



**CRITICAL SUCCESS FACTORS IN SUPPLIER SELECTION FOR A VENDOR  
MANAGED INVENTORY SOLUTION**

Lappeenranta–Lahti University of Technology LUT

Industrial Engineering and Management

Master's thesis 2024

Edvin Oinas

Examiner: Professor Janne Huiskonen

## ABSTRACT

Lappeenranta–Lahti University of Technology LUT

LUT School of Engineering Science

Industrial Engineering and Management

Edvin Oinas

### **Critical success factors in supplier selection for a vendor managed inventory solution**

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66 pages, 8 figures, 5 tables and 1 appendix

Examiner: Professor Janne Huiskonen

Keywords: Supplier selection, vendor managed inventory, supply chain, critical success factors

The aim of this master's thesis is to find critical success factors in supplier selection for a vendor managed inventory solution and how to implement such solution. The results of this study are used to enable successful supplier selection and implementation of vendor managed inventory solution. This is a qualitative study, and it is conducted as a case study. Relevant literature combined with empirical research done in the case company, was used to study the related phenomena and to identify the critical success factors. Carefully planned and efficiently executed supplier selection can create competitive advantages in organizations' purchasing operations. In addition, well planned and implemented vendor managed inventory solutions can enable companies to decrease costs and streamline their supply chains.

The results of this study propose that cooperation, transparency, identification of opportunities and desired outcomes, carefully defined scope of the project, effectively developed strategy, well defined roles and accurate information sharing are the most important critical success factors for a such project in the case company. There are more critical success factors identified in this study which should also be considered and examined in supplier selection and implementation of vendor managed inventory solution. For a collaborative partnership, trust and reliability are necessities for successful and productive long-term cooperation.

## TIIVISTELMÄ

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### **Toimittajan valinnan kriittiset menestystekijät toimittajan hallinnoimassa varastointimenetelmässä**

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Avainsanat: Toimittajan valinta, toimittajan hallinnoima varastointi, toimitusketju, kriittiset menestystekijät

Tämän diplomityön tarkoitus on tunnistaa kriittiset menestystekijät toimittajan valinnassa toimittajan hallinnoimaan varastointimenetelmään ja miten jalkauttaa kyseinen menetelmä. Tämän diplomityön tulokset mahdollistavat onnistuneen toimittajan valinnan ja toimittajan hallinnoiman varastointi mallin jalkautuksen toimeksiantoyrityksessä. Tämä diplomityö on kvalitatiivinen tutkimus, joka suoritetaan toimeksiantona yritykselle. Asiaankuuluvaa kirjallisuutta yhdistettynä empiirisen osuuden tutkimukseen, mahdollisti tutkimukseen sopivien ilmiöiden ymmärtämisen sekä kriittisten menestystekijöiden tunnistamisen. Huolellisesti suunniteltu ja tehokkaasti toteutettu toimittajan valinta voi luoda kilpailullista etua organisaatioiden hankintatoimiin. Lisäksi hyvin suunniteltu ja ja jalkautettu toimittajan hallinnoima varastointimenetelmä voi mahdollistaa kustannusten laskemisen sekä toimitusketjujen virtaviivaistamisen yrityksissä.

Tämän diplomityön tutkimuksen tulokset esittävät, että yhteistyö, läpinäkyvyys, mahdollisuuksien sekä haluttujen tulosten tunnistaminen, huolellisesti määritelty projektin laajuus, tehokkaasti suunniteltu strategia, hyvin määritellyt roolit and tarkka tiedon jakaminen ovat tärkeimpiä kriittisiä menestystekijöitä tällaiseen projektiin toimeksiantoyrityksessä. Näiden lisäksi tutkimuksessa on tunnistettu muitakin kriittisiä menestystekijöitä, joita olisi myös syytä harkita ja tarkastella toimittajan valinnassa sekä toimittajan hallinnoiman varastointimenetelmän jalkauttamisessa. Yritysten välisessä yhteistyö keskeisessä kumppanuudessa, luotto sekä luotettavuus ovat välttämättömyyksiä menestyskikkääseen, tuottoisaan ja pitkäaikaiseen yhteistyöhön.

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# 1 Introduction

Modern supply chains have become more complex than ever and there are widely different supply chain solutions for different needs and situations. In highly competitive industries, companies cannot be competitive enough if they are not cooperating and working in close collaborations with their external partners. Effective supply chains and partnerships can create competitive advantage when the physical materials and information is transferred fluently with all the parties in the supply chain. (Kram et al., 2015) Vendor managed inventory solutions can create significant benefits for the overall performance of the supply chain and all the parties involved. These solutions can decrease the overall costs of the supply chain and create more possibilities for all the participants. Vendor managed inventory solutions have been implemented in many different industries since it can offer competitive advantages to the supply chain and its performance. (Rad et al., 2014)

Businesses tend to pay more and more attention to different supply sources. Selecting the correct and most suitable supplier can be a complex multi-criteria problem that requires vast amounts of knowledge from individuals who are working in supplier selection related tasks. Usually there are trade-offs between limited resources and completing objectives and a lot of different factors can influence the judgement and selection of the supplier. (Watt et al., 2009) Well planned and executed supplier selection can create competitive advantages and improve the supply chain. Some studies even indicate that the supplier selection process seems to be the most notable factor in the success and performance of the supply chain. (Gurel et al., 2015)

## 1.1 Background

The need for this thesis originates from the case company in which the writer is working at the time of writing this study. The case company needs a new way of storing industrial cables for its operations and maintenance. In the case company, the storage area in which the cables have been stored in the past will be used for other purposes in the near future and therefore the storage area must be emptied. Some of the cable types have to be available at hand at all

the time for projects and maintenance which means that a new method for storing the cables has to be discovered. Since the cables take so much space and there is no place available for them at the case company's premises, the case company decided to select a method where one vendor would store the cables and purchase new ones to replace the cables which have been delivered for the case company and its projects. The case company uses vast amounts of cable in its projects every year and therefore the supplier has to have capabilities to manage the inventory and deliver the cables on time to the case company's site.

A similar project was ongoing in the past, but it ended without any solution because of Covid-19 and other uncertainties. The case company had a vision of how the vendor managed inventory solution would work but there were still some dead-ends, roles which were not defined properly and bottlenecks in the process which had to be fixed. A lot of resources were wasted on the previous project, but fortunately valuable data was gained, and lessons were learned. After some major projects were finished at the case company, the need for a new inventory solution emerged again. This is where the case company contacted the writer of this study and asked if the writer was interested in working on this project since the case company knew that the writer was looking for a subject for thesis. After studying the key concepts and theory, a new process was designed based on the old unsuccessful process and the dead-ends, roles and bottlenecks were solved. While the process flow was still under work, the supplier selection process had started since the supplier has to be heavily involved in the process. Supplier selection criteria were formed and negotiations with the candidates were ongoing.

## 1.2 Objectives and limitations

The aim of this thesis is to study critical success factors of supplier selection for a vendor managed inventory model as well as to study the critical success factors of vendor managed inventory models. The thesis consists of studying the key concepts, subjects and the theory behind both vendor managed inventory models and supplier selection. The thesis is limited to covering the design and the process flow of the vendor managed inventory model, and the supplier selection process and related phenomena and success factors in supplier selection and vendor managed inventory models.



### 1.3 Research questions and research methods

The research questions of this thesis are formed from the need of the case company. The project in the case company is still ongoing but the aim of the research questions is to find the answers to them which will help the project to succeed. The answers are necessary for the project to advance and to find the most suitable and capable supplier. The findings and recommendations of this study will be utilized in the case company in future projects as well. Therefore, it is important that the research questions are defined well. If the research questions are not defined well enough, the beneficial and valuable findings might not be identified and examined. In this study, there are two main research questions.

The first research question which this thesis aims to answer is:

*What are the critical success factors of supplier selection for a vendor managed inventory solution?*

The second research question which this thesis aims to answer is:

*What are the critical success factors of implementing vendor managed inventory solution?*

These research questions are answered throughout the whole thesis. First the theory for solving the problems of questions is examined and the actual problem solving is presented in the empirical part of the study.

The research method for this study is a qualitative case study. The theoretical part of this study gives the research a great baseline for understanding and identifying the phenomena and concepts related and necessary for this study. In addition, the available data, practices and tools used in the case company as well as the two separate interviews are valuable information for executing this research. This available and collected information enables the writer of this study to identify the success factors and challenges for both the supplier selection process and the vendor managed inventory solution. Based on the collected information and the research, it is also possible to give the case company suggestions to improve and develop both processes.

Qualitative research aims to study and understand the causes and phenomena around the subjects of the study. Such research is used to describe the characteristics and realities related

to the relationships and phenomena between the causes and events which can help to predict and understand why similar events happen now and in the future. (Merriam & Tisdell, 2015) The data collection for qualitative research is executed via interviews, observing interactions between persons or environment, studying patterns and theory related to the subject, executing experiments and analyzing activities. Sarah (2019) describes that qualitative research is usually driven by asking questions such as “why”, “how much” and “how often” and states that calculating and converting data into numbers is usually rare in qualitative research.

Case study research is used to gain understanding of causes for phenomena in real-life context. Theoretical understanding is necessary because it is usual that boundaries between phenomenon and context might not be observed clearly, or they might not be evident. Business case studies aim to understand and identify why certain phenomena occur within different situations and what are the relationships and factors that are involved. Case studies are empirical research where the research is executed using knowledge, experience and theory to support the investigation. In case studies collecting and analyzing data related to the subject is necessary for understanding the causes and relationships. (Farquhar, 2012)

The data for this study was collected from two interviews, case company’s internal instructions and from a previous similar project from which historical data and findings were available. There were vast amounts of data and guidelines available for sourcing related projects which helped the writer of this study to understand how and why the project related actions are made. Interviewing the project leading sourcing manager and the project related category lead also enabled the writer of this study to understand the importance of the project and different approaches for certain actions. It is worth mentioning that the writer of this study is employed in the case company and has been heavily involved in the project and its execution. The writer has been part of the project since the beginning of the prequalification and supplier selection phase and therefore has a lot of knowledge and experience from the project itself. A lot of the data for this study has been collected from various meetings within the company and related stakeholders as well as the early meetings with potential suppliers.

#### 1.4 Conceptual framework and key concepts

In this project, the supplier selection process is part of implementing the vendor managed inventory model. Since the supply chain must run efficiently to satisfy the demands of all the maintenance and investment projects to be completed on time within the limits of the defined budget, the selection of a competent and qualified supplier is necessary. The characteristics and implementation phases of different vendor managed inventory models must be recognized that the most suitable one can be designed in order to achieve the wanted results and performance of the supply chain. The implementation phases can require a lot of focus and resources from both the buyer and the supplier. After the supplier selection is made and the partnership can start, the supplier must be heavily involved in refining the vendor managed inventory model to be as effective as possible based on the capabilities of the supplier. The conceptual framework and related subjects of this study are presented in figure 1.

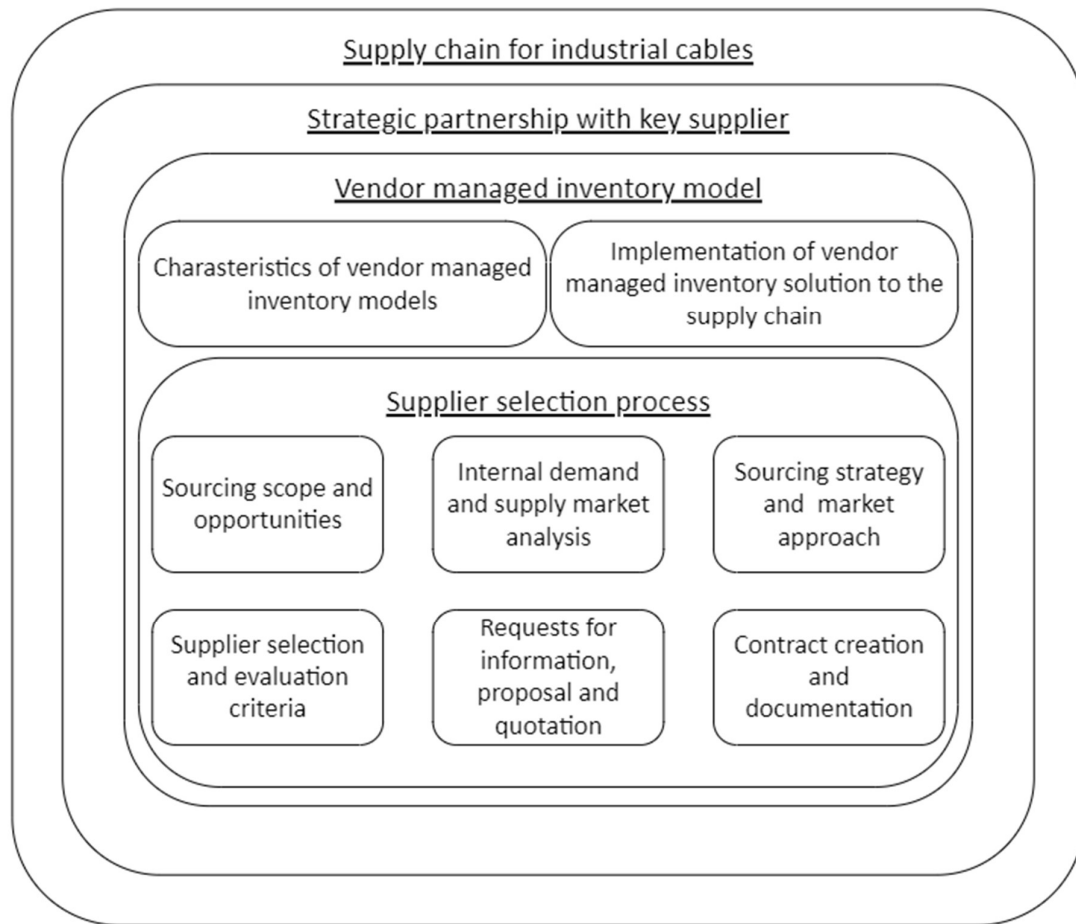


Figure 1. Conceptual framework

The few most important key concepts are presented in the following paragraphs which will make it easier for the reader to understand the study and its framework before the topics are presented more in detail in the theory and the empirical study sections.

