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*From Disruption to Efficiency: The role of
SRM and JIT strategies in Automotive Supply
Chains*

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Abstract

Purpose - The incessantly progressing automotive industry faces various challenges due to its complex supply chains. This study aims therefore to 1) explore the roots of material supply disruptions in the automotive industry and the challenges of managing these and 2) assess the role of Supplier Relationship Management (SRM) in mitigating these disruptions.

Methodology approach - The study used a qualitative approach, integrating theoretical perspectives on SRM and Just-In-Time (JIT) strategies with empirical data. Empirical data was gathered by a single case study at Volvo Group. Several semi-structured interviews and direct observations were conducted, providing a contextual understanding of the research objectives, in order to process the central research question.

Findings -The findings of this study emphasize the importance of improvement of SRM and JIT practices in order to mitigate various disruptions in a supply chain. Moreover, the findings also advocate the need for better supplier relationships and robust communication systems as well as strategies to enhance the flexibility between buyer-supplier in order to maximize operational efficiency and effectiveness.

Study Limitations - This study explores material supply disruptions and focuses on disruptions that impact the automotive industry's supply chain. However, the study does not encompass the full spectrum of the automotive supply chain with production, distribution, or end-customer interactions. Additionally, the conclusions are based on a case study that may limit their wider applicability. Nevertheless, the conclusions drawn provide a valuable framework for understanding and enhancing material supply disruptions and the implications drawn from it offer a significant contribution to understanding and improving supply chain resilience in the automotive industry.

Practical implications - This study contributes valuable insights to the automotive industry to evaluate and improve their SRM and JIT strategies and practices in order to enhance the robustness of their supply chains and managing material supply disruptions.

Keywords – Supplier Relationship Management, Just-In-Time, Supply Chain Management, Supply material disruptions, EDI, Supplier relationships, Procurement

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Abbreviations

SC - Supply Chain

Tier 1 - Primary level of suppliers

Tier 2 - Second level of suppliers

SRM - Supplier Relationship Management

SCM - Supply Chain Management

OEM - Original Equipment Manufacturer

EDI - Electronic Data Interchange

JIT - Just-In-Time

JIS - Just-In-Sequence

MRP - Material Requirements Planning

SCR - Strategic Collaborative Relations

SI&D - Supplier Improvement and Development

DFDS - Det Forenede Dampskibs-Selskab

MMOG - Materials Management Operations Guideline

KPIs - Key Performance Indicators

MDS - Minimum Demand Split

KEP7 - Volvo Group Logistics Requirement

1. Introduction

This chapter aims to provide an introduction and background to the thesis, starting with an insight into the complex supply chain of the automotive industry. Furthermore, it also outlines the purpose of the study, the central research question and ends by specifying the delimitations.

1.1 Background

The incessantly progressing automotive industry may have one of the world's most intricate supply chain networks, with an outsized reliance on suppliers for components, technology, and materials. This complexity requires an efficient and sustainable understanding of the challenges the firms and suppliers face, whether it may be logistical, technological, or economic difficulties. Supply chain (SC) disruptions can occur unexpectedly and ripple through the entire SC network, causing significant operational setbacks. These disruptions may be caused by both natural disasters and intentional or unintentional human actions (Snyder et al., 2016). According to Christopher and Lee (2004) the vulnerability of supply chains to disruptions has increased, and not only due to external factors, but also in reaction to changes in business strategies. Intensified competition and rapid market globalization have pressured firms to optimize intrafirm and interfirm business processes for greater efficiency and responsiveness (Wagner & Bode, 2006). Strategies such as outsourcing, offshoring, sourcing from low-cost countries, reducing inventory levels, and streamlining supplier bases have become common practice. Wagner and Bode (2006) also mention that although these practices enhance operational efficiency, they also lead to increased interdependence between firms and more complex, globally extended supply chains. As this exposes firms to a greater risk of disruptions within the SC¹.

¹ The automotive industry is impacted by various disruptions; however, this study will exclusively concentrate on material supply disruptions and their consequences.

In recent years material challenges and other major supply disruptions have made the need for stable supplier relationships more important than ever. As market volatility intensifies, it is evident that firms must shift from transaction-oriented strategies to those centred on building relationships for enhanced performance (Sheth & Sharma, 1997). Therefore, to maintain and enhance profitability and drive long-term efficiency, companies should consider constantly developing its Supplier Relationship Management (SRM).

1.1.2 Supply Chain Management in the automotive industry

Supply chain management (SCM) involves the planning and management of all activities in sourcing and procurement, conversion, and logistics management. It also includes coordination and collaboration with suppliers, intermediaries, third party service providers and customers. A supply chain in the manufacturing industry involves all aspects, from outsourcing to raw material supply, procurement, parts manufacturing, production, and distribution to the end-customer.

The logistical aspect of supply chain management is called supply chain logistics or logistics in a supply chain (Oskarsson et al., 2021). Logistics management is a part of supply chain management that plans, implements, and controls the effective forward and reverse flow and storage of goods as well as related information between the point of origin and the point of consumption in order to meet customers' requirements². Van Weele (2012) views SCM as managing the entire distribution channel from suppliers to customers, requiring strategic partnerships for coordination and monitoring of the supply chain. Effective SCM depends on suppliers meeting operational demands, emphasizing the need for supplier management.

1.2 Problem description

Material shortages and disruptions in material supply are posing substantial challenges for manufacturing firms. These issues are affecting a wide range of sectors, from automotive to electronics, and are having a noticeable impact on production schedules and the overall efficiency of operations. The automotive industry is currently grappling with critical challenges due to material shortages and disruptions in material supply. Other emerging issues

² Supply Chain Management Definitions and Glossary;

https://cscmp.org/CSCMP/Educate/SCM_Definitions_and_Glossary_of_Terms.aspx

the industry is facing are quality issues, demand variations, transport delays and other logistic difficulties. The challenges automotive firms currently face is not new. However, the scale of these problems is significantly wider than what these enterprises have encountered in the past.

Automotive supply chains are made up of manufactures, OEMs, dealers, distributors, customers, and multiple tiers of suppliers. An average motor vehicle is made of between 15,000-25,000 individual parts (Kowal, 2023). Even though that some firms manufacture these components in-house, most firms outsource a portion of the manufacturing process to independent vehicle suppliers for efficiency (Ciravegna et al., 2013). Nevertheless, this complexity makes the supply chains susceptible to disruption and a delay in one section. For instance, a Tier 2 supplier can prevent the production process at the Tier 1 supplier³.

Description of the outcomes of some frequent material supply disruptions (Prodan, 2022):

- If in shortage of one essential component, as the semiconductor, the entire entity will be significantly affected.
- If only one component is missing or has not been delivered, the finished product will not be made and will be an incomplete version.
- If one supplier is in shortage and not able to deliver, but other suppliers deliver the orders in accordance with the requirements transmitted by EDI, it will lead to an overcrowded warehouse and inefficiencies in inventory management.

The industry is famously lean and practices just-in-time (JIT) and just-in-sequence (JIS) manufacturing, meaning taking in the exact amount of inventory as needed for production. Those approaches have its benefits, but also represent a major challenge when the supply chain is not operating perfectly. According to Snyder et al. (2016) the JIT-method increases supply chains' vulnerability to disruptions and highlights that "*since a tightly optimized, lean design, which performs well under normal situations, leaves little room for error when circumstances change drastically*" (p. 2). Suppliers often fail to provide adequate notice about changes in availability or delivery schedules, posing challenges for manufacturers, especially in the automotive industry where JIT manufacturing is prevalent. Other causes of SC

³ In this context, Tier 1 suppliers are direct suppliers of the final product, while Tier 2 are suppliers or subcontractors to Tier 1. Disruptions at Tier 2 suppliers can therefore lead to material disruptions at the Tier 1 supplier, thus directly impacting the final product.

disruptions in the industry can be attributed to shifting customer demand, time delay and inventory shortages. This implies that any supply chain disruption can immediately lead to consequences. To manage these challenges, developing and strengthening supplier relationships is a key factor to reduce risks and mitigate the impact of disruptions. By working closely with suppliers and nurturing these relationships, manufacturers can gain better insights into potential supply issues which enables them to react more swiftly and effectively. Improved communication and collaboration with suppliers can also lead to more resilient supply chain strategies. This in turn helps to mitigate risks and ensure smoother production processes. As material supply disruptions occur for various reasons, it is critical to thoroughly understand the underlying causes to effectively develop and implement targeted remedial strategies. It is therefore essential to investigate the primary reasons for disruptions in material supply within a supply chain, particularly in relation to the interactions and collaboration between the company and its suppliers.

1.3 Research Objectives and Question

The purpose of this thesis is to identify the primary reasons for material disruptions within a supply chain in the automotive industry and explore different measures that can strengthen the resilience against these according to Supplier Relationship Management (SRM). The aim is to answer the following question:

- How can an improvement in supplier relationship management mitigate disruptions in materials supply?

