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Case Study of the Impact of Risk Management Practices on Supply Chain Efficiency

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ABSTRACT

This thesis is done in collaboration with Vestas Wind Systems A/S and its Onshore Procurement department within the Northern and Central Europe region. This research studies the critical relationship between a company's Project Risk Management practices and Supply Chain Efficiency within context of changing business environment. Efficient Risk Management is crucial for organizations to achieve their goals and objectives. In the context of rapidly changing business environment and the new requirements caused by it, it is important to understand how Risk Management practices can affect the project's success. The thesis focuses on Supply Chain Risk Management within a global wind turbine manufacturer Vestas' Northern and Central Europe region, specifically related to the suppliers providing manpower. The company has experienced significant growth within the last few years in this region which has resulted in a great need to adapt to several internal, organizational as well as external changes. In this research the different methods selected by the supply chain management to manage the risks under uncertain circumstances are inspected. A case method approach is used in this paper and as data-collection methods, semi-structured interviews are used to gain information from professionals and experts in the field of Procurement, in addition to observations and data collection from the company's different databases. The aim of this study is to recognize the key points in the company's risk management strategy when it comes to managing the supply chain, that have impacted the Project Success in the studied region during this volatile period in the organization. It also identifies the critical success factors such as having a clear objective, enabling efficient stakeholder involvement, and conducting thorough planning prior to the project execution. Additionally, the most common challenges are identified such as risk assessment, reactive management and lacking communication that are faced while managing these construction projects within the dynamic business environment.

KEYWORDS: Risk Management, Supply Chain Risk Management, Risk Management Practices, Decision-Making, Procurement Strategy.

1. INTRODUCTION

The construction and manufacturing field has faced significant challenges in recent years due to the dynamic business environment, for instance, rising interest rates, the impact that inflation has had on the prices of different resources and the overall increased uncertainty due to political unstableness. Hence, several companies operating in the field have been struggling to maintain a positive cash flow. The global Wind turbine manufacturer Vestas Wind Systems A/S is no exception. Despite the challenging times, Vestas has managed to stay afloat and even gain competitive advantage in the wind turbine manufacturing and installation market. One of the key factors affecting their success, is the company's supply chain management (SCM). This paper is a qualitative case study in which the impact of risk management (RM) practices on the supply chain efficiency and ultimately its competitiveness and success is studied. The thesis is conducted in collaboration with the wind turbine manufacturer Vestas Wind Systems A/S and the Procurement and Supply Chain departments in the Northern and Central Europe (NCE) region. There is a special focus on the supply chain management that is directly related to the main subcontractors providing manpower to the construction projects.

1.1. Motivation for the study

Supply chain risk management in large enterprises usually falls under the scope of its procurement department, which is the part of the company that manages the flow of goods or services from the suppliers, also known as supply chain management (SCM). Before signing a contract with a supplier, it is essential to go through a thorough selection process in which the competences of each potential supplier are evaluated to gain a better understanding of any possible risks associated with them. (Dooley et al., 2014). However, as per Christopher's early study (1992), this evaluation should not end with selecting a supplier, but it needs to continue throughout the whole collaboration within the network of companies. To attain competitive advantage within the market, it is also essential for companies to realize the importance of risk management. In this thesis, the focus is on the supply chain risk management practices within large enterprises, as the case company is a global

manufacturing firm. The concept can be quite complex due to the multiple aspects affecting a large company's supply chain efficiency. These aspects are further inspected in this research.

The role of risk management has become significant for several companies operating globally in recent years. Due to many globally significant changes that have occurred such as Covid-19 pandemic, the Russian invasion of Ukraine, lowering economic growth expectations and most recently, the increasing tariffs that the second Trump administration has imposed on multiple countries. How these changes will affect the long-term performance and success on businesses is a topic that needs to be researched.