**Vendor managed inventory** is an inventory management model in which the supplier has more freedom to plan its production and stock replenishment schedules according to the agreed service level. The supplier can optimize its production and deliveries both in performance and costs to meet the buyer's demand. Cooperation, data visibility and information exchange from both parties is essential for the model to succeed, which can result in reduced lead times and decrease the risks if there is demand fluctuation in the supply chain. (Claassen et al., 2008)

**Supplier selection process** is a process where an organization seeks to find a new supplier to supply goods for new or existing operations. Supplier selection has a large role in ensuring

the success of operations and impacting and influencing the purchasing actions in organizations. Selecting the correct supplier can add a lot of value for both the buyer and the supplier in terms of cost reductions, innovations, quality, on-time deliveries, flexibility and decreased lead times. Aligning the goals of the buyer and the supplier in a strategic partnership can create even more value for both parties. (Nair et al., 2015)

**Supplier selection criteria** can have quantitative or qualitative factors for supplier selection. For best results, it is necessary to form the criterion with trade-offs between quantitative or qualitative factors because weighing only one set of factors might not give the best results in terms of selecting the most suitable and capable supplier. The supplier selection criteria should be designed to influence the organization's purchasing decisions based on the state of the relationship between the buyer and supplier and the organization's competitive environment and strategies. For example, focusing only on a product category or cost savings might give sub-optimal results from the supplier selection criteria. (Sen et al., 2008)

### 1.5 Structure of the study

This study can be divided into four main chapters which have their own characteristics and contents. The main chapters of the thesis are illustrated in figure 2.

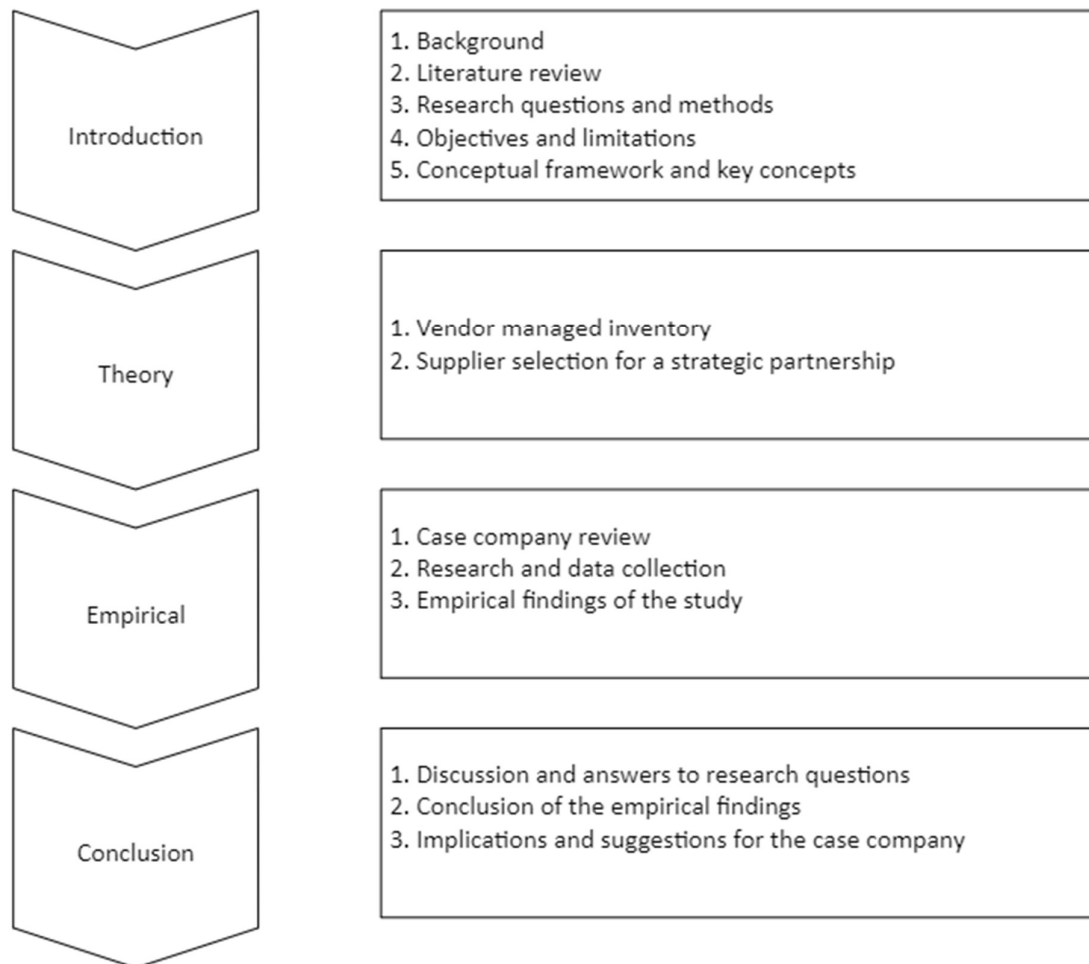


Figure 2. Structure of the study

The first chapter is an introduction chapter to the study which presents the scope of the thesis. First the background and the meaning for this study is presented which is followed by the literature review. After presenting those, research questions and methods, as well as objectives and limitations are examined. These parts are essential for the logical structure of the study. Finally, the conceptual framework and key concepts are presented which will prepare the reader for the rest of the thesis and its contents.

The second chapter presents the theoretical part of the thesis. It consists of two parts which examine the theory for vendor managed inventory model and supplier selection for a strategic partnership. The vendor managed inventory part presents the characteristics of vendor managed inventory models and the deployment and implementation phases for supply chains and organizations. Lastly, the benefits and challenges are examined based on

the literature and studies from the topic. The second part of the chapter introduces the reader to the supplier selection process for a strategic partnership. First the overall collaboration characteristics and factors of strategic partnerships are presented, followed by the supplier selection process. The supplier selection process examines the identification and prequalification of potential suppliers as well as the success factors and formation the supplier selection criteria.

Third chapter is the empirical part of the thesis. It introduces the reader to the case company and the problem which this study aims to solve. Both the vendor managed inventory process and the supplier selection process are presented which are related to each other. The project's scope is examined and the solutions for the problem at hand are presented. The designed process flow is illustrated, and the related points are clarified. The supplier selection part consists of examining the success factors for supplier selection.

The final chapter of the study aims to answer the research questions within the limitations of the study. The implications for the case project from the empirical study part are examined and the benefits and challenges are evaluated. The final chapter also presents the suggestions for future research and improvement suggestions for the case company's project. In addition, the future of the project is discussed, and the possible challenges are presented.

## 2 Vendor managed inventory solutions

Vendor managed inventory solutions have been utilized since the beginning of 1980's and there has been a lot of improvement made since then during its existence. Vendor managed inventory is a collaborative approach to inventory management where the buyer transfers the responsibility of managing inventory to supplier. There are few different approaches to said vendor managed inventory solutions from which supplier and buyer can decide the most suitable one for their partnership and situation. (Abbasi et al., 2022) Depending on the business environment in which the solution will operate, the supplier can manage the inventory in its own premises or somewhere else for an example next to the buyer's premises in a consignment stock, in remote warehouse or even in buyer's own warehouse (van den Bogaert & van Jaarsveld, 2020).

### 2.1 Literature review

Many studies and articles agree that vendor managed inventory solutions succeed only when the information flow is continuous and visible in the supply chain. The more accurate the information flow is regarding demand and forecasts, the more control the supplier can have over the planning of deliveries and supply replenishments. Most studies also state that it is necessary that all the parties which are involved understand their roles and responsibilities. Aligning goals and developing the supply chain can result in an even more efficient supply chain and process. (Claassen et al., 2008; Dong et al., 2007; Holmström, 1998)

There are also studies related to recognizing different supplier types in vendor managed inventory solutions and studies which focus on implementing the solution in supply chains (van den Bogaert & van Jaarsveld, 2020; Kauremaa et al., 2009; Zachariassen et al., 2014). Understanding categorizing different suppliers based on their behavior is useful in the right context because it can ease the process of improving the partnership. It is also essential to understand the broad picture and implementation phases of vendor managed inventory models in order to successfully prepare the supply chain for daily operation.



## 2.2 Characteristics of vendor managed inventory solutions

Vendor managed inventory model can be used to improve delivery times, flexibility of supply chain, respond time to demand and delivery performance in general. In figure 1 and figure 2 the differences between traditional supply chain and VMI supply chain model are illustrated. For the VMI to succeed, the buyer needs to provide vendor information about demand, product related costs, inventory levels and forecasts. The more accurate the information is, the more supply chain costs can be reduced with detailed optimization of supply replenishments and deliveries. This way the vendor can have more control over the planning of its supply replenishment or production if the agreed customer service level is achieved. (Claassen et al., 2008)

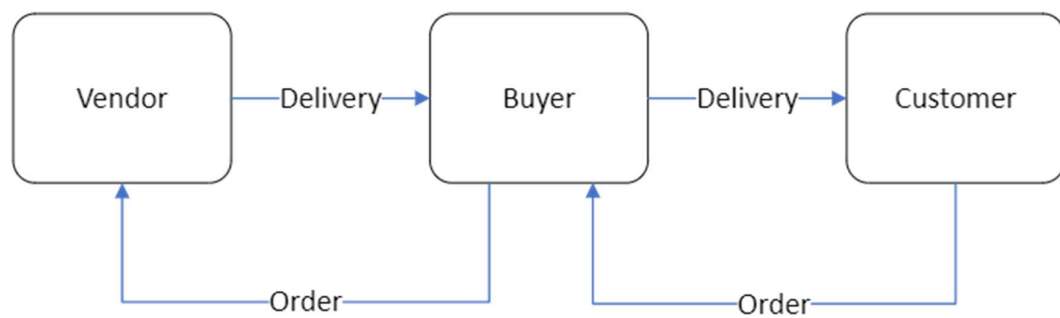


Figure 3. Traditional Supply Chain. (Govindan, 2013)

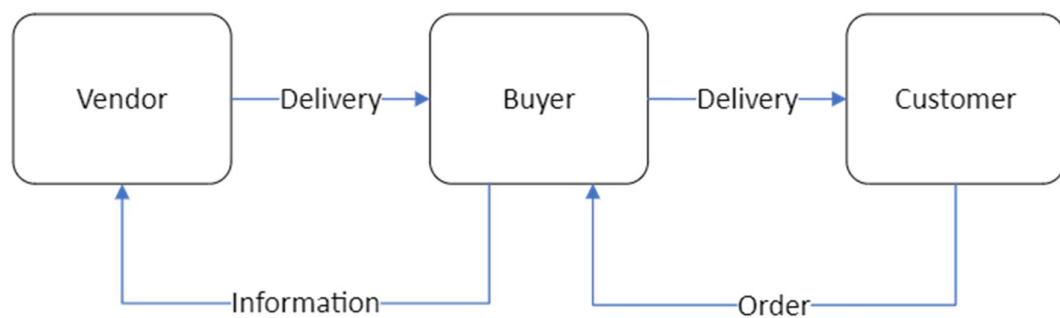


Figure 4. VMI Supply Chain. (Govindan, 2013)

Even though the buyer's inventory is managed by their vendor, the buyer still has a lot of responsibilities. The buyer has to cooperate closely with its vendor if they want to optimize the performance of the supply chain and reduce overall inventory costs. The buyer must plan inventory level, liability levels and share risks and common goals of the project with their

vendor. Both parties must cooperate and communicate efficiently to succeed. Therefore, goal sharing and transparency are both key elements in VMI relationships. (Dong et al., 2007)

Supply chain programs can enhance the overall efficiency of VMI. These programs and electronic data interchange (EDI) technologies are an important way to ensure that the information and data transfer is fast and uninterrupted. EDI and supply chain programs are both essential for reducing costs and increasing the service level of the VMI (Dong et al., 2007). They will also help with sharing the information regarding demand uncertainty and different external variables which could affect the performance of the supply chain.

Different situations and environments require different approaches and strategies for the vendor managed inventory solution. Fluctuations in demand and the resources required to manage the inventory can increase the costs of the operation. The delegation of autonomy and accurate demand visibility from buyer are widely recognized as key success factors for vendor managed inventory solutions. If the supplier's focus is elsewhere, communication is disrupted, deliveries are late, inventory levels and service level are not met, the supplier will be considered as an unreliable partner. Excellent vendor managed inventory solution partners are focused on customer service, easy to communicate with and meet the requirements of agreed service level. In some cases, the supplier might have to be unreliable depending on the markets and the business environment because there can be a lot of fluctuation in the demand, availability and price of raw materials. High fluctuation of demand, availability and price can increase the operating costs for the supplier which would in the end result in increased costs for the buyer. (van den Bogaert & van Jaarsveld, 2020)

It is crucial for the buyer that it has insight and influence in the supplier's way of managing the inventory and the operation. Therefore, it is essential to recognize the characteristics of different suppliers in vendor managed inventory models. The framework presented in figure 3 from the study of van den Bogaert & van Jaarsveld (2020) suggests that suppliers can be categorized in four different types depending on their behaviour and methods of operating the process. The four types are divided into two sub-categories which are "in control" and "out of control". These sub-categories represent the suppliers' reliability and performance. All the types are highly dependent on the situation and the business environment in which the operation is. These types are not viable in all situations and in some cases should not even be considered. The four main types are as follows:

### 1. Out of control suppliers

Out of control suppliers are unreliable and might cause constant violations to the agreed service level of the inventory and delivery times. Out of control suppliers' deliveries are late and their inventory levels are too low. This might be the result of problems in production and its capacity or issues in the supplier's supply chain. One reason could also be that the buyer is seen as a low priority customer from the supplier's point of view and the focus is therefore somewhere else.

