. This also led to the development of the joystick for maneuvering in 2006. On the industrial side, Penta offers engines for power solutions used at for example construction sites, concerts, hospitals, or the subway system. In

addition, their components can be found inside the engines of industrial machines used in forestry, agriculture, and construction vehicles, among others. Penta, therefore, has a two-sided role in delivering both complete engines in the marine sector, but also parts to industrial engines (Volvo Group, 2022; Volvo Penta, 2022; Evans, 2022).

1.3 Problem Discussion

One important aspect for a manufacturing company is to have a good aftermarket service and be able to deliver spare parts when repairs or services are needed. Hence, it is important to have parts available and a solid distribution chain to get the parts out to the Penta dealers. Compared to planning for production, it is much harder to forecast the demand for the aftermarket, since it is hard to predict when or where something will break and need a repair (Vera-Alvarez, 2022). Therefore, it is arguably the case that a well-functioning and efficient distribution system is even more important for the aftermarket. One aspect that can bring value and increase the reliability in a supply chain is visibility, as it eases the detection of any disturbances and enables one to make better decisions on how to handle disruptions better. When it comes to the visibility level in the supply chain for Penta's service market, it is for some parts of the chain currently more or less non-existing. This is especially the case for outbound transportation leg and the backorder processes which seem to be lacking visibility. This is causing inefficiencies and uncertainties in the process, especially for the dealers waiting for their parts. As of today, they do not receive information on the order status nor have the ability to trace the orders in transit once shipped. This results in not only uncertainty for them on how to plan for their operation, but also creates a behavior where they place many orders with the urgency classification to be sent out by air, only to secure the delivery of the part. The lack of visibility in the order process creates many challenges for Penta and most importantly creates inefficiencies in their operation (Roddie, 2022).

1.4 Research Purpose

The purpose of this thesis is: *to identify the potential benefits of having increased visibility in the outbound flow of spare parts in Volvo Penta's service market supply chain, both for Penta and their dealers.* The focus will lie on the current order process, what it looks like as of today and how certain parts of the supply chain could benefit from having an improved information flow. The potential benefits that will be investigated are overall efficiency gains within the supply chain, including improved service levels for the dealers, cost savings, and sustainability gains. In connection to this, there will be suggestions on which measures to take to increase the levels of visibility needed to derive benefits.

1.5 Research Question

In order to fulfill the purpose of this study, it is important to acknowledge that the research problem consists of two aspects, the benefits of increased visibility and how Penta can achieve this. Given this, the following two research questions will be used:

- How can increased visibility in the supply chain bring value to Volvo Penta and their dealers?
- What measures can Volvo Penta implement in their process to achieve improved visibility?

Although the research questions in this thesis are mainly focused on the case company studied, it should be noted that the findings from this study, especially regarding the first question, are likely to be applicable to other situations as well. This implies both similar companies, with a global and complex supply chain and network structure, but also applicable to the existing theoretical framework on visibility. Hence, one can argue that this thesis is also a contribution to the literature on supply chain visibility. To further keep this thesis within its scope it was decided to define the interpretations of some of the terms that are used, as these could be interpreted differently depending on the situation. Below follows explanations of how the authors have defined and utilized these terms in the research questions, for both clarification purposes, and for the reader to gain a better understanding of the rest of this thesis.

- **Visibility**: Visibility and traceability are terms that sometimes are used interchangeably, while there in some cases have been defined distinctions between the two. This thesis will define visibility as the ability to monitor and follow certain steps in the supply chain when they are happening rather than the ability to track down all steps a product has taken afterward which is often referred to more as traceability.

- **Increased visibility**: The term increased can be interpreted on many levels from being very small to very large, significant, or non-significant. In this thesis it is perceived that the starting point of visibility for Penta currently is non existing in its outbound transport leg, hence increased visibility will indicate any improvement in visibility compared to the current state, whether it will be a small or large improvement. Therefore, the term will in this case rather be judged by the influence the increase will have on the perceived value and whether it will generate a significant improvement for Penta and the dealer or not.

- **Supply chain**: The supply chain consists mainly of two parts, inbound and outbound, which all play an important role in building a well-functioning chain. In this thesis, however, the main focus when discussing supply chain will lie on the outbound logistics, more specifically on the transport leg from a warehouse to the dealer. The inbound part of the supply chain will be considered to a lower degree and mainly be addressed in its role in the flow of backorders. This delimitation was decided to be necessary since it is in the outbound leg of the supply chain where the main issues seem to lie for Penta regarding visibility.

- **Value**: In this thesis, it is the perceived value from peers involved in the supply chain that is in focus, both the perceived value for Penta themselves and from the dealers. The perceived value can then be translated and judged regarding aspects like awareness, reliability, and stability.

1.6 Delimitations

Certain delimitation has been made in this thesis, both those necessary and some due to the timeframe of the thesis. The first one concerns the geographical areas. Penta has two different order systems in use, the US has its separate one and the rest of the world uses another. In addition to this, the impression given from the interviews was that the system in the US is working somewhat better in regard to visibility, however, due to significant differences between the markets, this system cannot easily be adopted in the rest of the world. The decision was therefore to exclude the US from this thesis and instead focus on areas that were more easily comparable in terms of order process setup. Further geographical delimitation was made, which resulted in this thesis mainly focusing on region Nordic and Region Australia, for reasons which are discussed later in the methodology chapter. Moreover, there was a delimitation made on which order types to focus on in this paper, which was due to guidance from the Penta supervisor and time constraints. The order types included are those mainly used within the ordering setup. In addition, one aspect that proved to be of great importance in the discussion on achieving better visibility in a supply chain is the reliance on systems and IT solutions. This thesis will however not go into any technical details regarding which system Penta is utilizing and how they could do further developments or implementations of new systems. It was decided that in-depth discussion on technical details was out of scope for this thesis, and the authors decided it to be preferable to keep the discussion on a more general level. However, the technical aspect could be argued to be the natural next step for Penta to investigate, before implementing any of the measures suggested in this thesis.

2. Literature Review

In this chapter, existing literature on the subject will be investigated to gain an understanding of the subject and what influence visibility in the supply chain can generate. This literature review will later in this thesis be connected to the empirical findings in the analysis chapter.

2.1 Supply Chain Visibility - Definition

The term visibility, put in the context of supply chain management, has proven to have varying meanings. In some cases, it is discussed as traceability capabilities, whereas in others it concerns implementing separate visibility systems to support already existing supply chain management software. Further, visibility is discussed on the one hand as an abstract phenomenon and on the other hand as concrete technology (Francis, 2008).

Francis (2008, p.3). suggest a definition of supply chain visibility as: "Supply chain visibility is the identity, location, and status of entities transiting the supply chain, captured in timely messages about events, along with the planned and actual dates/times for these events". In this definition, he purposely excluded aspects of information systems and other software with the explanation that the definition itself is not influenced by how data is delivered. In a definition presented by Vitasak (2005), visibility depends on the accessibility of data at any given stage in the supply chain. Further, when visibility is described in connection to supply chain inventory, she put emphasis on technology systems as the tool that enables traceability. Barratt and Oke (2007) based their definition of supply chain visibility around information, and more specifically the level at which different entities in the same supply chain can share or access information, which is thought to be useful for the operations and can also generate mutual benefits to several entities. Hence, they emphasize that it is the information that can generate visibility and something which will not only be beneficial to one part but rather to everyone involved in the supply chain. McIntire (2014) addresses that some time in research history, supply chain visibility developed from being seen as a quality measure of the organizational process to being a solution to the challenges faced in a supply chain.

On the other hand, definitions of traceability are in some cases very similar to those for visibility. The International Organization for Standardization (ISO) presents their definitions of traceability as the "ability to trace the history, application or location of that which is under consideration" (ISO, 2000). This is discussed in connection to standards within quality management systems and further specifies that in the matter of tracing products, traceability is related to "the origin of materials and parts, the processing history, and the distribution and location of the product after delivery" (ISO, 2000). Olsen and Borit (2013) discuss several definitions for traceability that are based on the ability to trace the origin and history of a product. However, they also discuss the fact that several definitions of traceability instead emphasize tracing the physical flow of a product through the process, from production to delivery (Olsen & Borit, 2013). It is noticeable that there are similarities between the definitions of the terms visibility and traceability, and in some cases, they are used for describing the same phenomena. However, for clarification purposes as well as setting a framework for the scope

of this study, a distinction is made between traceability and visibility. Visibility is the term used for discussing information on where in the supply chain an item is and any circumstances that might be influential.

2.2 Information Flow

The term supply chain is often associated with the physical flow of goods, services, or materials from a supplier to a customer or within the organization. However, a supply chain also consists of the flow of monetary resources and information, which are all playing an important and complex role (Mentzer et al., 2001). Information is determining when it comes to creating visibility in a supply chain as it is the linkages of information between peers that, if managed properly, can generate visibility which in turn can give rise to improvement in the performance of operations (Barratt & Oke, 2007; Barratt & Barratt, 2011; Somapa et al., 2018). McIntire (2014) discusses that having accessibility to relevant information and contextual understanding will generate a more powerful supply chain. Further, Somapa et al. (2018) build their discussion around supply chain visibility around three wide characteristics which are associated with accessibility, usefulness, and quality of available information. They further elaborate on these terms towards automational, informational, and transformational characteristics.

2.2.1. Automational Information

Firstly, the automational aspect is related to the ability to gain and send the required information by using ICT, hence, using technology to capture wanted information related to the movements of goods through the supply chain and to coordinate information flows along with different parties in the chain. A determining factor for successful transmission of information is to have integrated IT systems between the supply chain partners so that the information is shared automatically. This would enable the parties involved to also be noticed directly if there is any disruption in the supply chain, for instance during the delivery, which would allow a buyer to reschedule its production accordingly (Somapa et al., 2018). In relation to the discussion made by Somapa et al. (2018) about ICT as an enabler for information visibility, Caridi et al. (2014) also highlight the importance of technology in gaining visibility in the supply chain. Implementing such systems is however discussed as time-consuming and requires a lot of investment, which is one reason why such systems are not applied to a larger extent in companies. Marchet et al. (2012) also advocate ICT as a pivotal factor when dealing with a complex supply chain, especially in those where transportation brings high costs. In their study, it was shown that by implementing ICT the organization that was investigated experienced an overall efficiency improvement in its supply chain.

2.2.2 Informational Information

Secondly, informational information concerns the quality of the exchanged information that generates supply chain visibility. Quality aspects are for example related to timeliness, how accurate the information is, and if the information is complete or not (Somapa et al., 2018). Whether the information is complete or not, is decided by judging if the information given is equal to the need for information for the particular user or if more or other information would

be required (Francis, 2008). In relation to data quality, McIntire (2014) discusses that quality itself is a measure affected by factors in the organizational setup rather than technology. This is because the processes within an organization are completely determining the business outcome, and although technology is acting as an enabler in many cases, the IT infrastructure is always implemented with the purpose to serve the organizational processes. He makes the comparison that a company might have limited technological infrastructure implemented but are still able to perform of high quality, and at the same time, a company might have a very advanced IT system in place and still produce bad quality performance (McIntire, 2014).

2.2.3 Transformational Information

Lastly, the transformational aspect relates to the use of the information gathered in relation to the business operations and how this information can contribute to value creation for the company, as discussed by Somapa et al. (2018). They further elaborate that the goal for the accessed information is to generate visibility in the supply chain that results in meaningful benefits for the business operations, otherwise, it is not useful. McIntire (2014) addresses that the usefulness of the information, and how well it fulfills the organization's needs is also a quality measure of the information available. Connected to outbound logistics, useful information which can generate meaningful benefits could for example be tracking devices allowing to follow the movement of goods, being able to track the goods can result in shortened lead times and higher reliability in when the delivery is to take place (Somapa et al., 2018). They continue to discuss the critical balance of considering to what extent the information is useful for each partner in the supply chain. It is important to recognize that two characteristics of visibility are to have access to useful information that is of high quality (Somapa et al., 2018). In many cases, organizations aim towards having as much information available as possible, however, they must be capable of sorting out unnecessary information that does not generate any value for the supply chain partners or managers (Caridi et al., 2014).

2.3 Visibility - Benefits

For those companies that put effort and succeed in implementing processes that increase visibility, several benefits can be derived. McIntire (2014) addresses two aspects of how visibility can impact the supply chain. Firstly, visibility can bring better knowledge to a situation, however, it cannot determine which actions to take. Secondly, visibility can enable decision-making on both a tactical level but also with a holistic view. He further discusses that visibility gives competitive advantages to those who can make use of information available in their supply chain, which implies both efficiencies and effectiveness gains. He addresses lowered transportation costs and reduced waste as two of these benefits. McKinney et al. (2014) argue that increasing the level of visibility in the supply chain can generate better timeliness of shipping data and a higher level of accurate shipping information, and through better visibility, cost reductions will also come along. On the other hand, a lack of visibility has been shown to hide everyday costs for many companies which could be avoided (McKinney et al., 2014). McKinney et al. (2014) further mention several benefits that can be derived from the use of systems that provide visibility. In their study focusing on moving containers, benefits derived

include the ability to earlier discover and act upon disruptions, generate a more precise estimated time of arrival to rely on, and the possibility to lower the insurance rate as the risk for the insurance companies is decreased when the visibility of the goods is higher. There have also been statements made that visibility in the supply chain could reduce the repercussions of a potential bullwhip effect throughout the supply chain (Barratt & Oke, 2007; Barratt & Barratt, 2011; Nooraie & Mellat Parast, 2015). The bullwhip effect refers to the order cycle created from irregular demand, and it is argued that if actors would have more information in the earlier stage of the chain, they would be able to better plan for their operations and avoid a chain reaction of uncertainties. Increased visibility in terms of the better flow of information is one factor that can hinder this bullwhip effect, hence creating a more efficient supply chain (Wisner, et al., 2019).

Moreover, achieving increased visibility in the supply chain can generate higher performance for companies and facilitate decision-makers (Caridi et al., 2014; McIntire, 2014). In the context of increased transportation visibility, information about in-transit disruption could enable the managers to reschedule distributions in advance and minimize the effect on customer service that comes with non-timely deliveries. It is argued that within a transport system, it is vital to apply this proactive approach. The timeframe of which a manager is made aware of disruption during the transportation determines how well they can respond to changes and redirect the transportation. Hence, it is evident that transport visibility is crucial, but receiving continuous updates during the process is also vital so that managers do not base their decisions on old information (Goel, 2010).

Goel (2010) further discusses how shipment tracking can have a huge impact on the reliability of delivery. In an example given, he argues that by having a tracking system in place for approximately 80 percent of a company's shipments, the likelihood of a punctual delivery increases by 95 percent in comparison to their competitors. In addition, it is presented that in one study, increased visibility generated a total logistics cost reduction of 5 percent for the companies investigated. In the study of Goel (2010), it was presented that a company that went from the stage of no visibility in the supply chain to have daily updates regarding deviations for the planned transportation, both on departures as well as arrival times showed considerable improvements in the ability to reschedule transportation, resulting in a higher percentage of deliveries made on time. Further, the study shows that the more visibility increases, the better delivery performance.

2.3.1 Sustainability

Another aspect that visibility in the supply chain can influence is regarding sustainability. Many companies today put emphasis on becoming more sustainable in their operations and according to Koberg and Longini (2019), lacking visibility makes it hard to discover where in the supply chain there is potential for improvement in regard to sustainability. Further, it is arguably also the case that this is applicable to discover where there are specific issues. Saqib and Zhang (2021), also discussed that information distribution along the supply chain is beneficial for making decisions, discovering potential environmental risks, and hence, also

being able to avoid undesirable penalties for wrongdoing in a sustainability aspect. They continue to argue that when the level of visibility in the supply chain is high, sustainable processes will be easier to manage since potential sustainable issues can be discovered and solved at the source before they escalate (Saqib & Zhang, 2021).

2.4 Technical Enablers

McIntire (2014) highlights that previous research addresses visibility to be a mixture of both technological enablers but also an organization's processes or policies. In his study, it was addressed that supply chain visibility is to some extent reliant on technological infrastructure, however not the determining factor for its success. Instead, understanding the company's processes and what they are aiming for is argued to be the primary factor, where technological enablers should in turn assist in the processes towards these goals. However, McIntire (2014) addresses that technological tools are in fact something that can facilitate transformations within a company and should not only be seen as an enabler. Hence, it is through the combination of the organization's process and the technical enablers that visibility can be achieved.

Several ICTs have emerged alongside the technical development, which among several benefits, have enabled better visibility of entities as they flow in the supply chain. Some of the earlier developments include barcodes and Radio Frequency Identification (RFID) tags, both of which are classified as Automatic Identification and Data Capture (AIDC) technologies that allow for better transmitting information between supply chain partners throughout the flow (Lim et al., 2013; Rushton et al., 2017; Calatayud et al., 2019). Calatayud et al. (2019) further argue that the benefits that have come with RFID development are, however, not derived directly from the technological tools, but instead generated from how the actors within a supply chain utilized the data that such technologies create. Other ICTs, as discussed by Caridi et al. (2014) are Enterprise Resource Planning (ERP) and Electronic Data Interchange (EDI), both of which are argued to facilitate increasing the visibility in the supply chain. ERP enables an organization to integrate data from different departments of the company, such as finance and marketing, into one merged system, hence, avoiding an often difficult and advanced process of transmitting information through various systems (Shen, 2015). Similar to AIDCs is EDI, which allows for immediate information sharing between business partners, however, more aimed toward forwarding data on electronic documents, for instance, invoices (Masudin et al., 2021; Rushton et al., 2017).

More recent technological developments have further advanced the role of ICTs in supply chains. In many cases, their ability is reliant on the vast amount of information, which is as of today gathered and further shared through people's use of devices that are connected to the internet, called the Internet of Things (IoT). These huge amounts of datasets that become available are often referred to as Big Data, which on the one hand enables advanced data analyses that can bring value to a business, but on the other hand also present a very complex challenge in terms of processing the data. As addressed by Calatayud et al. (2019), before the more recent technology development, the issue did not lie in the absence of available data, but

in technological tools to process and share the information. Another complex concept is blockchain, which can be described as a ledger available for the public to attach and verify transactions, blocks, with the use of a computer. The transactions could be monetary or on a contract basis. Any previous transaction cannot be removed or adjusted, hence, manipulation of the data is not possible. The anonymity of the parties involved is ensured through the use of encryption and since blockchains are accessible to anyone, the data is fully transparent. Blockchain is most commonly known in connection to the cryptocurrency Bitcoin, but in fact, blockchain has started to play a role in the business context when there is a need to make transactions outside of the regular systems due to a lack of it providing enough reliance and liability (Valacich & Schneider, 2018; Lu & Xu, 2017). Lu and Xu (2017) present in their study how a blockchain was able to replace a traditional centralized database for product information storing. This was beneficial as it provided transparency of data that supply chain partners could trust has not been manipulated. Hence, it is clear from the literature that there are several different technical solutions available to aid the processes of an organization and generate increased visibility.