1.4 Delimitation

In this thesis, there are certain limitations that can be identified in relation to its purpose and the research questions. These limitations may impact the overall scope and depth of the study, potentially affecting the validity and generalizability of the findings. Given that a supply chain incorporates the whole company, it is not possible to investigate every aspect of a complex global supply chain. Due to constraints in time and resources, the main focus will be on material supply (see figure 1), and therefore will not carry out any investigation on disruptions in the production, distribution or to the end-customer. This as it is primarily incoming material that causes disruptions to occur, which in turn affects the throughput time through the supply chain and indirectly to the end-customer. Nor will disruptions of any specific components or raw materials be examined; instead, the aim is to investigate disruptions in their entirety. Furthermore, the time limitations will also prevent a

comprehensive comparison with the supplier’s perspective on the findings. Regardless, this study will explore various methods and solutions which can be developed and implemented by a wide range of organizations. Nevertheless, researchers should consider the mentioned limitations.



Figure 1-1, Visual picture of a manufacturing company’s supply chain and their corresponding parts.

1.5 Outline

This thesis aims to explore the roots of material disruptions within a supply chain in the automotive industry and to gain an understanding of the challenges in managing those disruptions. Furthermore, it also aims to present solutions to mitigate material supply disruptions by improvement of SRM practices. This study has been structured in 6 chapters, considering the previously presented objectives, the paper is organized in the following manner:

A review of the literature and theoretical framework on SRM and JIT has been presented in the second chapter. In the third chapter, the methodology of research is outlined. The fourth chapter analyses the empirical findings from the single case study conducted at Volvo Group. Discussion and conclusion have been presented in chapter five. Finally, references have been presented in chapter six.

2. Literature Review and Theoretical Framework

This chapter focuses on theoretical frameworks crucial for understanding material supply disruptions in manufacturing (automotive). SRM and its role in efficient procurement and material supply will therefore be examined, highlighting supplier segmentation and managing different types of relationships. Lastly, JIT principles are analysed for their impact on the supply chain.

2.1 Supplier Relationship Management

There are different ways to describe and define SRM, with the common understanding that it's a systematic approach to effectively managing supplier relationships. Supplier relationship management is regarded as a business process encompassing the management of all interactions between a company and its suppliers (Tseng, 2014). Lambert and Schwieterman (2012) describes SRM as “...*the business process that provides the structure for how relationships with suppliers are developed and maintained. Supplier relationship management has become a critical business process as a result of: competitive pressures; the need to consider sustainability and risk; the need to achieve cost efficiency in order to be cost competitive; and the need to develop closer relationships with key suppliers who can provide the expertise necessary to develop innovative new products and successfully bring them to the market*” (p. 337) and further points out the possible benefits from better relationship management.

Furthermore, Moeller et al. (2006) defines SRM as the process carried out by activities such as establishing, stabilizing, developing, and dissolving relationships with in-suppliers and observing out-suppliers to generate and enhance value within these relationships. The ability to navigate both short-term and long-term relationships is crucial for a company's competitive edge (Santana et al., 2021). Managing relationships requires different aspects of mutual trust and commitment between the buyer and supplier, specifically in order to make decisions that mutually benefit both parties. Relationships, oriented towards quality management, tend to be very close and based on long-term common interests (Benah & Li, 2020). This type of collaboration is important to achieve the main principle of SRM, essentially maintaining

interactions and establishing long-term relationships where mutual benefits and shared success are fundamental (Tseng, 2014; Lambert & Schwieterman, 2012). Those relationships with mutual commitment and mutual benefits will sustain (Sheth & Sharma, 1997).

2.1.1 Benefits of SRM

An effectively implemented SRM strategy, as noted by O'Brien (2015), not only leads to competitive gains, stimulates growth, and enhances brand reputation, but also significantly enhances both the operational efficiency and strategic capabilities of an organization. An underlying reason for SRM is cost efficiency (Sheth & Sharma, 1997). Additionally, SRM contributes to sustainability efforts, enhances efficiency and effectiveness, increases competitiveness (Ibid) and provides valuable insights for the mitigation of supply-side risks.

In addition to cost benefits, SRM significantly improves the quality of products and services, and enables co-development of innovative solutions (Tseng, 2014). Having close relationships is also crucial in order to improve operational efficiency and productivity. By streamlining procurement processes and establishing clear communication channels, SRM simplifies administrative tasks, reduces time and resources spent on managing supplier relationships, and leads to greater overall efficiency. Furthermore, SRM cultivates stronger supplier relationships. These relationships often lead to a competitive advantage (Tseng, 2014), as organizations with robust SRM practices are typically first to access new supplier innovations, respond more rapidly to market changes, and maintain more reliable supply chains (Lambert & Schwieterman, 2012). A significant aspect of SRM is its alignment with sustainability and corporate responsibility. Through effective SRM, organizations can ensure their suppliers adhere to sustainable practices and ethical standards, aligning with corporate social responsibility goals and subsequently enhancing the organization's brand and reputation.

2.1.2 Challenges with SRM

Lambert and Schwieterman's article "*Supplier relationship management as a macro business process*" sheds light on several challenges that organizations face in implementing effective SRM strategies. One significant challenge in SRM is developing and maintaining strategic relationships with suppliers. Furthermore, they describe the difficulty with integration and collaboration with suppliers to enhance performance. This involves achieving the right levels

of supplier integration, which varies depending on the relationship, and tailoring strategies to individual suppliers. This complexity is further compounded by the need for cross-functional involvement across various departments within an organization, highlighting the challenge of internal coordination in SRM practices. This challenge is also crucial in order to evaluate and counteract to enhance the procurement performance and ensure the supply chain management to perform successfully. Park et al. (2010) asserts that addressing SRM from a holistic perspective is crucial, rather than concentrating exclusively on specific aspects like a purchasing strategy, supplier selection, collaboration, and supplier development.

Another challenge pointed out by Lambert and Schwieterman (2012) is managing relationships beyond the first tier of suppliers. This requires a broader view of the supply chain and understanding the implications of interactions with multi-tier suppliers, which can significantly affect the supply chain's overall performance. According to Oghazi et al., (2016) there are ten potential barriers that can decelerate or even prevent the integration process between suppliers and buyers. Those are the lack of trust, lack of communication and common goals, lack of common tools, lack of commitment, lack of willingness, specificities of the IT system, degree of formality, security barriers, inflexibility, and cost of integration.

While information sharing offers substantial benefits, such as improved integration, efficient inventory management, avoiding material shortages, cost reduction, mitigating the bullwhip effect, reduced cycle time from order to delivery and overall efficiency, it is hampered by challenges related to trust, technology, and organizational barriers (Lotfi et al., 2013).

A major challenge in SRM is managing conflicting goals and communication issues. Traditional focuses, such as prioritizing low costs, often clash with the strategic aims of SRM, like strengthening supplier ties or improving quality. Sheth and Sharma (1997) noted, *"Successful supplier relationships will provide firms with a first mover advantage, suppliers will come to the firm first to form relationships. Failures of alliances are due to a conflict in goals, lack of clear interaction partners, and shifting strategic requirements."* p. 96. Both sides need to invest in considerable resources, including finance and personnel, to develop this relationship. The reluctance to invest in resources often stems from uncertainty about the benefits of such investments.

2.1.3 Supplier Selection

The following sections offers a nuanced understanding of how supplier selection and segmentation are critical components of SRM by focusing on the role of the procurement function in SRM, the criteria used for effectively segmenting suppliers and finally the process of categorizing suppliers into different segments.

2.1.4 Role Of Procurement

The procurement function includes activities aimed at determining purchasing specifications based on expediency, selecting suppliers, and developing processes or procedures that enable this as well as preparing and carrying out negotiations with suppliers to reach an agreement. Procurement covers all activities necessary to manage supplier relationships in such a way that the supplier's activities are in phase with the company's overall business strategies and interests (Van Weele, 2012). SRM-programmes in organizations tend to be led by the procurement function and can be viewed by others as procurement-led initiatives. However, for SRM to have a purpose and contribute to organizational success, it requires wider terms of reference and cross-functional participation. If a company's SRM program instead takes its starting point on how the whole company can satisfy the end customer in a better way, they can improve their entire view of what they need from the supplier base to be able to create value for customers. Today's organizations need to get more out of their supplier base as customers desire more from them.

As outlined, the procurement function plays a crucial role in the implementation of effective SRM programs. It involves more than just selecting suppliers and negotiating contracts; it also ensures that these activities align with the organization's overarching business strategies and interests. In this context, Material Requirements Planning (MRP) emerges as a key component in realizing these objectives. MRP is a system that utilizes computer technology to manage the scheduling and procurement of products with dependent demand, with the aim of improving the productivity for businesses (Sethi, 2020). This system calculates the need for raw materials and components required for the final product based on the demand for that product. It then determines the quantities and amounts of these materials and components that should be ordered, considering the production and lead times. This is done by working backwards from the product's delivery date to ensure timely ordering and production (Sagbanşua & Alabay, 2010). MRP begins when the sales department develops a sales plan,

providing an estimate of the volume they believe can be sold in the upcoming months or year. This information is used as input in manufacturing planning and the control system (Van Weele, 2012).