### 2. Performance driven suppliers

Performance driven suppliers focus on keeping the buyer satisfied and avoid the risk of having no stock available for the buyer. Performance driven suppliers keep their inventory levels between the defined and specified levels and may choose to replenish their inventory well before the minimum stock level is reached. These kinds of suppliers have buffer inventory for the buyer which is convenient if there is uncertainty and fluctuations in demand.

### 3. Forecast driven suppliers

Forecast driven suppliers keep their inventory buffer low and rely on the forecasts which the buyer provides. For these types of suppliers, close collaboration and data visibility is essential for successful inventory management. Replenishment is usually done only when the minimum stock level is expected and about to breach.

### 4. Cash flow driven suppliers

Cash flow driven suppliers operate as efficiently as possible and continuously optimize their profits generated from the collaboration. They keep their working capital low and the cash flow high by keeping the inventory level for the buyer as low as possible. This is possible by delivering the stock to the buyer as soon as possible when needed, which results in earlier payments from the buyer and lower inventory management costs.

	In control			Out of control	
Obj.	Customer centric		Own profit	Unable to control	Focus elsewhere
Policy	Deliveries before minimum stock level breach	Deliveries around minimum stock level breach	Maximize cash flow		
Term	Performance driven	Forecast driven	Cash flow driven	Unreliable	

Figure 5. Framework of supplier types and their associated behaviour (van den Bogaert & van Jaarsveld, 2020)

### 2.3 Deployment and implementation phases

Vendor managed inventory needs a great amount of planning, designing and knowledge from the purchasing need and the patterns and factors of the supply chain. Kauremaa et al. (2009) suggest that there are three different patterns of vendor managed inventory solutions which have their own characteristics. These characteristics depend on the level of cooperation and the interests, benefits and outcomes which both the buyer and the supplier want from the partnership. (Kauremaa et al., 2009)

Based on cross-case analysis study of Kauremaa et al. (2009), three different implementation patterns and outcomes of vendor managed inventory models can be identified. These three are as follows:

#### 1. Basic vendor managed inventory

Basic vendor managed inventory is a model where buyer solely transfers the responsibility of replenishing its inventory to supplier. The buyer benefits from making its purchasing operations easier and efficient while increasing the operational efficiency by reducing inventory levels and improving the material availability from supplier. The supplier can increase or preserve its commercial position and create more value for the buyer which differentiates it from other suppliers.

#### 2. Cooperative vendor managed inventory

Cooperative vendor managed inventory model is an interorganizational process which requires deeper relationship and internal infrastructures between buyer and supplier. Its main goal is to improve the supply chain and increase both parties' operational efficiency. The cooperative model is more complex, and the supplier's focus has shifted to satisfy the end-customers' needs through product availability. Resource visibility, needs and forecasts are more visible in the cooperation and inventory levels, availability and efficiency are focused on. Deep relationships within the cooperation enable aligning the goals of both parties and create a positive environment where problem solving is easier. The cooperative model can create more value and new opportunities for both parties.

### 3. Synchronized vendor managed inventory

Synchronized model can be used to improve basic or cooperation model. Synchronized model aims to merge both parties' decision where all the relevant data regarding inventory values, deliveries and demand is available for both parties. Its objective is to improve production efficiency, coordination of deliveries and operations. It demands vast amount of motivation from the supplier, because the supplier must internally include the model in its operations planning.

Implementation of vendor managed inventory solution is a time-consuming process where it can take months before the actual operations start. Planning, designing, negotiations and contract preparing take a lot of resources from both parties before even the whole supply chain has been set up. Integrating the processes such as ordering, delivering and invoicing require vendor to set-up its internal systems in a way where it can operate its inventory and deliveries to satisfy the buyer's needs. Integrating the data from the buyer to the supplier's system is not easy and the data visibility should be clear for both parties. (Holmström, 1998)

According to Zachariassen et al. (2014) there are three implementation phases for vendor managed inventory project. First it is important to have initial discussions between the buyer and vendor regarding the project and its goals. The performance measures and total cost of operations of the supply chain should be identified in the beginning. Also, discussions and agreements regarding payment terms, price adjustments and other financial details should be held. It is also necessary to discuss and set the objectives for the project in order for it to succeed. The buyer's objectives could be freeing inventory space and money tied up to inventory or reducing inventory management and procurement costs. The vendor's

objectives could be improving the delivery performance and reducing delivery lead times, having access to more accurate demand data from the buyer and creating more value with less resources.

The second phase is to implement the VMI solution to the supply chain. In this phase both parties have together formed a supply chain where the products move fluently. The transportation methods and solutions are selected and optimized so that the agreed service level is met, and delivery and inventory costs are optimized. The vendor must be able to efficiently supply and stock items for the buyer, based on the information that buyer is providing from their demand and forecasts. The payment terms and terms of delivery should be agreed between both parties in a way where they share the risks equally and the cash flow is fluent throughout the supply chain. (Zachariassen et al., 2014)

In the third phase the day-to-day operations and VMI solution are evaluated and measured. The financial performance, service level and lead time are monitored and possible adjustments and improvements in the supply chain are made. A lot of data is available from the process and therefore possible increases or decreases in costs in different areas can be found and analyzed. Both buyer and vendor also might be able to identify new cost savings in the process and their operations. If the planning and implementation are done correctly and there are no major changes in the market, the VMI solution should create value for both buyer and vendor and the total costs for the operations should be lower than before the project. (Zachariassen et al., 2014)

## 2.4 Challenges

One of the main challenges of vendor managed inventory model is to find the right partner(s) to work with. The whole model needs a lot of cooperation and commitment in order to be effective and provide the desired results. The organizational cultures and values should also match or be aligned. The information sharing should be accurate and the contract between both parties should be done in a way where both can profit and benefit from the relationship as much as possible. In this kind of model, trust and reliability are essential for success. If they decrease, then the whole performance of the model will decrease. Commitment to

multiple levels of the organization between both partners is essential for long term relationship and efficiency. (Claassen et al., 2008)

Since the organization is giving the control of managing its inventory to other party, it requires a lot of trust and belief that the supplier will act according to the buyer's interest. The supplier has to be trusted with confidential information regarding demand, forecasts and inventory items and values which is not something that every organization is confident of. This can also raise some concerns regarding security issues if highly confidential information is shared. The buyer should also be certain that the supplier has the capabilities to manage the inventory. (Beheshti et al., 2020)

Outsourcing the inventory management to vendor can damage the critical inventory management and purchasing skills of the buyer. At the same time, the buyer also becomes more dependent on the supplier and its services. According to Yalcin et al. (2018) too close cooperation and dependency can cause harm to the relationship. Too social and close buyer-supplier relationship could increase supplier's opportunistic behavior and decrease buyer's objectivity. Highly collaborative relationships can cause over-dependency which could decrease the performance and efficiency of the supply chain.

Some issues regarding the strategic misalignment of both parties have to be addressed. Both parties should have an explicit understanding of strategy in the partnership and the added value should be as equal as possible for both parties. It should also be noted that selecting only one partner can cause issues in the supply chain if one of the parties is unsatisfied with the service and working methods of one another. In worst case scenario, both parties are stuck with each other in an unhealthy business relationship. Therefore, the cost efficiency and quality of the service should be evaluated constantly. If the service is not satisfying, a new supplier for the partnership or supplying the goods should be searched for. (Beheshti et al., 2020)

The integration of technologies and systems will be challenging in the partnership. There will be a lot of adjustments and compromises required before the processes of the partnership can start and operate efficiently. The information regarding planning, forecasting, inventory values, deliveries and invoicing should be available and visible for both parties for the partnership to succeed. The customer relationship should also be constant so that both parties can address their issues and give feedback. Signing contracts with third-party delivery

companies will also take some time and the length of the contracts is usually several years. Therefore, it is important that the partnership is planned properly, and both parties commit to it appropriately. (Beheshti et al., 2020)

Businesses don't want to have too high inventory levels, because it can take a lot of unnecessary space from their warehouse, and it increases the amount of capital which is tied to the goods. This capital could be used more efficiently in some other process in the company. Vendor managed inventory solutions tend to ease these kinds of problems since the responsibility of restocking is transferred to the supplier which can improve the inventory turnover. Optimizing the frequency of deliveries and inventory fill rates can release a lot of capital for other processes. Accurate forecasts given to the supplier can make the supply chain even more efficient. (Abbasi et al., 2022) In most traditional supply chains where the supplier responds to buyers demand only after the buyer has sent the purchase order and both parties only focus on and optimize their operations, the overall performance of the supply chain is suboptimal. Vendor managed inventory solutions can enable the supplier to respond to the buyers need faster with buyer's demand data and the distortive effects in information sharing is lowered. (Holmström, 1998)

Information distortion problems can create a lot of issues for the whole supply chain. If there are issues in information sharing in the first parts of the supply chain, the problems will most likely grow larger in later parts of the supply chain. Late deliveries and fluctuations of available goods can increase the lead times a lot and the end user receive the goods later than anticipated. Visible information sharing, forecasts and demand information can increase the efficiency and the performance of the whole supply chain which can decrease the magnitude of the "bullwhip effect". (Kauremaa et al., 2009) Bullwhip effect is a term which describes the fluctuation of demand in the supply chain. The buying company operates purchases more variably from suppliers than it sells to its customers. This can cause issues and mismatches in the demand and production which decreases the overall efficiency of the supply chain. Therefore, visible information sharing, forecasts and demand information from the buyer can make the supply chain more effective. (Bray & Mendelson, 2012)



### 3 Supplier selection for strategic partnership

This chapter focuses on the theoretical part of supplier selection. It gives an overview of collaboration in strategic partnerships and examines the supplier selection process in detail.

#### 3.1 Literature review

Supplier selection is a topic which has been researched widely for decades and a lot of information is available from it. Vendor managed inventory solutions have been around for few decades and different models have been researched but not nearly as much as supplier selection (Abbasi et al., 2022). The literature and research of vendor managed inventory solutions are mainly focused on retailing and manufacturing businesses and not for the needs of maintenance operations which makes this study interesting. There are a lot of similarities in the models, but the needs and field of work are different since the reels in which the cables are delivered have to be returned and it makes the cash flow a little bit more complicated.

Even though supplier selection is a widely researched topic, most studies agree that using tools which help supplier selection are essential for successfully selecting the most suitable supplier. Supplier selection requires a lot of resources and everything which helps the process and makes the decision making easier can be considered as valuable tools. Also, many studies agree that categorizing the most important factors and capabilities of potential suppliers is a great approach to the supplier selection process. (Monczka et al. 2002; Govidan et al. 2015; Zaraté, 2013) Some studies focus more on detail in the supplier selection tools, phases of supplier selection process and some have researched the importance of identifying and prequalifying the potential suppliers. (Boer et al. 2001; Monczka et al. 2002; Goh, 2018)

#### 3.2 Collaboration in strategic partnerships

Today, strong collaboration and relationship with key suppliers is considered as a value-creating opportunity. Sharing data and resources can create a more efficient and transparent supply chain between buyer and supplier. This can generate more wealth and success for

both parties. Of course, the availability of alternative sources of supply can be considered as a safer way of approaching markets but that heavily depends on the markets that the buyer is approaching and operating in. This demands that the buyer puts effort into creating reliable relationships with multiple sources of supply. (Moser, 2007)

The ever-increasing competition in today's markets has resulted in companies trying to create more value and cut costs in supply chains. This has created the need for more collaborative buyer-supplier partnerships rather than using vast numbers of different suppliers. These more collaborative relationships focus on sharing the long-term benefits and risks between buyer and supplier and bring more balance to the power of both parties. (Moser, 2007) The previous statement has been supported by the empirical results of Pearson et al. (1995).

According to Bancuen et al. (2017) the development of relationship between buyer-supplier partnership is an important process to a successful strategic collaboration. The market and innovation development can be enhanced with commitment, trust and visibility between buyer and supplier. This creates more confidence between both parties and can increase valuable data sharing. In addition, close relationships tend to enable both parties to focus and develop the long-term benefits of the collaboration.

Strong collaboration with key suppliers can create huge benefits to both parties such as reducing lead times and bullwhip effect in supply chain, development of capabilities, increased flexibility and more value to buyer and supplier as well as the end user such as customers or stakeholders. Data sharing and transparency in strategic partnerships can also lead to more detailed and accurate forecasts, cost reductions and inventory control. Therefore, there is a significant link and positive influence that strong collaborations will lead to a more efficient and effective supply chain. (Mofokeng & Chinomona, 2019)

### 3.3 Supplier selection process

Supplier selection is a complex and resource demanding process which involves a lot of planning and decision making. It requires collaboration with internal and external stakeholders and a great amount of knowledge from sourcing and its processes.