2.5 Visibility - Challenges

Supply chain visibility is discussed as an important matter to consider in supply chain management but also as something very challenging, which is partially due to its implementation (Francis, 2008). Although there are technical solutions today that can provide a high level of visibility into the supply chain, many companies consider implementing it to be one of their greatest challenges. In some cases, the information needed might be available, but it is not prioritized to develop tools to make use of it (McKinney, et al., 2014). Although companies are well aware of the benefits and efficiency gains that increased visibility brings, few supply chains have a sufficient level of visibility implemented (Somapa et al., 2018; Caridi et al., 2014; Goel, 2010). It is difficult to measure precisely what the improvements are as a direct result of increased visibility. In many cases, other factors have been targeted at the same time as visibility, and it is therefore difficult to distinguish from where which benefits comes. This inability contributes to companies not having enough incentives to implement more advanced ICTs (Somapa et al., 2018; Caridi et al., 2014). Goel (2010) discusses the cost-benefit trade-off that comes with a high initial investment for implementing ICT systems that can offer visibility, against the intangible values it brings to a company. In his article about in-transit visibility, he continues this discussion by addressing that research has not been able to demonstrate what the concrete benefits are from increased levels of visibility in this context.

One important aspect in the discussion made by McIntire (2014), is the organization's role in achieving visibility. His discussion is around the organizational commitment and the willingness to actually make changes in order to generate greater business success. Research shows several cases where a lack of willingness has been the hindering factor to achieve increased visibility in the supply chain. In addition, it was shown that companies working with customer-focused visibility initiatives had greater success than those mainly focusing on technical aspects of it. McIntire (2014) therefore argues that investing in technology should be done as a measure towards achieving the organization’s goals, and the investment itself should

not be seen as an individual goal for the company. In connection to the organization's role, Barratt and Barratt (2011) discuss gatekeepers as a hindering factor for the flow of information, indicating that information might get stuck at certain points in the supply chain and hence not reach the end-user. The reason why the gatekeepers might intervene in the information flow could for example be because they do not believe that the suppliers will be able to utilize the information provided or a belief that the information would not make any difference if delivered or not. Further, it could also be the case that the gatekeepers that get the information simply might not have the knowledge of how to share the information onwards, hence stopping it (Barratt & Barratt, 2011).

3. Methodology

Below a description of how this thesis has been constructed and executed will be presented, including decisions made affecting the direction of the thesis and the reasoning behind. The aim of this chapter is to provide the reader with an understanding of the process of writing this thesis.

3.1 Research Philosophy

When discussing research methodology, the term research paradigm appears. This implies that philosophy and expectations of the surrounding environment determine what the process of a research should look like. In addition, the research is also affected by the characteristics of knowledge, meaning the scope of information that mankind possesses. Theories are true until proven otherwise, comparable to the current knowledge that the earth is in the shape of a globe and not flat, as discussed by Collis and Hussey (2014). Saunders et al. (2019) refer to research philosophy as being a structure of assumptions and thoughts on how to build new knowledge and something that will shape the process of the research and interpretation of the findings. In connection to the research philosophy, one has the research paradigm, two paradigms are mainly discussed, namely positivism and interpretivism. Positivism has its origins in natural science and is aiming to develop theories based on conducted research that has observed and examined an occurrence. This is how knowledge is created and also enables us to prove the theories' legitimacy. Positivism separates the world from any influence of human behavior and claims that the social context does not affect the surroundings. This paradigm has been put in relation to quantitative research methods, where results can be quantifiable and statistical. In contrast to positivism is interpretivism, which arose from a critical view of the beliefs that positivism is based on. Interpretivism has a more comprehensive view of the social context and what influence subjectivity has, hence, it is related to qualitative research methods that analyze non-numerical data (Collis & Hussey, 2014; Saunders et, al., 2019).

The paradigm most relevant to this thesis can be argued to be interpretivism, as the data collection and analysis has a qualitative approach. Through interviews, the researchers have aimed to get a social dimension to the situation and to see each individual's experiences and perception of the context, aligned with the characteristics of interpretivism. Collis and Hussey (2014) do however discuss that a researcher should be cautious when describing their research approach with certain terms, as the framework of each paradigm has been developed to differentiate one's research. Hence, they argue that one should not separate the terms as if they would exclusively be related to only one of the paradigms. In connection to this, one might therefore argue that although the previous literature on this subject does not to a large extent include quantified results on what the benefits are of increased visibility, they do rely on research based on observations and examination, aligned with the positivism approach. Therefore, this thesis cannot exclusively be referred to as the interpretivism paradigm as the research is based on previous studies which one might argue have influences of positivism.

3.2 Research Logic

Another aspect to consider is the research logic one will adopt. Two of the most common ones are the deductive and the inductive logic, where deductive is more connected to positivism and inductive more to interpretivism (Saunders et al., 2019). The deductive logic implies the development of theories and hypotheses which will then be tested (Saunders et al., 2019; Collis & Hussey, 2014). Collis and Hussey (2014) describe that when using a deductive approach, one will move from being general to becoming more particular. On the other hand, the inductive logic implies that one will instead move from being specific to becoming more general. In this logic, the theory will be developed from empirical findings. Although these approaches do have clear differences, Collis and Hussey (2014) argue that the chosen logic might help guide in which way the research will best be conducted, however, one should not feel constrained by the chosen logic as research can have influences of both. One logic that can be seen as a combination of deduction and induction is abduction. Abduction is suitable when one is conducting qualitative case studies which also include reflection between existing theories and the case investigated. In an abductive logic, the existing literature serves as a knowledge-building background to be able to analyze the empirical findings in the best way possible (Conaty, 2021). The abductive logic is arguably the one most applicable to the logic used in this thesis, where the literature is serving as a ground for knowledge on the subject in order to better understand and analyze the empirical data from the case.

3.3 Research Approach

When classifying research in relation to its purpose of it, four different terms are generally used, two of which are particularly relevant to this thesis, namely exploratory and descriptive research. Exploratory research aims to find and develop patterns and ideas from the findings and is often used when there are not very many earlier studies in which information could be found. An exploratory study also often builds a ground on a subject for more in-depth investigation later on. A case study is a common technique used when doing exploratory research (Collis & Hussey, 2014). Saunders et al. (2019) further elaborate on exploratory research to be flexible and that it is common that in the beginning, the researcher is likely to have a rather broad focus which later gets narrowed as the research process is progressing. The next approach, descriptive research, aims to find and collect information on a specific issue. It goes more in-depth in examining an issue compared to exploratory research since it is more focused on a certain issue and its characteristics (Collis & Hussey, 2014). This research does arguably have influences from both being exploratory as well as descriptive since this research is a case study where a specific issue has been investigated, however, the aim is also to gain knowledge about the issue to support the need for further action. The early stages of the study are arguably more related to an exploratory approach to gain a proper understanding of the subject of visibility through existing literature, and the specific case through interviews with Penta employees. Interviews in the earlier stage of the research included more open-ended questions in order to allow the interviewees to explain how the case company is working and the challenges they are facing. Hence, it is arguably the case that the focus of the thesis was in the beginning somewhat broad and then narrowed down as the authors got a better

understanding of the case. After the authors had gained a good understanding of the subject and the case, the research entered a more descriptive stage including process mapping and a more in-depth analysis of the situation and challenges faced by the case company. The interviews held in later stages included questions that were slightly more specific to the subject and allowed for more discussion with the interviewees on the subject.

3.4 Research Method

The research approach is set depending on how the researcher plans to collect the data. It can either be quantitative, hence collecting data that can be quantified and use statistics for analysis or qualitative data where more interpretative methods are used to analyze it. One can also choose to use a mixed approach using both qualitative and quantitative data. The choice of which approach to use is influenced by the nature of the research to be conducted, both the overall paradigm and the research questions or problem to be investigated (Collis & Hussey, 2014). In the initial phase of this research, the idea was to mainly use a qualitative approach but to support the findings with some quantitative data that would be gathered from Penta's databases. As the thesis proceeded, the authors decided to not include such data, hence, excluding any quantitative approach previously considered. This was because the information gathered from the interviews was seen as satisfactory and enabled an in-depth analysis of the issue. Although quantitative data could give further credibility to the findings, the authors believed that it would not contribute to any new information. It would also be a time-consuming task to conduct a quantitative data collection in addition to the interviews, hence, the authors decided that it was preferable to instead dedicate all the time to interviews and analyzing the information collected.

3.5 Case Study

There are several different methodologies to take into consideration when forming a suitable research approach. One methodology that is used when one wants to explore a real-world phenomenon in its natural setting, including diverse methods to gain in-depth understanding and knowledge of the phenomenon, is case studies (Collis & Hussey, Yin, 2018). Saunders et. al., (2019) further argue that case studies are particularly a good choice if one aims to reach a proper understanding of a situation, which the authors believe to be the case for this thesis. One example of a type of case study is an opportunist case study which indicates that the authors have an opportunity to investigate a phenomenon through access to a specific company. Another example is an explanatory case study which means that one uses existing theory to gain an understanding and through which a phenomenon can be explained (Collis & Hussey, 2014). This research could be seen as a mix between an explanatory and an opportunist case study, as the authors have access to a specific company case at Volvo Penta and used previous theory in order to gain a proper understanding of the subject and to explain the challenges faced by Penta.

According to Yin (2018), a case study is suitable when one wants to answer research questions formulated as how and why. He argues that the reason for this is since such questions review

and follow operational processes over a period of time. Yin (2018) summarizes that there are three distinctive characteristics that, when all present, creates a situation in which it is advantageous to use a case study approach. These three characteristics are 1) when questions are asked aim to answer "how" or "why", as previously mentioned. 2) when there is a contemporary setting of events to be investigated and 3) when the researcher is lacking control of the settings. All three of these characteristics can be argued to be applicable in this study. The research questions are formulated with "how" and "what" which opens up for research that requires an in-depth investigation of the issue and Volvo Penta's operation in order to be answered. Further, the subject of this thesis is a present issue within the organization, based on circumstances that the authors do not have any control over and can only observe them. These factors strengthen the choice of conducting a case study.

3.6 Sample Selection

In research, the terms population and sample are present in the discussion about the source of data collection. A population refers to the entire groups of people or objects the researcher intends to study and make conclusions on. However, considering a whole population for a study is more or less impossible due to time restrictions as well as practical complications. Because of this, a sample derived from the population is chosen, which is a subgroup of the entire collection of people or objects that will represent the entire population (Collis & Hussey, 2014; Saunders et al., 2019). Under the interpretivism paradigm, the need of choosing a sample that adequately represents the population in order to make generalizations of it, is not as relevant as under the positivism paradigm. Moreover, this results in that the sample selection does not have to be done randomly (Collis & Hussey, 2014).

There are several methods of sampling collection available when the sample does not need to generate a generalization of an entire population, which is also referred to as non-probability samples. Firstly, one of the methods that can be used is snowball sampling, or networking, which should be used when the participants are required to have knowledge of the subject studied. Throughout the sample selection process, the researcher is made aware by the participants who else could be suitable for the study, hence, the researcher has gained a new link in the network. The second method is called judgmental or purposive sampling, which also implies that specific people are included in the study due to their knowledge of the subject (Collis & Hussey 2014; Saunders et al., 2019). In this case, the participants are chosen in advance and the sample selection is not extended during the process. The third method is called natural sampling and means that a researcher does not decide who to include and the selection is made on a more natural basis, for instance since the availability of participants is limited.

Given that the thesis was done together with Volvo Penta, it has a direct effect on the sample selection. The authors were informed by their supervisor at Penta which employees were suitable to interview for the thesis. This lack of influence could be related to a natural sampling, however, it was not a case of natural limitations but rather due to which participants were more suitable for this study. The authors themselves did not have this information in advance, for obvious reasons. This aspect is therefore also strongly connected to the judgmental sampling,

as participants with experience and responsibilities in the subjects were included. Further, during the thesis process, additional interviewees became of interest due to information given during the interviews or as a response to questions asked to the mentor at Penta. This can be connected to a snowball sampling, or networking, as the representatives suggested the authors to get in contact with their colleagues. When it comes to the interviewees representing dealers, the authors did not have any influence on the choice of participants themselves. Instead, their supervisor at Penta suggested suitable dealers to contact after internal discussions, hence, it can be argued that for the dealer interviews, the natural sampling method was used. The reason why dealers are also interviewed is to include their perception of the issues since this is a crucial aspect to consider in the discussion of Penta's information flow.

3.7 Data Collection

For a researcher to really get an understanding of the qualitative data that has been gathered, the information needs to be put into context, which is known as contextualization. This requires the researcher to also gain an understanding of the background to a situation, which eventually enables for analysis at the end of a study. For this to come true, it is vital to implement a collection method that is structured and systematic (Collis & Hussey, 2014).

Data in a study can be categorized as either primary or secondary data. Primary data in a qualitative study is most commonly gathered from interviews or observations, and for this thesis, interviews are the main source of primary data. The secondary data in qualitative research usually comes from printed text, such as newspapers, articles or books, but it can also be data from diagrams, tables or similar (Collis & Hussey, 2014).

3.7.1 Primary Data

Yin (2018) describes interviews to be one of the sources of data in a case study that has the highest importance. He further argues that this is because interviews are helpful when wanting to answer how and why questions as the interviewees easily can give their insights and reflections to a question. An interview can be categorized as either unstructured, semi-structured, or structured. What determines the type of interview is the characteristics of the questions asked and how well-prepared and well-arranged the interview is. An unstructured interview implies that questions have not been prepared before the interview, they are instead invented as the interview proceeds and are often asked in a way that requires the interviewee to develop its answer, a so-called open question. A semi-structured interview on the other hand is when some of the questions are prepared in advance so that the researcher has somewhat of a guideline during the interview and can ensure that the right subjects are covered. Additional questions can be brought up during the interview and the researcher does not have to follow a strict structure during the process. Finally, a structured interview strictly follows a pre-decided structure where all questions are prepared before conducting the interview. This does not give as much flexibility as the other type of interview but does ensure resembling data (Collis & Hussey, 2014; Saunders et al., 2019).

In this thesis, the very first interview was held in the early stage of the process, as the aim was for the authors to gain a good understanding of what the order process at Penta looked like at that point in time. The interviewee was made aware of this in advance, and therefore gave the authors good explanations of the situation during the interview. Given the purpose, the first interview was unstructured with a more interactive approach and with open questions that were not prepared in advance. This approach proved to be suitable as it enabled the interviewee to communicate and describe the process well, especially since the authors had very limited knowledge of the issue (Collis & Hussey, 2014; Saunders et al., 2019). The following interviews were all semi-structured since the authors have gotten a better understanding of the context, which allowed them to better prepare questions in advance. However, the choice was made to still have an open approach to the interviews and be flexible in the questions asked, hence, conducting structured interviews was not seen as suitable in this study. Conducting semi-structured interviews can be argued to be beneficial to gaining an understanding of context as well as offering the possibility for the interviewees to explain the situation freely. Keeping a strict set of questions could simply hinder the interviewees from truly giving their perception of the issue. This argument is supported by Yin (2018), stating that interviews for case studies should look more like a guided conversation and not strictly structured. Saunders et al. (2019) further elaborate that unstructured and semi-structured interviews are likely to be advantages in an exploratory study, which this thesis as argued earlier has influences of being since it allows to go more in-depth on the subject and hence create a thorough understanding.

Examples of interview guides used during the interviews with both Penta employees and the dealers can be found in Appendix 1 and 2. However, it is important to note that for the interviews with Penta employees, all of the interviewees had different areas of expertise, hence, the variety of questions was necessary. The structure of the questions asked took shape during the interview rather than following any pre-decided agenda. The questions also varied a lot from the interviews in the earlier phases, as the questions were affected by the level of knowledge the authors had. In general, 5-8 questions were prepared in advance on the subjects that the authors wished to address during each interview. For the dealer interviews, the same interview guide was used for all three interviews.

Table 1 below shows a summary of the interviews held. The table includes both the formal interviews held with dealers and Penta employees, which are referred to as either unstructured or semi-structured in the column “Type”. There were also feedback sessions held with the Penta supervisor throughout the process, referred to as “Feedback Session” in the column “Type” in the table. In these meetings, discussions were made on the advancement of the thesis between the sessions, this was done in order to ensure that the information stated was correct as well as to keep a dialogue on the findings from the interviews and the proceeding work. Most of these feedback sessions were held remotely with the supervisor at Penta, however, two of the sessions were held physically in their office. For one of these meetings, two other people from the supervisor’s team were present, as they wanted to get a view of the ongoing work. These feedback sessions have been found to be very beneficial, as it has given good guidance throughout the process. Since they were an important part of the thesis process, they are included in the same table as the interviews.

As also seen in Table 1, there were three interviews held with dealers, all of them being VPCs and hence playing a significant role in the network serving their markets. In two of them, more than one person was participating, however, since there was a wish from one of the dealers participating to be anonymous in this thesis, it was decided to refer to each dealer interview as Dealer A, B, and C, where Dealer A and B represents Region Nordic and Dealer C represents Australia. Although their reference will be in singular, since they represent a company, their statements are referred to in the plural.

Some time after the interviews were held, all interviewees from both Penta and the dealers received a draft of the empirical findings that included information derived from their respective interviews. This was done so that they had the opportunity to check all the facts stated as well as to provide feedback on potential misunderstandings. The draft was sent out in the middle of April so that there would be enough time to adjust and change the text if needed. The interviewees were asked to come back with potential feedback before a certain timeframe, and it was communicated that if the authors had not received any feedback after that time, it would be interpreted as a silent confirmation of the text. Only one of the interviewees had feedback on the text, however, only addressed two sentences where the wording from the authors could be misinterpreted, which was changed accordingly. The authors believe that since the Penta supervisor had already given his feedback on it and addressed sections that were either unclear or incorrect, the quality of the text was good when sent out to the interviewees. Two of the interviews were held at the end of April, where confirmation was given from the interviewees that it would be enough if the Penta supervisor would confirm that the text was correct. The correspondence confirming the text with all interviewees is not included in Table 1 but was done to ensure a better quality of the findings and secure the validity of the study.