2.1.5 Segmentation Criteria

A good supplier selection process is crucial for efficient purchasing and manufacturing. Before it is relevant to start looking for suitable suppliers, the firm must specify what they are going to buy and what their requirements are. An effective segmentation requires that the company considers a multitude of factors and thus presupposes a larger set of criteria (O'Brien, 2015). There are several different systematic methods for supplier assessment that are based on setting up several criteria to compare the different supplier alternatives (Oskarsson et al., 2021). Lambert (2012) mentions a team that identifies the criteria that can be used to further segment suppliers to determine who the firm will develop tailored product and service agreements (PSAs) with. Risk is almost always included as a criterion when segmenting a supplier base, which includes, among other things, the risk of incorrect deliveries, delivery delays and quality risks (O'Brien, 2015). A central part is to determine which level of delivery service is desired, such as delivery time, desired delivery frequency or the possibility of rapid ups and downs in ordered volumes (Oskarsson et al., 2021). Other possible segmentation criteria include: the service level necessary, profitability, the capacity available from the supplier, sustainability, the volume purchased by the supplier, the culture of innovation at the supplier and criticality (Lambert, 2012). Before a company can conclude an agreement, the company and the supplier need to agree on the logistical aspects of the contract (Oskarsson et al., 2021). There is no company for which all the points mentioned are relevant, it depends on the company's needs and business goals (O'Brien, 2015; Lambert, 2012).

2.1.6 Supplier segmentation

Supplier segmentation involves grouping suppliers with similar characteristics and after segmenting the suppliers, specific strategies are considered to communicate and cooperate with each segment (Lajimi & Majidi, 2021). Some suppliers are more important than others and this motivates different types of collaborations or relationships. The company's strategy and goals, how they satisfy their customers and the value they need from their supplier base form the starting point for the segmentation of the supplier base. Decisive for SRM is that the suppliers who are important needs to be given special attention (O'Brien, 2015). Supplier

segmentation plays a key role in SRM and a failure to fulfil it can result in a waste of resources, as well as working together with undesirable suppliers (Lajimi & Majidi, 2021).

A common approach to supplier segmentation involves dividing the supplier base into three groups in the form of strategic, important, and transactional suppliers (Mattsson, 2002; O'Brien, 2015). It can be visualized with a supplier pyramid (see figure 2) to describe the relationship between an organization and its suppliers, the higher up in the pyramid, the more important the suppliers become. At the lowest level are vendors with whom no special interaction beyond the transaction itself is required. For organizations with tens of thousands of different suppliers, these are of little or no importance other than fulfilling a simple order, purchase, or transaction. For the suppliers in the middle of the pyramid, performance monitoring, performance improvement or some form of governance is required. It can also involve that the supply chain behind these suppliers needs to be understood and subjected to stricter governance. At the top of the pyramid, there are usually only a handful of suppliers who are so important that the company tries to establish close cooperative relationships with them (O'Brien, 2015). Developing and maintaining partnership relationships requires a lot of effort, both in terms of time and resource consumption. It is not practically possible to establish partnership relationships with many suppliers (Mattsson, 2002). The pyramid can aid when a company wants to distinguish between different suppliers and identify possible collaborations and interactions at each level. The final step in the segmentation process is to determine appropriate relationships in relation to key suppliers and which relationships are possible based on the resources available (O'Brien, 2015).

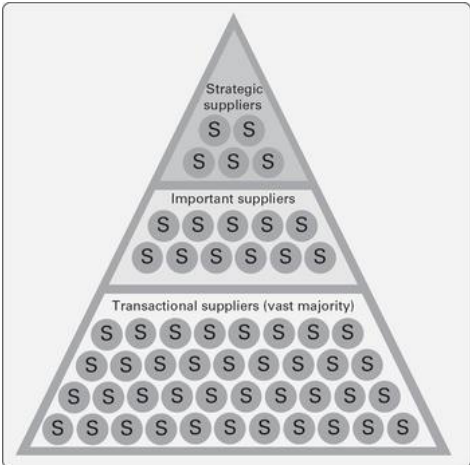


Figure 2-1, Visual picture of a supplier pyramid

2.1.7 Strategies for improvement of relationships

The following sections provides a comprehensive understanding of how to navigate and optimize different types of suppliers by presenting various strategies and approaches to enhance relationships with different types of suppliers. As each category of supplier requires their unique approach, an understanding of the category's distinct needs and dynamics is pivotal in order to be managed.

2.1.8 Strategic partners

Strategic collaborative relationships represent the highest level and are appropriate only in relation to those suppliers of strategic importance that have the potential to create critical benefit and value for the company (O'Brien, 2015). Partnership suppliers include joint product development, frequent information exchange on production processes, products, and quality issues. This often means joint investments in new technology and that improvement efforts are carried out together (Mattsson, 2002). Strategic Collaborative Relations (SCR) is an approach that aims to establish and improve relationships at a strategic level with a few critical suppliers who can add the greatest value to the organization. Relationships with strategic suppliers are today of crucial importance for all companies that want to survive and compete in an ever-changing, fast-moving, and volatile global environment to achieve competitive advantages (O'Brien, 2015). Granovetter (1985) believes that companies get partners who work with them by creating effective relationships, they do not get personal relationships through regular performance reviews or by agreeing on development plans.

Strategic collaborative relationships become possible through the interdependence between trust, transparency, coordination, communication, the potential benefits for both parties and an agreement on the partners' goals (O'Brien, 2015). Companies do not have relationships with companies, strategic collaborative relationships are based on the relationships between individuals. Due to this, there must be a clear division of roles and responsibilities for everyone involved, a relationship-enhancing structure and working methods, sufficient resources and investments that can support the continued relationship building (O'Brien, 2015). The goal is to make process improvements a win for both the firm and the supplier. If both parties do not gain from the relationship, it will be difficult to gain the supplier's full commitment to the company's goals (Lambert, 2012).

Examples of conditions that must exist for a successful relationship to be possible are:

- Clear and visible support from the suppliers' management
- The company is organized in a way that frees up resources for the relationship
- Visible cross-functional working methods and communication

2.1.9 Important suppliers

With important suppliers, SRM suggests working with Supplier Improvement and Development (SI&D) which is an essential part of the overall SRM approach and the potential it holds is dependent on how well it works with the other components of the SRM approach. It can involve simple actions aimed at getting a supplier to solve a problem with what they deliver. This can be done by working closely with a supplier to develop the competence of an entire process in a way that generates benefits for both parties. Every approach in this area is unique and should be adapted to the supplier and flexibility is of crucial importance for the right approach in every situation. The efforts can be divided into two categories based on how important the supplier is and the requested outcomes. Supplier improvements are corrective actions, and continuous improvement with a possible starting point in past performance, to achieve a new and improved position. Supplier improvements are most relevant to key suppliers and are mainly reactive in nature. Improvements may involve fixing a supplier-related problem, reducing, or eliminating known risks, reducing costs, improving performance and process efficiency (O'Brien, 2015).

Supplier development is when the company collaborates with suppliers to progress towards an agreed goal. Supplier development is most relevant to strategic suppliers and is proactive in nature. Development measures include, among other things, developing competence, developing a new product or service, creating a new differentiation factor, and releasing new value that benefits both parties. Improvement and development measures become more effective if they form a part of a more comprehensive SRM approach. The improvement initiatives are directly linked to the key figures and the development initiatives take their starting point in what the organization needs to get out of its supplier base. If the company has been effective in its development of the key figures, it will provide the measures and indicators they need to be able to move forward towards set goals. Corrective actions are sometimes not sufficient when problems arise with key suppliers since the company may need to take additional measures aimed at preventing the problems from recurring. With very important and strategic suppliers, the company can create greater opportunities for new value

creation in the supplier base. Through collaboration with key suppliers, significant competitive advantages are realized if the company avoids reactive approaches. This can mean anything from simple improvements to far-reaching collaborative programs that support the joint pursuit of mutually agreed goals to the company making some efforts to help the supplier develop its skills (O'Brien, 2015).

2.1.10 Transactional suppliers

SRM does not really deal with these suppliers other than to ensure that they fulfil their contractual obligations. The segmentation process aims to identify and confirm suppliers who are important or of strategic importance. With transactional suppliers, the company needs to find an arrangement that ensures that they handle their spend effectively with a minimum of effort. This involves minimizing resource needs such as not working with supplier follow-up for the vast majority as well as clear specifications and job descriptions (O'Brien, 2015).