### 3.3.1 Identifying the need and developing sourcing strategy

For a successful sourcing project, it is necessary to identify the need for sourcing within the organization and its needs. There can be different reasons why the organization needs a new sourcing approach or suppliers and some of the most common ones are related to lowering prices, increasing quality, reducing inventory costs and creating more value for the customers. (Bruel, 2016) Depending on the case and the industry in which the organization is working in, a cross-functional approach for sourcing strategy is recommended. The cross-functional approach is very effective since the internal need is examined in detail with the organization's functions that need or are involved in the processes where the product or service is required. The organization's experts and end-users have the exact knowledge of the product or service and its more detailed needs, so for a successful outcome the knowledge and insight of these functions should be utilized. Cross-functional teams can also be utilized to identify and analyze the opportunities of the sourcing project and process. (Sollish & Semanik, 2011)

Before the sourcing initiative develops the sourcing strategy, the opportunities and needs should be examined more in detail utilizing historical data from the existing suppliers and spending history. It should be considered if one existing supplier of certain goods should be replaced, or if additional suppliers should be evaluated and selected to supply the goods if there has been poor supplier performance. This approach also improves competition, for example if there is only one key supplier, since different supplier options are evaluated and examined and possibly new opportunities for decreasing the costs or improving the quality are found. A larger pool of suppliers who supply similar items from the same manufacturers can also be decreased to a single or few key suppliers. This way the performance of the supply chain can be increased, and the costs could be reduced if a longer-term contract is signed between the key suppliers. There is no single right approach or answer for these problems since all these problems are highly case, industry and market dependent. (Sollish & Semanik, 2011)

When the sourcing strategy is developed, certain key decisions should be made. It should be decided how much internal resources and stakeholders need to be involved for a successful project. More opportunities could be discovered when there are enough experts and key

personnel involved in developing the sourcing strategy. One of the main decisions is whether the supply or services should be purchased from a single-source or if there should be multiple-sources. This is highly dependent on the market and the supply and demand phenomena. Using multiple sources can decrease the risk of, for example, supply not being available or if one supplier has production issues. Using only one source can be useful because then the cooperation can be more effective and therefore additional costs generated from warehousing and deliveries could be decreased. Using one key supplier could also bring more value for the supply chain and end-users if the product or service is developed together. (Bruel, 2016)

It is important to identify the different costs which are involved in the sourcing process and for the wanted benefits and results. This can vary depending on the nature of the purchase because different cases can have various costs which are highly case dependent. Direct and indirect purchases can include different additional costs and additional agreements. Therefore, it is necessary to understand the need and reason for the sourcing. One of the key steps in the development phase is to develop the benefits and cost reduction ideas. These need to be identified and documented for a successful sourcing project. These are the main factors that can create value for the supply chain and operations, and these can be beneficial for both the supplier and the buyer. It is also important to define the roles of the sourcing project well so that the responsibilities are divided equally and logically. Everyone must play their own part and contribute so that the wanted benefits are achieved. (Bruel, 2016)

Determining the market approach is necessary when the sourcing strategy is developed. The competitive positioning of the suppliers should be examined as well as the potential risks which can be foreseen in the supply chain should be studied. If there is a lot of competition in the market, the possibility for a competitive sourcing process is enabled. Also, the main competitors and customers of the suppliers should be identified since they create demand for the market, and they might have a large impact on the suppliers' capabilities and supply availability. The demand fluctuations in the market can also affect the supply availability in a negative way and this should be reviewed as well. It should be agreed together with the supplier how much stock of supply they should have available so that the risk of production disturbance is reduced. The financial profiles and history of the suppliers should be evaluated so that risks related to cash flow and deliveries are decreased. (Seshadri, 2015)

The scope of the sourcing project has to be defined and determined in detail for a successful outcome. The selection criteria should be measurable and according to the sourcing need and the selection criteria should be defined so that the suppliers' capabilities can be measured in detail. The selection criteria are necessary for fair competition and reasoning in the decision-making process. It's a necessary tool to support decision making and for the evaluation of suppliers. The selection criteria are very case and project specific. The specifications and terms should be defined well for the project's scope such as level of quality, key performance indicators and commercial terms. (Sollish & Semanik, 2011) Some deviations for the scope can be made depending on the project and the scope and those should be negotiated together with the suppliers and key stakeholders in the organizations. Sometimes deviations are necessary so that the most suitable and value-creating solution is achieved.

### 3.3.2 Identification and prequalification of potential suppliers

The need for a new supplier must be recognized first, which usually originates from an example from the need to create a new product or service, when purchasing new equipment or services, when current suppliers are not performing well enough or when an organization is expanding into new markets or products lines. When the need has been recognized it is time to focus on selecting the sourcing strategy. Selecting the sourcing strategy can be difficult because sometimes no single sourcing strategy is completely correct and might not satisfy the requirements of all purchases. According to Monczka et al. (2002) there are six key decisions when selecting the sourcing strategy options. In this study, the key decisions are not covered in detail, but since they are necessary for a successful sourcing strategy, they are presented below. The six key decisions are the following:

1. Single versus multiple supply sources
2. Short-term versus long-term purchase contracts
3. Selecting suppliers that provide design support versus those that lack design capabilities
4. Full-service versus non-full-service suppliers

5. Domestic versus foreign suppliers
6. Expectation of a close working relationship versus arm's-length purchasing

According to Monczka et al. (2002) there are a total of ten different ways and sources of information for identifying new potential suppliers for a new or existing partnership. The five most common sources of information in today's purchasing are current suppliers, sales representatives, purchasing personnel experience, trade shows or events and internet searches. Current suppliers are useful and probably the easiest approach because there is a high chance that there is data from the performance and capabilities of the existing suppliers and a new relationship does not need to be created and maintained. The downside is that when selecting an existing supplier, no new suppliers are evaluated, which might have been a better option. Sales representatives can provide a valuable source of information from new suppliers and sources and purchasing personnel probably have a lot of experience from different suppliers which can be useful. Trade shows and events are excellent ways of discussing with similar suppliers and at the same time the buyer has the opportunity to see what the suppliers have to offer. Internet searches are of course very cost and time efficient ways to view what kind of suppliers there are and what they have to offer.

Once the potential suppliers have been identified, the supplier selection pool must be narrowed down in order to find the most suitable supplier. Before moving forward to supplier selection process and creating the selection criteria, the supplier pool can be narrowed down by several different evaluation methods. This is essential because the performance and capabilities of different suppliers can vary widely. Limiting the pool also helps create more in-depth selection criteria for evaluation. Monczka et al. (2002) present three different methods for prequalification process. The first one is financial risk analysis which is used to recognize if the potential supplier has serious financial problems which could create risks in the partnership. External sources such as Dun & Bradstreet reports can be consulted for evaluating the supplier's financial status. The second method worth noting is evaluation of supplier performance from previous experiences. Evaluating the supplier's performance from previous experiences or from material which the supplier has previously provided to another part or function of the organization could prove valuable in the prequalification process. The third method is to evaluate the information which the supplier has provided based on buyer's requests for information. Requests for information are an excellent way to

pre-qualify suppliers because they help recognizing if the supplier is capable of providing the supply or service the buyer is looking for and to recognize which suppliers are interested in the partnership. The financial strength, business strategy, strong and appropriate management, manufacturing and design capabilities of the supplier are something that Monczka et al. (2002) suggests that the buyer should evaluate as well.

### 3.3.3 Supplier evaluation and selection criteria

Supplier selection is a time and resource consuming process for companies. Selecting the most suitable supplier can create a lot of value for the buyer and in best-case scenarios refined collaborations with supplier and buyer can benefit both parties and help them grow their businesses. Especially in strategic collaborations there can only be a limited pool of potential suppliers which have the necessary skills and capabilities to fill the buyer's needs. Selecting the correct supplier is a complex process which can be simplified with tools that are able to analyse data and help categorise the most important factors for decision making and supplier selection. (Govidan et al. 2015)

There are four phases for supplier selection according to de Boer et al. (2001) which have different needs and means for each phase according to the situation and complexity of the purchasing. In the first phase, which is the problem definition, the buyer needs to understand the situation and the need for a new supplier, if there is any. The importance can be defined by considering how important the future purchase or partnership is and is only one time purchase or will there be a longer cooperation. The buyer should also consider are there any new supplier options for the purchase or if multiple or fewer suppliers should be used.

After the problem has been identified, the next step is to form criteria in which the supplier will be evaluated. For this phase historical data from suppliers is extremely valuable because it is much easier to define the factors and evaluate the suppliers' capabilities if there has been cooperation or purchasing done in the past. In addition, previously used criteria can be utilized in the evaluation if it has been proven to be useful and effective before. This can save a lot of time and ease the evaluation. If there is no data or previous purchases from the suppliers, the decision maker must be careful with the evaluation because there can be factors which might not be considered or evaluated in detail. (Boer et al. 2001)

The third phase is qualification in which the suppliers will be qualified before selection. The qualification phase consists of a pool of suppliers which are seen as potential candidates for cooperation. There can be different sizes of pools depending on the situation, need and the market. In this step it is the decision maker should utilize a tool which helps them to evaluate the suppliers and their performance. Historical data is extremely useful in qualification, but it might not always be available. (Boer et al. 2001) Most useful and common tools will be explained later in the study. This is the most critical step because after the qualification the supplier which is considered to be the most suitable will be selected. Errors and unconsidered factors in this phase can lead to selecting an incompetent supplier instead of selecting the most suitable one. An incompetent supplier might harm the buyer's business after the cooperation has started.

After the qualification is the choice step in which the supplier or multiple ones will be chosen to start cooperation with. If there is only one candidate which is considered to be the most competent the choice will be sole sourcing. In a sole source situation usually, there is only one supplier who can provide the goods or services most cost effectively. If there are many suppliers to be chosen to start cooperation with, the volumes of purchases have to be allocated for each supplier depending on how capable they are and how well they perform. (Boer et al. 2001) This is usually a great way to source goods or services since the risk of interruptions in deliveries is lower than in sole source situation. The supplier selection in the choice phase is highly dependant on the situation and the need. There is no single right choice because the business environments, circumstances and locations in which companies work can differ to a great extent.

For supplier selection there are a lot of tools for different needs depending on the complexity of the supplier selection process. In-depth knowledge of supplier selection and the purchasing need is essential for finding the most suitable supplier. The decision maker in supplier selection has to understand the relevant information, factors, interests and needs for the new supplier in order to make the right decision. (Zaraté, 2013) Therefore, knowledge and experience from previous supplier selection projects is valuable for evaluating the potential suppliers and for finding the most suitable and capable one. Tools for supplier selection should only be used to weigh the performance and capabilities of the potential suppliers. Usually, the supplier selection process is a multi-criteria evaluation process which



requires a lot of knowledge and preferably historical data from the potential suppliers. Therefore, supplier selection tools should only be used to support the decision making and not solely for the actual decision making. (Boer et al. 2001)

Today, there are many useful and effective tools to evaluate suppliers and their performance. Decision making tools will help the decision-making process and possibly guide the decision maker to the most suitable supplier. It will make the decision-making process faster and simpler, since all the relevant factors can be examined more in detail. These tools should be only used to support decision making and the results should not be the only reliable data when selecting the supplier. They are used for making the decision easier and traceable and should only be used for guidance. According to Goh (2018) most common and effective tools and methods to evaluate the potential suppliers and their capabilities to meet the needs of buyer are:

### 1. Categorical method

Categorical method is the simplest and fastest tool to identify suppliers' performance. First performance variables and factors are defined and then the buyer rates the suppliers' performance according to them. The points are given according to the score which the suppliers receive for each performance category. Then the points are summed up and the supplier which received the most points should be the most suitable and potential candidate. This method is not to be utilised in decision making because of its simplicity but it can easily give you an idea of which supplier could be the most suitable candidate. An example from categorical method is presented in table 1.

Table 1. Categorical Method for Supplier Evaluation

Supplier	Categorical method for supplier evaluation				
	Delivery	Service	Quality	Price	Total
1	Fast (1)	Good (1)	Poor (-1)	Low (1)	3
2	Neutral (0)	Good (1)	Neutral (0)	Neutral (0)	1
3	Slow (-1)	Poor (-1)	Good (1)	High (-1)	-3

### 2. Weighted-point method

The weighted-point method is the common tool used in supplier selection according to Goh (2018). The weighted-point method is similar to categorical method but instead of just giving

points according to the factors and suppliers' performance, buyer weights the factors and gives it a value depending on how important buyer thinks the factor is. Each supplier is then evaluated and the supplier which has the most points should be the most potential candidate. The weighted-point method can be more effective than categorical method because all the factors are not pointed out as equals. Values which are more important and relevant for buyer's choices will have more importance in the criteria which then can give a more accurate representation of the suppliers' overall capabilities. An example from weighted-point method is presented in table 2.

Table 2. Weighted-point method for supplier evaluation

Weighted-point method for supplier evaluation				
Factors	Weight	Supplier 1	Supplier 2	Supplier 3
Delivery	0,20	0,15	0,10	0,05
Service	0,10	0,10	0,10	0,05
Quality	0,30	0,05	0,15	0,30
Price	0,40	0,30	0,20	0,10
Total	1,00	0,60	0,55	0,50

### 3. Cost ratio method

The cost ratio method is a tool which gives an estimation from the total cost of each purchase. Suppliers' total costs for buyer's each purchase is calculated by adding additional costs which will be part of the purchase price of goods. These factors are suppliers' internal operating costs such as delivery, service and quality. These factors will be converted to a cost ratio which gives an estimation from the total value of the purchase. The cost ratio is then applied to the purchase price which will be the suppliers' quoted unit price. The supplier with the lowest unit price should be the preferred candidate. An example of the cost ratio method is presented in table 3.

Table 3. Cost ratio method for supplier evaluation

Cost ratio method for supplier evaluation						
Suppliers	Delivery cost ratio (%)	Service cost ratio (%)	Quality cost ratio (%)	Total penalty ratio (%)	Quoted price/unit (€)	Net adjusted cost (€)
Supplier 1	2 %	2 %	2 %	6 %	15,50 €	16,43 €
Supplier 2	3 %	3 %	4 %	10 %	16,50 €	18,15 €
Supplier 3	5 %	4 %	7 %	16 %	18,00 €	20,88 €

#### 4. Analytical hierarchy process

Analytical hierarchy process is more commonly used in problem solving because it can be utilised in situations where there are multiple levels and criteria of problems. Analytical hierarchy process has similar point system like in weighted-point method but more detailed levels and weight importance for factors can be utilised. This method can give you an even more detailed and accurate estimation of suppliers' capabilities and performance. Analytical hierarchy process is an excellent tool to support decision making. An example of the analytical hierarchy process is presented in figure 6.