In connection with the anonymity of the dealer, Collis and Hussey (2014) discuss several ethical aspects that a researcher needs to consider. Apart from offering the possibility to be anonymous in a study, the researcher should also consider the integrity of the participants and show respect for their confidentiality and their privacy. The ethical aspects taken into consideration in this study mainly concerns the anonymity of the dealers, as that enables them to provide more honest answers during the interviews. The authors also made sure to give all interviewees the possibility to confirm the draft of the empirical findings. This was to make sure that the authors had not misinterpreted any information and also to ensure that the interviewees felt comfortable in the way the authors had made use of the information given.

Interviewee	Position	Type	Date	Duration	Laguage	Platform
Stephen Roddie	Outbound Logistics Director	Feedback session	2022-01-17	1 h	English	Teams
Aaron Vera Alvarez	Excellence Expert Transport Management	Unstructured	2022-01-31	1 h	Swedish	Zoom
Stephen Roddie	Outbound Logistics Director	Feedback session	2022-02-09	1 h	English	Teams
Sten Åkerström	Senior Excellence Manager, Order and Distribution	Semi-structured	2022-02-14	45 min	Swedish	Zoom
Stephen Roddie	Outbound Logistics Director	Feedback session	2022-02-14	1 h	English	Teams
Walter Vendrame	Parts Logistics Process Director	Semi-structured	2022-02-16	1 h	English	Teams
Martin Granic	Transport Developer	Semi-structured	2022-02-16	1 h	English	Zoom
Stephen Roddie	Outbound Logistics Director	Semi-structured	2022-02-28	1 h	English	On site
Eva Kristoffersen	Manager Service Center Nordic	Semi-structured	2022-03-01	1 h	Swedish	Zoom
Stephen Roddie	Outbound Logistics Director	Feedback session	2022-03-17	1 h	English	Teams
Dealer A	Dealer - Region Nordic	Semi-structured	2022-03-22	1 h 15 min	English	Zoom
Dealer B	Dealer - Region Nordic	Semi-structured	2022-03-24	1 h	English	Zoom
Dealer C	Dealer - Region Australia	Semi-structured	2022-03-30	1 h	English	Teams
Stephen Roddie	Outbound Logistics Director	Feedback session	2022-03-31	1 h	English	Teams
Stephen Roddie	Outbound Logistics Director	Feedback session	2022-04-11	1 h	English	Teams
Stephen Roddie	Outbound Logistics Director	Feedback session	2022-04-21	1 h 30 min	English	On site
Kristin Evans	Director Parts Logistics	Feedback session	2022-04-21	1 h 30 min	English	On site
Gunnar Gustavsson	Inbound Logistics Director	Feedback session	2022-04-21	1 h 30 min	English	On site
Glenn De Rudder	Manager Shipping	Semi-structured	2022-04-22	50 min	English	Teams
Maria Athanasiadou	Service Center Coordinator	Semi-structured	2022-04-28	30 min	English	Zoom
Stephen Roddie	Outbound Logistics Director	Feedback loop	2022-05-09	1 h 30 min	English	On site
Stephen Roddie	Outbound Logistics Director	Feedback loop	2022-05-17	1 h	English	Teams

Table 1: Summary of interviews

3.7.2 Transcription

After conducting an interview follows the transcription process. An important aspect when transcribing is to capture the meaning of the words and not solely what has been said. Further, how well the transcription is done affects the quality of the data that has been generated (Brown, 2002; Saunders et al., 2019). It is therefore evident that transcription plays an important role in data handling as it sets the ground level for data quality. In addition, the transcription process enables an interpretation of the information communicated during the interview, which could be argued to create vulnerability due to subjective rendering by the authors. Brown (2002) suggests that when transcribing, one should consider what information is relevant to the research and exclude aspects that are not. This mindset was to some extent implemented when transcribing the interviews for this study, however, mostly applied to unnecessary wording or irrelevant information. As some interviews were held in Swedish, those were also transcribed in Swedish, and the data was later translated when put into text inserted in the empirical findings. This could be argued to also generate a slight risk of misinterpretation or incorrect translation. However, given the language skills and knowledge of the subject, the authors do not believe this to be a relevant issue to consider. Further, after doing a thorough transcription of the first interview it was decided that it would not be necessary to do that for the following interviews, this decision was made since all interviews have been video recorded and hence it was easy for the authors to go through the interviews and not miss out on any information in that way. When going through the recordings of the interviews, the parts including information used in the thesis was transcribed whereas other information not relevant to the topic was not.

3.7.3 Secondary Data

The secondary data collected in this thesis has mainly been gathered from academic articles or literature available at the University of Gothenburg's own search platform Primo. In addition, Google Scholar has been used for finding relevant material, however, all sources have been accessed via Primo as this platform enables better ensuring that the material has been peer-reviewed. The majority of literature is peer-reviewed, as this can be considered as a measure to assure good quality of the research. Further, the snowball technique was used when searching for relevant literature, hence, when reading articles more material was found and explored from the references in those articles (Collis & Hussey, 2014).

When it comes to the time aspect it was decided to not limit the search to specific years, this decision was made to not miss out on influential articles that still provide interesting theoretical insights even though they were published some years ago now. The authors did however keep in mind that the evolution of especially technological systems allowing for increased visibility has developed tremendously in the last few years indicating that older articles might in some aspects have become a bit outdated. Therefore, there was some consideration of the publication year for the sources used in the chapter on technology.

When searching for literature, some specific keywords or key phrases were used, such as: “Value supply chain visibility”, “Supply chain visibility”, “Supply chain visibility sustainability”, “Information quality”, “Technologies visibility” etc.

3.8 Data Analysis

To analyze the empirical findings collected in a case study has been argued to be a stage in the process where many researchers are struggling since compared to statistical analysis, there are few clear guidelines on how to proceed and interpret the findings (Yin, 2018; Collis & Hussey, 2014). Yin (2018) argues that the best way to prepare oneself when analyzing a case study is to define an established analytical strategy with the purpose to be able to relate the empirical findings with key concepts aimed to investigate in the study and then let these concepts steer the way one analyzes the data. Yin (2018) further elaborates on four different established analytical strategies that are often used in case studies, where the first one is to rely on propositions found in the theory and follow them throughout the analysis. In this case, the objective of conducting the research is likely based on theoretical propositions which in turn have formed the research questions and shaped the literature review. The theoretical findings then help to guide and organize the empirical findings and give guidance on how to analyze them. This strategy was found to be aligned with the design of this thesis, where the authors developed the research questions and literature review from the theoretical concept of supply chain visibility, which was later connected to the empirical findings derived from the interview.

3.8.1 Analytical Technique - Pattern Matching

Yin (2018) further discusses several different techniques for data analysis that can be suitable when doing a case study. One of them is pattern matching, which is presented as being desirable

to use in analysis for case studies. In this technique, one takes a pattern based on the empirical findings and compares it with a pattern based on predictions made before the data collection. If the patterns from the predicted and the empirical one proves to be similar, this will be helpful to prove the strength of the internal validity in a case study. When conducting an explanatory study, the "how" and "why" questions may further be related to the patterns found, however, this technique is also relevant when the research is more descriptive (Yin, 2018; Saunders et al., 2019). Given that this study has explanatory influences, pattern matching was decided to be a suitable technique for data analysis. The technique of pattern matching also matches the general analytical strategy for empirical data, as described in the previous section.

Yin (2018) also discusses that when analyzing the empirical findings, it is important to clearly address the aspects in the case that are most significant. It was evident in the early stage of conducting the interviews that the issues that seem to be suffering the most from lacking visibility are the outbound transportation leg and the backorder process. This was aligned with the perception that the authors already had when approaching the subject, hence, the discussion quickly steered towards focusing on these aspects. Three characteristics of information that are discussed in the literature in connection to generating visibility in the supply chain are the accessibility, usefulness, and quality of available information. These three patterns could all be related to the empirical findings, and where all were present in the discussion on visibility to varying extent. Although not explicitly stated in the analysis, these three characteristics can summarize the discussion made around the information flows and visibility.

3.8.2 Analysis Feedback Loop

To further strengthen the analysis, it was decided to have a feedback loop with the Penta supervisor to discuss some of the suggestions proposed by the authors. This was decided to be favorable in order to establish a more thorough understanding of the suggestions presented on improving the visibility of the case company, and potential reasons as to why measures would not be possible to take. This is aligned with Collis and Hussey's (2014) discussion that it might strengthen the validity of the conclusions made in research if one chooses to discuss the findings with the interviewees to get their opinions and reactions. The process of the feedback loop was done by having one initial meeting where a draft of the suggestions was discussed. During the session, the supervisor gave his general feedback but also inputs on measures that would not be able to be taken. It became evident that the suggestions presented, due to the structure of the analysis, lacked enough connection to the arguments around visibility that were more thoroughly done in the analysis. The suggestions were initially presented at the end of the analysis as a list of bullet points. However, the authors chose to change the structure of the analysis so that the suggestion would be presented in the relevant section of the analysis, in order for the suggestions to be more coherent with the rest of the text and more aligned to the scope of visibility. After these changes were made another feedback loop was held where the authors together with the supervisor discussed the findings from the analysis. The discussions held during this meeting gave the authors a good understanding of which parts might need to be clarified and elaborated on a bit more, as well as which parts the supervisor found to be of high importance to be especially highlighted when presenting the findings for Penta. No major

changes were needed to be made after this second feedback loop but rather smaller changes to improve the quality of the thesis even further.

3.9 Quality of Research - Validity and Reliability

There are several factors influencing the quality of research and in particular, when it comes to a case study like this, it is natural that the case company has an influence on some choices which might affect the quality of the work. When it came to the decision on which markets to investigate, the authors had more or less no influence on the choice of markets and were instead given two regions from their Penta supervisor. He explained that the choice of looking into the Nordic region and Australia was because in those areas, the issues caused by a lack of visibility were prominent. There was however communication between the author and the supervisor regarding the scope of regions since in the very early stage of the thesis process discussions were made on having Region International as one of the focus areas. This was however decided to be too broad, and a narrower focus was preferable, hence the choice to focus only on Australia within region International. One might argue that the lack of influence from the authors' side on which markets to investigate might lower the quality of the study, and there might be bias involved from Penta. The authors do believe that the choice of markets could only be done in this way, as there would have been a need for a much deeper understanding of the issue if they were to make the decision themselves. Hence, they do not believe that this has affected the overall quality of the study negatively, and instead, the two regions together give a clear view of how a lack of visibility can generate different issues depending on geographical location. In connection to this, the authors did not have any influence on which dealers to interview from the different regions. However, the authors believe that the same discussion made on the choice of regions can be applied to dealers, as it would not have been possible to make such a decision without in-depth knowledge of the context.

One thing that can be discussed to have an impact on the overall quality of the study is, however, the dealers participating in it. Only three interviews in total were held with representatives from the two regions, which might be argued to be quite a few. The reason why more interviews were not held was because the authors believed that they got a clear view of the situation and had enough information to conduct an analysis that would connect the empirical findings with the literature review well. Further, since all three dealers interviewed are VPCs it was decided that they all are good representatives of their respective markets and important players in the dealer network, which strengthened the decision to not need more dealer interviews. In addition, the time aspect and scope of this thesis were kept in mind and conducting more interviews would most likely bring up even more issues which would either extend the thesis too much or result in a lot of information being removed. From the three interviews held with dealers, there were already some aspects that had been discussed that were removed from the empirical findings in order to keep the thesis within the scope. Overall, the authors aimed towards addressing the two regions equally in the thesis, although the discussion with them somewhat varied. From the two interviews with dealers from the Nordic region, one of them generated more information in the chapter with empirical findings, which was due to the level of the discussion held. If the thesis process would have extended over a longer period

of time, it would have been of interest to either interview more dealers from the two chosen regions, or to interview dealers from other regions to see if the issues were similar to those addressed in this study.

Moreover, there are several criteria commonly used in the literature when judging the quality of research. When it comes to the discussion on case studies, Yin (2018) puts emphasis on four different quality tests that should be addressed, namely construct validity, internal validity, external validity, and reliability.

3.9.1 Construct Validity

Construct validity is argued to be particularly challenging when conducting a case study and relates to the ability to strengthen that one has correctly interpreted the concepts examined in the case. To strengthen the construct validity, tactics to be used include using several sources when collecting data and letting the main interviewees review the final draft of the thesis to confirm and agree on the interpretation of the empirical findings and hence reduce the risk of misrepresenting of data (Yin, 2018). Both of these tactics have been applied in this study as a way to strengthen the construct validity and ensure higher quality. As discussed in previous sections, data collection was naturally made from several sources where the authors to a large extent received the same, or very similar, information from the interviewees regarding the issues. In those few cases where interviewees' statements were contradicting something said in a previous interview, the authors made sure to double-check that they had understood the issue correctly and if needed, they discussed the issue with their supervisor to get an explanation of where the misinterpretation might be. In addition, the majority of the interviewees were sent the final draft of the thesis in order to give their confirmation and to give any feedback on the context. Moreover, feedback sessions were held with the supervisor at Penta continuously during the process to ensure that the authors have interpreted the interview findings correctly, as well as to have an opportunity to discuss how to further strengthen the thesis.

3.9.2 Internal Validity

Internal validity is something that mainly needs attention when conducting an explanatory case study when one aims to investigate how or why something is influencing an outcome. In a case study, a risk in regard to internal validity can be connected with inferences made by the researchers and potentially biased conclusions, without including all possible angles. One way to reduce this risk and increase the internal validity is to make sure to use an analytical tactic when analyzing the data, for example, pattern matching as previously described (Yin, 2018). This analysis tactic is applied in this thesis, which can be argued to be a measure taken to increase the internal validity of the thesis. Further, the authors have aimed towards addressing the topics discussed in the study from more than one point of view. Whenever there has been any uncertainty in the information collected and where one’s reasoning might affect the actual facts in the matter, they have made sure to discuss the issue with the supervisor. There is still a potential risk of bias present in the thesis, however, one might argue that given the subject that is investigated, such bias is not very likely to have any greater influence on the overall quality of the study or determining the end result of the study. The feedback sessions with the

supervisor can also be argued as a measure to decrease the risk of bias from the authors, however, one should keep in mind that the Penta supervisor might as well be somewhat biased on certain topics. This has also been taken into consideration by the authors who have been sure to take all interviewees' standpoints in mind.

3.9.3 External Validity

External validity addresses the issue of deciding on whether the findings from the study will be possible to generalize in a context outside of the particular case studied. It is commonly stated that there is an inability to generalize the results when using a case study approach. One tactic to use in order to strengthen the external validity when conducting a single-case study is to use and build the research around the theory. Further, the goal of a case study is, rather than being able to generalize a population, to generalize and enlarge the theoretical theories, hence, the study aims to be generalizable on an analytic level rather than on a statistical level (Yin, 2018). Saunders et al. (2019) also add to this, stating that if one relates the research conducted to the existing literature, one will be able to display that the finding will also show significance on a broader theoretical level outside of the particular case. This case study is in one way narrow in its research as it addresses particular issues experienced at Penta. However, the challenges that come with lacking visibility in a supply chain can be argued to be applicable to any company with a long and global supply chain. Hence, it does have relevance outside of Penta as well and one could say that the findings could be generalizable to some extent. Further, this study builds on a thorough literature review, in which the theoretical findings were applied on an analytical level, rather than to make statistical statements, which is aligned with Yin's (2018) and Saunders et al. (2019) perception of how to increase the external validity.

3.9.4 Reliability

Reliability concerns the ability of another researcher to be able to, by following the same research design on a new study on the same case, generate the same result as the current study. The reliability of a study aims to minimize possible bias or other errors. Although there is seldom a desire to conduct the same research on the same case again it is important to address this and document the procedures taken when conducting a case study to allow for the possibility to repeat the research in principle (Yin, 2018). It is arguably the case that if someone would replicate this case study, they would receive fairly similar findings. There might be some aspects that differ, for instance, if the interviewees would not be the same people or if the focus would lie on other markets than those in this study. However, the main findings are very likely to be similar since the issues addressed are widespread for Penta and not investigated in a narrow way. One could argue that the main risks lie in how well understood the methodology chapter is, as well as in the interpretations made during the process. For instance, there are always considerations made on what to include in the literature review and from the interviews. In addition, although some connections are rather obvious, the authors' perceptions of the situation are determined in the execution of the analysis.

4. Empirical Findings

This chapter will present the findings from the interviews held. The current processes Penta has in their order and distribution system in the service market will be explained, together with inputs from the interviewees. In the first part of this chapter, the empirical findings from Penta will be presented followed by the findings from dealer interviews. The empirical findings are presented per subject in order to gain a better understanding of the bigger picture.

4.1 Order types

The current order system mainly consists of three different types of orders that the dealer can choose from when placing an order, namely: stock orders, day orders, and VOR. Firstly, a stock order is for articles that are used more often and where the demand is higher, hence, these articles are often held in stock and continuously replenished when needed. Stock orders generally have a lead time of 5 working days when shipped within Europe. Secondly, there are day orders, which are placed by the dealer when a need occurs for a certain article (Vera-Alvarez, 2022; Vendrame, 2022). These can be parts that are not used as often, hence, not held in stock. The third option is to place VOR, which is supposed to be used for emergency repairs and does not involve any consideration of costs for transportation, instead, they are always sent the fastest way possible. VOR stands for vehicle off-road, and its basic purpose is to be used when a machine has broken down and requires immediate repair. It could for example be a machine at a construction site where the breakdown results in complete work delays, which implies significant costs (Åkerström, 2022). VOR and day orders do in general have the same lead time of 1-2 days depending on location, and for obvious reasons longer when shipped overseas. However, the cutoff time is later for a VOR than for a day order, hence you can put a VOR order later the same day and still get the delivery the next day. The main difference between placing a VOR and a day order is that when you place a VOR, it will be handled manually as a specific high priority case which will generate better visibility through the chain (Vendrame, 2022). In addition, there is a hierarchy between the different order types that determines the level of prioritization between them. A VOR has the highest priority, followed by day orders and finally stock orders. This implies that if there are articles allocated for order types of lower priority, and a dealer has placed a VOR order for this article, that VOR order will be served ahead of a day- or stock order, regardless of which order was placed first (Åkerström, 2022).

Moreover, there is also a fourth order setup implemented for certain dealers. This setup is called Volvo Penta Inventory Management (VPIM) and here SML is in charge of tracking the dealers' sales and order data in a system that calculates and generates an automatic refill flow when stock levels are becoming low. In this setup, SML is responsible for making sure the dealers have a certain amount of stock for certain articles (Vendrame, 2022; Åkerström, 2022). In Europe, 90 percent of the dealer network have VPIM implemented, and the aim is to increase the number of dealers using VPIM in the rest of the world as well (Roddie, 2022). However, due to the different order process setup, VPIM will not be addressed much further in this thesis.