Furthermore, the role of supply chain risk management (SCRM) has also naturally become increasingly prominent, especially for large multinational enterprises operating in a highly interconnected global economy. For large enterprises, managing supply chain risks effectively requires not only efficient internal procedures but also transparent and collaborative relationships with suppliers across different tiers of the supply chain. As noted by Dooley et al., (2014), resilience in the supply chain is strongly tied to the ability to anticipate, respond to, and recover from unexpected disruptions. This involves developing comprehensive risk identification frameworks, implementing mitigation strategies, and conducting regular evaluations of supplier performance and compliance.

Digital transformation plays a critical role in enhancing supply chain visibility and responsiveness. Technologies such as data analytics, blockchain, and AI enable real-time monitoring and better forecasting capabilities, thereby supporting informed decision-making and quicker response to emerging risks (Queiroz et al., 2020). For global manufacturing firms like the case company examined in this research, integrating such technologies can offer a strategic advantage in navigating volatile environments.

Ultimately, this thesis aims to explore how large enterprises approach SCRM within the context of complex global operations. It investigates the strategies and tools utilized by

procurement departments to manage uncertainty and ensure the long-term stability and competitiveness of their supply chains.

1.2. Research gap

There are several known challenges for companies operating in the renewable energy sector, especially in the wind turbine manufacturing, installation and servicing business. This is due to the fact that the business environment at a global level is highly dynamic as the laws and regulations affecting renewable energy are constantly changing, which causes a need for an on-going re-evaluation of both internal and external risks.

Decision-making naturally plays a critical role in supply chain risk management. There are some methods and techniques that exist to serve as tools for decision-making and risk management when dealing with suppliers. It is essential to keep in mind that due to the unique circumstances which every organization is operating in, not all methods can be directly applied to all purchasing organizations. (Christopher, 2016). The tools, techniques and practices used to support risk management within a purchasing company need to be carefully selected based upon the specific needs and requirements. The ones inspected in this paper are chosen particularly by having the case company in mind.

The literature in this thesis indicates that several researchers agree on the most common challenges of supply chain management, including, for instance, uncertainty while decision-making and which criteria to use for supplier evaluation (Dooley et al.,2014; Faisal et al., 2017). As stated by Benzie et al. (2019), it is important for the procurement department to have proper tools and practices to enable as efficient collaboration with the supplier as possible. Also, the importance of maintaining the buyer-supplier relationship is easily forgotten by enterprises as they do not necessarily see the value it brings in the long term. Although awareness of supply chain sustainability governance has increased recently and there have been more investments in it recently, its importance is still not recognized enough, which often may lead to the collaboration to deteriorate. (Benzie et al., 2019).

Too many companies make hasty decisions that are not based on proper basis when it comes to managing their supply chains under changing and uncertain situations, which will end up being costly for them. Godfrev (2020) claims that instead of thorough planning, when faced with uncertainty several companies base their decisions on improvising. To avoid it, researching the topic of supply chain risk management in the context of a dynamic and uncertain environment is important not only to the case company to gain a better idea of their current standing, but also in terms of further research and scientific literature. If the topic is studied further, more companies can benefit from understanding the type of risks they are facing and what kind of risk management practices they could integrate to be able to adapt to the changes within their environment. In addition to the construction industry, future studies could, for instance, focus on other fields and even be more area specific.

1.3. Research problem and objectives

The main purpose of this case study is to identify the essential risk management practices that the case company, Vestas Wind Systems A/S, is using within its supply chain management and how they contribute to the supply chain's efficiency. This topic is studied in the context of highly uncertain and changing business environment. There have been many external changes in recent years that have affected Vestas and forced it to adapt to the market changes. The aim is to find out what the risk management practices are recognized and how to maintain benefiting from them.

Considering the above, there are three research questions that can be formed, which will address the focus areas.

RQ1. *How can supply chains be managed successfully under uncertainty?*

The first question has to do with the company's ability to adapt to the changes and uncertain situations within its business environment, while specifically considering its supply chain. It

is essential to identify the most significant factors that are affecting the supply chain's performance and to find out what is causing the uncertainty.