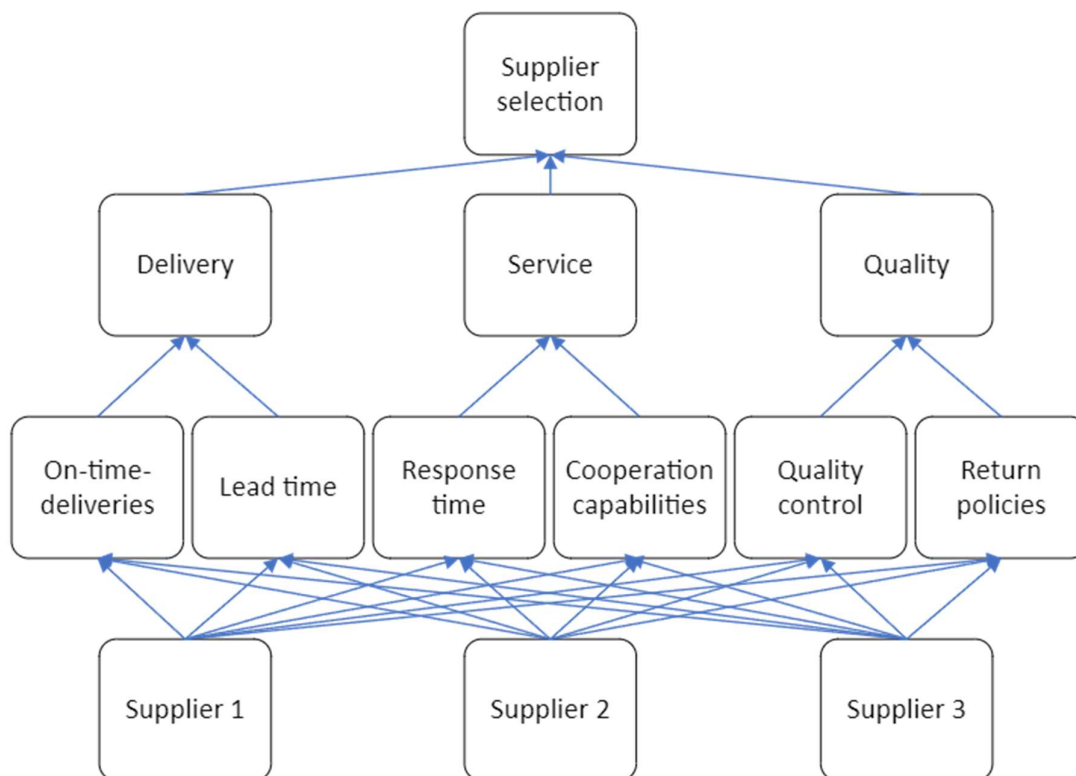


Figure 6. Analytical hierarchy process for supplier evaluation

## 4 Empirical findings

The main goal of this study is to understand the practices for a successful supplier selection process and to understand the phases and different factors of a vendor managed inventory model in the case company. To select the most capable candidate cost effectively, it is necessary to identify the success factors in the supplier selection process. For well implemented vendor managed inventory solution, it is necessary to identify both good and challenging factors in the process and to keep the communication with potential suppliers transparent and ongoing. The empirical findings for this qualitative study are based on the data that was collected in two separate interviews, from the internal guidelines and from the findings of a previous similar project as well as the meetings which were held internally and together with the supplier candidates.

### 4.1 Case company introduction

The case company produces crude oil-based and renewable feedstock-based fuel and renewable polymer and chemical solutions. Its main strategy is to produce renewable fuel for aviation industry and road transportation. The oil products are for road transportation and aviation and marine sectors. In 2022 the case company's revenue was 25,7 billion Euros, the comparable EBITDA was 3,5 million Euros and it employed total of 5244 employees internationally. The case company has production in Finland, the Netherlands and Singapore and other offices spread out internationally.

In 2021 the case company outsourced its Porvoo's refinery's maintenance and harbour warehouses to a large, well-known international logistics company. This approach releases internal costs from case company and enables it to focus more on its core processes. This cooperation streamlines the complex and demanding warehousing processes at the refinery. The logistics company has decades of experience in logistics and warehousing and these assets are valuable for developing processes and decreasing the costs in the refinery area.

Cables take up a lot of space and therefore are expensing to warehouse. The existing area where the cables have been stored in the past will be used for other purposes in the near

future. The cables have been stored in a large gravel field next to the case company's project warehouse which is separate from the main warehouse. At the moment, the case company has a large quantity of cable stored in the refinery area which takes up approximately 10 000 m<sup>2</sup> worth of space. This amount cannot be warehoused in case company's premises in the future, and it increases the internal costs quite a lot.

The case company uses cable worth of hundreds of thousands of euros every year in different maintenance and investment projects. In major turnarounds the spent is even higher and the estimated amount of cable in meters needed in next turnaround is little bit over 270 000 meters. The largest contractors which work in the refinery area usually use cable from their own stock and then charge the case company. This streamlines the project management and does not overload the purchasing if a lot of cable is needed, and many projects are ongoing at the same time. The problem is that there are a lot of smaller contractors which do not have their own cable inventory, and so far, the case company has purchased and provided the cable for them to use in their works in projects. It is challenging that in the future the case company cannot store and provide the needed cables confidently from their own warehouse. In addition, it is risky to move the responsibility of purchasing the needed cables to smaller contractors because sometimes the work definition and needs are finalized too close to the start of the projects. This would also compromise the transparency of price; the costs would not be optimal, and overcharging could not be avoided.

#### 4.2 Vendor managed inventory solution

Before examining the findings and success factors for the supplier selection process, it is important to understand the vendor managed inventory model because it adds variables and challenges for the sourcing process. The vendor managed inventory model of this study is rather complex, since it has three different parties involved and the nature of the cables which are the main reason for the need of the model increase the complexity even more. The cable reels take a lot of space in the inventory, and they are currently stored in a cable storage area at the case company's premises. Depending on the cable type, one reel can take up space from 0,2 m<sup>3</sup> up to 16,77 m<sup>3</sup>. The cable reels are often returned back to the vendor after the whole reel is used, but if all of the cable is not used, the cable reel is kept for storage. The

reels hold valuable information such as the date it was shipped to the buyer, for what project it is and what is its batch number. Therefore, not fully used cable and its reel is kept for future projects and needs. From time to time, new standards and cable types replace old ones. This causes the existing cables to be unused and sometimes these cables can stay in the inventory for years if not scrapped.

Usually, the most uncommon cables will stay in inventory for years inside the warehouse or outside in the cable field. If the cable is kept outside, like it usually is, the cable will rot, and it will be unusable in the future. Unfortunately, there are tens of kilometres worth of expensive and unusable cable outside in the cable field which is not being scrapped and these cables cause unnecessary expenses to the case company. In addition, project planning usually plans the need for cables a little be more than they need because they don't want any surprises in the project works if the purchased amount isn't enough or if some of the cable is damaged.

The projects usually need vast amounts of cable in their works and often it is safer to purchase whole cable reels. The project's wish to pull the cable from one reel and combining two or more shorter cables to match the needed length is something that the project's do not want to do. This generates some tens or hundreds of meters of unused cable to be returned back to the inventory. Sometimes the surplus cable is used in smaller projects or in urgent needs but after years go on, the amount of cable stumps which were not used will stay in the inventory. Really small lengths of surplus cable, such as cable under 5 meters, will almost never be used in the future. Over time this adds up and the inventory value from unused cable slowly rises.

According to the two separate interviews held with the project's sourcing manager (interview 1) and the procurement category lead (interview 2) this project is very important and they estimated that the project's size is a small to medium size in terms of investment, time and complexity. Both interviewees agreed that the project is not important only from the procurement perspective, but it is important also for the internal stakeholders, for example engineering, project management and asset management. All the internal stakeholders wish that there is no delay in the execution of the project. Interviewee 1 also stated that the project is very important because the existing land which is used for storing the cables will be used for other purposes in the near future. Therefore, it is important to

design and refine the model together with the potential candidates. Interviewee 1 stated that it is very important to listen to and examine what the supplier candidates have to offer. The project needs input from the candidate suppliers as well because cooperation and well-designed process together with the supplier are the critical success factors for the project's execution. Interviewee 1 also added that the case company knows what it needs but it should listen to the candidate suppliers' recommendations.

The vendor managed inventory model which was designed for this study has three main roles which have their own responsibilities. It is necessary that all the parties that are involved understand their roles and responsibilities. Otherwise, the process will not operate efficiently, and the wanted benefits are not achieved. The contractor performs the cable pulling in the projects works and the supplier takes care of sourcing of the cables and ensures that it has enough cable in its inventory for the case company's needs. The supplier manages the inventory and keeps the stock level of cables at the defined service level based on the forecasts and historical data which the case company has provided. The case company has three sub-roles which are project management, purchasing and account payable, which have their own responsibilities and functions. Project management plans and executes the field work of the projects such as cable pulling. Purchasing ensures that there are enough cables and items available for the projects' work when needed. Account payable's responsibility is to process the invoices after the purchasing personnel have matched the invoice in the system. The roles and responsibilities as well as more detailed steps of the operation are presented in the process flow chart of the model in figure 7.



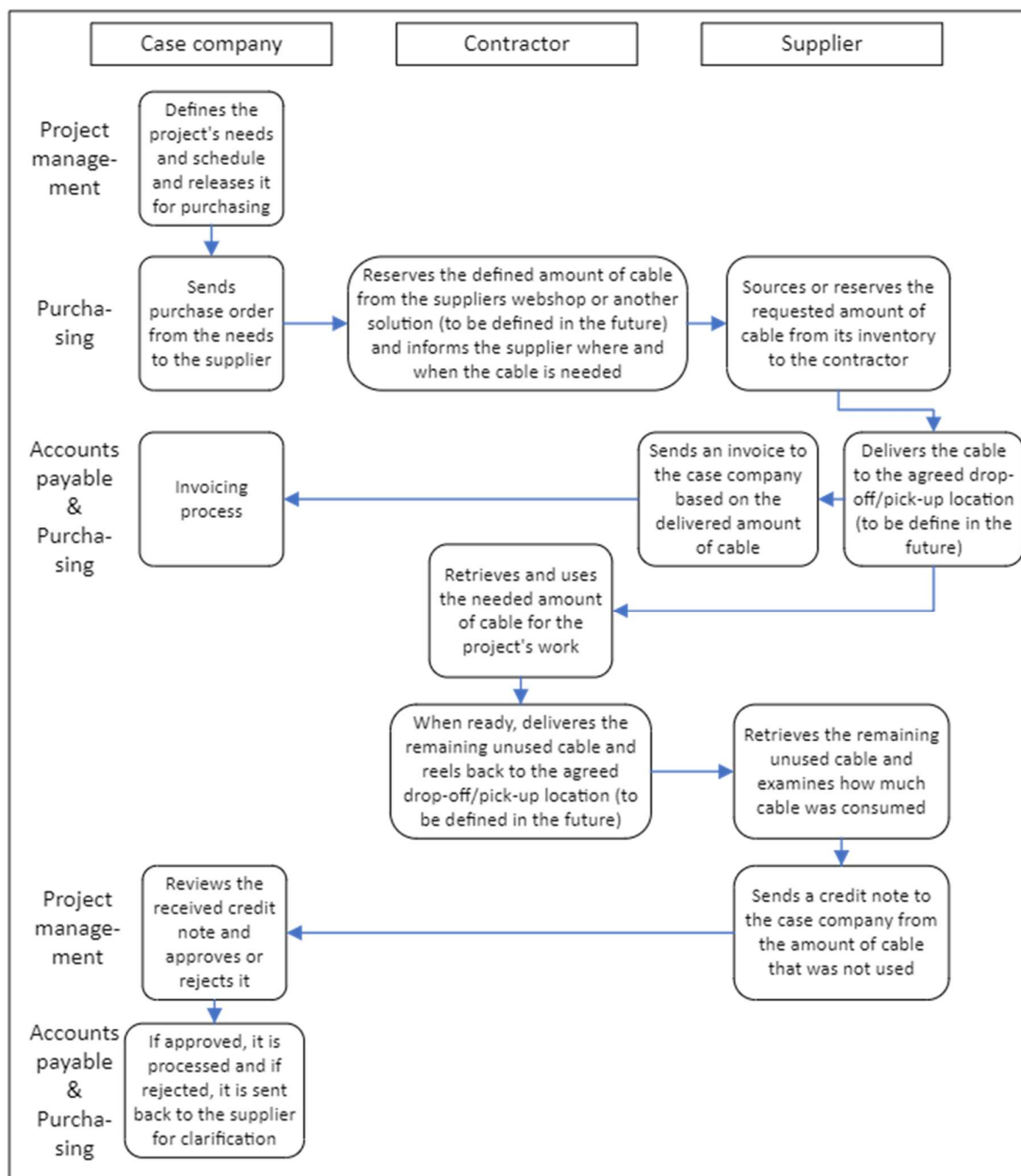


Figure 7. Process flow chart

In the beginning of the process flow, the project management and design engineers define the needs for the project. The design engineers calculate how much cable needs to be pulled and what type of cable is needed. The project management plans the schedule and calculates the budget needed for the work. In this step the cable needs and wanted delivery date for the cables to be on site are issued in the system. The earlier this phase is completed in the

process, the more time there is for sourcing of the cables and the risk that the project's schedule will be delayed is decreased. Sometimes the needs are defined too late which will lead to difficulties for the sourcing step of the cables. Some cable types can have months long lead time to manufacture, and some cables are manufactured specifically for the case company's needs.