4.1.1 Prioritization

As previously mentioned, there are different priorities between the order types and these prioritization rules do give rise to certain issues. Since there is no customer directly behind a stock order, and they are rather placed for replenishment purposes, these have the lowest priority in the hierarchy. This implies that if a dealer places a more prioritized order type, such as day order or VOR order, that one gets prioritized before the stock order. This in turn can lead to a chain reaction where dealers experience that they do not receive their stock orders since they have been allocated to a higher prioritized order instead placed by another dealer. Hence, the next time this dealer is more likely to place a day order instead to be sure that their order is not deprioritized. The same applies to VORs, where the dealers might choose to place a VOR instead of a day order as this will have the highest priority. This is done to secure the delivery of that specific article, based on the experience that they did not receive their stock or day order the first time. Hence, the system in place sometimes generates delays due to day orders and stock orders being deprioritized but also allows the dealers to misuse this setup by placing unnecessary VORs. This has proven to be a commonly occurring situation where the dealers place a VOR in order to ensure timely delivery of a certain article even though there is no real VOR case behind the order (Åkerström, 2022; Kristoffersen, 2022). The prioritization hierarchy is visualized in Figure 1.

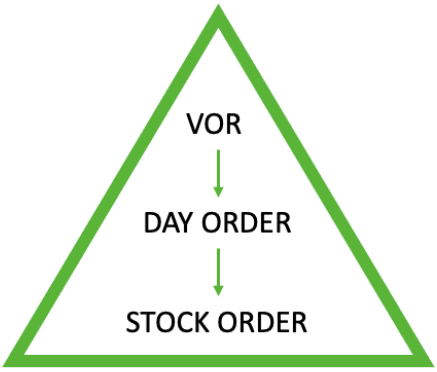

Figure 1. Order prioritization. (Author's own interpretation).

4.2 Distribution System

Volvo Penta's order process is a very complex system that is well-integrated with other actors, both within the Volvo Group but also with other parties in the industry. Their distribution system is built out of the central distribution center, (CDC), regional distribution centers (RDC), and support distribution centers (SDC). Figure 2 below is showing the warehouse network, with the blue dots representing CDCs, the green ones RDCs, and finally the black ones SDCs.

Figure 2: Location of Volvo Groups warehouses. (Source: Volvo Penta, modified by authors).

There are two CDCs located in Ghent, Belgium, and in Byhalia, USA. There is also a third CDC in Lyon, France, however, that one is currently not serving Penta and is hence not considered in this thesis. Further, since the US has been chosen to be excluded due to its different market structure, it will in this thesis be referred to as Ghent when mentioning CDC. The average stock holding value in the CDCs is 300 mSEK. The RDCs and SDCs have different roles in the network. The SDCs are located within Europe and aim to minimize cost and environmental emissions in the distribution of parts to the dealers. They serve the dealers with day orders and VORs, while stock orders are delivered from the CDC. The SDCs are the smallest warehouses and do in general hold a stock value of 3.6 mSEK. The RDCs, which instead are located globally outside of Europe, are in place to minimize the lead time of parts distribution, these are larger in size with an average of 25 mSEK in stock value. The CDCs are in charge of stocking up the RDCs and SDCs around the world and dealers place their orders to the closest RDC or SDC depending on where in the world they are located. The RDCs and SDCs are not keeping all parts in stock, but only the ones most frequently needed, therefore if the ordered part is not available in the RDC or SDC it will be sent from a CDC instead, either through the RDC or SDC or directly to the dealer. Although there is a network in place, in some cases transportation of parts is done between dealers as well in order to secure the fastest delivery. There are transport solutions for this where SML is involved but also between the dealers themselves outside the SML network (Roddie, 2022).

4.2.1 Transportation Setup

Volvo has a logistics purchasing department serving the whole Volvo Group, which covers both production and aftermarket, aiming toward consolidating transportation for all brands within the group to operate more efficiently. The transportation setup used for the outbound transportation between the different warehouses and from the warehouse to the dealers varies depending on the geographical areas. Further, it also depends on the order type since some of them demand a faster transport solution. In Europe, and in central Europe in particular where distances are generally shorter, road transport is used to a larger extent for all types of orders (Roddie, 2022). Granic (2022) explains that different countries often use different carriers which all vary in size from large global players to smaller carriers only operating locally. In some cases, it could be that one carrier is used for the international leg from Ghent to the carrier hub, and then from the carrier hub to the dealers, another local carrier could be used. Since there are so many different carriers used it complicates the ability to properly track the shipments. Further, the carriers have different abilities to deliver tracking information, some actors are able to offer tracking services whereas others, especially smaller ones, cannot. This means that Volvo themselves often lack information to forward to the dealers. Vera-Alvarez (2022) further discusses that the demand is very difficult to predict when it comes to spare parts since one cannot plan for a vehicle break-down or the location of it. This requires planning for having the right parts in the right place. Given this, Penta works with so-called on assignment transport, which is how the main part of the transportation from their warehouses works. On assignment means that they have scheduled departures from their warehouses at certain hours on chosen days every week. This is regardless of volumes and hence, becomes a trade-off between costs and service, in which the latter is of great importance for the aftermarket. Given this, having a set schedule for departures seems most reasonable. De Rudder (2022) explains that to make the loading as efficient as possible, Ghent consolidates all shipments leaving the warehouse. In addition, they aim toward having the orders leave the warehouse as fast as possible, which implies that the orders are not always completed in one package before being sent out. This means that orders can be split into different packages which can be delivered on different trucks, arriving either the same day or on another day. The order will then be invoiced on a package level indicating that an order can be invoiced separately if split on different trucks, De Rudder (2022) does highlight that although being invoiced separately, the original order number is always shown on all invoices. This is however not the case if there is a backorder, then there will be a new order number used on the invoice where some numbers from the original order number often are included but not in their full order.

He further explains that for trucks going to the Nordic region, there is no track and trace system in place. They can see what has been loaded onto each truck in terms of packages, but to see to which order those are connected, they must manually look at the transport documents made for the shipment and see what invoice numbers are stated. The trucks and the packages loaded into the trucks are scanned so that Ghent has that information, however, this is not shared further on in the chain and there is no linkage done to which orders the shipments are connected to within any system (De Rudder, 2022).

For shipments of more urgent orders, the road transport will not satisfy the lead time and instead, air transportation is used. In this case, two different setups are used, the first one being a dedicated integrator service. This setup is mainly used for bigger or heavier parts on routes with frequent volumes. The other alternative is to use a freight forwarder and ship as belly freight on passenger aircraft which is mainly used for smaller shipments and is preferable on routes where volumes are very infrequent (Granic, 2022). In connection to air freight, Kristoffersen (2022) presents that the tracking possibilities are often somewhat better, at least for the air leg, since due to safety aspects there are more thorough checks that the correct goods are loaded onto a plane, compared to a truck. It is also easier to track a plane since it is possible to see when they have departed from or landed at the airports.

For overseas regions, the aim is to mainly use sea freight in containers when there is no critical time limit, however, for day orders and VOR orders, there is naturally a need for airfreight if the RDC outside Sydney cannot satisfy the order (Roddie, 2022). De Rudder (2022) explains that compared to the flow of trucks leaving Ghent, container shipments are not scheduled on a fixed basis. Instead, they foresee the number of containers necessary depending on the volume of incoming orders and book the shipments on the first available vessel. As soon as they have a confirmation on what volume they can book on a vessel the goods are picked and packed to be loaded into a container. If there is the case that the needed volume is not available on the next vessel, only the volume that is to be shipped will be prepared for packing and the rest of the volume will have to wait for the next available vessel. This setup also means that Ghent is deciding whether there is a need to book a container or not. Hence, if the containers are not filled to a certain level, they might decide to hold this shipment and wait until they are able to fill it more before shipping it.

When containers going overseas are loaded, the shipping department will not give any directives to the loading team on which orders are to be loaded into which container. The focus lies on loading the containers as fully as possible in an efficient way, regardless of how the orders are split between the containers. The packages are scanned before being loaded into the container to detect any deviations and if there are no errors, they will be scanned again and loaded into the container, followed by a third scan confirming that those packages have in fact been loaded into the containers. Ghent will then have information on what is inside each container and the respective container number, which will be invoiced to the receiving warehouse accordingly. Given this, the receiving warehouse, according to De Rudder (2022) should have sufficient information to track the orders.

Vera-Alvarez (2022) discusses that geographical location might affect the need for visibility. He argues that for distances with a rather short lead time, for instance within central Europe, the need for transport visibility might not be as important. If there is a delay, this could be a matter of a few hours, which might not have an as significant impact on the dealers' operations, unless the order is assigned to a job the same day. In contrast, for longer distances, such as to Australia, a delay is more likely to imply several days or even weeks.

4.2.2 Transportation Costs

The carriers invoice SML the cost for transportation on a weekly or monthly basis, which implies that SML is unable to directly see the cost per order but only on an aggregated level. Hence, they are unaware of the exact transportation cost for each order (Granic, 2022). Roddie (2022) on the other hand argues that there is a possibility to calculate this manually since they have fixed freight rates and they know what is being sent out. However, given that no such calculation is done, SML is unable to give the dealers an exact transportation price for each order shipment, as discussed by Kristoffersen (2022). In turn, the dealers are charged an accumulated transportation cost by SML which is not directly affected by what the actual transportation costs result in. Due to this, the dealers are not informed of the cost associated with each transport mode used, hence, they are not aware of what the shipment cost for each individual order is (Vera-Alvarez 2022). Åkerström (2022) adds to this, stating that the dealers are only interested in the lead time of their orders, however, he believes that if SML were to charge the dealer the transportation cost corresponding to each specific order, this might encourage dealers to plan their operations better and hence accept slightly longer lead times. However, Vera-Alvarez (2022) also expresses that this is affected by the business model chosen by the organization.

4.2.3 Backorders

If an order placed by a dealer includes a part that is currently out of stock, both at their closest warehouse as well as in the CDC, a backorder is created which will be sent out as soon as it is available again in the CDC (Vera-Alvarez, 2022). The dealers are made aware immediately if their order becomes a backorder in the DFS and at that same time, the system is supposed to deliver an estimated time of arrival (ETA) of when the part is estimated to be back in stock. According to Vendrame (2022), the situation with backorders creates “kind of a black hole”. The ETA available in the DFS is general lead times on when the specific part will be delivered to the warehouse and not when it will be delivered to the dealer. Further, that the part will be available in the warehouse again does not mean that it will be allocated to that specific dealer due to prioritization rules between the different order types. The allocation pattern is quite complex and even though a dealer knows what quantities are incoming to the warehouse, they cannot be certain if they will get their order or not, which is a challenge for the dealers to cope with. In addition, SML has an issue with delivering reliable information on ETA for backorders. This is an issue often brought up by dealers when they conduct surveys. SML does not always have updated data of good quality on the ETA, and in some cases, they are unable to give an ETA at all, which poses a great weakness. If dealers were to receive a more accurate ETA, they could plan better (Åkerström, 2022). Vendrame (2022) further elaborate on this and discuss that there are meetings held regarding this issue where they are working for improved quality of information. However, there are no existing measures for how to define quality regarding the ETA information as of today. However, Roddie (2022) states that there are ongoing pilot projects that have defined measures for quality regarding the ETA, but this has not yet been developed to a global standard.

According to Åkerström (2022), the backorder flow normally works well, however, he emphasizes that it is the discrepancies that determine how solid the process is. In contrast to this, Vendrame (2022) argues that this is not a well-working process and something that has to be improved. The backorder situation is currently worse than usual due to the disruptions faced in supply chains globally, much as an effect of the Covid-19 pandemic, which is also stressed by Åkerström (2022). Vendrame (2022) also discusses the issues that the prioritization rules between order types allow for concerning backorders. This leads to a situation where if a dealer places a day or stock order in the DFS and sees that the part is not currently available they will cancel the order and instead place a VOR to ensure delivery of that part. At the moment, there are stock orders which never get fulfilled because of the allocation rules, where other order types take the parts from the stock orders. This is why there are tendencies to cancel stock orders and place VORs instead. Vendrame (2022) states that when parts availability is low there is an increase of VORs to ensure that backordered parts will be fulfilled, even if the order is not a VOR case in reality.

4.2.4 Service Center

Within Volvo Group's organizational setup there are service centers that work to support the dealers towards having as much uptime as possible. They assist with all order classes when there is an issue, with the aim to make sure that parts are delivered where they are needed. The service center also assists with logistical issues in general, for instance, questions regarding when a certain article is back in stock, any discrepancies on the orders, or transportation issues. In short, anything that might occur in connection to logistical matters is handled (Kristoffersen, 2022). For instance, when a dealer is to make a VOR order, they place the order in a system called Argus, which is a case-handling system within Volvo Group, which is then manually handled by someone at the service center. What is special in the case of VORs is that the service center is in charge of handling all the administration concerning the order. In addition, if an order is delayed, the dealer can contact the service center, which in turn assists in tracking where the order is in the chain (Åkerström, 2022; Kristoffersen, 2022). Kristoffersen (2022) presents that for Service Center Nordic which she represents, handling VORs is the most commonly occurring case which in normal times represents about 40 percent of the cases. However, as of today, this has increased to approximately 70 percent. This is due to the issues of availability and the global material shortages and disruptions present in all supply chains. The increase of VORs implies a lot of administrative handling for the service center, time which they cannot use to deal with other cases that arise. Although VORs require significant manual handling, there are in Region Nordic no extra charges to place a VOR for the dealers today. Kristoffersen (2022) believes that if dealers were charged extra when placing a VOR, it could work as an incentive for dealers to avoid placing unnecessary ones. In contrast to this, Roddie (2022) presents that in other regions dealers are charged extra for placing VORs.

Given the urgency with VOR, these are sent out as fast as possible and the time aspect is the main priority. Given this, the cost aspect becomes secondary although efforts are made when possible to use road transport from the nearest warehouse. Hence, it is evident that VORs should only be placed when really needed. The service center can be said to act as a filter to

make sure that VORs are not placed carelessly. The service center might refuse a VOR case if it is obvious that the order is not an urgent matter. A challenge in this is the lack of technical knowledge for the workers at the service center, hence, there are difficulties in filtering out other than obvious cases.

In Region Nordic compared to some other regions, whenever an order is sent, the service center receives a tracking number from the transporter which they can share with the dealers. Kristoffersen (2022) presents that information is forwarded on an order basis, meaning that they attached the tracking link for a shipment in the order so that the dealer themselves can access it. A weakness with this system is that it relies on the fact that items are scanned in-transit, and as of today there are gaps in how much that is being scanned when in route. In those cases, the result is that the dealers are unable to trace their orders. The visibility that the dealers do get is information on when an order has arrived at a hub for further processing, but Penta cannot offer much tracking in real-time on when an order has left their warehouse.

Kristoffersen (2022) further states that in Region Nordic, they share as much information with the dealers as possible as soon as they can. In many cases, the service center receives information about discrepancies per email, which is forwarded to the dealers. She presents a robot that was implemented in the region two years ago, which collects information regarding the tracking numbers and summarizes this information at the end of each day. This information is being sent out, along with a deviation report from the warehouses, during the night to the dealers to find the next morning, which allows them to replan their work if needed. It is stated that the information is combined and presented with a more user-friendly layout. This is an email presenting any possible deviations from the warehouses followed by an excel sheet including information about the order, such as order references, article number, quantity, description, and transporter. In addition, it includes the tracking links for each shipment for the dealers to use in order to see the status of their shipment.

She presents that they have received positive feedback from the dealers on this robot, which has also been developed together with the dealers. This gave the dealers the possibility to share any inputs on the layout of the email and which information that is vital. Most importantly, as expressed by Kristoffersen (2022), is that this information is shared automatically with the dealer without any manual involvement. Noticeably, this has so far only been implemented in the Nordic region, but there are plans to further develop this in Europe. Kristoffersen (2022) presents that this was a way for the process to gain more visibility, without the need to develop a whole system.

4.3 Information Flow

Vendrame (2022) discusses that the dealer needs information in every step taken when they have placed an order, for instance, they need to know if the part is available or not, when they will receive the order, when it has been shipped and which carrier that is used. This is important for tracking where in the process the order is and how they can follow up in case there are disruptions. He continues to relate this process to the information that is often given when a

private individual orders something online, which enhances the customer experience since one can follow when the order will arrive. The dealers need to get clarity throughout the order process from order to delivery so that in case there is a problem, they will be able to plan for it. In general, the DFS will show the dealer the instant availability, hence, they will know if they will get their order or not. If the part is available there are standard lead times depending on which order type is used, and the dealer knows when they can expect to have the order delivered (Vendrame, 2022). Vera-Alvarez (2022) adds that the dealer will see if their order is available at their closest warehouse or sent from a CDC and in this way they will know that the lead time will be slightly increased if the order is sent from CDC.

Kristoffersen (2022) discusses that internally, they have good visibility, which is until the pallet is leaving from Ghent. Every pallet is being checked out from Ghent, but there is no scanning of what is leaving the warehouse on part level. This implies that when an order has left the warehouse, the control of the shipment's location is lost. Aligned with this, De Rudder (2022) explains that the shipping department's responsibility stops as soon as the goods have left Ghent and another department is in charge of monitoring the in-transit leg. Further, for container shipments, he explains that it is the receiving market that is responsible for the tracking after the containers have been loaded onto the vessel, for instance, it is RDC Sydney that is responsible for shipments going to Australia.

This would be important for the dealers to be able to follow, however, something that is missing in Europe and region International (Vendrame, 2022). Vera-Alvarez (2022) argues that the order process is rather manual when it comes to providing information since no information is provided automatically. If there is a wish from SML's side to receive information on where an order is after it has left the warehouse, this must be done manually by contacting the transporter. As an order is shipped, SML is provided with a tracking number, however, there is no connection in place between the tracking numbers provided and SML's internal order numbers, hence, generating a need for using coherent reference numbers (Vera-Alvarez, 2022). All missing information drives inefficiencies for the dealers' operations, according to Vendrame (2022), the efficiency gains of receiving information at an early stage are hard to quantify. He continues with the example that if the dealer has a repair scheduled that cannot be performed due to an order not being delivered as scheduled, the dealer does not get the information about the delay until they notice that the part did not come as planned. This will ruin the whole schedule for the dealer, while if they would have received the information about the delay earlier, they could have planned for it better.