RQ2. *What is considered as the primary cause of risk in supply chain management?*

The second objective is to find out by interviewing the procurement professionals, what they see as the most crucial casues for risk within their supply chains. It is also necessary to gain more insight through existing literature and case studies about risk management practices and which factors have been identified to be successful in previous studies. The aim is to find out the most important and useful methods that the procurement team's members themselves have found to be useful in their work.

RQ3. *What are the key success factors for risk management practices for long term success of the supply chain?*

The objective is to find out which risk management practices contribute to the supply chain's success long term. Aim is to figure out how to implement those practices within the whole supply chain and therefore gain most benefit and ultimately competitive advantage.

Answering the above-mentioned research questions requires theoretical analysis of the key concepts and themes related to supply chain risk management, as well as by gathering data through interviews, observations, and by inspecting the existing material found on company's different data sources.

1.4. Thesis structure

After the introduction, the second chapter of the study focuses on theoretical background on supply chain management and risk management practices, together with different relevant processes commonly used within the field of supply chain risk management. In the third chapter, the used research method is introduced, and case selection is further described, after

which the data collection process is described in detail, including information on the interviews that were held with the different members of Vestas procurement departments. The fourth section of the research presents the results of the study, firstly, with a thorough description of the company's background and current standing, and moreover with the theoretical findings and case analysis. In the fifth chapter the conclusions and implications are introduced, formed of theoretical findings and managerial implications. This last chapter also points out the limitations of the research and a variety of suggestions for future research.

2. LITERATURE REVIEW

This chapter explores the role of supply chain management (SCM) in large-scale organizations. First, in order to establish a comprehensive basis for understanding supply chain risk management, the fundamental elements of SCM are presented, including the definition of a supply chain and the components of the supplier selection process. It further identifies and discusses the key stakeholders involved in the supply chain network. Subsequently, the focus shifts to the analysis of risk management practices within SCM, emphasizing the processes and considerations that support decision-making while operating in a dynamic business environment and under uncertain circumstances.

2.1. Stream 1: Supply chains

To further explore the topic of supply chain management, defining the concept of a supply chain first is vital. In their early study La Londe & Masters (1994) called supply chains as sets of businesses that pass materials forward. In other words, a supply chain consists of all the processes of each separate company that is needed to manufacture a product, which will finally proceed to the end user, i.e. the customer. Companies that usually are considered as part of a broader supply chain are often, for instance, producers of raw materials, wholesalers, retailers, or transportation firms. A supplier can solely provide either goods or services, or a combination of both. Tischner & Tukker (2017) claim that even the companies focused on providing products are in an increasing manner aiming to also provide additional services, due to increased market demand. Regardless of what a company provides, it usually is part of multiple different supply chains throughout its existence (DeWitt et al., 2001).

There are differing views to how a supply chain ought to be defined, for instance, according to Christopher (2016) the term “supply chain” is a little bit misleading due to the actual construct of it. The supply chain is rarely formed as a chain, but rather as a wide network that consists of multiple vendors that provide several types of goods or services. The network includes different organizations that all contribute to producing value to the end customer.

Christopher (1992) states that a supply chain can be divided into three main streams; upstream firms (suppliers), downstream firms (distributors) and customers. He is not alone with this view, as there are several other researchers that see the final customer as one part of the supply chain too (La Londe & Masters, 1994; Lambert, Stock and Ellram, 1998).

2.1.1. Supply chain management

According to Hugos (2018), the principal idea behind supply chain management is that the supply chain is formed by several different organizations that come together to contribute to the same cause, often to create something with a material outcome. SCM is the part of a company that deals with the entire flow of goods or services from the company's suppliers to its end-users (Jones & Riley, 1985). SCM is a set of practices with a common aim, and which is constant throughout all the processes that start from receiving services and/or raw materials and finishes with an end result. As stated by Hugos (2018), a well-managed supply chains can serve as a crucial advantage to a company. All the supply chain activities are aiming for maximizing customer value and therefore also customer satisfaction, and eventually, also to reach significant competitive advantage within the market. As per Stevens' early study (1989), the largest objective of SCM is to synchronize the customer needs with the flow of goods from vendors in such a way that the conflicting goals of high quality customer service, inventory management and low unit costs would all somehow be well-balanced out.