In the second step the purchasing department receives the information regarding the schedule and cables which are needed for the project. Procurement purchases the cables from the supplier to be stored for the project and then forwards the received data to the contractor which was selected for the project's work. Purchasing has to react quickly so that no time is wasted if the need for the cables is urgent or if there are some special cables which have long lead times. Each contractor has a named contact person who receives the information regarding the project's materials. Then the contractor proceeds to request the needed cables from the selected vendor managed inventory solution supplier and informs the delivery dates and delivery location. The contractor uses the supplier's web shop or similar application to order the cables using the case company's rights. The supplier has set up an account for the case company for its web shop or similar application. The contractor will have limited rights for the case company's account or preferably an alternative account, but this has not yet been decided at the time of writing this study. The case company's or contractors account is used to track deliveries and cable returns. The contractor is accountable for the cable reel which it has requested and must pay for it if the reel or cable goes missing or if those are damaged.

When the supplier receives the order and requested delivery date and location from the contractor, it begins the sourcing or reserving processes for the requested cables. In optimal situations the supplier has the cable available in its stock but cables which have more rare historical consumption must be sourced from manufacturers or other suppliers. The supplier must keep a safety stock for the highest consumption and critical cables and the quantities are determined together with the case company using the data regarding historical consumption and previous safety stock values. The safety stock values can be adjusted after the partnership has started.

After sourcing or reserving the requested cables, the supplier prepares the delivery process for the cables. The cables are delivered on the requested date to a predetermined drop-off location or directly to the contractor. This part has not yet been decided at the time of writing

this study since the negotiations are ongoing and the preferred delivery method will be selected together with the supplier. Most preferable option would be one or more cable drop-off and pick-up locations. Delivering the cables directly to the contractors can be difficult and resource consuming since there are so many contractors working on the case company's projects. The drop-off and pick-up locations are still open since the possibilities and most optimal locations around the refinery are still under investigation. The supplier will send an invoice to the case company after it has delivered the cable reels and it will be processed by the purchasing and the accounts payable departments in the case company.

When the project's cable pulling or instrumentation works start, the contractor picks up the needed cable reels from the requested location. The contractor uses as much cable as it needs and then returns the cable back to a predetermined location. The cable will not be used for any other projects or purposes because otherwise it would distort the costs of the project it was meant to be used in. There is also a risk that the cable reel could go missing if it is immediately not returned back to the predetermined location for the supplier to pick up. The cable reels will be marked with data sheets that have information regarding what cable is in the reel, for what project it is, what contractor will use it and what date it was delivered. The contractor will make sure that the returned cable and the reel are not damaged or otherwise it has to pay the costs to the case company.

When the project's cable pulling or instrumentation work is done, the supplier retrieves the returned cable and reels from the predetermined location. This can be done once a week or more often if there is a lot of cable ordered and returned from the projects. The supplier will be provided with the information regarding how much cable was used from each reel and then calculates the consumption to make sure that the information is correct. The supplier also checks that the returned cables and reels are in good condition and usable in the future. After the calculations are done, the supplier sends a credit note to the case company regarding the amount of cable that was not used and from the costs of the returned reels. This ensures that the case company only pays for the cable that it has used, and the project's costs are correct.

The project management then inspects the received credit note and approves it to be paid if it was correct and in line with the used amount of cable. If more cable was used without proper explanation from contractor, an issue will be raised and discussed with the contractor.

If no proper explanation is received from the contractor, it must pay for the amount of cable that was not supposed to be consumed in the project's works or if the cable is missing or damaged. After the credit note has been approved by the project management, the credit note will be processed by the purchasing and the accounts payable departments in the case company.

This process aims to decrease the number of unused cables and reels to stay in the case company's premises and worksite. It is more cost effective if the case company only pays for the cable it uses and the rest can be used for other projects or sold to the supplier's other customers. This way the amount of waste and scrapping can be decreased. The process is also used to shift the deliveries and warehouse management responsibilities of the cables to the supplier. Since there is no way to store the cables reels in the case company's premises, the process is a reasonable solution for that. There are some challenges in the process such as invoicing and deliveries, but they are not deal breaking issues. The discussions for practical solutions are ongoing with the potential suppliers and internally in the case company.

### 4.3 Supplier selection

In this section the critical success factors in supplier selection are examined. The data for this section was collected from the two interviews as well as from the internal guidelines for supplier selection process. The questionnaire was the same for both interviewees and has a total of 20 different supplier selection and case project related questions. The internal guidelines focus on the topics related to supplier selection and procurement processes, instructions and practices.

The case company has internal guidelines and policies for sourcing projects which are followed when sourcing is executed. These policies and guidelines ensure that the wanted results for the project's scope are achieved. Sourcing templates are necessary for healthy competition and cost effectiveness, and they are a must for transparent and traceable sourcing project execution. The templates and documentation from the project can also enable organizational learning across different functions. Through various projects in the past, learning experiences and documentation, interviewee 1 described the most common

steps of the sourcing process which are presented below in figure 8. Next the steps are explained generally based on the answers of interviewee 1 and according to the internal guidelines. The most important steps for the study are examined more in detail after that.

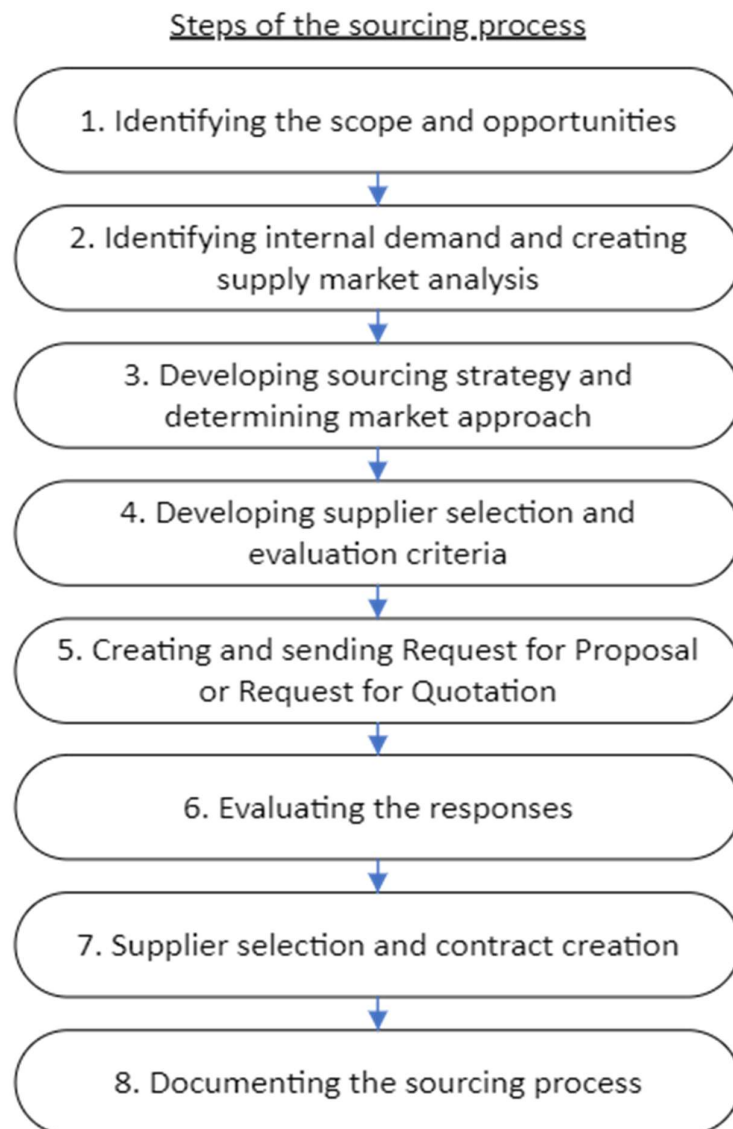


Figure 8. Steps of the sourcing process

At the start of the sourcing process, it is necessary to understand the scope of the project and what are the desired outcomes. These are identified and examined together with the internal cross-functional teams and other relevant stakeholders. For the scope, it is also necessary to define and agree on the roles and responsibilities of the project and to examine what kind of

support is needed from different teams and functions. To proceed with the process, the project manager has to internally create an official sourcing initiative and get it approved. In the sourcing initiative the targets, spend, benefits, risks, schedule of the project, roles and resources are defined. The official sourcing initiative is created by utilizing the internal templates and guidelines.

In the second step the internal demand is identified more in detail and the supply market analysis is created. It is necessary to identify the characteristics of the category in which the sourcing initiative is created. The categories and needs can differ a lot depending on the category and therefore this is a crucial step in terms of the success of the project. The current purchasing patterns and processes in the category are examined and the future demand estimations are studied. When the market supply market analysis is created, the market structure and segmentation are evaluated as well as the industry trends and competition. Potential and existing suppliers are profiled, and new alternatives are examined for possible new solutions and innovations. Both interviewees stated that internal tools and templates have to be used in this step for a successful outcome.

After the internal demand is identified further and the supply market analysis is created, it is time to develop the sourcing strategy for the project. When developing the sourcing strategy, it is necessary to identify the total cost components which are involved in the project. The benefit and cost reduction ideas are examined and developed, and the target benefits are validated. The sourcing strategy has to be approved internally and the market approach is selected. The request for information, proposal or quotation material is prepared and the pricing structure and section criteria are created. In addition, the category specifications and commercial terms and conditions are examined and defined. The material, information and all the related documents are sent to potential suppliers, and they are given enough time to answer. The answers are evaluated using the developed supplier selection criteria and other sourcing tools and templates.

Negotiations with the most potential candidates are held and after that the tender winning supplier(s) is selected. The commercial and technical terms are agreed and negotiated together with the supplier(s). After those have been agreed on, the contract is signed, and the implementation phase starts. The implementation plan is refined and finalized together with the supplier(s) and a possible collaboration model is set up. This is a crucial step for a smooth

and effective implementation transition. The whole supplier selection process is documented and to understand the reasoning for the selection. It is necessary that the benefits and decision making can be traced in the future for learning experiences and for evaluation.

All the steps in the sourcing process require a lot of negotiation and discussion with the suppliers and internal stakeholders and therefore the process has to be transparent and relevant information has to be available for everyone who is involved. Both interviewees also stated that everyone who is involved have to understand what the scope is and what is needed. Otherwise, the wanted results and benefits might not be achieved if the scope is not defined well enough and if communication is difficult. There can be major difficulties in the sourcing process and implementation phase is all the involved persons have not understood their roles and responsibilities.

#### 4.3.1 Identifying the need and scope of the sourcing process

The supplier selection process in the case company starts with identifying the need for the sourcing. This is highly dependent on the case and the category of need since, for example, services, materials and equipment differ a lot from each other in terms of need and sourcing. The identification is done in cooperation with various internal stakeholders in cross-functional teams where the benefits are sought together. The identification process is executed based on the internal guidelines supported by standardized sourcing templates, documents and data. In addition, total cost of ownership is heavily present in the identification process since price is not the only factor that matters. (Interview 1) Total cost of ownership approach focuses on the total value received from purchasing and using goods or services rather than focusing only on the price. This approach combines the price and value in sourcing decisions which can create cost savings in terms of cost management and cost of ownership in the supply chain through cooperation with suppliers. (Wouters et al., 2005)

Defining the scope of the sourcing process is an important step for a successful sourcing project. According to both interviewees, the project will fail if the scope is not defined carefully and with expertise. Interviewee 2 stated that you have to understand what is the product or service that needs to be sourced and what the scope for it is. It is the buyer's

responsibility to understand and define the scope well so that the supplier can precisely answer the buyer's need. One of the main goals of procurement is to support the internal stakeholders so that they can plan, engineer and execute their projects and operations. Successful sourcing projects require that the roles and responsibilities in the project are well defined to ensure that the resources are used efficiently, and the competences are achieved.

In the case company, the scope of the project is defined together with the internal stakeholders because they have the technical expertise from the product or service that they need. Therefore, it is necessary to always involve the internal stakeholders in the sourcing projects. The internal stakeholders also take part in the negotiations with the suppliers when needed, which ensures that they will receive the product or service they need. The scope can be adjusted according to the need and what the suppliers have to offer. It is important to listen to the suppliers and what they have to offer because they might be able to offer something that creates even more value to the purchase. It is also important that the suppliers can say what they can do and what they cannot do. If the scope is not defined well enough the suppliers might not be able to understand what they should be offering and what the project aims to achieve. (Interview 1)

#### 4.3.2 Identification and prequalification of potential suppliers

The identification process starts with examining the availability of suppliers in the market. It is preferable to use suppliers which are on the approved vendor list, but other options should be observed as well. Depending on the project, all potential suppliers might not have the capabilities to satisfy the needs and efficiently answer the scope of the project. This again is highly dependent on the scope, the project and category of need. For example, for special equipment there can sometimes be only one supplier who can time and cost effectively deliver the product. Items which are being used in multiple industries and companies have much more competition and therefore the product or service on the market can be much more widely available. This should be examined in detail since it might bring up some issues and problems in the future if the competition was not foreseen and reacted accordingly.

First approach when the scope of the project is decided, requests for information or proposal are sent. If information is not sufficiently available for request for proposal, a request for



information will be issued. Request for proposal is only issued after there are enough details and information available to the suppliers. Suppliers can competitively place their proposals if they do not have the full knowledge of what the buyer needs. This also ensures that there is fair competition and bid evaluation between all the suppliers. In addition, the suppliers need enough time to place their bid competitively. The suppliers should not be in a rush when they prepare their offer since it can affect the quality and details of the offer in a negative way. It is also according to the case company's policies that all the suppliers receive the same information equally, which again ensures fair competition.