It is evident that the lack of information about where in the chain their orders are one of the challenges faced by Penta. This concerns both being able to deliver information to the dealers, as well as it is generating uncertainties for Penta since they are also unaware of which stage the orders are in. If there is no visibility on when a stock order is to be delivered and the delivery precision is unstable, uncertainty in the process is created. This increases the risk of dealers making a day order instead, in many cases with air, simply to be certain that what they need will be delivered in time. If the dealers would have more information on when orders are to arrive, this could be hindered (Vera-Alvarez, 2022). A hindering factor to the transport

visibility, as discussed by Kristoffersen (2022), is that when orders are in transit, only the entire truck is being scanned, and not every single pallet. She further argues that it would require a huge investment in order to develop such a tracking system. Vera-Alvarez (2022) further adds that the case is similar when transportation is carried out by deep-sea shipping, where SML is lacking information on exactly which orders are loaded in each container. In contrast to this, as previously mentioned, De Rudder (2022) presents that in Ghent, they have information on what has been loaded into the containers since everything is scanned. In addition, it is possible to obtain information on which goods are packed in each through the invoices sent out from Ghent to the receiving warehouse. Although possible, one has to go through several systems before finding these connections, which is presented as a weakness by De Rudder (2022). There is a lack of connection between the systems, which have been addressed within the organizations however, there are currently no solutions implemented. Aligned with this, Athanasiadou (2022) presents that the service center in CDC Ghent does share all shipment information available with the RDCs, which implies the information generated from Ghent when loading containers, as presented by De Rudder (2022). She further states that it is the RDC's responsibility to share this information with the dealers.

Athanasiadou (2022) presents a reporting tool used within the organization for follow-up and status point tracking of the shipments, which all RDCs have access to. In this tool, they can follow up on lead times on all shipments divided into the internal lead time before the shipment is sent to the port and then the external lead time being the time from when it has left the warehouse until arrival. The tool enables the user to see information on when the container was at certain steps in the process. All information that concerns the external lead time is automatically generated from another system called Atlas, which is a Volvo system that is connected to all shipping lines. Atlas is the system used for making the bookings with the shipping line and all handling of the container is reported into Atlas, which is then interlinked with this tool. In addition to having access to the tool, the RDCs do also receive weekly emails with the transport documents connected to each shipment including the ETA of the vessel to the receiving port. In particular, information is found in the Bill of Lading which states the container numbers and invoice numbers, hence the RDC should through this be able to track the shipments and find which orders are on their way through the invoices. Although the RDCs do receive or have access to all information necessary to be able to track shipments sent out from Ghent, Athanasiadou (2022) describes the process of utilizing the information available and tracking orders from it as very manual and not very straightforward. She continues by explaining that they work with many different systems, not only within the Volvo organization but also with the shipping lines, resulting in difficulties to get enough information available on part level, however, the information is in fact available if one searches for it manually. She also addresses that some delays, such as delays in the clearance of goods, are hard to follow up on part level as they cannot know which containers will be cleared when.

Åkerström (2022) addresses that without transport visibility, SML does not receive any confirmation on when the order has been delivered to the dealer. Hence, unless they are made aware of any discrepancies from the dealer, they assume that the order arrived as it should. Vera-Alvarez (2022) continues discussing this as a matter of creating credibility and that

providing dealers with any information available is better than nothing at all, as also expressed by Vendrame (2022).

4.3.1 System Visibility

Another factor that is making information distribution more complicated is that the Volvo Group has many different systems that are used for different tasks. For instance, they have one order system and another inventory system, which are not always integrated. Some of these systems have been used for a very long time and are not very modern in today's setting. Further, the dealers also use their own systems which are not connected with Volvo's. It is complicated to both integrate current systems and implement a new one into the existing setup (Vera-Alvarez, 2022). De Rudder (2022) also expresses concerns for the shipping department that they are indeed working in a very old system, which might be serving the basic purpose, but it is outdated and has become a bottleneck for the operation. They are lacking one single aligned system, instead, they are working with several different system systems not integrated with each other, and this is causing challenges. De Rudder (2022) further explains that for instance for the container flows they have an Excel file that states all shipment details, including the invoice numbers linked to each container. He believes that other departments do have reading access to this file, but it implies time-consuming manual searches to find the right information and then link the invoices to the correct orders. He explains that they are currently using several add-ons outside the main system, and they do have plenty of data but are lacking ways to interlink and use the data. De Rudder (2022) expressed that the shipping department would not find as much added value from these linkages in their operation. However, it is a weakness in the system which likely reduces the visibility further on in the chain, hence, affecting the end customer and experienced service level. For trucking within Europe, the process is even more manual, as they must search in the paperwork from previous days in order to find the invoices connected to every truck and through this see what has been shipped in each truck. Hence, this is extremely manual and not a very user-friendly way to find information.

Vera-Alvarez (2022) explains that there is currently a transport management system (TMS) that is used in some parts of the Volvo Group, and there is an aim to implement TMS in all of their SDCs, however, Volvo Penta has no part in the TMS today. De Rudder (2022) expresses a need for the whole organization to have a significant system change to become better "... and we want to be the best, then we need it" (De Rudder, 2022). He believes that the usage of workarounds like the excel file mentioned which are not interlinked with the system itself is not the way forward. He acknowledged that this shift would be challenging and require substantial investments, however, necessary to ensure future performance.

4.3.2 Proactive Information

It is presented by Vera-Alvarez (2022) that Penta is lacking a working system that can deliver relevant information to the Penta dealers. He also points out that it is important to share information that is beneficial for them, sending out a huge amount of emails telling them about what is happening at every step in the process might not be useful. In addition, Vera-Alvarez (2022) also points out that all information should not be pushed out to dealers, however, a

dealer should be able to access information when needed as well as be alerted when there are events that will affect the deliveries. He expresses a need for having a more proactive approach, which is also stressed by Vendrame (2022) who states that the dealers have expressed wishes that they want to have proactive information and not be the ones who have to look for the information themselves. However, Penta is today very reactive in its behavior, much because they are not made aware of any issues until the dealer contacts them to tell them that the part did not arrive as it should have, it is not until then people take action to solve issues.

Vera-Alvarez (2022) presents that as of today, there is no information regarding the transportations that is forwarded to the dealer, except within Region Nordic as presented by Kristoffersen (2022). Vera-Alvarez (2022) also states that if they were to be more proactive in providing information about any discrepancies during the process, dealers would be able to better plan and perhaps realize that some orders can be delivered the next day without causing any issues for their business. However, delivering this information too late, or not at all, hinders the ability to make good decisions. In connection to this, Kristoffersen (2022) states that it is the service center's role to report any disruptions that occur in transportation to dealers. This could for instance be to report that there is a disturbance at a transporter affecting the delivery of an order. Vendrame (2022) says that there is an ongoing project in Europe that aims to ensure that Penta receives the carrier information, however, at the moment the project is not progressing very fast although they are very positive to see what this project will bring. He continues that in the meantime, the robot emails sent out by the service center are a workaround for this issue. The dealers have expressed that they think it is good that there is a workaround, but they want to be able to follow their orders in the DFS and not need to use different interfaces to get information.

In relation to this, Vera-Alvarez (2022) also discusses a need for offering a platform where dealers can access information in an easy and user-friendly way and there is a need for a better shared platform where dealers can access enough information to follow the order flow. They should be able to access information on when an order has been picked, packed, shipped, be able to follow the in-transit journey as well as be made aware of any disruptions. Vera-Alvarez (2022) discusses that, for instance, it would be advantageous if SML could inform that a delivery is delayed by two hours. It is desirable to be able to provide information that could facilitate better decision-making by the dealers in their operation, and Vera-Alvarez (2022) continues stating that the least information necessary to share with the dealers is when a certain order is shipped and which articles it contains.

Both Vera-Alvarez (2022) and Vendrame (2022) discuss a wish for having a culture within the organization that works more proactively with service and support. In connection to this, Kristoffersen (2022) argues that increased visibility and better proactivity could have an impact, however, she also points out that the dealers play a role in this, and the level of proactivity varies between the dealers and there is room for improvement from their side as well. However, although a dealer has had a proactive approach when placing orders, due to the prioritizing hierarchy, there is a risk of this not being awarded and instead, a VOR is prioritized for that article. This has a negative impact on the trust in the system. Vera-Alvarez (2022)

addresses that in some cases, there is a need for a behavioral change among the dealers, for instance, they could be more patient and accept a slightly longer lead time instead of placing VOR or day orders by air. He also discusses that if they were to have a more reliable system where dealers can trust that orders actually will get delivered on time, this could decrease the number of unnecessary VORs and day orders.

4.4 Sustainability

Within SML there are targets to reduce CO_2 emission by 30 percent by 2030 and there are ongoing projects to better be able to calculate the CO_2 impact, both on an aggregate level but also on a dealer level. If this information was available, it would be possible to forward it to the dealers, together with the differences in CO_2 emissions based on their choice of order type and transportation mode. For instance, the differences between placing an order as a day order by truck instead of a VOR by air, in which the lead time might only differ by a few hours. If this information was available and forwarded to the dealers it might change the behavior of only looking at the fastest lead time for some of the dealers (Granic, 2022). Vera-Alvarez (2022) adds to this by stating that fewer VOR orders would result in less CO_2 emission, and the dealers also to some extent have the responsibility regarding this. He believes that increased visibility of the emissions could facilitate behavior changes.

4.5 Dealers

To begin with, all three dealers believe that the order system as of today is in general working fairly well, however, they all express that it is a bit old-fashioned and not very up to date. They all acknowledge that there is plenty of room for improvement while they at the same time realize that Penta is a large organization, and it is understandable that changes therefore can take a long time to implement. Dealer B (2022) emphasize that in particular, the process of ordering VORs is especially manual and would prefer an easier process.

For Dealer A and Dealer B which both operate in region Nordic, their orders will be fulfilled from either the SDC in Eskilstuna or if not available there, from CDC Ghent. Dealer C on the other hand, operating in Australia will order from the RDC Sydney and if Sydney cannot satisfy their need, the order will instead be shipped from CDC Ghent. In most cases, the orders from Ghent will transit through the RDC in Sydney before being distributed to the dealers. Dealer C (2022) presents that, compared to the Nordic region, they have for obvious reasons significantly longer lead times for orders shipped out of Ghent. For stock orders the normal lead time is up to 3 months, day orders have 10-14 days, and VORs 7-10 days, which they believe is reasonable given the long distance from Ghent to Australia.

Dealer A (2022) expresses that the mode of transportation is not of great importance for them, most day orders are today shipped by air or truck. However, they do not give much thought to which mode of transport is used, instead, the important factor is that they actually receive the parts on time. Dealer C (2022) presents that due to the distance, day orders and VORs are

naturally sent by air from Ghent, if the part is not available in the RDC Sydney, whereas stock orders are usually shipped by sea freight.

4.5.1 Order Type Behavior

When it comes to the choice of order type, Dealer A (2022) explains that they are often placing day orders when they have work assignments, and a specific part is needed. They further mention that they have discussed the choice between placing day or stock orders with their customers. However, since most repair shops do not want to invest in a big inventory, they rather pay slightly more to get the parts when they are needed, and as long as they receive them within the expected lead time. They believe this to be more beneficial for them than keeping parts on stock themselves.

For VORs, Dealer A (2022) states that they only use this for emergency cases where the parts availability is low or there are long backorders, which would imply that placing a day order would not be fulfilled. However, they express uncertainties about how the VOR process actually works. When they have an emergency case and the parts are not available as a day order, they can place a VOR through Argus which is usually approved, and quickly solved. Dealer A (2022) continues stating that they sometimes have day orders on important parts that are backordered and which they are waiting for, but if they place a VOR then suddenly it is delivered the next day. They do not know from where this part is delivered but their perception is that there is some backup stock not included in the stock balance visible in the DFS. Dealer B (2022) has a similar perception that there is a stock that is not visible for them in the DFS, but that there always is some extra stock available for VOR orders. If they then see that the stock level for a part is very low, they choose to place a VOR instead to ensure delivery. This is especially true if they have a critical case, however, sometimes they choose this option even though there is not a critical VOR case behind the order, simply to make sure the parts will be delivered. They further express a wish that it should be easier and less manual administration to place a VOR. Aligned with other dealers, Dealer C (2022) also expresses that they are placing day orders when they have work assignments in which the parts are needed. They further state that they do not place VOR orders unless they do have a critical case that needs to be handled, for them, there is no major difference in the lead time for a day order or VOR order due to the distance. When they place a VOR, they get better visibility in terms of more direct communication with the VOR team in Australia, who can only answer when an order is leaving RDC Sydney. He states that the VOR team is very helpful, they normally send an email if they can detect a delay and give an approximate time that the dealers can expect delivery. However, as presented by Dealer C (2022), it is not visibility in terms of locating the order precisely and how it is progressing in the supply chain, but rather that Penta has acknowledged that this is a VOR order, which is a priority and will get prioritized throughout the process.

4.5.2 Prioritization

The prioritization rules described earlier do sometimes also cause uncertainties. Dealer A (2022) suggests that it would be fairer if a first-in-first-out principle was used to a larger extent. They also stress the case where they might plan well and place a stock order, this one can get

backordered and would then have the lowest priority given its order class. However, if they then place a day order for the same item, this one will arrive the next day since it has a higher priority, which is presented as being quite illogical sometimes. Further, this encourages them to place more day orders instead of stock orders, since even though they do their planning and place stock orders, it will not pay off and instead they choose to place a day order to ensure deliveries and hence, maintain better customer service. Dealer B (2022) also discusses the uncertainties caused by the prioritization rules and states that they would choose to place a day order instead of a VOR, even if available stock is low, if they could trust that it would be allocated to them. However, they express that since they cannot know if someone else will order the same part during the same day, they often choose to place a VOR instead of a day order when the stock level is low to ensure their order will be prioritized and delivered in time. They continue explaining that since both themselves and their customers are aware that stock orders have the lowest priority, they are likely to place a day order or VOR instead. They express that if they would have completely trustworthy information on stock levels and if the availability were good, more stock and day orders would be placed and fewer VORs (Dealer B, 2022). Dealer C (2022) also agrees that it would be important for them to be able to see if a part has been allocated to their order, in their case due to the distance from Ghent. They believe that having this information would be very valuable and help prevent issues for them and their customers.

When discussing the prioritization rules and how they sometimes affect the dealers, a statement made in one of the interviews was that “It is pretty stupid that those doing the planning and really keep up their stock are the last ones receiving the goods.”

4.5.3 ETA Issues on Backorders

One issue highlighted by all dealers was the lack of accurate ETAs on backorders. When an order is on backorder, the dealer should get an ETA on when the parts are supposed to be back in stock in the warehouse. Dealer A (2022) describes that they sometimes get an ETA but not always, and when they do get an ETA, they state that it will most probably not be kept and that “it is so uncertain that it is completely unnecessary” (Dealer A, 2022). Before, they used to keep track of the ETAs themselves in order to deliver the information to their customers on what and when they would be able to deliver. However, since they noticed that the ETAs are far from accurate, they stopped giving out this information as it only created more uncertainties. Dealer A (2022) continues to relate this to the prioritization rules and states that if you have a stock order on backorder, one will never know when that part will be delivered since incoming day orders or VORs will always be prioritized before, hence, taking the part from the stock order they placed. They explain that this is also a reason why they choose to place more day orders instead of stock orders.

Dealer B (2022) explains that when they have placed an order, they receive an order confirmation. The following morning, they will get an email informing if something in the order will be delayed or is out of stock, and in that case along with an ETA. However, as Dealer A also describes many times the ETA is missing. In contrast to Dealer A, Dealer B (2022)

believes that when they do receive an ETA it is quite accurate, however, when the ETA is missing or is incorrect, they have to spend a lot of time searching for the information themselves. An approximate estimation given by Dealer B (2022) is that the ETA is accurate 50 percent of the time, and in contrast to Dealer A, they always deliver the ETA to their customers. When the ETA deviates, they have to place an Argus case to investigate the new ETA with Penta. The service center often responds quickly, however, they seldom give a helpful answer directly since they must investigate internally which results in it taking several days before they receive a final ETA. Similar to what Dealer A discussed, Dealer B (2022) also believes that a more trustworthy ETA would affect the type of orders they place. They argue that this could result in fewer VOR cases, although they will always have critical cases which need VOR treatment, the ability to trust the ETA would imply that they could choose to place a day order instead more often. Further, they state that they would like to receive more information from Penta if the ETA changes through, for instance, an email instead of them having to chase the information through Argus.

In the case of Australia, Dealer C (2022) presents that they receive backorder reports, but no information on an ETA is included. The question arises many times from their customers, but it has been concluded that no ETA information should be given out within Australia since prioritization rules create disruption, which affects Australia to a very large extent given the geographical distance. For instance, VOR orders always pose a risk of stealing the backorders, which could result in a substantial wait before that part can be delivered to Australia again. Dealer C (2022) presents that the week prior to the interview, they had 340 orders listed as backorders, 18 of which were delivered to them the week of the interview, and they were completely unaware that they would arrive.

4.5.4 Visibility

This section will be divided by region since the Nordic and Australian markets are significantly different in their nature and hence experience different issues.

4.5.4.1 Region Nordic

Dealer A (2022) presents that they are experiencing issues with their order deliveries. Day orders are usually being delivered the next day if it has been placed before cutoff, but whenever a day order is not delivered as expected it results in much effort locating where it is. In most of the cases when an order is lost in transit, Dealer A (2022) presents that they make a discrepancy report through Argus, ask them to send a credit invoice for the order, and then place a new order for that part again. Sometimes the first order shows up later, sometimes not, however, Penta bears the costs for the late or lost order. If the missing part arrives the next day, then they report it to Penta who decides how to handle it, either it is returned to Penta, or the dealer receives a new invoice for it and keeps it. Dealer A (2022) presents that for locating a shipment, they have the possibility of receiving the airway bill and tracking it through the transporter's websites. However, it is not always very accurate, often simply stating that the package is in transit but no specific information on where. It is further presented that if they were to have

better information on delays, it would save them time and discrepancy reports could be avoided if they knew that the order is just a few hours late.

Dealer A (2022) presents that tracking information is provided to them through an email each morning sent from the service center, including an excel table with information about all the shipments. It is presented that from there, they have to find each order themselves and, in some cases, all orders are not included. This is discussed as being a too complicated way to follow up on delivery of their orders and although the tracking links are helpful, they are not always functioning. These emails are presented to be somewhat beneficial, however, all orders are not included and, in those cases, they have to make an Argus case of the missing order. It is evident from the interview with Dealer A that the emails to them are deficient and that they do not use these emails to a very large extent in their operations.