Usually, larger enterprises have a separate department which specializes in SCM and is oftentimes called a procurement department, whereas small and medium sized enterprized might withstand with just one specialized employee (Sollish & Semanik, 2006). The SCM team in large enterprises may include roles such as a procurement manager or agent, contracts manager, purchasing manager or some other employee within the company who is authorized to perform the required tasks. As stated by (Reinecke et al., 2007; Christopher, 2016), these parties are often named as "buyers", whose main priority lies with bringing most value to the company through well thought-out decisions when it comes to supply chain. This means that

they heavily rely on acquiring the needed information on, for example, the financial, legal and technical aspects of their work. Ensuring that decisions are made by relying on the available information, is crucial for avoiding costly mistakes. Hence, thorough and frequent communication with the relevant stakeholders is important. According to Beil (2009), the buyer's role is to serve as a link between multiple internal and external people and organizations to enable smooth collaboration on their part. He also states that forming a cross-functional team that contributes to the supply chain management is likely beneficial to a large company due to the insight that each expert from different parts of the organization can bring to the table when dealing with the suppliers. Each bringing their own sets of skills that knowledge, will in the end improve the chances of achieving an efficient supply chain.

Supply chain management encompasses various practices that, when implemented effectively, contribute to a successful and competitive supply chain. According to Bowerson and Closs (1996), one critical element for a successful supply chain is integrating behavior across all parts of the supply chain, including customers, to ensure shared information, risks, and rewards. Cooper et al. (1997) emphasize the importance of communication and cooperation among suppliers, internal departments like finance and marketing, and other stakeholders. This collaboration often involves joint planning and performance evaluation activities, all aimed at building long-term, trust-based relationships. La Londe and Masters (1994) highlight that having all members of the supply chain focused on serving customers is a key success factor, which requires aligned processes and management techniques across firms.

According to Hugos (2018), despite varying market demands, most supply chains face similar challenges in five core areas: production, inventory, location, transportation, and information. He argues that the way how a company manages all these factors determines the efficiency and strength of its supply chain, and that a capable company considers these factors from the very beginning – even before forming supplier relations. Hence, the importance to invest in the above-mentioned factors has become more important, however, many companies still struggle to identify in which ones and how much to invest. Hugos

(2018) also points out that the investment plan should align with the company's overall strategy. For instance, if a firm aims to provide affordable products to a broad customer base, it should prioritize minimizing production costs. To form the most advantageous strategy, the company must rely on effective and well-structured decision-making process. Given the increasing complexity and unpredictability of today's markets, investing in SCM has become more essential than ever. Reliable suppliers and well-informed decision-making processes help firms gain a competitive edge.

2.1.2. Supplier selection process

Globalization has intensified competition among businesses, making it vital for companies to enhance product quality, reduce costs, and meet evolving customer demands. As stated by Gaikwad et al. (2014), it is increasingly more important to take all possible factors into consideration when aiming for cost efficiency and productivity. Procurement being one of the most relevant activities within SCM, it is central for a company's productivity to select the suppliers with the most potential. Choosing the right supplier helps increase efficiency and competitive advantage, while poor choices can jeopardize the entire supply chain and can lead to high costs for multiple companies that are depending on the supply chain's efficiency. Hence, it is necessary to consider carefully whether the supplier is enabled to procure the required quantity of products with the expected level of quality and within a reasonable time frame and expense range (Izadikhah, 2012).

Building a strong partnership between buyers and suppliers is crucial for understanding each other's needs, fostering trust, and creating a reliable working relationship. The quality of this relationship plays a key role in the overall performance of the supply chain (Booth, 2010). Nadeem et al. (2014) emphasize that working with capable suppliers can significantly enhance a company's efficiency and competitive edge. Nevertheless, they also acknowledge that choosing the right suppliers and sustaining those partnerships is a complex task, as numerous factors influence a company's ability to make such decisions.