In terms of the prequalification, it is necessary to have a large enough pool of suppliers for healthy competition and variety. If there are too little options and suppliers available, it is hard to compare their offers and proposals. This can cause difficulties later in the evaluation phase and could even risk the operations or projects if there is not enough source of supply available on the markets. This is again dependent on the case since for some items and services there might be few or only one capable supplier available.

The prequalification phase also includes a lot of discussion, negotiations and meetings with suppliers and internal stakeholders. These are necessary since all the available knowledge and information must be available for both the buyer and the suppliers so that the buyer receives the product or service it needs in line with the defined scope. The suppliers have to know the scope on detailed level so that they can place their bid cost effectively and evaluate if they have the capabilities for the contract. If the bid competition winning supplier does not have the capabilities to supply the goods or services to satisfy the needs of the buyer, it can compromise the operations or projects of the buyer. The suppliers must be able to supply the goods according to the agreed service level.

#### 4.3.3 Supplier selection criteria and evaluation

According to the internal guidelines the supplier evaluation should be done based on the predefined supplier selection criteria. The criterion should be planned and designed before sending the request for proposal to potential suppliers. This way it is ensured that all the relevant information and data will be received from the suppliers for evaluation. All the candidate suppliers should also receive the same information. This enables healthy

competition and fairness in the bidding process. The weights and factors of the supplier selection criteria should be defined properly which ensures that the objectives and fair competition are achieved. The whole request for proposal process including the criteria, detail, bids received from the suppliers and reasons for the requirements should be documented to ensure the transparency of process and to back up the decisions which will be made. All the suppliers who will take part in the tender shall accept and comply with the case company's code of conduct. If there are any requests for deviations, they must be managed according to the case company's internal processes and policies. It is not uncommon, and some deviations can be made so that both parties can find a reasonable middle ground for the partnership and contract. (Interview 2)

The supplier selection and evaluation process must include a weighted criterion which is always case and project specific. The factors in the criteria should be measurable and can include qualitative or quantitative questions. The suppliers must accept and comply with the case company's supplier code of conduct and the suppliers must pass the compliance check and receive a positive evaluation from the credit check. If the supplier does not meet the requirements of one of those factors, it cannot be considered as a potential option. It is also preferred that the supplier accepts the case company's commercial general terms and conditions but some deviations and adjustments to those can be made. The case company has templates for the selection criteria and evaluation which can be utilized in the selection process. The factors in the criteria are usually, for example price, technical suitability, quality, service level, reliability, safety and sustainability and more case specific factors can be included.

Both interviewees agree that a successful supplier selection process is transparent and traceable. It is important to document all the steps in the process and all the relevant information. These documents can be used to back up decision making and for future learning experiences. All the documentation and data are useful for future sourcing projects as well. The case company has a lot of historical data from vast amounts suppliers in the industry as well as experience from doing business with them. This information is valuable for evaluation and when the potential suppliers are examined. It is preferred to use suppliers that have proven their reliability and performance. Failures and bad experiences should be

documented as well, because from them it is possible to learn what went wrong and what should be improved for future success.

## 5 Discussion

In this part the results of the study are examined and discussed. First the theoretical and empirical parts are compared, and findings are examined. Then those parts of the study are analyzed, and critical success factors are identified.

### 5.1 Vendor managed inventory solution

Table 4 aims to conclude all the relevant findings and summarizes the critical success factors for implementation of vendor managed inventory solution. After the summary, the critical success factors are examined and discussed more in detail.

Table 4. What are the critical success factors of implementing vendor managed inventory solution?

What are the critical success factors of implementing vendor managed inventory solution?	
<b>Findings from theoretical research:</b>	<b>Findings from empirical research:</b>
Cooperation	Cooperation
Finding the right supplier	Finding the right supplier
Communication, data transferring and transparency	Communication, data transferring and transparency
Accurate information sharing	Accurate information sharing
Integration and development of processes and technologies	Integration and development of processes and technologies
Risk and goal sharing	Clear scope definition
Delegation of autonomy	Definition of roles and responsibilities
Buyer has insight and influence on supplier	Historical data from suppliers
Recognizing the suppliers characteristics	
Identification of model characteristics	
Recognition the implementation phases	

For a successful vendor managed inventory model the literature and empirical study suggest that cooperation and finding the most suitable partner are the most important critical success factors. If the supply chain and everyday operations are aimed to be optimized and efficient, the cooperation, communication and data transferring has to be constant and clear.

Interviewee 2 suggested that meetings on a weekly basis are needed for the communication and process flow to be efficient. In the beginning of the partnership, communication has to be continuous so that the process can be refined, and possible challenges are noticed early. Dong et al. (2007) identified in their study that both parties in the partnership have to share the risks and common goals of the project and operation. The cooperation has to be close so that the performance can be optimized, and overall costs of the process can be reduced for both parties. Data and information transparency are also a necessity for a successful partnership. Claassen et al. (2008) also suggested that for a healthy partnership, the organizational values of both parties should be aligned and similar.

According to Claassen et al. (2008) one of the critical success factors for a prosperous partnership is accurate information sharing. The buyer has to provide accurate information about demand and forecasts so that the supplier can react to the needs as soon as possible. This way the bullwhip effect can be controlled, and the supply replenishes, and deliveries can be optimized. Both interviewees agreed that accurate information sharing is needed for the partnership to work. The information sharing has to be accurate from the beginning of the project since the process flow has to be defined together with the supplier. In addition, the scope of the project should be clear for both parties. The suppliers know their capabilities and therefore their input regarding capacity, ideas and opportunities are a must for an efficient process flow. The buyer knows what it wants to achieve with the process, but suppliers' recommendations and ideas are needed for a well-defined scope of the process in the partnership.

Both interviewees highlighted the importance of defining the roles and responsibilities for the partnership. This is an extremely important task since everyone has to know their part and input in the process. The supplier and their employees have their own responsibilities and tasks in the process and so do the buyer and its employees. The everyday work in the process does not work and the desired benefits of the partnership are not achieved if someone in the process does not play their part or if the roles and work descriptions are not defined well and clearly.

Van den Bogaert & van Jaarsveld (2020) stated that delegation of autonomy is widely recognized as one of the key success factors for vendor managed inventory solutions. The delegation of autonomy allows the supplier to have more control over the planning of supply

replenishments and deliveries which enable better service level in the partnership. Van den Bogaert & van Jaarsveld (2020) also mentioned that an excellent vendor managed inventory solution partners are highly focused on customer service. One of the critical success factors of partnerships is to find a supplier who is easy to communicate with and focus on the partnership. The agreed service levels will not be met if the supplier's focus is somewhere else. This can result in late deliveries, high inventory costs, disrupted communication and unreliability in the overall cooperation.

Van den Bogaert & van Jaarsveld (2020) and Kauremaa et al. (2009) suggest that there are certain patterns and supplier types which should be examined and identified when selecting a supplier for partnership. For the buyer, one of the critical success factors of supplier selection for a vendor managed inventory solution is to have insight and influence in the supplier's way of managing the inventory levels and operation. This can be made easier if the supplier's characteristics in the partnership are recognized. Interviewee 1 mentioned that historical data from previous business interaction is helpful here since the past experiences gives you an idea how customer service orientated and focused the potential candidate suppliers are. If the business interaction has been ongoing for years, it is easy to recognize from historical data if the supplier's deliveries tend to be late or on time and if the communication is excellent or poor. In the study of Van den Bogaert & van Jaarsveld (2020) four different supplier types were recognized. The supplier types are as follows:

1. "Out of control suppliers" which have little to none focus on the partnership and cannot meet the agreed service levels. Even some contractual violations can happen.
2. "Performance driven suppliers" which focus on keeping the buyer satisfied all the time and strive to have the inventory levels on the agreed quantities. These suppliers do not want to take risks of having no stock available for the buyer.
3. "Forecast driven suppliers" which keep their inventory levels and buffer as low as possible and handle the restocking solely based on the forecasts of needs that the buyer delivers to them.
4. "Cash flow driven suppliers" which operate as efficiently as possible. These types of suppliers continuously optimize their profits generated from the collaboration. This can be cost-effective for both parties if service levels are not compromised.

Kauremaa et al. (2009) also identified three different characteristics of vendor managed inventory models which depend on the level of cooperation and general interests and investments on the model. The three characteristics are as follows:

1. “Basic vendor managed inventory” in which the buyer has only transferred its inventory management to the supplier and reduced the need of purchasing in its organization. This can make the inventory levels more cost effective and increase the material availability.
2. “Cooperative vendor managed inventory” in which the relationship in the partnership is deeper compared to the basic model and the goals of both parties are aligned. The main goal is to improve and develop the supply chain and to increase overall operational efficiency. This requires continuous communication and visibility regarding demand, forecasts and product availability.
3. “Synchronized vendor managed inventory” in which the basic or cooperative model are enhanced. The supplier has included the model in the planning of its operations and both parties’ goals are merged and key decisions are made together.

Interviewee 1 stated that one of the critical success factors is the integration and development of processes and technologies in systems to support the model. Both parties have to set up their systems so that the information sharing is fluent, and the data is up to date. The process has to work both in the systems and in practice in everyday work. According to Holmström (1998) integrating processes such as deliveries, invoicing and ordering have to be set up in internal systems in a way where both parties are satisfied and have visibility. Sometimes even merging and integrating both parties’ systems can be a viable option. This enables more transparent data and up-to-date information regarding inventory levels and delivery statuses for both parties.

Implementation phases of the vendor managed inventory models is one of the critical success factors that must be recognized. Zachariassen et al. (2014) recognized three phases which are vital for successful implementation. These phases are backed up by both interviewees since both stated that the scope definition together with the supplier is necessary for a successful project. The suppliers should be listened to, and the implementation phases should

be done in close collaboration with the selected supplier. The three recognized phases are as follows:

1. Setting the goals and defining the scope
2. Implementing the model to the supply chain
3. Monitoring the day-to-day operations and developing the model

These steps are examined more in detail in the theoretical part of this study, but cooperation and communication must be highlighted since they are needed in every phase for a successful outcome.

## 5.2 Supplier selection

Table 5 aims to conclude all the relevant findings and summarizes the critical success factors of supplier selection for a vendor managed inventory solution. After the summary, the critical success factors are examined and discussed more in detail.



Table 5. What are the critical success factors of supplier selection for a vendor managed inventory solution?

What are the critical success factors of supplier selection for a vendor managed inventory solution?	
<b>Findings from theoretical research:</b>	<b>Findings from epirical research:</b>
Historical data	Historical data
Identification of opportunities and needs	Identification of opportunities and needs
Utilization of cross-functional teams	Utilization of cross-functional teams
Continuous and transparent communication	Continuous and transparent communication
Developing sourcing strategy	Developing sourcing strategy
Identify and develop cost reduction ideas	Identify and develop cost reduction ideas
Identification and prequalification of potential suppliers	Identification and prequalification of potential suppliers
Selecting enough suppliers for competitive bidding and evaluation	Selecting enough suppliers for competitive bidding and evaluation
Determining market approach and identification of competition in the market	Determining market approach and identification of competition in the market
Well defined supplier selection criteria	Well defined supplier selection criteria
Utilization of available tools and methods for supplier selection	Utilization of available tools and methods for supplier selection
Identification of the availability and need of internal resources	Identification of the availability and need of internal resources
Deciding the number of suppliers to be utilized in sourcing	Deciding the number of suppliers to be utilized in sourcing
Identifying the sourcing related costs	Transparent and traceable process
	Documentation
	Standardized ways of working
	Clear scope definition
	Identification of sourcing category characteristics
	Studying current purchasing patterns and processes
	Analyze market structure nad segmentation
	Following internal guidelines and processes
	Analyze suppliers' reputation and technical and financial capabilities

Both interviewees agreed that a successful supplier selection process is transparent and traceable. All the steps in the process should be documented for future reference and traceability. The documentation can be utilized if the decision making requires explanation and reasoning and for future learning experiences. The case company has recorded and documented a lot of historical data and experiences from vast amounts suppliers in the industry. Such information is valuable for every sourcing project if the potential suppliers are evaluated and examined. Failures and bad experiences should be documented as well, because they can be useful when the failures are being examined. The process can be developed to be better if the weaknesses and failures can be identified.

Bruel (2016) mentioned that one of the critical success factors in supplier selection is to identify the need and opportunities for sourcing within the organization and its operations. The need for a new supplier or multiple suppliers must be recognized first. This need usually originates from a need to create a new product or service or if the current suppliers are not performing well enough to meet the buyer's operational needs. One reason can also be that the organization is planning to expand its production, service portfolio or if it aims to breach into new markets or overseas operations. In the case company, the identification of needs and opportunities is done together with internal stakeholders. Sollish & Semanik (2011) stated that a cross-functional approach is necessary for successful sourcing projects. All the relevant stakeholders should be involved in the identifying process since some of the stakeholders are end-users which need the sourced product or service in their everyday work. Interviewee 1 added that also other stakeholders such as legal and risk management specialists are required when the scope is being defined. For a successful outcome the knowledge and insight of every relevant stakeholder should be utilized.