2.2 Just-in-time (JIT)

A common philosophy utilized by the automotive industry is JIT which means allowing each flow to occur when there is an actual demand for it, and components are delivered exactly when they are needed (Lantz, 2015). Elements of JIT include inventory reduction, process improvement and elimination of waste (Kumar et al., 2013). One implementation of JIT focuses on reducing the buffer stock, which helps to identifying and addressing operational challenges like long set-up and lead times, but also quality issues (Ignatio & Mbohwa, 2006). This can in the long run lead to process improvements (Lantz, 2015).

Many companies have implemented production and material management routines based on JIT principles, primarily to reduce tied-up capital (Mattsson, 2002). This JIT implementation demands careful planning, frequent deliveries (Jonsson & Mattsson, 2011), and a reliance on efficient and dependable transportation systems (Kumar et al., 2013). A key principle of JIT is to avoid unnecessary practices such as overproduction, but rather manufacturing only what is demanded and exactly when it is needed. The main advantages of JIT are that it reduces inventory levels, improves product quality, as various operational issues are addressed, and shortens lead times. The drawbacks are the increased complexity in planning due to irregular demand and that it can take a long time before a JIT-based system operates effectively (Lantz, 2015).

For the JIT-philosophy to function, it must be supported by all functions in the company, it is not possible to limit JIT to just manufacturing. When JIT is used in purchasing, it is a philosophy that aims to make exactly the right amount of materials and products available at the exact moment they are needed. Effective JIT purchasing relies on well-coordinated communication with suppliers, often through advanced EDI systems. This coordination is crucial for ensuring timely deliveries and aligns closely with the production schedules, making the supply chain more responsive and efficient (Van Weele, 2012). The requirements placed on the suppliers within JIT are in most cases stricter, the requirements apply to both fault-free products and delivery precision which are two central criteria to assess suppliers. The suppliers are expected to provide error-free deliveries so that arrival checks can be avoided (Van Weele, 2012).

2.2.1 Delivery Precision

Delivery precision refers to the extent of which delivery takes place at the delivery time agreed with the customer (Mattsson, 2002). This variable primarily refers to the ability to deliver items that are not kept in stock and ready-made, both too early and too late deliveries are defined as low precision. Delivery precision is measured as the number of deliveries at the agreed-upon delivery time in days or a time interval in relation to the total number of deliveries (Jonsson & Mattsson, 2011). Delivery precision has become more important as many companies have reduced their stocks and receive smaller and more frequent deliveries. Car manufacturers are particularly sensitive to a lack of delivery precision (Oskarsson et al., 2021).

2.2.2 Order Accuracy

Order accuracy refers to the extent of which the right products are delivered in the right quantities (Mattsson, 2002). Order accuracy is defined as the number of customer orders without remarks, in relation to the total number of delivered customer orders. Remarks can be that the delivered items do not correspond to the agreed quantity or that the delivered items do not meet the set quality requirements. Reasons for the insufficient quantity can be that the wrong article or the wrong amount of articles is picked and packed at the supplier. Quality defects can occur in the supplier's processes and quality controls, they can also be caused during transport and handling after it is delivered from the supplier (Jonsson & Mattsson, 2011).

In summary, this thesis primarily focuses on the two theories above: SRM and JIT. By examining SRM, the study sheds light on the importance of maintaining robust supplier relationships and the impact of these relationships on supply chain resilience. In parallel, the focus on JIT offers insights into the operational aspects of supply chain management, particularly in terms of inventory management and process optimization. JIT is explored to understand how they can reduce the vulnerability to disruptions.

A crucial link between these two theories is the application of Electronic Data Interchange (EDI). EDI facilitates efficient communication and standardized information exchange, pivotal for both SRM and JIT. In SRM, EDI aids in maintaining robust and responsive supplier relationships, while in JIT, it ensures timely delivery and alignment with production schedules. According to Hill and Scudder (2002), EDI is defined as the transmission of standardized business transactions from one computer to another. Webster (1995) argues that EDI enables “*sharing of information and thus much closer relationships between trading partners, allowing them to alter radically their procedures for dealing with one another in procuring supplies, delivering goods and services, and carrying out financial transactions*” (p. 32). EDI is primarily used between companies and organizations who have a regular and recurring exchange of information based on structured information (Mattsson, 2002), and for order for the system to function, both systems must use the same standard (Jonsson & Mattsson, 2011). Furthermore, implementation of EDI in organizations is crucial as it enables rapid and automatic information transfer, leading to more effective and efficient integration and coordination between the business partners (Masudin et al., 2021).

3. Methodology

This chapter outlines the methodological framework of the study, and includes the concept of a single case study and the combination of inductive and deductive approach to explore the topic and fulfil the purpose of the study through semi-structured interviews and observations. Furthermore, this chapter also outlines the study's credibility and the procedures for maintaining the validity and reliability of the findings.

3.1 Research approach

In this thesis, a qualitative approach was chosen for its effectiveness in capturing the nuanced details of SRM and supply chain dynamics. This method aligns with the aim of gaining a deep, contextual understanding of the automotive industry's challenges. Furthermore, the study used a combination of deductive and inductive reasoning. Deductive reasoning was initially used to apply established supply chain management and SRM theories to Volvo Group's context. Inductive reasoning played a crucial role in analysing empirical data from interviews and observations within Volvo Group. This approach helped to draw broader conclusions about supply chain disruptions and SRM practices, grounding theoretical concepts in practical, real-world scenarios. The combination of qualitative analysis, deductive, and inductive reasoning offers a comprehensive understanding of the subject, effectively meeting the study's objectives.

3.2 Single case study

For the purpose of obtaining an understanding of the research question, this study includes a single case study at Volvo Group.

The Volvo Group, founded in 1927 by Assar Gabrielsson and Gustav Larson, is today one of the world's leading manufacturers of trucks, buses, construction equipment and marine and industrial engines. The group's portfolio includes a range of brands like Volvo Trucks, Volvo Buses, Volvo Construction Equipment, Volvo Penta, Mack Trucks, Renault Trucks (Company presentation, 2023). Volvo Group has a global presence in over 190 markets, employs around 102,000 people, and has production facilities in several countries. Volvo Group also has a network of 50,000 supply chain partners who contributes significant value to the company's operations. With approximately one million individuals engaged in delivering to the Volvo Group, the network is responsible for providing 2.5 billion parts to Group Trucks plants every year. This highlights the scale and impact of the collaboration between Volvo Group and its extensive supply chain.

Volvo Group was chosen since it is a large, global organization with a complex supply chain. Studying Volvo Group offers rich insights into the challenges and strategies to managing disruptions within a supply chain. Additionally, as an established organization in the automotive and manufacturing industries, Volvo Group likely already has different systems and strategies in place to manage disruptions. Furthermore, Volvo Group works with different

strategies such as JIT, SRM and EDI. Analyzing these strategies and approaches within the context of a real-world organization allows for a practical examination of theoretical concepts. This makes Volvo Group an ideal subject for a comprehensive case study for this thesis and the research objectives. Furthermore, the selection of this case company make the findings and possible solutions applicable to other companies in the automotive industry as well.

3.3 Data collection

To address the research question of the study, several approaches were carried out for data collection. The study originated with an extensive literature review to construct and establish the theoretical foundation for the thesis. This was complemented by a case study where several interviews and observations were conducted to gather empirical data. In addition, analysis of relevant internal and external documents from the company in the case study was undertaken, in order to deepen the understanding of the practical applications and implications of the theoretical concepts.

Interviews and detailed observations were conducted to collect the primary data essential for the case study. Concurrently, an extensive review of literature sources, including books, articles, papers, and reports was undertaken to gather secondary data to provide a comprehensive context for the primary findings.

3.3.1 Collection of Empirical Data from Volvo Group

In this study, empirical data was gathered through a comprehensive case study at Volvo. The data collection included various semi-structured interviews, in-depth observations, and thorough examination of the company's internal and external documents. Due to confidentiality, internal material could not be shared outside the interviews. Instead, notes were undertaken. The interviews were conducted as semi-structured interviews, as predetermined questions and probing follow-up questions are combined (Patel & Davidson, 2011). This multifaceted approach was designed to garner a rich and detailed understanding of the company's practices and challenges, focusing on SRM, supplier base issues, and logistics operations.

3.3.2 Selection of interviewees

Selection of the right participants is crucial and must be systematically selected according to a formulated criteria that are either theoretically or strategically determined (Holme & Solvang, 1997). This study has used strategically determined criteria in the selection process.

In order to gather a comprehensive understanding of the disruptions regarding material supply and challenges faced by both the firm and its suppliers, numerous respondents with different experiences and positions were interviewed. The selection process was carefully conducted, prioritizing individuals with significant expertise and informed perspectives in key areas such as supplier management, JIT practices, inventory management, procurement, and SRM. This careful selection ensured that the participants possessed the necessary experience and knowledge to provide valuable insights relevant to the study's objectives.