Investing in a thorough supplier selection process helps minimize the risks involved with engaging new suppliers. A major challenge in this process, as highlighted by Dooley et al. (2014), is the limited amount of information typically available from suppliers, which makes it difficult to accurately assess and compare them before making a decision. Given that buyer companies often have to make choices under conditions of uncertainty, it is essential to develop a tailored supplier selection process (SSP) that aligns with the specific requirements of the company (Dooley et al., 2014).

As stated by Sanayei et al. (2010), the supplier selection process involves reviewing, evaluating, and picking the most suitable suppliers to be merged as a sustainable part of a company's supply chain. However, Dooley et al. (2014) note that there is no universal method for this process, as each organization must tailor its approach based on its unique needs. Regardless of the method used, the primary goals are to reduce purchasing risks, maximize value, and foster strong buyer-supplier relationships (Sanayei et al., 2010). While there's no single framework that could be directly applied to all organizations, several studies outline similar stages in the SSP. The duration of each stage varies depending on the buyer's needs. For example, in short-term projects the selection may be simpler, whereas long-term partnerships require more critical evaluation, as the focus is on building lasting and reliable supplier relationships (Brard & Taherdoost, 2019).

In this paper the SSP is presented as a seven-step process, starting with recognizing the need for a new supplier and ending with a stage of supplier monitoring and risk assessment. Hence, the stages are as follows: 1) Recognizing the need for a new supplier, 2) identifying criteria and assigning weights to it, 3) determining the procurement strategy, 4) defining the technique and methodology for assessing and evaluating the suppliers, 5) prequalification, 6) signing a contract and 7) supplier monitoring and risk assessment (Bhojak et al., 2013; Brard & Taherdoost, 2019; Karanjkar, 2007). These stages, as also seen in Figure 1, are combined from several studies that describe the process in a slightly differing manner when it comes to where the process is considered to start and where to end, however, all stages have been

included in this figure. During the first four stages, SCM should develop a survey for supplier selection, after which during the next two stages, it should perform a supplier audit and make the final selection. Lastly, the seventh stage is a practice that should be continued throughout the entire supplier relationship and not be limited to just the onboarding phase; supplier monitoring and on-going risk assessment.

Figure 1 Stages of the Supplier Selection Process

Supplier selection typically begins when a company identifies the need for new suppliers. This need can arise from various circumstances, such as the establishment of a new business requiring vendor networks (De Resende et al., 2018), or due to existing suppliers going out of business, contract expiration, rising costs, or declining performance (Monczka et al., 2009). Additionally, buyer firms may seek alternative suppliers that offer more advanced technology, improved efficiency, or lower costs (Beil, 2009; Pullman & Verma, 1998). Business growth and increased production demands may also prompt the search for suppliers with sufficient capacity or the required offerings. Early recognition of such needs is crucial for minimizing financial risk. Hedderich et al. (2006) note that being aware of the need early can prevent significant losses, particularly when issues with current suppliers emerge.

As per the second stage, establishing clear and well-prioritized criteria is essential for effective supplier selection. According to Pullman and Verma (1998), criteria should assess multiple aspects of a supplier's operations, such as financial stability, managerial and technical competence, support resources, and quality systems. Among these, financial strength is often viewed as the most critical, as it supports long-term reliability (Pullman & Verma (1998). Alignment in management practices and sufficient technical capability are also necessary for successful collaboration, for instance, technological competence has become one of the most important selection criteria across industries (Garg et al., 2013). Additionally, suppliers must have adequate resources and quality systems to support consistent production and delivery (Cebeci et al., 2003). Dickson's (1966) early research highlights quality, cost, and delivery performance as the top three criteria valued by purchasing managers and is a study that is often referred to in SCM research. However, Pullman and Verma (1998) reveal a common discrepancy between stated preferences and actual decision-making, with cost and delivery often outweighing quality in practice.