Dealer A (2022) expresses a wish to be able to trace the parts when they have left the warehouse in Ghent until they arrive at their own warehouse, as this would be very helpful for their operations. The Nordic dealers are however somewhat contradictory in their perception of in-transit visibility, where Dealer B (2022) stated that the tracking is not an issue for them and that they can track most of the orders sent to them through tracking links, which in the majority of all cases works well. Dealer A (2022) presents that for their stock orders and VPIM, they are made aware that an order has been shipped from Ghent through an invoice. After that, they are lacking visibility until the order arrived at their warehouse. Although it is beneficial for them to know when parts are leaving Ghent, it is stated that "the only thing interesting is when it is arriving at our warehouse" (Dealer A, 2022). What they imply with this is that if they would be able to track the order, they would have this information and hence, they would be able to have time to prepare for handling the orders. This is especially for larger orders and knowing 1-3 days in advance is presented as desirable. Further, they state that they do not automatically receive information that an order has been picked and packed, however, they can go into their order system and search for order status themselves. This is presented as a very manual and time-consuming process, as they are required to check line per line to find relevant information regarding each order. In some cases, all parts are not included in the same packing list, parts are delivered on different pallets or places as a backorder and there is no clear structure that distinguishes this. The process is the same for day orders, they can see the order status and once it is invoiced, they can be certain it has been shipped.

4.5.4.2 In-transit Visibility - Australia

When it comes to Dealer C (2022) located in Australia, the situation is somewhat different, as the lack of proper visibility for the shipments from Ghent to Australia is causing many issues. As mentioned earlier, they have a 10–14-day transit time for all day orders coming out of Ghent, which is presented as being completely acceptable and satisfies customer expectations due to the geographical distance, given that deliveries are consistent. However, as of today with very unstable deliveries, Dealer C (2022) expresses a wish to have better visibility through the whole process. Due to the distance and current difficulties with getting slots on planes going to Australia, orders have been severely delayed, and they are not receiving information about the delays, which is causing issues. When they tell their customer that the lead time is expected

to be 10-14 days, they are satisfied with that given the distance, "…and when it actually arrives within this time, they are thrilled" (Dealer C, 2022). However, when delays occur, if they at least would be able to give them information that an order is on its way, it would improve the customer experience.

Dealer C (2022) presents that they receive an invoice when RDC Sydney has received the goods, packed, and shipped the order. A tracking link is also provided which allows them to have good visibility of the shipment within Australia. What is important to note is that the order has to reach Australia before they are made aware that the order is on its way. Hence, they have no visibility on the order until the invoice is received from Sydney, which is stressed as being a critical issue for them. Not being able to have in-transit visibility generates many Argus cases as this is the only way they can locate an order before it has reached Sydney. Many times, stock orders are in transit, but no one is able to locate them. If they contact their Argus team and request a certain part, the Argus team often does not know that a shipment is about to arrive in Australia the next day, including these specific items they are requesting. If they place an order knowing that the parts are available in Ghent, they consequently expect the order to arrive within the set lead time of 10-14 days. However, due to the lack of visibility, they are completely unaware whether the parts have actually been allocated to them, if there has been a freight delay or if any other issue has occurred. It is further presented that they cannot look into any system to see whether an order is on its way to Australia or has even left CDC Ghent. To receive a notification on when items have left Ghent is presented as something that would be very valuable for them. Dealer C (2022) presents two examples of when orders got lost in transit, where not even SML could identify where it was located, only for the orders to arrive at RDC Sydney quite shortly thereafter.

It is desirable for them to have the same insight into CDC Ghent's processes similar to what they see today in RDC Sydney in terms of order status. Since their visibility is limited to RDC Australia, all matters beyond are handled by Argus cases. Dealer C (2022) states that RDC Sydney informed them that the number of Argus cases has increased from approximately 30 to 40 cases a day, to 380 due to today's situation with supply chain disruptions. All of these concerns parts request, ETA information, lead time, among others. Dealer C (2022) presents that in-transit information should preferably be included in the DFS, along with information on availability. Although increased visibility for all order classes is preferable, it is stated that visibility on day orders is most crucial, especially in cases when they cannot meet the expectation on a lead time of 10 to 14 days.

4.5.4.3 System Visibility - Australia

When placing an order in the DFS, they can only see if the item is available in the Sydney warehouse, and no information is seen on the availability in Ghent, which they express would be beneficial. There is however a workaround in the system where they can see Ghent's stock levels, though not when placing an order. What they can do is to search part numbers individually at Ghent's stockholding and see each part individually, however, a process presented as an untenable task. Dealer C (2022) explains that if they would be able to see both

warehouses' stock levels on the same interface, it could benefit them in their order decision-making process. For instance, if an order is partly filled by RDC Sydney and partly by CDC Ghent due to stockouts in Sydney, and they had better visibility on this, they could plan accordingly with the prolonged lead time from Ghent. It is further expressed that as the situation is today, there are some quick wins possible for them by only making smaller changes. Some of the information needed on order status is already in the system, but not available where it should be on the same interface.

Dealer C (2022) states that they are only made aware that an order is late when their customers call them and notify them of it and the process is then to make an Argus case to locate the order. In some cases, it takes several days to receive an informative answer, resulting in even further delays in simply receiving information on where the order is. He expresses that the service center can only give general updates, such as the reasons why it is delayed but no further details or estimated arrival. He further states "we understand that, and the customer and dealer understand it at the moment, because of what is going on in the world. But, if everything goes back to normal, they are not going to accept that in 2023." (Dealer C, 2022). They express that if they would receive information about when delays occur and could trace their order, this would considerably decrease the number of Argus cases. They believe that about 80 percent of the cases could be avoided, as the vast majority of them today concern locating parts. This would also help them in having confidence that parts in fact are on their way. They emphasize that being able to see that an item has been allocated to them would be "the bare minimum, really. And if they can do it in Sydney, they surely can do it in some form in Ghent" (Dealer C, 2022).

Dealer C (2022) stated that an increase in visibility would generate better customer success and in general decrease the number of inquiries in their network. He states that if they would be able to simply go into a system to see the status of an order, whether it has been shipped or at least allocated to them, this would generate more credibility and give them the tools needed for managing customer relationships and to achieve the customers' expectations. Dealer C (2022) states that a year ago when there was consistency in the shipments, their customers could expect a 10–14-day lead time until they (Dealer C) had the goods and then their customers knew that after those days it would take another few days until it arrived at their door. When the process was more stable, they were able to better handle customer expectations. As the situation is today, they can have unpredictable delays for up to several weeks, resulting in an unacceptable situation from a customer service perspective.

4.5.5 Consolidation and Order Numbers

Another issue raised by the dealers concerns when they receive parts at their warehouse and the corresponding invoice. Dealer A (2022) discusses that when they place an order in the DFS, they already have an order number for the order generated by their own system. This order number is then entered into the DFS and should follow through in the Penta system and be included on the invoice, enabling them to more easily match the orders between the systems. However, this is not always done and instead, Penta sometimes uses yet another order number

which complicates things even further and it becomes difficult to match an invoice to the order in the dealers' internal system. This issue is especially the case for backorders which often receive a new order number, resulting in a lot of additional manual handling when parts arrive at their warehouse since they cannot easily match the incoming goods with the invoices received and therefore need to more thoroughly count everything. Further, this sometimes leads to them having old unfulfilled orders that according to their system have not been received. However, they have been invoiced from Penta which indicates that they then have been taking the order into their stock but due to the difficulty with connecting orders to the right order number they have connected it to the wrong order number in their system, hence, the systems are not aligned. There are packing lists included in most of the deliveries, however, these are sometimes not complete. There is a wish for Penta to include more clear order information on the invoices and onto the pallets delivered. As expressed by Dealer A (2022), they should at least include their original order number, so it is possible to search and find the order in the system.

Dealer B (2022) agrees to the issue with changing orders number and further connects it to the consolidation of orders. They describe that Penta is consolidating many orders and when this is done, a completely new order number follows for the consolidated shipment. This new number should follow all the way to both their internal order number and Penta's original order number. This is however not always the case, especially when larger orders are placed, resulting in them having to manually connect the deliveries to the respective orders before taking the order into their storage. This is creating daily issues for them in connecting new order numbers with the original ones, and Dealer B (2022) believes that even if Penta were to consolidate the orders, the numbers originally given from Penta should follow through. Dealer B (2022) continues mentioning a recent example where they received a very large delivery which included several consolidated orders and the original order numbers were missing which led to them having one person working several days to just sort out the shipment into the correct orders and invoices.

Dealer C (2022) on the other hand does not agree with this issue, they only find the issue with changing order numbers in VOR cases, which for them is such a small part of all orders that it is manageable.

4.6 Summary of Empirical Findings

The main findings from the empirical data are summarized below in Table 2. This table will serve as an overview of the empirical findings in order to ease for the reader.

Sections	Main findings
4.1 Order Types	Three order types: stock order, day order, and VOR. There is a prioritization hierarchy between them, which has led to a misuse of the setup by some dealers to ensure fast delivery of parts.
4.2 Distribution System	CDC, RDC, and SDC which all serve different purposes in the distribution setup.
4.2.1 Transportation Setup	Different modes of transportation depend on the geographical distance and required lead time. Trucks run on a fixed schedule and containers are booked when needed. Air transportation for urgent orders when the geographical distance requires it.
4.2.2 Transportation Costs	Invoicing on an aggregated level. Dealers are unaware of the cost per shipment, not reflecting on the costs when deciding which order type to place.
4.2.3 Backorders	ETA is delivered to dealers on their backorder, however, very low quality of the information. Penta is struggling with delivering accurate ETAs, partially due to today's supply chain disruptions. The prioritization hierarchy complicated the issue further.
4.2.4 Service Center	Assists the dealers in having as much uptime as possible. Handles all Argus cases manually, the majority of which are VOR cases. VOR cases have increased recently due to supply chain disruptions. Service Center Nordic sends out tracking numbers to Nordic dealers.
4.3 Information Flow	The information is available in DFS but does not cover all stages of the order process. Lacking the possibility to track orders in transit. A manual process to provide information, where all missing information drives inefficiencies for the dealers' operations. Much information is available but not forwarded properly through the systems, due to a lack of integration. Lack of visibility results in dealers choosing higher prioritized order types.
4.3.1 System Visibility	Many different systems in place which are not integrated. Some of them are not up to date. Many workarounds are used in the daily operations and manual processes to retrieve information. Outdated, non-integrated systems become bottlenecks in the information flow.
4.3.2 Proactive information	Wish to be more proactive within the organization, more reactive today partially due to lack of information. Information should be available in the DFS. Dealers should be able to access necessary information, not ask for it. Proactive information could impact dealer behavior.
4.4 Sustainability	Target to reduce CO_2 emission by 30% by 2030. Having increased transparency on the CO_2 emission might affect dealer behavior.
4.5 Dealers	Tendency to place higher prioritized orders to ensure delivery – better visibility would decrease this. Prioritization rules affect the choice of order type and good planning is not rewarded. Great uncertainties in ETAs which generate more day orders and VORs. Different needs for visibility depend on the region, but it is lacking overall. All discrepancies generate Argus cases, mostly due to lack of visibility. Manual and time-consuming process to find tracking information. Lacking information on delays. The issue is worse in Australia due to longer lead times. Wish from dealers to have all information gathered in the DFS. Increased visibility would generate customer success and decrease inquiries in the network. Nordic dealers experience an issue with changing order numbers for backorders.

Table 2: Summary of Empirical Findings

5. Analysis

Below follows the analysis which begins with a discussion of the empirical findings received from the interviews and how these are connected to what was found in the literature. Aligned with the structure in chapter 4, each subject is presented and analyzed per subject as a way to more easily match the patterns. Further, suggestions are presented on which measures could be taken to increase the visibility of the process. Throughout the entire analysis, the discussion is only made with connections to Penta. This is somewhat incorrect as many parts of their operations addressed are conducted by SML. However, the decision was to only refer to Penta in this chapter, as a way to facilitate and simplify for the reader.

5.1 In-transit Visibility

The inability to follow shipments in transit from the warehouse to the dealer is described to be an issue from both Penta themselves as well as by the dealers. In Region Nordic they do receive an email from the Service Center including tracking links so that they can follow their orders through the carrier's website. One of the Nordic dealers did seem to think that the visibility this provides is good enough and not really an issue for them. However, the other Nordic dealers were not as satisfied with this, although they express that the email with tracking links is helpful to some degree, they believe that it is still too complicated and implies unnecessary administrative work. This is due to it being a manual process in combination with the vast amount of tracking numbers that are forwarded from the service center. In addition, they state that the tracking links provided are not always functioning which, hence, takes away the little visibility they would have with a functioning link completely. According to Dealer A (2022), the main issue with not being able to track their orders in transit comes when there are discrepancies, for instance, if an order is late. In relation to this, Goel (2010) discussed that the ability to track shipments can have a huge impact on the reliability of delivery. Increased visibility would also facilitate better decision-making around discrepancies, as elaborated on by Caridi et al. (2014) since information about in-transit delays or disruptions would allow managers to plan around it which consequently would increase efficiency and possibly avoid additional costs generated from unforeseen delays. As addressed by McIntire (2014), visibility can be argued to be a solution to those challenges faced in a supply chain. This is arguably very applicable to this case since if dealers could track their orders better and be aware of delays, they would be able to plan accordingly and not feel the need to place an Argus case reporting a late order. Hence, the system would become more reliant and better visibility would imply less administrative work for both the dealers and Penta due to fewer Argus cases. In addition, it would likely decrease the number of extra orders sent out to dealers that are aimed to replace the lost order, which might not in fact be lost. This would bring cost and environmental savings as well as generate efficiency gains and better customer service.

It is arguably the case that geographical location might affect the need for visibility, as addressed by Vera-Alvarez (2022). He argued that for distances with a rather short lead time, the need for transport visibility might not be as important. This is somewhat applicable to this case, and although it seems to be an issue with lacking visibility for one of the Nordic dealers,

the issue is perceived to be significantly larger for Dealer C located in Australia. In particular, they do not have any visibility at all for orders shipped from Ghent, which is causing issues. Dealer C (2022) argued that if Penta would be able to at least inform them them that an order has been shipped from Ghent and is on its way to Australia, this would be very beneficial for them and could improve the customer experience. As De Rudder (2022) explained this information should already be available for the RDC receiving the goods, although through a very manual process. The very manual process to retrieve this information is clearly one explanatory factor to why information does not reach the end-user, hence lowering the visibility and decreasing efficiencies.

In addition, although it would likely be positive for Dealer C to know that goods are on their way to Australia, one needs to keep in mind that the prioritization hierarchy still can complicate matters. This is since an order shipped from Ghent is not certainly allocated to a specific order before it has gone through and left the RDC in Sydney. Even though a part is shipped with the objective to fill a certain order it can be the case that during transit, another order with a higher priority comes and steals that part. With that in mind, it would still be highly appropriate for Penta to make sure that information is forwarded when goods are shipped from Ghent to their destination. This would eliminate situations described by Dealer C where goods might arrive in Australia within the next few days without anyone's knowledge. This is not only applicable to Australia but rather to all markets globally where similar issues might be present. One solution could be to make sure to forward information that parts have left Ghent to Australia, along with the information that these parts will be allocated to their order unless a higher prioritized order is placed during the transit time. If the part is reallocated, the dealer should immediately be notified. Further, when the part has reached Australia and gone through the RDC, the dealer should receive a new final notification that the part is certainly allocated to them and on its way. This would allow for better transparency for all parties and a possibility for dealers to plan better and decrease uncertainties. Moreover, having in mind that the containers are not booked on a fixed schedule but rather booked when Ghent decides the need is there, is also important information to forward. The decision to not book a container will directly affect the lead time for arrival at the dealer, which is arguably important information to pass on to the dealers so they will be able to plan accordingly. One additional suggestion discussed during the feedback loop is to implement a hard allocation rule for orders going overseas, for instance to Australia. This would imply that a part is allocated to a specific order when it leaves Ghent regardless of incoming orders during the transportation. Implementing a hard allocation would generate more credibility for the dealer and ease their planning. It might also reduce the number of VORs that are consequently placed when a part is stolen during transit, which in turn generates huge costs and CO_2 emissions. This suggestion is supported by the authors, although this option could bring challenges in the lead time for VORs, hard allocation could result in a more stable process.

Although precise tracking information in some cases might be missing for all parties, in this case, the information that goods have in fact left the building in Ghent towards Australia is there, as described by De Rudder (2022). What is remarkable is the fact that Athanasiadou (2022) presented that information including shipping details and tracking possibilities is in fact

sent out to the RDCs from Ghent. In the case of RDC Sydney, they should have all the information needed in order to track the incoming container shipments, which one could argue should bring a sufficient level of visibility. It was stated by Dealer C that their perception when communicating with RDC Sydney is that they do not have this information and are therefore unable to track any incoming containers. One might therefore question why this issue is present and at which stages in the process the information flow is disrupted. What is noticeable, and to some extent, a great weakness for Penta, is that similar contradictions between Penta employees are present at some places in the empirical findings as well. For instance, there is a perception from one of the interviewees that there is no information available on what has been loaded into each container. This was however contradicted by another interviewee, who stated that this information is in fact available, which could be argued as concerning since it implies that there might be a lacking understanding of the whole process from people within Penta, which likely worsen the information flow even further. This does not only result in a lack of understanding of the whole chain but could also imply that there is an unawareness within the organization about available tools and solutions to find information. For instance, the tool presented by Athanasiadou (2022) does have a lot of the information that is discussed as missing for some parts of the process. Hence, if this tool would be used to a larger extent it would most likely generate increased visibility. However, the perception given is that those that would benefit from using it are either not aware of its existence or are simply not using it, for reasons unknown. The lack of a holistic understanding within the organization is arguably a great weakness for Penta.

The fact that information seems to not reach the end-user can be related to the discussion that Barrat and Barratt (2011) had about gatekeepers where information might get stuck at certain points in the supply chain and, hence, not reach the end-user. In the case of Penta, these gatekeepers are likely unaware of how to forward the information properly due to lacking routines. I might also be the case that those possessing the information might not understand how valuable it would be for the dealer to receive it. In addition, as discussed by De Rudder (2022), another gatekeeper is arguably the lack of integrated and up-to-date systems to facilitate information sharing. This is certainly something that needs to be investigated further to find out which information is available already within the organization and then develop tools and standards to make sure this information reaches the end-users. It was evident from Athanasiadou (2022) and also a general perception given from the interviews that the process of retrieving relevant information is very manual and cumbersome, hence, it is evident that a weakness in the system is the lack of easy access to the information needed, which could be the explanation to why information is not reaching the end-user. Automation of information flows is a good option to ease this problem, which would make better use of existing data. Since this is possible to do without substantial investments in new systems, this would be a good starting point to improve the situation. Automating such information flow would also decrease the risk of human errors and the risk of information getting stuck due to gatekeepers.