Respondent	Position	Interview Format	Duration (min)
R1	Head of Material Cost Control	Face-to-face	60
R2	Logistic Management Scouring	Face-to-face	90
R3	Global Process Manager	Virtual interview	90
R4	Material Controller	Face-to-face	80

3.3.3 Observations

Observations provide an opportunity to witness the actual practices, behaviours, and processes within an organization, offering a practical perspective that might not be fully captured through interviews alone. The conducted real-time observations provided valuable insights into the dynamics of the production processes, as well as a clear understanding of various operations and tasks, such as inbound material handling and material inventory management. The observations were documented to ensure validity and reliability.

The chosen locations for the observations were DFDS⁴ in Gothenburg and the Volvo Truck production site in Tuve. These sites were selected due to their relevance and contribution to the research objectives. The observations at DFDS provided insights into logistics and transportation aspects, as well some insights of Volvo's JIT practices. The visit to Volvo Trucks production site in Tuve allowed for a closer examination of their manufacturing

⁴ DFDS is a Danish international shipping and logistics company, providing maritime freight and logistics services.

processes, inventory management, deeper JIT practices, supplier relationship and supply chain management.

3.4 Data Analysis

The complexity and volume of qualitative data, interviews, site observations and secondary sources, required a structured and iterative analysis process. The process started with transcribing interviews and closely reviewing observational notes, in order to organize the primary data. This process set the stage for the research approach, which integrated both deductive and inductive reasoning. The collected data was then compared against the studied theoretical framework, using deductive reasoning to ensure that the findings from the case study were grounded in the theoretical framework.

Simultaneously, through inductive reasoning, this thesis remained open to new patterns and insights that emerged from the case study data, going beyond the existing theoretical framework. This combined approach ensured a balanced and thorough analysis, grounding the findings in theory, while also exploring new perspectives in the outlined theoretical framework. Such a methodology was designed to provide a holistic and insightful perspective on the subject of matter, allowing to answer the research question, draw meaningful conclusions and, if possible, suggest recommendations for improvements.

3.5 Validity and Reliability

While interviews and observations were valuable methods to pursue this study's research questions, they were not without challenges. By approaching a critical reflection on those methods, measurements were undertaken to address its limitations and potential biases. In order to enhance the reliability of this study, all conducted interviews were recorded and transcribed in detail. Observations and other documents were also documented to increase the reliability of this study.

Regarding the interviews, there is always a risk of inaccurate information from the chosen participants on their perception or based on their individual interests and perspectives rather than the actual reasons behind their supply chain disruptions. This issue is compounded by the potential unwillingness of the participants to disclose certain information due to confidentiality or fear of implications. Unfortunately, the participants' names are concealed to

maintain confidentiality, yet as a compromise, their roles are specified to provide context to their insights and perspectives, and thus minimize the risk of reducing the replicability of this study. Furthermore, one limitation should be addressed regarding the interview questions. The majority of the interview questions were asked to all participants with some exceptions due to their different positions. In order to further enhance the reliability and validity of the findings, strategies as triangulation has been used. Triangulation is when gathering data through several sources to confirm the given information. If the same result is obtained, the data is valid (Zohrabi, 2013).

4. Empirical Findings

In this chapter, the focus is on Volvo Group's approach to SRM and their supplier base, highlighting the challenges encountered in maintaining robust supplier relations.

Furthermore, the chapter also examines the implementation and operational challenges of JIT and EDI systems at Volvo Group, emphasizing their role and hurdles in ensuring effective supplier communication and supply chain flexibility.

4.1 The sourcing process and requirements

The sourcing process at Volvo consists of a cross-functional core team with surrounding functions who support when necessary, depending on the purchased part. The primary reason for sourcing is when Volvo needs suppliers for new parts, where approximately 70% is new parts and the remaining with pre-existing parts (R2). The focus is not in finding the lowest price, both respondents R1 and R2 highlights that the quality requirements are particularly crucial. The process for sourcing is complex and long, where there is approximately a 3–4-year gap between signing contracts and start of deliveries, which presents some challenges (R2). As the sourcing function operates in advance, it faces difficulties in securing all the required inputs for meeting the contractual obligations (R2). As part of the sourcing process, the sourcing team examines the supplier's volume capacity and how much they can handle but does not specify volumes in the contracts. Furthermore, the minimum requirements for

suppliers follows the KEP 7 protocol, requirements include amongst others a minimum delivery precision of 85% and EDI communication⁵.

“All the requirements from the cross-functional team are gathered when they send a request for proposal. Thereafter a potential supplier list is created, the whole process involves finding the best supplier based on all parameters.” – R2

Within the core team a financial analyst examines the potential supplier's financial stability and how high their dependency is on Volvo (R2). Both Respondents R1 and R2 mentions that Volvo does not want the supplier to be dependent on them and that this goes both ways. Volvo monitors the supplier's financial situation to see if they can aid the supplier before a crisis is a reality (R1). In the upcoming, years financial crises and bankruptcy awaits due to an expected recession which will affect many suppliers. This is something that Volvo will have to pay attention to, partly from a supplier going completely bankrupt to a reconstruction at the supplier (R3). Volvo keeps developing and adding new criteria's, an important new requirement is sustainability.

4.1.2 Handling suppliers

Volvo's primary suppliers have been and are strategic or important due to the specific parts Volvo demands, the company barely deals with transactional suppliers (R1). However, partnership suppliers have been a new strategy in recent years where Volvo invests more in strategic suppliers where the aim is to work together in the long run. This is especially evident if the suppliers have a technology Volvo requests in their Trucks (R3). If the contract is not long-term, the supplier would be hesitant to invest themselves in innovating in product development. There are also higher demands on the strategic suppliers with EDI where direct connections for communication are specified in the contracts (R1).

Volvo has segmented their supplier base according to materials and processes such as metal, windshield wipers and casting and forging (R1;R2). Thereafter, it is evaluated how many suppliers are needed within each segment, where they should be located, and how to work with them in the long term. Volvo reviews the suppliers base within the segments at least once a year and how they wish to continue forwards (R2).

⁵ See “4.3.1 Supplier Requirements”, page 26 for further explanation.

All incoming materials are made-to-order as Volvo works with just-in-time where the emphasis is on flexibility and customer customization. Communication takes place regularly through EDI where MRP is shared for requested quantities. Despite this, Volvo has problems with wrong quantities or quality which has caused them to carry out arrival checks. Problems with delayed shipments is something that occurs daily as well (R4). Even though Volvo has implemented JIT with their suppliers, quality and technical solutions at the supplier outweigh their primary KPI delivery precision (R2;R3).

4.1.3 Known disruptions and challenges ahead

A lot of the disruptions are not random and could be predictable. The most common reasons for disruptions are capacity changes, cyber security, shortage of components and geopolitical risks (R2). Other identified disruptions involve customs and lead times. In order to overcome disruptions, due to long-distance suppliers with long lead times, Volvo requires a facility or a warehouse in Europe. Occasionally, Volvo also steps in and makes an investment in a new machine or a production line to increase the capacity. If a type of disturbance concerns quality, the parts are sent back where an assessment with the supplier takes place to review the deficiency. It is more beneficial for both parties if a crisis does not emerge (R1). The trend is to switch to regional suppliers, nearshoring, dual sourcing, and resilience given the experienced disruptions due to the COVID-19 pandemic (R2). The greatest challenge ahead is the conversion to electromobility, as several of the partnership suppliers have specialized in Volvo's diesel engine. These suppliers will probably be terminated and replaced by new ones. This could lead to Volvo acquiring an unknown supplier base with suppliers who have never worked in the automotive industry before (R1).

“The main causes to disruptions are capacity changes up and down, cyber security and hackers. Others are strikes, geopolitical issues and lack of components.” – R2

4.2 Volvo Groups view of SRM

Volvo emphasizes the importance of SRM in their operations. This approach is reflected in their strategies to build and maintain relationships with suppliers. Their SRM approach is also not just a process for management and maintaining existing relationships, but a strategy to create long-term partnerships. Furthermore, it was clear that their view of SRM focuses on maintaining a flexible and responsive supply chain, a strategy that is central to both their daily

operations and long-term goals. By focusing on open communication, mutual trust, and collaboration, Volvo strives to establish strong ties with its suppliers.

“The overarching thing is that Volvo Group wants open, straightforward, and honest communication. We also feel that as long as there is mutual trust, especially between the materials controllers and the planners, the supplier benefits greatly from this, and the collaboration becomes much stronger with them.” – R3

4.2.1 SRM as a strategy

The SRM function at Volvo is divided into two approaches, proactive and reactive. The proactive side primarily focuses on establishing and maintaining standards and procedures to prevent potential problems and optimize supplier relations (R3). This includes ensuring that suppliers adhere to logistics requirements and standardized certifications like MMOG (Materials Management Operations Guideline) which covers broad aspects of operational efficiency from a logistics perspective. However, this proactive approach is challenging, given the extensive and diverse range of suppliers involved. Instead, the focus is primarily on the top suppliers based on the procurement value and other criteria (R3).