Beyond these core criteria, companies should also consider context-specific factors, which may include innovation capability, production flexibility, geographic location, technical expertise and risk exposure (De Almeida et al., 2017; Thanaraksakul & Phruksaphanrat, 2009). More recent considerations include environmental and social responsibility, cultural compatibility, political and workplace stability, and customer satisfaction (Beil, 2009).

Given the limited information typically available from suppliers, adopting a multi-criteria decision-making approach is recommended to reduce selection risks (Garg et al., 2013). This allows for a more comprehensive evaluation by incorporating diverse data sources such as customer feedback and product inspections (Brard & Taherdoost, 2019). Prioritizing or weighing the selected criteria facilitates supplier comparison but can be quite complex. Effective internal communication and gathering relevant data are therefore crucial in making informed decisions (Cebeci et al., 2003). Ultimately, each company must define its own tailored set of criteria, recognizing that requirements may vary significantly across industries, market contexts, and purchasing needs. Once the criteria are established, the procurement

team can advance to the next phase of the supplier selection process.

The third stage of the SSP involves forming a procurement strategy that effectively aligns with the buyer's specific needs and broader organizational objectives. According to Watts et al. (1995), procurement strategy is a long-term plan focused on securing necessary goods or services in a cost-effective and risk-conscious manner from the most suitable suppliers. As Walker et al. (2008) explain, key elements influencing this strategy include budget, timeline, and risk management, with the overarching goals typically centered on cost reduction, risk mitigation, and business growth. They state that an effective procurement strategy offers several benefits, such as enhancing policy compliance, reducing procurement errors, and identifying cost-saving opportunities.

Developing such a strategy begins with an internal analysis. The buyer must gather and assess input from internal stakeholders and current suppliers to understand organizational spend and business requirements. Tools like Total Cost Ownership (TCO) can assist in uncovering hidden costs, while frameworks such as the category positioning matrix help define strategic priorities, including supplier location (domestic vs. international) and contract duration preferences (Brard & Taherdoost, 2019; Walker et al., 2008). Following internal analysis, external factors must be evaluated. This involves collecting preliminary data on potential suppliers, which is often limited to publicly available information, and analyzing market conditions. Strategic tools such as Porter's Five Forces, PESTEL, and SCOPE analyses can assist in understanding the competitive landscape and external influences (Walker et al., 2008; Brard & Taherdoost, 2019).

A critical component of this stage is the establishment of clear procurement objectives and policies. For example, SWOT analysis can be used to assess the company's current procurement practices and to identify potential risks, forming the foundation for a set of best practices aimed at addressing inefficiencies. Additionally, investment in modern procurement software is increasingly recognized as a strategic asset. According to Chan and Singh (2022), such technologies improve accuracy by reducing manual data entry,

accelerating the procurement process, and enhancing employee productivity and engagement. Therefore, companies should assess the potential value of implementing or upgrading procurement systems within this stage. With both internal and external data collected and analyzed, the organization can draft a procurement strategy that includes specific, measurable, and attainable goals and objectives (Brard & Taherdoost, 2019). This strategic plan will guide subsequent stages of supplier selection and ongoing procurement operations.

The primary objective of the fourth stage in the SSP is to determine the most appropriate technique and methodology for analyzing the data collected on potential suppliers and for narrowing the pool down to the most promising candidates. In large organizations, the number of suppliers under consideration can be substantial, making it necessary to use an approach that accommodates the evaluation of multiple options.

Azadfallah (2016) states that the chosen technique should enable the assessment of both quantitative and qualitative supplier attributes. The inclusion of qualitative factors introduces subjectivity, requiring human judgment, which in turn increases the potential for uncertainty and bias. After the list of potential suppliers has been shortened, additional techniques may be needed for more detailed evaluation. Thus, selecting the most suitable methodology for each phase of the process is essential, though challenging, given the wide range of analytical models available.