Vendrame (2022) compared the in-transit visibility that should be available to the dealers with the one often available when one orders something online as a private individual, where updates are often received on where in the process the product is. He argue that the same kind of updates

should also be sent out from Penta, which is reasonable to agree with. As Vitasak (2005) stated, visibility in the supply chain is dependent on the accessibility of data at any given stage in the flow, and for Penta, it is crucial to evaluate which data is already available and for which stages data is missing. This needs to be done in order to find solutions to better share existing data as well as to find solutions in how they can receive data on the stages that are lacking it today. This would then likely generate mutual benefits for every entity involved in the supply chain, including Penta, their dealers, and the dealers' customers. As McKinney et al. (2014) discussed, a lack of visibility has shown to hide everyday costs that could be avoided for many companies, in the case of Penta, visibility might facilitate finding hidden costs in their operation, which would allow them to act upon those. Moreover, it cannot be neglected that it would be a great challenge to properly implement the needed technical solutions to gain a high level of visibility for the whole supply chain, as also discussed by McKinney et al. (2014). Further, several authors discuss that few supply chains have sufficient levels of visibility today although being well aware of the gains it would bring (Somapa et al., 2018; Caridi et al., 2014; Goel, 2010), which is clearly applicable in this case, where in essence, every interviewee expressed wishes for changes in the operations that would generate higher visibility and the benefits that would bring.

It is difficult to suggest which level of in-transit visibility that is sufficient to implement, however, one could argue that a dealer should be able to trace all stages of the order process, including the transport leg. It is reasonable to demand the possibility to track orders which are aligned with the thoughts expressed by the dealers, hence, Penta needs to address this more. One suggestion to increase visibility is to only use carriers that can provide sufficient in-transit information, however, Penta also needs to ensure that they have a solid platform to make use of the received information. Hence, the main suggestion in regard to improving the in-transit visibility is to implement a TMS for the whole organization.

5.2 Order Types and Prioritization Rules

Although the different order types and the prioritization rules between them do have a purpose, it is arguably a root cause of unwanted behavior and misuse of the setup. This is something that was acknowledged during the interviews by Penta, addressing that the system as it is allows for misuse of the order process, however, it is at the same time a necessity for ensuring uptime. Having a system that generates more VORs than necessary also puts a huge strain on both costs and environmental performance from Penta’s side. The perception from the authors is that these two aspects were not emphasized enough during the interviews, although it is understandable that their goal is to secure uptime, these aspects should be neglected. It was also discovered from the dealer interviews that there might be a knowledge gap from their side in how the different order types are working, especially the VOR orders. Both Nordic dealers showed a lack of knowledge of how the VOR setup is functioning and how it is supposed to be used. Although a VOR case triggers a search for parts from other sources, if not available in the SDC or CDC, there is no such thing as a separate warehouse or stock kept only for VOR orders which seems to be their perception. This is arguably a possible factor why some dealers are placing VOR orders even though they might not have a critical case. It is not likely to be the

only factor, but a more thorough education for the dealers on how the VOR system is working and the intention of how it is supposed to be used, could decrease the number of unnecessary VORs to some extent. McIntire (2014) discusses that having access to relevant information and a contextual understanding would generate a more powerful supply chain. In this case, the contextual understanding is arguably lacking from the dealers and is therefore a factor that affects the process negatively. From the feedback loop held with Penta, it was addressed that it is true that there is no separate warehouse for VOR orders, however, Penta does protect some stock which is reserved for critical cases, this is although to a very limited extent. Hence, the dealers do have some ground for their statements, however, their perception of it is far from accurate. Therefore, it is evidently a knowledge gap from the dealers' point of view which should be addressed by Penta. It is also somewhat remarkable that all dealers interviewed for this thesis are VPCs and, hence, should be well educated. For Penta to be even more transparent and educate the dealers more thoroughly on how the order system is working would likely increase the understanding from the dealers' side, and through this, possibly decrease the current misuse of VOR orders.

The prioritization rules do arguably have an even larger effect on the choice of placing day orders instead of stock orders. As stated by the dealers, they see a risk of not getting their order on time if they place a stock order, since it might be taken by a more prioritized order. Because of this, they choose to place day orders instead, even though stock orders would be an option given that they would have more confidence that they would arrive within the given lead time. The current supply chain disruptions do clearly affect this behavior since issues with low availability trigger the choice to place higher prioritized orders to ensure timely deliveries. However, the behavior itself does also trigger the issues to become more severe as the dealer notices that they get more deliveries on time with a higher prioritized order type and, hence, are likely to continue this behavior. This system setup creates a chain reaction similar to the bullwhip effect discussed in the literature by Wisner, et al. (2019). The prioritization rules might be there for a reason to secure uptime but since the setup clearly seems to be misused, Penta should consider how it should be handled and what possible changes that could be made to promote better planning among the dealers, to shift more orders towards stock or day orders, and decrease the misuse of VOR orders. It is easy to agree with the statement that one of the dealers made that “It is pretty stupid that those doing the planning and really keeping up their stock are the last ones receiving the goods”.

As long as the supply chain is vulnerable with lacking availability, and there are clear benefits to choosing higher prioritized orders, dealers are likely to continue with this behavior. One thing that could benefit in a shift towards more stock orders would be better in-transit visibility, which is today lacking, as discussed earlier. As McIntire (2014) discusses, visibility can bring better knowledge to a situation, however, it cannot determine which actions to take. Therefore, increased visibility would not necessarily change the behavior of the dealer when placing orders, but having better knowledge might facilitate this shift. Further, Penta should investigate whether they should implement some kind of incentive for dealers that are in fact planning and placing more stock orders as well as implementing an extra hurdle for dealers to place unnecessary VOR orders. To implement a hurdle to place VOR orders is the opposite of the

wish of Dealer B, who expressed a wish to have an easier order process for VORs. However, it is arguably evident that Dealer B is one of the dealers that is somewhat misusing the setup in placing unnecessary VORs, where day orders could have been an option. The implementation of an extra step in the VOR order process should however be carefully considered as there is a thin line between hindering the unwanted behavior and decreasing the customer service level for the real VOR cases. In McIntire's (2014) discussion, he points out that increased visibility can bring both efficiencies and effectiveness gains, where reduced transportation costs and waste are two of those gain. If Penta were to achieve a higher level of visibility, a reduction of VORs would be likely and they would consequently reduce their transportation costs since VORs imply especially high transportation costs in order to meet the urgent requirements. If there were incentives in place for dealers who do their planning and choose less prioritized order types, this would likely result in being both cheaper for Penta and more environmentally friendly. For instance, different charges in transportation costs between the different order types where stock orders are the cheapest and VOR orders would imply an extra fee, could encourage the dealers to do their planning better and more often accept slightly longer lead times. Especially in regions like Europe where the transportation time would only increase by a couple of days, an incentive like this is likely to generate the desired outcome. The dealers would then still have the possibility to place a VOR order when needed, although the increased fee might make them think twice before placing an unnecessary VOR. However, if they are faced with an urgent situation, the cost aspect is not likely to play a determining role in the choice of order type. This could also help in moving some of the day orders to stock orders instead as that then would decrease the costs for the dealers while, if they plan properly, not affecting customer service.

5.3 Backorders and ETA

The availability of parts has clearly been worsened by the ongoing disruptions in the supply chain, which have led to more orders becoming backordered. Although Penta does try to give out an ETA on when the parts will be back in stock, at least within Region Nordic, the dealers are clearly not satisfied with the quality of the ETA and, hence, the usefulness of the information. As Somapa et al. (2018) and McIntire (2014) discuss, it is important to consider if the information given can contribute to value creation for business operations, and in the case of the ETA given on backorders, it is due to bad quality clearly not very value-creating for the dealers. As Dealer A (2022) described, the ETA is currently of such a bad quality that they believe that it is completely unnecessary and is instead only creating more uncertainties. Penta themselves do also acknowledge the unreliable ETAs as an issue, and that it is something the dealers often bring up in surveys. It is further presented that there is ongoing work to develop a global standard to be able to measure the quality of the ETAs. Although Dealer B was a bit more positive towards the ETAs given compared to Dealer A, their statement that the ETA is accurate 50 percent of the time cannot be viewed as satisfactory and something that Penta should really acknowledge. This issue can further be related to the discussion made by Somapa et al. (2018) about how accurate and complete the information shared between parties in the supply chain is. As mentioned, information quality is determined by the usefulness of the

information and how well it fulfills the organization's needs (McIntire, 2014; Somapa et al., 2018). In this case, it is clear that the ETA information given today is not satisfying the informational level needed. This gives rise to inefficiencies, as discussed by the dealers, where the incorrect ETAs result in difficulties to plan their operation properly, as well as leading to more Argus cases that need to be manually handled. Further, as acknowledged by the dealers, if the ETAs would be more trustworthy it would most likely affect their choice of order type towards less time-sensitive options. This could result in cost and environmental savings from slower and, hence, cheaper transportation options as well as less administrative work for the service centers handling VORs, since these could be decreased. This is also supported by several authors in the theory, who agree that if information between peers is managed properly, it will generate better visibility in processes which in turn can result in improvements in the operational performance (Barratt & Oke, 2007; Barratt & Barratt, 2011; Somapa et al., 2018). An improvement in the quality of the ETAs would generate efficiencies and hence cost savings for both the dealers and Penta. However, one needs to also acknowledge that several factors are making it difficult to give correct ETAs, especially with the ongoing disruptions and shortages in the world's supply chains. For Penta to be able to deliver better ETAs they will in turn also need to get more trustworthy ETAs from their suppliers. An incorrect estimation early on in the supply chain will escalate and impact the ETAs given in the end, hence, from Penta to the dealers. This situation could arguably be related to the bullwhip effect and as Wisner, et al., (2019) argued, a better information flow that then creates increased visibility can help reduce unwanted fluctuations in the process. This highlights the need for Penta to increase the transparency in the information flow towards their dealers so that the issues caused by the supply chain disruptions can be better managed and planned for.

It is evident that the ETA issue is currently worsened due to today’s situation with supply chain disruptions. Therefore, one alternative for Penta could be to temporarily remove the ETAs from the system, and later introduce them again when the availability is more stable. Likely, an incorrect ETA will only imply more uncertainties than not receiving an ETA at all. When addressing this suggestion during the feedback loop, it was evident that most dealers have expressed a desire to receive ETA information in surveys made, therefore it would be unreasonable for Penta to remove this information. One can therefore argue that in this case, there is a clear gap in theory and practice. If one were to rely strictly on the literature, the ETA should be removed since the quality of the information is low and does not bring value to the dealers, as discussed by McIntire (2014) and Somapa et al. (2018). However, in practice, it is clear that other aspects have an influence on the issue, and Penta in this case would likely not take such a measure that would go against the wishes of their dealers. In addition, it was discussed during the feedback loop that Penta employees would also oppose such a decision as they use this information in their daily work. Another option discussed during the feedback loop is to also indicate the probability for the given ETA to be accurate in the DFS. This option might be valuable, however, something Penta should discuss with the dealers to find out if it would bring any value to them, otherwise, it is regarded as an unnecessary measure.

Further, one possible option for Penta that could reduce the issues currently faced with backorders would be to simply remove the option to place an order when something is out of

stock. If one relates this to when shopping as a private individual, if something is out of stock, it will not be possible to place an order, but instead one might be able to ask for a notification when the item is back in stock and, hence, place the order then. This might be viewed as an impossible option from Penta's side since one cannot compare the need for a spare part for their products with a private individual's wants for products. This was confirmed during the feedback loop where it was explained that if they would forbid backorders, they would not be aware of the urgent demand and, hence, not able to act on the customers' needs. Due to the nature of their products, they are obligated to offer the spare parts needed to be able to repair a product. To not be able to place a backorder would, hence, worsen the customer service significantly and, as learnt during the feedback loop, it would also imply penalties for Penta since they have penalty clauses for downtime of their engines. However, to increase the transparency to the dealer, one option could be to display how many backorders that are already in line for a certain part. Although this could bring value for the dealers and increase their ability to plan, one needs to have in mind that it could also increase the misuse of VOR orders. This is since the dealer might choose to place a VOR as a way to skip the line if they can see that there are already many backorders on this part.

5.4 Proactivity in the Information Flow

To be more proactive in delivering information was raised as desirable both from the dealers and from Penta. The emails sent out each morning by the Service Center to Nordic dealers are a measure towards a more proactive work. However, the dealers present different perceptions of its usefulness. As previously mentioned, Dealer B believes it to be helpful and working well, whilst Dealer A states that the information included in the emails is not always complete and in addition, there are sometimes technical errors in the tracking links. Dealer A discusses it as being a complicated way to follow up their orders and in those cases where the information is incomplete, it creates more Argus cases. This can again arguably be connected to what Somapa et al. (2018) discuss about the usefulness of the information in relation to business operations and how it can bring value. Although the idea behind sharing this information is that it should be valuable for the dealers, it was evident from Dealer A that in their operation this information is not used to a large extent. One could therefore question the usefulness of sending out information that is not always useful for the receiver. As discussed by Vendrame (2022), these emails are only a workaround since there is no system in place to give updates on in-transit information. One might argue that any information is better than none, but if the quality of the information is not satisfactory, then it loses its purpose. Penta should make an effort to not need such workarounds and instead seriously consider taking measures to make all information available in the DFS, which will be elaborated on further in section 5.5 System Visibility.

There is a wish presented by both Vera-Alvarez (2022) and Vendrame (2022) for having a more proactive approach within the organization. Informing the dealers about disruptions or delays in the process would allow them to better plan their operation and be more prepared to manage any delays. This is aligned with what Dealer A expressed about wanting to have a few days to prepare for the handling of orders, especially larger ones. Findings in the literature from

both Caridi et al. (2014) and Goel (2010) support this, stating that having a proactive approach regarding transport visibility and informing about disruptions is crucial, since it can allow for rescheduling and better managing of the operations. This is discussed as a way to minimize the effect a disruption can have on customer service. Although Kristoffersen (2022) agrees with the need for proactively, she on the other hand puts some responsibility on the dealers to also work more proactively in their operation and plan their orders better. However, as she presents due to the prioritizing rules, such behavior is not directly awarded, which was also clearly criticized by one of the dealers.

It is noticeable that Dealer C in Australia takes the situation with lacking information in the whole supply chain slightly more serious, they discuss that given the current global supply chain disruptions, both dealers and their customers understand that there are delays and long lead times, but as expressed, the lack of visibility will not be accepted once we go back to normal. This really shows Dealer C's perception of urgency in the matter, something which is not stressed to the same extent by Penta. A reason for this might be that the dealers are those closest to the end-customer, hence, experiencing the consequential problems firsthand. If Penta were to implement a more proactive approach, there is a great chance that the number of Argus cases would decrease, since dealers would not have to go into Argus as soon as an order is delayed. Instead, they would be informed in advance and could perhaps be more patient. Although it would require resources from Penta to do such, the administrative work that is saved due to decreased number of Argus cases can be argued to weigh heavier in the long run. As McIntire (2014) argued, having access to relevant information will generate a stronger supply chain, which one could argue should be incentives enough for Penta to take measures towards a more proactive approach. In connection to this, a crucial factor that McIntire (2014) also addresses is the organization's role in achieving visibility. He presents the organizational commitment and the willingness to actually make changes in order to generate greater business success as completely determining. If Penta really wants to achieve greater visibility, there must be a united willingness from all actors involved to make the necessary changes, or else it will likely not be achieved.

It is vital for all parties involved to understand each other's needs in the setup, which could be done through increased communication. The perception that the authors got from the dealer interviews is that they do not really have any communication with Penta about their thoughts on issues today. With the dealers being Penta's business partners, their opinions must be valued and taken into consideration in order to build an efficient and customer-focused operation. Penta should focus on increasing the communication with dealers in order to become aware of their opinions and possible areas for improvement. In the feedback loop with the Penta supervisor, it was explained that channels for this communication are already in place, however, it is clear that these do not seem to be functioning properly and should therefore be reviewed. They should first and foremost make sure that the dealers are aware of whom to turn to if they experience any issues or have any suggestions for improvements. Secondly, it is of great importance that this person in question has the time and resources to bring this up in the organization so that this person does not become a gatekeeper. A clear guideline on how this should be handled should be developed and implemented.

5.5 System Visibility

In connection to the discussion about proactive information, the issue of where information should be available was also brought up. Vera-Alvarez (2022) believes that all information should not be pushed out to dealers but instead, they should be able to access it through their system when needed. Aligned with this, Vendrame (2022) stated that dealers have expressed a wish to be able to find all information themselves in the DFS and not use several platforms to access transport information. This is also addressed by Dealer C, stating that both in-transit and availability information should be available in the DFS. They believe that being able to see stock levels for both CDC Ghent and RDC Sydney could benefit them in their decision-making process, as low stock levels could influence the expected lead time. At the moment, they can access this information but only through a workaround and not through the same interface used when placing an order. It is also expressed that there are quick wins possible since much information is available but not integrated into the same platform. There could however be issues with dealers having insight into Ghent's stockholdings since this could create false perceptions of parts availability and that the parts will be allocated to them, which is not certainly the case due to the prioritization rules previously discussed. However, as long as all dealers are well aware of this risk and how the prioritization rules are working, it would arguably generate more benefits than potential issues to be completely transparent in the stock levels towards the dealers.

Further, being able to access in-transit information in the DFS is highly requested and there is a general idea that this could heavily decrease the number of Argus cases. One could argue that it is completely reasonable to have all information gathered on the same platform so that dealers can access the information they need more easily. Having additional sources of information to check in their daily operation is unlikely to generate the benefits that were intended. This was for instance evident in the case of one Nordic dealer not using the emails sent out by the service center. System integration, as addressed by Somapa et al. (2018), determines how well information is transmitted to supply chain partners, and ideally, information should be transmitted automatically. If the DFS were to be developed so that in-transit information, availability, and order status would all be included in the same interface, all parties would enjoy great benefits from it. As of today, the dealers are completely reliant on making Argus cases to receive any information regarding delays or discrepancies. Hence, an increase in visibility would ease the process for dealers to receive this information and significantly decrease the number of Argus cases. It is therefore evident that not only the dealers would benefit from this but also Penta, who would experience an ease in administrative work with fewer Argus cases, as well as sharing useful information between departments.