On the reactive side, the SRM function is geared towards immediate problem-solving and crisis management when unforeseen issues arise. This approach is more operational and short-term oriented. Volvo handles those types of crises through several specific strategies and processes (R3), such as;

- *Escalation Ladder*: This strategy is employed to manage and resolve ongoing issues with suppliers, as disruptions and delays of material. When material controllers identify a problem that cannot be resolved immediately, the issue is progressively escalated through the organization. It starts with material controllers attempting to address the problem and, if unsuccessful, the matter is forwarded to higher-level managers and eventually to the SRM team. The SRM team then takes over and collaborates with the supplier to find a solution. This collaboration is a part of Volvo's crisis management, where two diverse processes have been adapted to handle crises effectively. 1) implementing different action plans, conducting site visits, and KPI monitoring to help suppliers quickly overcome operational issues and disruptions and 2) carry out what's known as Minimum Demand Split (MDS), as they distribute

available supplier inventory to different Volvo sites based on urgent needs and priorities.

- *Task Force Groups*: This approach is usually conducted in response to a more specific, often complex, and urgent crises. This by bringing together a cross-functional team of experts who are capable of handling specific crises effectively. These groups take a comprehensive approach to the situation, from identifying problems to implementing solutions. This is usually something that is coordinated by SRM. Depending on the issue, they review the needs and organize and combine the necessary resources.

The respondent emphasized that they don't send out Task Force Groups to all of their suppliers in need and crises, but rather only if it concerns suppliers with recurring issues or when there is something quite critical, such as disruptions of an important component (R3).

"Important to remember that we do not send out Teams to all suppliers during a crisis, it is impossible. We do it with suppliers who have repeated problems, or when there is something quite critical. We have resources, but they are simply not sufficient for all suppliers." – R3

There have been several successful cases where they have sent out Task Force Groups to suppliers in order to resolve different urgent crises (R3). For instance, when a supplier was hit by a cyberattack and couldn't use their IT-system for several weeks, Volvo sent out a group in order to reestablish production without IT support. Another occasion was when there was a shortage of a particular type of rubber due to an accident at the supplier, resulting in disrupted production. The group resolved the issue by finding and using a different type of rubber as a substitute in the affected articles (R3).

Further, the respondent points out a significant challenge in SRM when suppliers are reluctant to be transparent (R3). SRM is solely focused on logistics and delivery aspects of the relationship, while the procurement is responsible for commercial relationships.

The role of SRM is described as a coaching role, guiding larger suppliers towards better practices and efficiency. They do this by consulting suppliers about production practices, tracking Key Performance Indicators (KPIs), examining factory operations, reviewing delivery follow-ups, and understanding how suppliers manage their subcontractors (R3). The

challenge arises when the suppliers believe they manage these aspects themselves and are unwilling to share how they work with different processes.

"In other words, SRM in our organization plays a coaching role. Ultimately, it's up to the suppliers how they choose to utilize this resource, the coaching from SRM. It's also possible that the suppliers feel that they manage these aspects themselves and do not wish to share with us how they work with various processes. Thus, it's about how transparent they want to be." – R3

4.3 Electronic Data Interchange (EDI)

Volvo implements Electronic Data Interchange (EDI) to streamline its daily operations, as evidenced by insights from the respondents. EDI is primarily used to manage and communicate important details about material needs and deliveries between Volvo and its suppliers. This system allows for quick and accurate data transfer, which is crucial for a seamless production process.

4.3.1 Supplier Requirements

The KEP 7 document from Volvo addresses EDI by establishing clear communication protocols for their supply chain. It mandates precise standards for EDI transactions and ensures that the data exchange between Volvo and its suppliers is standardized and efficient. This approach facilitates accurate and timely order processing, dispatch, and delivery tracking, which are critical for maintaining a smooth and responsive supply chain. The emphasis on EDI in the KEP7 document reflects Volvo's commitment to leveraging technology for improved logistics and operational efficiency.

4.3.2 Daily Use of EDI

Respondent R1 and R4 emphasize how EDI enables them to send weekly volume forecasts to suppliers, offering a dynamic and flexible approach to procurement. This system allows Volvo to avoid fixed volume commitments, crucial for adapting to market changes and demand fluctuations. EDI also contributes to strengthening partnerships with suppliers through open communication and shared data (R3).

According to respondent R3, EDI is an invaluable tool in daily material management. It provides real-time data on inventory levels, expected deliveries, and facilitates proactive management of potential shortages and disruptions. Respondent R2 also underscores the importance of EDI for logistical requirements, such as ensuring that suppliers meet expected standards for delivery precision and efficiency.

4.3.3 Challenges with EDI

Despite its advantages, Volvo has also encountered challenges with EDI, as shared by the respondents. A recurring theme is the need to ensure that all suppliers are fully compatible and efficient in using EDI. This challenge is particularly prominent when integrating new suppliers or dealing with suppliers from different parts of the world, where technical and operational standards may vary.

Respondent R1 mentions specific EDI requirements in contracts, especially for strategic suppliers, which can be challenging when working with smaller suppliers or those new to the system. Respondent R3 emphasizes the importance of clear and open communication through EDI, which can be challenging when trying to manage and resolve disruptions in the supply chain. To address these challenges, Volvo has taken measures including regular training and support for suppliers to ensure smooth integration and use of EDI. They have also developed internal processes to quickly identify, and address issues related to EDI communication, which Respondent R4 highlights as crucial to avoid production disruptions. Despite the challenges associated with its implementation and use, Volvo has utilized EDI as a tool to improve its operational flexibility and responsiveness in a dynamic global market.

4.3.4 Supplier Communication

Within Volvo, communication with suppliers is a core component that must constantly navigate an environment characterized by uncertainty and change. This dynamic process requires a combination of both traditional and digital communication methods to effectively manage supplier relationships. The company relies heavily on EDI to enable fast and standardized transfers of order and delivery information, which is crucial for minimizing errors and misunderstandings.

In addition to EDI, Volvo involves regular meetings, email exchanges, and sometimes direct phone calls to address specific issues such as delivery delays or quality problems. This

multifaceted communication strategy is necessary to quickly handle disruptions that can lead to material disruptions and production problems (R4). This flexibility in communication is crucial for keeping pace with the fast-moving and unpredictable nature of the automotive industry (R4). Communication with suppliers varies in frequency depending on needs and situations. During periods of high demand or significant market changes, interaction can be daily, especially with suppliers critical to production. Volvo strives for a communication model that is open, transparent, and regular in order to enable quick responses to changes and reduce the risk of misunderstandings. Respondent R3 emphasizes the importance of strong and honest relationships with suppliers, which requires a constant and open dialogue.

One of the biggest challenges for Volvo is managing the uncertainty and volatility inherent in vehicle manufacturing. Respondent R1 highlights the difficulties in providing accurate volume forecasts. This uncertainty makes it challenging for suppliers to effectively plan their production, often leading to communication shortfalls and delivery problems. Additionally, another challenge is integrating new suppliers into the system, particularly considering the transition to electromobility (R1;R2). This transition entails new technical requirements and the need for detailed and technical communication to ensure that suppliers can meet Volvo's specifications and standards.

These challenges require a deeper and more sophisticated communication strategy where Volvo must work proactively not only to react to current problems but also to anticipate and plan for future challenges. It requires a balance between maintaining stable supplier relationships and being flexible enough to adapt to an ever-changing market (R2). This is central to Volvo's success in a competitive global environment.

4.4 Just-In-Time

Volvo's Just-in-Time (JIT) strategy is a crucial part of their success in the automotive industry, where they continually adapt to new challenges and market changes. This strategy focuses particularly on flexibility in production and procurement, efficient management of supplier relations, and adaptation to technological shifts such as vehicle electrification.

4.4.1 JIT's role in enhancing flexibility

Flexibility and customer customization is a key principle in Volvo's JIT system. They avoid fixed volume commitments, allowing for rapid adjustments to market fluctuations. This

approach, supported by regular and detailed volume forecasts, ensures that the company can meet varying demands without committing to specific quantities. Respondent R1 emphasizes the importance of not committing to specific volumes to quickly adapt to shifting market demands. In more than 99.9% of cases with suppliers, there is no volume clause in the contracts.

According to Respondent R3, inventory levels vary depending on the factory's geographic location, with a tendency towards very low inventory levels in European facilities. However, there has been an increase in inventory levels due to recent challenges (R3). This trend is especially noticeable in factories located far away from their suppliers, such as the factories in the USA that rely on deliveries from Europe. Volvo has ensured that JIT will function since they have implemented regional pick-up points and requires that long-distance suppliers have a facility or a warehouse where they can make call offs from.

Sea freight, a critical component in the logistics chain, has proven exceptionally sensitive to disruptions (R3). Monthly reports show average delays of over six days per delivery since the COVID-19 pandemic, with some delays extending to 14 days or more. These delays are significantly higher than those experienced before the pandemic, and a return to previous volumes or efficiency levels has not yet occurred. In response to these logistical challenges, the group has, according to Respondent R3, taken steps to increase safety stocks at factories located further away from their suppliers. This strategy is necessary to ensure a continuous production process and to minimize the risk of disruptions in the production flow caused by delayed deliveries. These strategic adjustments in inventory management are crucial for maintaining an efficient and stable global operations structure (R3).