Tahriri (2008) classifies commonly used evaluation techniques in two main categories: quantitative and qualitative. Although the use of qualitative methods has grown significantly since the early 2000s, most approaches integrate both dimensions. Among the most frequently applied methods are the Analytical Hierarchy Process (AHP), which organizes evaluation criteria into a structured hierarchy and supports both qualitative and quantitative data; and the Analytic Network Process (ANP), a related model that represents interdependent criteria within a network structure. Other widely adopted techniques include the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and Multi-

Attribute Utility Theory (MAUT). Numerous adaptations and combinations based on these models have been developed to meet the evolving demands of supplier selection, some of which are collected and presented in Figure 2, which is created by Brard & Taherdoost (2019). As stated by them, each method has distinct strengths, and it is essential that buyers carefully assess which approach aligns best with their organizational needs, industry context, and predefined selection criteria.

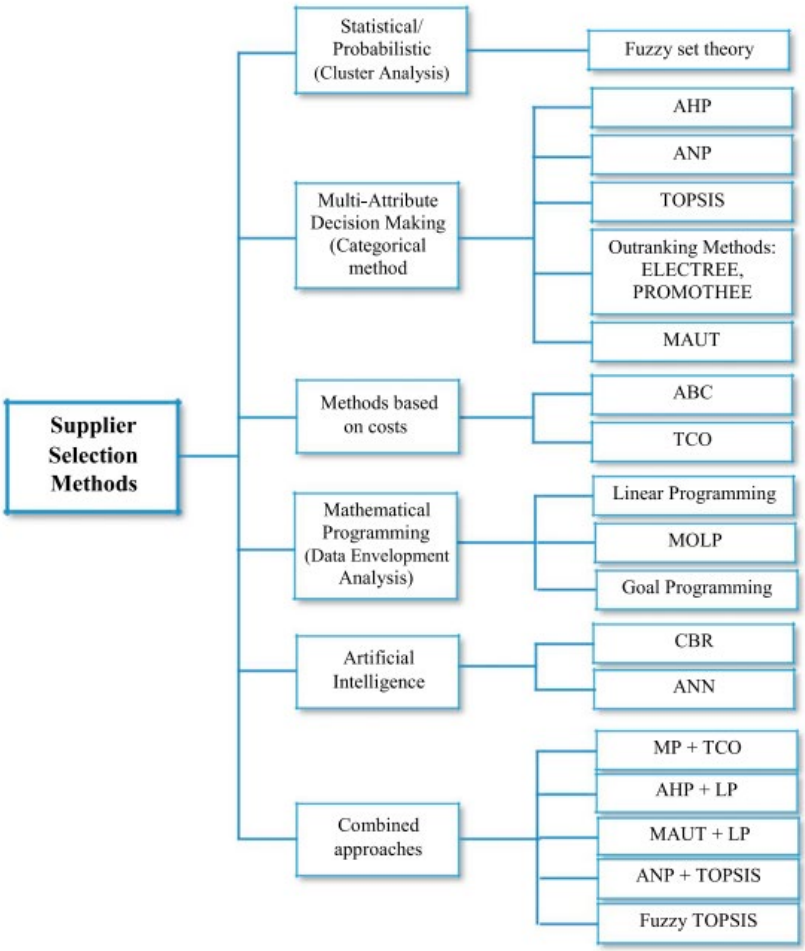

Figure 2 Classification of the Supplier Selection Methods (Brard and Taherdoost (2019)

Once the appropriate evaluation method has been selected and they have developed a survey, the buyer proceeds to assess the previously gathered supplier data and conduct a

prequalification process. This fifth stage aims to determine which suppliers are capable of meeting the buyer's specific requirements. However, as Eisele (2019) notes, prequalification may be unnecessary in low-risk or infrequent purchasing scenarios. The evaluation which is carried out using the chosen techniques helps narrow down the supplier pool by identifying those best suited to the buyer's criteria. Prequalification is particularly useful when there is a high number of potential suppliers or when the cost of preparing or evaluating bids is high.