According to interviewee 2, communication and transparency are necessary when identifying needs and opportunities. Everyone in the project should bring their best knowledge and ideas to the table. In the case company, the identification process is done according to the internal guidelines and principles and by utilizing existing data and knowledge from past experiences. Interviewee 2 added that standardized ways of working are required for a successful project. If something does not work in the process or if it is outdated, the issues should be investigated in detail and documented for development. Both interviewees agreed that the project will fail if the scope is not defined clearly and with

expertise. It should be clear what is the product or service that needs to be sourced since this can affect the nature and requirements of the sourcing. Interviewee 2 also added that the buyer is responsible for defining the scope so well that the supplier can efficiently deliver the product or service to satisfy the buyer's needs. If the scope is not defined correctly and in detail, it can risk the whole project and operations if the contract is signed and it turns out that the supplier is not capable of satisfying the buyer's needs. During the project and negotiations, the scope can be adjusted according to the need and what the suppliers have to offer. It is important to listen to the suppliers and what they have to offer because they might be able to offer something that creates even more value to the purchase. (Interview 1)

Both interviewees agreed that since there can be multiple reasons and needs for sourcing, it is necessary to identify the characteristics of the category in which the sourcing initiative is created. The approach of the sourcing process can change depending on the category and items which need to be sourced. Therefore, identifying the category and its characteristics is a must for a successful sourcing project. According to the internal guidelines the current purchasing patterns and processes in the category should also be examined for a clearer understanding of the needs and possible demands in the future. In addition, one critical success factor is to analyze the market structure and segmentation. There can be changes in the industry trends and competition which might be useful to know when the need for sourcing is evaluated. According to interviewee 2, the internal guidelines and processes in the case company are success factors for supplier selection. In the previous projects they have proven to be excellent for supplier selection but there is always room for more development and improvement.

According to Bruel (2016) when the sourcing strategy is developed, certain key decisions should be made. The availability and need of internal resources and stakeholders should be identified and involved for a successful project. New opportunities can be discovered when the experts in their own field share their ideas and proposals for the sourcing strategy. Interviewee 1 stated that probably one of the most important steps when developing the sourcing strategy is to decide if the products or services can or will be purchased from single or multiple sources. This decision can also change as the project moves forward if there are enough potential suppliers who can satisfy the needs of the buyer efficiently. But this again is highly dependent on the market and the category as well as supply and demand. Using

multiple suppliers can decrease the risk of products not being available from one supplier and using only one supplier is the better option if the cooperation is planned to last for multiple years. Using only one supplier can also enable the development of the supply chain, product or operations, which can decrease the costs for the end-user. In the case company, the selected sourcing strategy has to be endorsed and approved internally before the sourcing project can move forward.

Selecting the sourcing strategy is a difficult decision and requires a lot of knowledge and experience from strategic sourcing. There is no single correct way which suits every sourcing project and need. Monczka et al. (2002) proposed that there are six key decisions and options for selecting the sourcing strategy, which are as follows:

1. Single versus multiple supply sources
2. Short-term versus long-term purchase contracts
3. Selectin suppliers that provide design support versus those who lack design capabilities
4. Full-service versus non-full-service suppliers
5. Domestic versus foreign suppliers
6. Expectation of a close working relationship versus arm's-length purchasing

Bruel (2016) stated that it is important to identify different costs and resource needs for the sourcing process for achieving the wanted benefits and results of the project. The costs and resources can vary a lot depending on the category and the need and therefore those are highly case dependent. Bruel (2016) also added that one of the key steps in the sourcing process is to identify and develop the cost reduction ideas of the project since these can create a lot of additional value for the organization, and its supply chain and operations. These cost reduction ideas should create value for both the buyer and the supplier.

According to the internal guidelines in the case company, the potential suppliers for the partnership should be identified. This is one critical step for successfully selecting the most suitable supplier. This identification is done by using the existing database from existing suppliers and examining new potential candidates. These candidates can be abroad or from the same country in which the operations are. This needs detailed evaluation since there can

be additional costs if the new supplier is from abroad or if there are legal or geographical related risks in the country of origin. According to Monczka et al. (2002) the five most common sources of information for identifying supplier candidates are: current suppliers and past suppliers, sales representatives, trade shows, the experience from purchasing personnel and events or internet searches. The downside of only including existing and known suppliers in the supplier selection is that no new potential suppliers are evaluated and examined and therefore all the possibilities are not examined.

The potential suppliers should also be prequalified. The prequalification can be done by sending the suppliers requests for information or requests for proposals. This way the suppliers who are not interested in the project can be removed from the pool of potential suppliers and the suppliers can give their first offers and ideas. After the responses are evaluated, the first discussions with the suppliers can be started. Both interviewees stated that this is a crucial step for successful projects and communication is one of the critical success factors in supplier selection. Communication has to be continuous and transparent, and all the relevant stakeholders and personnel should be involved in the discussion and meetings. This ensures that the sourcing project delivers the technically correct product or service the operations and stakeholders need. According to the case company's guidelines and principles, all the suppliers must receive the same proposal materials and information so that the competition is fair, and all the suppliers are treated equally. All the suppliers have to have the same detailed information to give proposals from the product or service as best they can.

Monczka et al. (2002) stated that once the potential suppliers have been identified, the supplier selection pool must be narrowed down. Limiting the pool helps to create more in-depth selection criteria for evaluation. In the case company, there has to be at least three supplier candidates for competitive and fair supplier selection. Both interviewees suggested that this way it can be made sure that the evaluation process is reliable, and healthiness of the competition is enabled. Of course, this is also highly case dependent, since there might not be enough suppliers who can efficiently offer wanted solutions or products for the organization's needs. If this is the case, then the sourcing process moves forward with the number of suppliers that are considered capable.

According to Seshadri (2015) determining the market approach is necessary for successful sourcing project. After the potential suppliers have been identified, their competitive positioning in the market should be examined. If there is a lot of competition in the market for the product or service which needs to be sourced, the bidding process will become more competitive. Also, the main competitors and customers of the potential suppliers should be examined. These create more demand in the market and might have an impact on the suppliers' capacity and available supply. In addition, if the market is highly competitive, there can be fluctuations in the availability of products or services, which is also something that must be examined.

According to interviewee 1 the financial stability, business strategies, reputation, technical suitability and manufacturing and design capabilities of the potential suppliers have to be analyzed. There are different methods and tools to do this successfully and in the case company the preferred and required tools and methods are used. External sources and reports can be consulted, for example to identify the financial statuses of the suppliers. Previous experiences and data can be utilized, and some information can also be requested directly from the suppliers. Analyzing the suppliers is necessary for the successful outcome of the sourcing process and should not be neglected.

Sollish & Semanik (2011) stated that supplier selection criteria should be measurable and made according to the sourcing strategy and need. The factors for the criteria should be defined so that the capabilities and potential of the supplier can be measured in detail. The factors can be qualitative or quantitative. Well-developed and defined selection criteria is one of the key success factors of sourcing projects. It is necessary for fair competition and for finding a supplier who can deliver the product or service efficiently. The results from the supplier selection criteria should only be used to support the decision-making process and the decisions should not be made only based on the results. It is a tool to be used for backing up the decision-makers' decisions and not to make the decisions on behalf of the decision-maker. The decision-maker in the supplier selection process has to understand all the relevant information, factors, interests and needs for the new supplier in order to make the right decisions. The selection criteria are always case specific, and the factors can differ from project to project. There are usually a set of factors that are included in every selection criterion in every project, but the project can have more variable factors which support the

project's needs and decision-making. According to the internal guidelines in the case company and interviewee 1, the most common factors are: price, quality, technical suitability, reliability, safety and sustainability.

The case company also has requirement that the suppliers who are considered to be candidates for partnership and can continue in the tendering phase have to accept and comply with the company's supplier code of conduct, pass the compliance check and receive a positive result from the credit check. The supplier should also accept the company's commercial general terms and conditions, but some deviations can be made to those in accordance with the internal processes and policies. According to interviewee 2, the suppliers can suggest deviations to all the points in the terms and conditions, but everything cannot be accepted. This is also case dependent, and some suppliers can have more influence on the terms and conditions if they are the sole supplier or have a strong position in the market.

When the supplier selection criterion is being developed, Boer et al. (2001) stated that there are few useful methods for creating it. Historical data is extremely valuable since the factor definitions is much easier when the suppliers' capabilities, strengths and weaknesses are known from the past. For new suppliers, it is much more difficult to create the criteria since all the factors must be carefully evaluated and selected in order to get the most valuable and accurate information and results from the criteria. For a new project this can be an issue, because there might be factors that have not been used before or even considered and examined in detail. Errors and factors that have not been considered can lead to selecting the less capable supplier or even incompetent supplier. This can cause issues for daily operations if the selected supplier is not capable and cannot meet the requirements of the buyer in practice.

To back up the decision making, there are a lot of useful tools and methods for developing supplier selection criteria and guiding the decision maker to select the most potential supplier. Goh (2018) identified four most common methods for creating supplier selection criteria which are categorical method, weighted-point method, cost ratio method and analytical hierarchy process. In the case company weighted-point method is preferred to support the decision making. It is the most commonly used method because of its simplicity and effectiveness. It gives an overall idea of the suppliers' capabilities objectively. The

suppliers can be quickly compared, and the results can be easily presented to stakeholders if the decision making needs to be traced, backed up and documented.



## 6 Conclusions

In this part, the research questions will be answered based on the findings of this study. Finally, suggestions for the case company and its project are given and possibilities for future research will be discussed.

### 6.1 Answers to research questions

This study focused on finding and examining the critical success factors for supplier selection and vendor managed inventory solution implementation. After the discussion and more detailed examination and identification of the findings it is time to answer the research questions. The first research question of this study is:

*What are the critical success factors of supplier selection for a vendor managed inventory solution?*

There are many important critical success factors which should be considered and examined in supplier selection, but the most notable ones are communication, accurate information sharing, well defined scope, well developed sourcing strategy and supplier selection criteria, utilization of cross-functional teams and historical data.

The second research question of this study is:

*What are the critical success factors of implementing vendor managed inventory solution?*

After studying and identifying many important critical success factors, the most notable ones are cooperation and communication, finding the right supplier, accurate information sharing, clear scope definition and well-defined roles and responsibilities. There were also other critical success factors identified, which should also be considered and examined when implementing vendor managed inventory solution.

## 6.2 Recommendations for the case company

In the beginning of the cooperation, the case company should focus on communication and making quick fixes to the process if necessary. The case company should also make sure that the contractors know their new role in the process. They should be aware of what they need to do and what the new practices are. If they are not trained well enough for the process, they could create a big bottle neck. Also, the invoicing process should be made clear for both parties. All the relevant and necessary invoice references should be used in invoices and the approval of credit notes should be swift so that the cash flow is not interrupted. The returning of reels might also cause some challenges since they have proven to be challenging in the past as well. The contractors should be required to return the reels to when their work is done on the site, so that the remaining cable can be returned back to the supplier and then a credit note could be issued.

Harmonization of the supplier selection related materials should be done. There is a lot of different information and guidelines which cannot be found easily from one place. It was difficult to study the guidelines and ways of working when all the relevant and useful instructions were not to be found in a single place. In addition, the templates in the case company are also difficult to find. Gathering all the relevant information for the empirical part of the study was not easy, since the writer had to ask its' colleagues where useful information could be found. After that the material which consisted of many different instructions and presentations needed to be studied and examined in for this research.

## 6.3 Limitations and suggestions for further research

One of the main limitations of this research is that it was done by a single person while working full time in the case company. The writer of this study had also other responsibilities in the company which in a way limited the focus of the research. Another limitation worth mentioning is that the vendor managed inventory solution focused on the industrial cables. They differ a lot from another general items since the reels create a new variable and challenge for the process, and at the time of writing this study there was not any literature from similar projects. In addition, the sample size of this study was limited, since there were

only two interviewees and there were other major upcoming projects in the case company which limited the availability of other relevant stakeholders.

For future research for this project, the inventory values and process optimization could be studied. Before the process can start, inventory values such as safety stock and service level should be calculated and examined. In addition, when the day-to-day operation starts, some key performance indications for the process should be studied and developed. Those are necessary for improving the process and for making it efficient. This requires a lot of documentation and monitoring, but it will pay off when the bottlenecks can be identified, and less cost-efficient parts of the process can be made more streamlined.

In vendor managed inventory solutions integrated enterprise resource management systems can be integrated between the partners. This of course requires that both companies utilize the same system. Integrating the systems would make the process much more efficient since the data visibility could be transparent all the time and manual work which both companies have to do in systems could be decreased. This would create a lot of cost savings and projects could utilize the information from real time product availability for planning and executing their work in the field.

The last suggestion for future research is that similar research could be done in the case company. The case company already has consignment stock solutions with some of the suppliers and the critical success factors of those solutions could be studied. Some future supplier selection processes could be studied as well, and the results of this study could be compared to that. The results of the study might be different if different sources of information are utilized and if the writer identifies other critical success factors.

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## Appendices

### Appendix 1, Interview questionnaire

1. How important is this sourcing project for the item category?
2. Comparing it to the previous sourcing projects, how large scale is it?
3. How does the scale affect the selection criteria and prequalification?
4. How many phases are there in the sourcing process?
5. What is the most common approach to sourcing projects?
6. Has case company done business before with the tendering suppliers? How much?
7. How many suppliers do there need to be for competitive bidding? Is there policy for minimum number of suppliers for bidding?
8. What are the main factors and criteria for selecting the supplier? Service level, quality, price, reputation?
9. How much can the tendering suppliers suggest deviations to T&C?
10. What happens if none of the suppliers do not have the capabilities for the project?
11. What happens after the supplier has been selected and the contract is signed?
12. What are the advantages of the VMI model?
13. What are the challenges of the VMI model?
14. How much cost savings can be achieved? How can they be achieved?
15. How usual it is for Neste to make a frame agreement with a supplier? How successful they usually are?
16. What are the success factors in the current supplier selection process?
17. What are the challenges in the current supplier selection process?
18. Have there been improvements made to the supplier selection process in the past?
19. How important is communication with the supplier in the selection process?
20. What are the potential risks of this project?
21. Do you have anything to add?