4.4.2 Risk Management

A central element of Volvo's JIT strategy is the use of dual sourcing, especially for critical components such as semiconductors. This method reduces the risk of production being at a standstill and enhances competitiveness, even though it incurs higher costs compared to single sourcing. Dual sourcing became particularly relevant after the challenges during the COVID-19 pandemic, highlighting the importance of not being overly dependent on a single supplier. However, it is more costly to maintain multiple suppliers, and the process of maintaining these and quality controls is more expensive than single sourcing (R1).

4.4.3 Previous Challenges

Volvo has encountered and addressed several challenges in its JIT implementation. Among these challenges was a lack of flexibility in the supply chain, which the company managed by introducing weekly volume forecasts and avoiding fixed volume commitments in their contracts. Another challenge was their previous dependence on individual suppliers for critical components, which was addressed through dual sourcing. The company has also faced global disruptions, such as economic crises and pandemics. This has driven them to increase geographic diversification and develop more robust risk management strategies. As Volvo requires that their suppliers have a facility or warehouse in Europe, there are relatively few items that are shipped over long distances where Volvo handles the freight. An early challenge was balancing low inventory levels with a smooth production flow, which was solved through improved forecasting methods and optimization of internal logistics processes.

Looking forward, Volvo is concentrating on advancing their delivery and transport policies, which naturally also impacts their JIT strategy, with a particular emphasis on sustainability and environmental responsibility (R1). By integrating environmentally friendly processes and setting higher standards for suppliers' sustainability practices, they position themselves as a leader in responsible and sustainable vehicle production. Overall, Volvo's JIT strategy has evolved into a dynamic and adaptable model that effectively responds to current and future needs in the automotive industry (R3).

5. Discussion and Conclusion

This chapter provides an overall discussion and conclusions. It starts with an overview of the current state at Volvo Group and ends with possible solutions and recommendations.

5.1 Discussion

Based on the findings, Volvo's SRM approach seems to be engaged heavily in handling immediate and urgent issues within the supply chain rather than proactive supplier development. While this reactive approach is necessary for addressing unexpected and short-term disruptions, it can lead to neglect of strategic planning when shifting away from traditional SRM roles, such as nurturing and developing supplier relationships. This often

results in weakened supplier relationships and missed opportunities for strategic improvements with already existing suppliers, leading to the costly process of sourcing new suppliers. This shift away from traditional SRM roles seems especially evident in recent years at Volvo for various reasons, particularly due to the COVID-19 pandemic. The pandemic has posed significant challenges for Volvo, as well as the entire automotive industry, causing substantial delays in sea freight deliveries and disruptions with suppliers. Especially electronic component suppliers stand out statistically, where they have experienced significant problems with production and delivery, particularly of semiconductors (R3). Consequently, this has required more focus on reactive approaches at the expense of proactive ones. However, this does not mean that Volvo entirely excludes proactive approaches. The problem, as we see it, is rather how and which suppliers they work proactive with. According to a respondent, due to limited resources, they mainly work proactive with their absolute biggest suppliers (R3) after specific criteria, such as procurement value.

There are several issues with this type of selection:

Feeling of neglect. Suppliers would be more willing to invest in assets to enhance the value provided by the buying firm if they feel they have a relationship with the firm (Sheth & Sharma, 1997). By excluding smaller suppliers, Volvo increases the risk of supply chain disruptions. Suppliers may feel overlooked, potentially resulting in diminished engagement and the willingness to be flexible during demand fluctuations. This poses a significant issue as Volvo has no volume clause in the contracts and anticipates suppliers to remain adaptable to fluctuating demands (R1).

Lack of visibility. By only working proactive with its biggest suppliers, Volvo risks leading to situations where suppliers, with unique innovations, do not get the support they need to develop their offerings to Volvo. The absence of proactive approaches with these suppliers can also result in a lack of visibility into their capacity situation or other challenges, leading to communication failures, material shortages and delivery delays.

Duplicate efforts. Larger suppliers often have their own comprehensive support systems and resources in place for self-improvement and crisis management. Volvo's proactive support may therefore not be as impactful as intended, potentially leading to a waste of resources and inefficiencies. This is also challenging when SRM at Volvo is described as a coaching role,

where the ultimate utility of the resources provided depends on the supplier's willingness to engage and be transparent about their processes (R3).

Unwilling to share information

As mentioned above, the effectiveness of proactive approaches largely depends on the willingness of the suppliers to utilize the guidance and support offered by Volvo. Thus, the underlying assumption that larger suppliers automatically require or will benefit from proactive development efforts may be misguided. Therefore, Volvo would benefit from a more tailored and discerning approach in their SRM practices, where they identify and direct their resources towards suppliers who genuinely need and are open to such support, irrespective of their size. By focusing on a tailored approach in their SRM practices, they can also proactively address potential risks before they escalate into disruptions. Through identifying suppliers who are vulnerable or crucial to the supply chain and to get an understanding of their challenges, capabilities, and needs, Volvo can offer tailored support and enhance the overall resilience and reduce the likelihood of disruptions. The findings also revealed that Volvo barely deals with transactional suppliers, however, they did not minimize their spend on these. By identifying these transactional suppliers, they could free up resources to focus more on proactive solutions with strategic suppliers. In order to do so, Volvo needs to form an idea of what interest the supplier has in improvements.

However, with important suppliers they need to manage the supplier improvements to ensure some form of corrective action where improvement or progress occurs. It is important that the overall SRM approach is characterized by such an approach as the results and outcomes Volvo seeks will not be realized if they remain passive. When a company requires improvements and development, the company cannot assume that the supplier will meet their requirements, they need to evaluate the extent to which the supplier is receptive and interested in the company's requests for improvement (O'Brien, 2015).

How the procurement function operates at Volvo is aligned with the SRM theory, emphasizing a cross-functional team that examines all necessary aspects of a potential supplier. The findings also revealed that Volvo is grappling with dual pressures of high vehicle demand and complex supply chain challenges (R1). When Volvo is sourcing a supplier, it takes approximately 3-4 years before they start to deliver, which implies that this gap can be the potential cause for supplier implications. Given the fact that Volvo is in the

process of sourcing new suppliers for the conversion to electromobility, they should consider integrating more advanced analytics and predictive technologies in the review of the process. Additionally, they should also consider well-specified terms and processes in order to implement SRM at an early stage.

The high vehicle demand Volvo is experiencing could also be an additional motive behind the shift away from traditional SRM roles, as this may force Volvo to prioritize immediate, day to day problem-solving over strategic supplier development. These advanced tools can provide valuable foresight into potential disruptions, enabling the SRM team to anticipate challenges and formulate proactive strategies. This shift from a reactive to a more proactive stance can mitigate risks and minimize the impact of potential disruptions. Predictive analytics do not only improve immediate operational effectiveness by providing real-time insights for better decision-making, but also contribute to the strategic aspect of SRM. By anticipating potential supply chain disruptions and preparing accordingly, Volvo can ensure a more stable and reliable supply chain.

As previously mentioned, the fact that Volvo has an almost non-existing volume clause in the contracts with suppliers is something that can be contributing to the material supply disruptions. One solution to this issue is better communication and collaboration between the SRM and the procurement department at Volvo. Such a cooperative approach can provide procurement with a more comprehensive understanding of which suppliers require more explicit contract terms, guided by insights provided by the SRM. With the information provided, procurement can get an understanding of which suppliers pose higher risks or those that have shown a pattern of inconsistency such as in delivery service. This information can then be used by procurement to negotiate contracts with relevant specifications and volume commitments. Such detailed contracts can help in managing expectations and obligations on both sides, leading to a more predictable and reliable supply chain. Furthermore, this can also provide Volvo with critical information on how to strategically decide correct safety stock from suppliers identified as high-risk, and therefore mitigate potential supply disruptions more effectively.

Volvos current JIT approach

One aspect of SRM involves Volvo's implementation of JIT, while SRM focuses on the relationships with suppliers, JIT focuses on streamlining the whole supply chain which

naturally includes all suppliers. One implication of implementing JIT is that the company will be prone to disruptions in material supply since this philosophy requires that everything works smoothly and fault-free. If one entity within a supply chain fails to deliver according to plan, the entire supply chain is affected. One particular aspect that stands out is that suppliers are expected to provide quality, quantity, and time assured deliveries so that arrival checks can be avoided. The findings reveal that the JIT practice at Volvo is not aligned with the theoretical philosophy since they still carry out arrival checks due to daily disruptions with order accuracy and delivery precision. This implies that trust, communication, and supervision could be improved in order to have a smoother flow. By having a minimum delivery precision requirement of 85% according to KEP 7, even though Volvo expects 100%, they should consider raising the limit. However, given that quality outweighs delivery precision, it is impractical to find a solution without doing a more comprehensive study. A more practical solution would be to increase the inventory provided there is space enough even if it goes against the JIT theory. Volvo needs to evaluate whether the inventory costs match the total costs of disruptions within material supply. What mainly affects the choice of supplier is not the purchase price, but the total cost levels such as the costs including waste that occur due to low supplier performance, safety stock, quality controls and possible production stops (Van Weele, 2012).