Moreover, all dealers state that the system used is to some extent old and many factors could be improved. In addition, they all understand that it would take time to change the IT infrastructure in a large organization such as Penta. As Goel (2010) discussed, one should consider the cost-benefit trade-off in implementing new systems. They are on the one hand very expensive but on the other hand they can also bring many benefits and especially increase visibility. Although Penta as a large organization is likely to have the finances for implementing

a new system, it would require significant resources and time, and to put that in relation to the initial benefits it would bring might not seem reasonable in the short run. Another important factor to address in this, as presented by McIntire (2014), is that although IT infrastructure is an enabler, it is factors within the organizational setup that sets the ground for high-quality business performance. He states that technology is an enabler but not the determining factor, and instead it is the processes within an organization that will determine the business outcome. The role of technology should instead be to assist in achieving the goals that are set within a company. In the case of Penta, technology is likely to be one of the factors that will determine how well they can achieve better visibility, however, the focus should not solely lie on implementing new systems, but instead to ensure the quality of their processes. One focus area for Penta should arguably be to find ways to integrate the information already available in the systems. By making rather small changes, they could generate big wins, as Dealer C (2022) expressed. As McIntire (2014) addresses, technology is on the one hand an enabler, but it can also facilitate transformation. In the case of Penta, it could enable better accessibility of the information already available, which would create huge improvements in their processes and enable great efficiency gains.

It is evident from the literature that technology and advanced IT systems play a huge role in gaining more visibility in the supply chain (Marchet et al., 2012; Caridi et al., 2014). As several researchers have presented, many technological developments have enabled better capturing and transmitting of information within a supply chain, all of which have proven to increase the visibility in the supply chain. More recent developments, such as IoT, have led to huge datasets, Big Data, which in turn is difficult for companies to process. In connection to this, as addressed by Calatayud et al. (2019), the companies have lacked enough technological tools to process and share these huge amounts of information. This can be related to the case of Penta, since it is evident that they have a lot of information available but no automated system in place for information sharing, which one could argue should be implemented. This is especially important for organizations with complex and global supply chains, such as Penta, where visibility is a determining factor for business success. One technology that has recently received more attention is blockchain solutions which have been presented as a way to replace the more traditional centralized database and create secure connections to the data, this could be something that Penta could investigate further as well. From the feedback loop, it was presented that Penta is working on blockchain solutions already which is viewed as promising. Given the technical enablers available today, one could really question the lack of system integration and, hence, the manual processes that are needed for information to be shared further in the chain to the end-user.

To implement an IT system that is fully integrated between departments and other peers in the supply chain is clearly a huge project in itself which will require both a substantial investment of money as well as time and commitment from everyone involved. As Caridi et al. (2014) discussed, the effort that is needed is an important reason why many companies do not have better systems. Although the difficulties it implies to fully integrate systems, it would arguably be the only way forward if Penta wants to be the best in their market in the long run. As McIntire (2014) addresses, visibility gives competitive advantages to those who can make use of

information available in their supply chain. Therefore, if Penta has a wish to stay competitive in the market, improving its visibility through investing in the IT infrastructure could be argued to be a crucial factor. However, taking the time aspect of integrating systems into consideration, it would also be important to find a solution for increasing visibility in the short run. Penta should acknowledge the information already available, who would benefit from receiving it, and how they could set up clear guidelines for a more proactive information-sharing routine until they reach a stage where they have an integrated system. The technical enablers available today give rise to the possibilities for integrating systems with a shorter time frame and decrease the need of implementing new systems. As discussed during the feedback loop, using cloud solutions to transform and connect available data from legacy systems to be able for better integration is one way forward. This would imply fewer financial investments as well as not being as time-consuming as implementing new systems.

A comprehensive suggestion is for Penta to consider a more advanced IT infrastructure, as this could be argued to be one determining factor to reach the desired level of visibility that will allow for a seamless automated information flow between all peers in the supply chain. This would require substantial investments in terms of finances and resources, however, some of the systems already in place could likely be developed further to fulfill the technical needs of Penta. For some areas within the organization, it would be worthwhile to evaluate implementing a completely new solution, for instance, a TMS for all warehouses. Although there are great possibilities for Penta to make use of the information already available within their organization, there is still a gap in the data available on in-transit visibility, which could be solved by implementing a TMS. It is clear that for Penta to be the best in their market, something they have expressed that they are aiming for, they need to make sure that they have the best processes possible which can only be fulfilled with sufficient technical infrastructure.

5.6 Order Number Alignment

One issue raised by the Nordic dealers is the sometimes missing alignment between order numbers and invoices which creates much unnecessary administrative work in matching the incoming orders to the correct invoices. The issue is mainly concerning backorders since Penta is using a new order number when backorders are sent out, as De Rudder (2022) explained. Although they aim to keep parts of the original order number in the new order number, the original order number does not follow on the invoice together with the new backorder number and it is therefore understandable that this is generating issues for the dealers. Somapa et al. (2018) discussed that a determining factor for being able to transfer information successfully is to have integrated IT systems between the supply chain partners. As previously discussed, this is something that Penta is lacking today and something that was described as a bottleneck by several people within Penta and SML. If an integrated system would be in place where the new backorder number would be connected to the original order number, the current issue of not being able to match incoming orders to invoices would be decreased. It should, however, be fairly easy for Penta to also make great improvements in this area without too much effort in the short run, before the systems are integrated to the desired level. For instance, instead of

changing the order number for a backorder, they could instead simply add a few numbers so that the original order number is still intact, and the dealers would be able to easily find which order number the backorder originates from. If the original order number would be 12345 the new backorder number could for example be 12345-6789 or BO-12345. This would ease handling of the orders significantly and facilitate the current issues described by the dealers.

One factor which is complicating this issue further, as described by the Nordic dealers, is that the orders are sometimes consolidated and, hence, contains parts from several other orders without clear documentation. The fact that Penta is consolidating shipments is natural, as it makes the transportation more efficient, and it cannot be seen as a feasible option to not consolidate. However, although consolidating, the paperwork that follows the shipments should always clearly state which order numbers it contains, as well as be aligned with the information given on the invoices. This would make it much easier and save the dealers time when matching incoming orders to the invoices in order to check which orders they have received. It would also decrease unnecessary administrative work for Penta as the dealers will not have the same need to contact the service center to sort issues out. Hence, although this is something that Penta themself might not find to be a great issue, their dealers clearly do as handling of incoming orders becomes much more complex and time-consuming resulting in lower customer success for Penta as well as unnecessary work for the service centers.

5.7 Sustainability

Another important aspect to discuss is the environmental impact generated from all additional and unnecessary orders, both day orders and VORs. It was clear from the interview with Dealer A that whenever an order is lost in transit, a new part if often sent out to recover the lost part. In some cases, both would turn up at their warehouse, where one of them is either put on stock or sent back to Penta. This results in excessive transportation of parts and could also result in unnecessary scrapping if the dealers end up placing parts on stock that are then never used, due to being ordered for a specific job. Further, the system as it is generates more VORs than necessary, which are being sent by air due to it being time-critical, as presented by Kristoffersen (2022). It is common knowledge that air is the mode of transport emitting the most CO_2, hence, an area where Penta has the possibility to heavily decrease their CO_2 emissions. This is, however, already acknowledged where Vera-Alvarez (2022) addressed that a decrease in VORs would decrease their CO_2 emissions.

Granic (2022) presented a target to reduce CO_2 emission by 30 percent by 2030 and that there are several ongoing projects to better calculate the CO_2 impact. It is evident in this case that due to a lack of visibility in the whole process, and not enough information passed on to the dealers, many extra orders are placed. If the visibility was better, dealers would have better confidence that orders will in fact arrive. One can therefore argue that if Penta were to take measures to increase the visibility of their order process, it would not only bring efficiency gains but also benefits in terms of heavily reduced CO_2 emissions. Hence, the environmental gains would come as an added value and would not require any additional actions besides the

measures taken for increased visibility. Better visibility would also enable Penta to discover where in the supply chain there is clear potential for improvements regarding sustainability. As Koberg and Longini (2019) discussed, lacking visibility makes it significantly harder to find areas for improvement, hence, higher visibility would benefit Penta in reaching their goal to decrease CO_2 emission.

There is also a discussion on where the responsibility lies for all the excessive orders. Vera-Alvarez (2022) argues that the dealers have their share of responsibility, and in connection to proactivity, Kristoffersen (2022) also addresses the dealers' responsibility. Both Vera-Alvarez (2022) and Granic (2022) argue that an increase in visibility where information on environmental effects was forwarded to dealers could have a positive effect on the dealers' behavior and a shift towards not only looking at the fastest lead time. One could, however, argue that the issue lies in a lack of visibility in general and the fact that the system allows for misuse, which is the main cause for the excessive CO_2 emissions generated by Penta. This is aligned with the findings in the literature which shows that visibility can have a positive impact on sustainability, where a better flow of information can benefit actors in decision-making processes that concern environmental impacts (Saqib & Zhang, 2021).

5.8 Summary of Analysis

To ease for the reader, a summary of the main points from the analysis can be found below in Table 3. It should be highlighted that this is only a short summary and to understand the whole context, one should read the full text.

Section	Main findings
5.1 Lacking in Transit Visibility	The lack of in-transit visibility brings challenges to both dealers and Penta. The tracking links provided to Nordic dealers do not seem to be fulfilling their purpose, partially due to it being a manual and time-consuming process for follow up. Whenever there are discrepancies, the lack of visibility is creating great challenges and generates Argus cases. The issue is especially present for the Australian dealer, due to the long geographical distance. There is a wish to have more visibility in all stages during the order process and it is presented that much information is available within the organization, but not forwarded to the dealers, which is aligned with the discussion around gatekeepers. The literature supports that in general, increased visibility would bring efficiency gains.
5.2 Order Types and Prioritization Rules	The characteristics of the order types and the prioritization rules cause unwanted behavior and misuse of the setup, however, also necessary to ensure uptime. The system in place generates more VORs than necessary, which puts a huge constraint on the costs and environmental impact. Knowledge gap from the dealers' side on the VOR setup, clearly a lack of contextual understanding. The prioritization rules result in dealers placing orders of higher priority only to ensure timely delivery. Penta should investigate possible ways to promote better planning amongst dealers. Better visibility could facilitate a shift towards fewer VORs and day orders. A suggestion for Penta is to implement a hurdle on placing VORs, however, should be carefully considered due to the actual reasons for placing VORs.
5.3 Backorders and ETA	Backorder and ETA situation is worsened by the global supply chain disruptions. The dealers are unsatisfied with the quality of the ETA, and it cannot be seen as useful information. The ETAs are clearly of bad quality and do not bring much value to the dealers' operations. This gives rise to inefficiencies which could only be improved with a more accurate ETA. However, given today's situation, it is a very complex matter to improve.
5.4 Proactivity in the Information Flow	Wish from Penta to be more proactive, but important to ensure that the proactive information is of good quality and useful. The emails sent out from the Service Center are presented as not being useful to all dealers. The emails are however only a workaround, as the information should be available in the DFS. Proactivity can enable replanning of operation if needed, which is desirable from the dealers' perspective. Proactivity would likely decrease the number of Argus cases, which would bring efficiency gains. The literature addresses the organization's role in achieving increased visibility, the commitment, and the willingness to make changes in order to generate greater business success is completely determining.
5.5 System Visibility	The information should be accessible for the dealers when needed, on the same interface. Dealers wish to have all information in the DFS. More information available would likely decrease the number of Argus cases, which implies benefits for both dealers and Penta. A united perception of rather outdated systems but requires a cost-benefit trade-off for implementing new IT infrastructure. Technology is an enabler, but the business outcome is determined by the organization's processes. However, technology plays a crucial role in achieving increased visibility. Quick wins are possible through the integration of the data available within the organization, preferably done through automation of information sharing.
5.6 Order Number Alignment	The lack of order number alignment is an issue for the dealers, mainly for the backorders since a new order number is created in those cases. The lack of integration in the system, as discussed in the literature, could be a potential cause for this issue. Consolidation of order adds to the issue and, although necessary from an efficiency point of view, the administrative work that follows is a challenge for the dealers. Ensuring that the paperwork always states sufficient and correct information would ease the issue.
5.7 Sustainability	All additional and unnecessary orders have a negative environmental impact due to excessive transportation and CO_2 emissions, as well as potential scrapping. Excessive transportation by air has a huge impact on Penta's sustainability performance. An increase in visibility could contribute to a positive change. By taking measures to improve visibility, environmental gains would come as well.

Table 3: Summary of Analysis

6. Conclusion

The purpose of this thesis was to identify the potential benefits of having increased visibility in the outbound flow of spare parts in Volvo Penta's service market supply chain and to investigate which measures that could be suitable to take. This will be done by answering the two chosen research questions.

- How can increased visibility in the supply chain bring value to Volvo Penta and their dealers?

To begin with, there is a united perception, from both the literature and the interviewees, that increased visibility would generate benefits for all parties involved. This does not only apply to the process itself but also overall efficiency gains in Penta's operation. It is pointed out that in general, increased visibility could results in improved service level and generate better customer success. Having more information available and accessible for the dealers would also improve the credibility of their system, enabling them to better manage customer relationships and in turn the customers' experience of Penta. A crucial factor is also that dealers would not be as reliant on creating Argus cases to retrieve, in many cases, quite crucial information. More information available to dealers would enable them to look into the DFS themselves and seek the information necessary to better plan their operations. This could also facilitate a decrease in dealers misusing the system, placing other order types than those actually needed. Any Argus case that is avoided saves the service center much administrative work and would allow them to focus more on real value-adding customer service and not need to answer questions where the answer should already be available in the DFS. In addition, with an increase in visibility, Penta could decrease the workarounds currently present in their processes and decrease the amount of manual handling. Also, with an overall increase in visibility in their order process, there will likely be environmental gains without Penta having to take any additional measures.

- What measures can Volvo Penta implement in their process to achieve an improved visibility?

There are some measures that Penta should consider implementing, as discussed in the analysis, where some of them are quite straightforward, for instance making sure that the order numbers are aligned. Table 4 below is displaying some of the measures that should be considered by Penta together with a reasonable time frame needed for implementation. However, one needs to address the fact that this is a very complex situation where several different measures are needed to improve the overall end-to-end supply chain visibility. It is also clear that much information which could increase visibility is already available within their systems, however, not reaching the ones who need it. Hence, Penta needs to investigate why this is the case and take measures to set better routines for the information flow. There is evidently a need to implement technical solutions which would enable them to ease the information flow, gain visibility, and move from old outdated systems to new integrated solutions which would remove the need for workarounds. Many of these challenges are likely possible to solve without implementing new systems and instead finding other automated solutions to integrate the

already existing data. However, when it comes to the in-transit visibility, there seems to be a lack in the data available which can arguably only be solved by implementing a TMS. Although indicating much time and resources, this cannot be neglected if Penta wishes to be the best and most desired business partner within their market segment.

Hard allocation on orders going overseas	Short term
Better utilization of existing data	Short term
Dealer education	Short term
Implement incentives for placing stock orders	Short term
Holistic understanding between departments	Short term
Alignment in the order numbers	Short term
Proactivity in the information flow	Short term
Integrate system	Short – Medium term
Automation of information flow	Medium term
Implement TMS	Medium – Long term
All information in DFS (Dependent on TMS)	Medium – Long term

Table 4. Summary of measures

However, no matter the measures taken for increasing the visibility, one could argue that the most important aspect for Penta is to ensure that everyone in the organization is striving to create a more efficient environment where supply chain visibility and better information flow is a naturally prioritized aspect in the daily work. It is evident that there is a lack of understanding between departments today which will decrease the efficiency and effectiveness of the whole supply chain end to end. There need to be a more holistic approach looking at the whole picture which should be embedded in the company culture, to avoid a continuous work in silos with lacking communication between them. Although some people might be pleased with working in old legacy systems that are functioning well, everyone needs to understand the possibilities that technologies provide and how these solutions can improve and ease everyday work for every entity in the supply chain. This would allow Penta to put more focus on how to improve their operations further and not need to put effort into unnecessary administrative work as a reaction to issues that would not be present with a more proactive approach. A more stable process would free up time and resources to focus even further on serving their customers and provide more added value for the dealers, which should be the main focus for Penta. In the end, Penta and their business partners would clearly benefit from achieving an increase in visibility in their service market supply chain compared to how it looks today.

6.1 Future Research

This topic could benefit from being further investigated. The existing literature lacks focus on defining the value that supply chain visibility can bring in numerical terms, for instance regarding concrete cost savings. Therefore, the authors of this thesis would find it to be of great interest to conduct studies examining this. To be able to concretize the value in monetary terms would require time-consuming studies over a longer period of time, but it has the potential to bring important insights to the literature and for companies to support measures to take in order to increase visibility. It was also noted in this case that the findings from the literature were

somewhat contradicting to what was reasonable to implement in practice, for example, the literature would suggest Penta to remove the ETAs until they are more reliable which cannot be seen as reasonable in reality, therefore it would be of interest to compare the literature to other cases as well to see if there are similar contradictions.

If one were to elaborate and research deeper on this particular case, it would be of great interest to also include a quantitative approach to be able to concretize the findings. It would also be interesting to broaden the geographical scope and investigate other regions to see if the same findings would appear, or if other issues would be highlighted. In addition, it would be of interest to include even more interviews with employees from different RDCs and SDCs as this could give an even deeper understanding of where in the supply chain the information flow is broken. In addition, it would be interesting to take the sustainability aspects further into consideration and investigate how an increase in visibility might generate improved environmental performance for Penta, aligned with their 2030 CO_2 emission goals.

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Appendix 1

Interview with Penta employee

1. Would it be okay for us to record this interview? It will be used for remembering purposes and not shown to anyone else.
2. Could you explain your role at Penta and your main responsibilities?
3. Which visibility would you say is in place as of today?
4. What information is available on where in the process an order is?
5. When parts are shipped, which carriers can be used for follow-up?
6. What visibility would you say is missing today?
7. Where are the weak sports in the system?
8. During the order process, what does the information flow look like to the dealers?
9. Which information is available to Penta?
10. Which information is passed on to the dealers?
11. Which choices does a dealer have when placing an order, for instance mode of transport?
12. For which parameters do you have data today?
13. How is the VOR tracked until arrival?
14. What is your title?
15. Would it be alright if we referred to your name when including the information given form today's interview?

Appendix 2

Interview with dealer

1. Would it be okay for us to record this interview? It will be used for remembering purposes and not shown to anyone else.
2. Can you briefly introduce yourself, the company you are representing and your relation to Volvo Penta?
3. How do you think the order process is working today, in general?
4. Regarding the information flow from Ghent, do you experience issues due to a lack of visibility?
5. Where in the process do you experience the most issues?
6. When are you made aware that something has been shipped?
7. When are you made aware that something is late?
8. Do you place more VORs in order to get better visibility?
9. When in the process do you receive tracking links for shipments?
10. What is the mode of transport mostly used for your orders?
11. What is your perception of the ETA information given on backorders?
12. Do you also experience issues due to change order numbers from backorders and consolidated orders?
13. Does the lack of visibility make you order more day orders?
14. How would it benefit you if you would have more information along the supply chain?
15. Where would you like the information to be available?
16. Would it be alright if we referred to your name when including the information given form today's interview?