Volvo has, however, implemented JIT according to theory in another aspect since all trucks are made-to-order, inventory levels are kept at minimum, and they work with continuous improvement. Volvo has focused on minimizing their buffer stock to the point where they explicitly said that they do not have any safety stocks. They have sufficient components for one day, this means that their JIT practice is very fragile to disruptions. Many companies have decided to introduce production and material management routines based on the JIT philosophy to reduce tied-up capital. In many cases, this has led to a reduction in tied-up capital in the companies in question, but at the same time it has increased to a corresponding extent for their suppliers. This means that the costs are merely shifted, sooner or later the suppliers have to take out their costs for the increasing capital tied-up towards the customer. It does not imply any actual streamlining of the supply chain as a whole (Mattsson, 2002). One of the challenges with JIT is that it requires suppliers who deliver the right materials, at the right time and with the right quality. The findings revealed that Volvo suffers from all these factors.

Disruptions and potential solutions

Capacity changes are the primary cause of material disruptions according to R2, this implies that the weekly forecasts may be a bigger problem for their suppliers than expected. Volvo should ensure that their selected suppliers have enough resources for demand fluctuations. The suppliers are an important part when implementing JIT, they must be challenged to find new ways to improve their operational processes. If the material planning changes often due to changes in the production planning, disruptions occur in suppliers' delivery plans. The MRP systems must be updated frequently with correct information otherwise the planning information becomes unreliable. It is also important that the basic logistics information is updated regularly (Van, Weele, 2012).

If the company works with incorrect information about stock levels and delivery dates, orders will be placed too early in relation to suppliers' lead times, which creates extra work and increases transport costs. In order to make the suppliers' work easier, they should be informed about production planning and related purchasing needs every day, week, and month. This way of working allows the supplier to anticipate the customer's future needs and thus the production and material needs can be planned more efficiently. The suppliers can connect their production and material planning systems with the customer's system; however, this requires developed EDI systems, otherwise the customer will opt out (Van, Weele, 2012). One additional point is that the procurement function should examine if the suppliers can handle sudden capacity changes more thoroughly given Volvo's demand fluctuations. These kinds of disruptions could be prevented by acknowledging that required volumes may go up or down by a certain percentage according to theory. Another solution may involve having closer communication or supervising their suppliers in order to be more prepared to handle a potential disruption before it emerges.

Improving EDI communication

The findings reveal that some of the daily disruptions could be resolved by improving communication through EDI. Volvo has an advanced EDI system where they communicate with their suppliers daily. However, given that some communication issues were highlighted by R4, a solution would be to implement a time window in their contracts with suppliers to eliminate the problem with suppliers who do not answer fast enough. Since Volvo has weekly volume forecasts sent to their suppliers through EDI it is important that they can ensure that

the supplier has taken part of the information. If a problem occurs it is crucial that Volvo is informed in time to possibly assist the supplier.

5.2 Conclusion

This thesis has explored the complex dynamics of SRM and JIT practices in the automotive industry. The investigation of this thesis reveals that the automotive supply chain is characterized by a high level of interdependence among suppliers and manufacturers, and faces significant challenges in terms of material supply disruptions. These disruptions are often the result of capacity changes, geopolitical risks, cyber security threats, and other emerging challenges such as the conversion to electromobility.

In order to gain a comprehensive understanding for this study's research objectives, a single case study was conducted at Volvo. The findings underscore that while Volvo has implemented effective strategies and practices in managing its supply chain, there remain areas for improvement, particularly in the realm of proactive supplier management.

Volvo's reliance on reactive SRM approaches, though effective in crisis management, tends to overshadow the traditional SRM role of nurturing supplier relationships. This shift towards a more reactive stance, aggravated by the COVID-19 pandemic, has led to a focus on immediate problem-solving at the expense of strategic planning and supplier development.

The study also highlights the critical role of JIT in enhancing the flexibility and efficiency of the supply chain. While Volvo's JIT implementation aligns to the theory in several aspects, it still faces challenges related to supplier delivery precision and order accuracy.

These issues, combined with minimal stock and no volume clause in the contracts with suppliers, increases the supply chain's vulnerability to disruptions. The need for improved forecasting and supplier capacity management is evident as well as the importance of maintaining a balance between minimizing inventory and ensuring a smooth production flow. While Volvo effectively utilizes EDI for daily operations and communication with suppliers, the findings indicate that there are opportunities to enhance its functionality. This includes implementing more stringent communication protocols and time windows in the contracts to ensure timely and efficient information exchange.

Overall, the research suggests that Volvo, as any other company in the automotive industry, can benefit from a more integrated and balanced approach to SRM, where proactive supplier

development is given equal emphasis alongside reactive crisis management. Enhancing communication protocols through EDI and refining JIT practices to better accommodate supplier capacities and market fluctuations can lead to a more resilient and efficient supply chain. These improvements are not only essential for mitigating current supply chain challenges but also for preparing to navigate the future landscape of the automotive industry, particularly in the face of technological shifts and evolving market demands.

6. References

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Appendix A – Interview Questions

1. What is your role/title and responsibilities?
2. Do you work with SRM throughout the company?
 - a. What are your view of SRM in the company, and what is it for you?
3. How would you say the relations are with your suppliers?
4. How is your communication with your suppliers?
 - a. Do you communicate the same amount with all suppliers?
 - b. Do Volvo spend the same amount of resources on everyone?
 - c. What are the biggest communication challenges you encounter in your relationship with suppliers?
5. What have been the most significant challenges in managing supplier relationships at Volvo Group?
6. How do disruptions in supply from critical suppliers impact your operations?
 - a. Can you discuss any specific instances where SRM played a crucial role in overcoming material supply disruptions?
 - b. What is the most common causes to material supply disruptions at Volvo?
 - c. What is your current strategies or approaches toward handling these disruptions?
 - d. What do you foresee as future potential disruptions?
7. What lessons have been learned from previous supply chain disruptions, and how have they influenced current strategies in managing supplier relationships?
8. How do you foresee the role of SRM evolving in the face of emerging global supply chain challenges?
9. Could you walk us through the initial stages of your procurement process, particularly how you choose suppliers?
10. What is your most important criteria when sourcing for new suppliers?
 - a. How do these criteria align with your strategic goals in procurement?
 - b. Are logistical aspects included in procurement criteria when choosing suppliers?
11. What is the main priority when choosing a supplier?
12. What level of delivery service, specifically delivery reliability, is considered optimal and in accordance with your goals?
13. Have you segmented your supplier base, if yes, then how?
14. How has Volvo Group's procurement strategy adapted over time in response to market volatility and global events?
15. What are the predicted future trends or challenges in procurement, and how does Volvo Group plan to address these?
16. Are procurement activities organized into separate units within the company (silos)?
 - a. How is communication managed between these units?
17. Can you describe how strategic supplier relationships are established and maintained at Volvo Group?
18. How have strategic collaborations with suppliers contributed to the resilience and efficiency of Volvo Group's supply chain in the past?

19. Looking forward, how important do you see the role of strategic supplier relationships in managing future supply chain risks?
20. How do you measure supplier performance?
21. How does Volvo Group evaluate supplier performance in terms of delivery accuracy and order accuracy?
22. Can you elaborate on the specific criteria Volvo Group uses to evaluate supplier performance?
 - a. How have these evaluation criteria evolved over time, especially in response to past challenges or market changes?
23. How does Volvo Group address issues with underperforming suppliers?
 - a. Could you provide examples of strategies or actions taken in such situations?
 - b. Have there been instances where supplier underperformance led to significant changes in your procurement strategy or long-term supplier relationships?
24. What measures are in place to ensure continuous improvement in supplier performance?
25. How does Volvo Group balance the need for cost efficiency with quality assurance in supplier performance?
 - a. Can you discuss a situation where this balance was particularly challenging to achieve and how it was managed?
26. Can you walk us through how you work with JIT and its implications at Volvo?
27. How important is JIT for Volvo and what are the primary challenges today and onwards?
28. How does JIT influence your procurement strategies?
 - a. How do you ensure alignment between JIT requirements and supplier capabilities?
29. Do you utilize EDI at Volvo?
 - a. Is it your main tool in communication with suppliers?
 - b. What are the benefits and challenges with EDI?
30. Can you discuss the role of this technology in your procurement processes and its impact on supplier communication?
31. Could you provide examples of how JIT and EDI have been effective in past supply chain management scenarios at Volvo Group?
 - a. How have those systems evolved in response to past challenges?
32. What future improvements or enhancements are being considered for these systems?