Following this, the buyer reaches out to shortlisted suppliers through requests for information (RFI), request for a proposal (RFP), or for a quotation (RFQ). The responses are then reviewed comprehensively, considering not only price but also technical, logistical, quality, financial, and legal factors (Brard & Taherdoost, 2019). A well-designed prequalification system can streamline procurement, reduce unnecessary costs for both the buying company and the supplier, and help eliminate suppliers with high risk. Once the proposals are reviewed, negotiations begin. Buyers may engage with multiple suppliers to find the most advantageous terms. Despite having substantial data, final selection can remain challenging if several candidates appear suitable. As Brard and Taherdoost (2019) suggest, at this stage, buyers should also assess the less tangible elements, such as their company values and long-term compatibility, before concluding the SSP with one or more selected suppliers.

Following the selection of the most suitable supplier(s) and the successful conclusion of contractual negotiations, a formal agreement is carried out by both parties. The nature of the contract is shaped by various factors, including the scope of the procurement, the duration of the supply agreement, the negotiated terms, and the agreed payment structure. As outlined by Beil (2009), the contract defines the specific goods or services to be delivered by the supplier and outlines the compensation framework, i.e. whether the supplier gets paid through fixed or variable payment terms. It is often the case that the contract remains subject to termination should either party breach the stipulated terms and conditions.

The final stage as outlined in Figure 1 is supplier monitoring and risk assessment, during which the buyer company should perform continuous performance review of its supplier(s).

Ongoing monitoring of the suppliers is a critical activity within the SSP, as it provides the company with essential insight, for instance, to make informed decisions in future procurement activities (Beil, 2009). According to Lambert and Schwieterman (2012), well-sustained and frequent collaboration with suppliers significantly influences the buyer's overall performance. For both organizations to achieve optimal financial outcomes, the relationship must generate mutual value. This value is cultivated through continuous interactions, underscoring the importance of improving communication channels between the parties (Gaikwad et al., 2014).

Supplier monitoring also facilitates the evaluation of performance quality and long-term compatibility with the buyer's requirements. If a supplier consistently underperforms and their actions lead to financial losses, the buyer must reassess the relationship's viability. In such cases, it may be necessary to terminate the agreement and initiate a new SSP cycle to identify more suitable partners. This scenario often arises when critical factors were overlooked during the initial evaluation, when there are external changes such as legislative changes affecting the supplier, or when the quality of goods or services has declined since the contract's inception (Gaikwad et al., 2014). Eriksson (2020) emphasizes the need for investing in adequate means of communication, noting that buyer-supplier relationships, which on average span 15 to 20 years, rely heavily on ongoing and reciprocal collaboration.

2.2. Stream 2: Risk Management practices

In this chapter the topic of risk management (RM) practices is explored. First, it is necessary to define what a risk is. Thereafter, the concept of decision-making is inspected as it plays a significant role in a company's risk management capability and is therefore worth a closer review.

2.2.1. Definition of risk

It is quite challenging to define risk as there are multiple different ways to define it as per the

existing business literature. Even though the concept of risk and risk assessment has an extensive history, going way back to over 2400 years to the Athenians expressing capability to assess risks before decision-making, risk management in scientific sense has not existed more than 50 years (Bernstein, 1996; Aven, 2016). According to Aven (2016), several of the RM and assessment practices and principles established early on within the scientific field are still forming the basis for current literature, albeit with some considerable theoretical and practical developments.

Risk is frequently conceptualized as the likelihood of harm or as loss of assets, typically excluding any potential associated gains. This omission is significant, as in many instances, returns are evaluated independently of risk. As claimed by Sarfraz and Ivascu (2021), the main purpose of risk management is to decrease costs even before they materialize.

2.2.2. Decision-making under uncertainty

In this chapter decision-making as a concept is defined and its role in risk management is explored. More precisely, decision-making related to supply chain management in large enterprises is analyzed. Further on, the topic will be studied in the context of prevailing uncertainty, under which the decisions are often made.

As per the early study by Duncan (1973), a decision is a deliberate choice from a set of alternatives aimed at solving a specific problem, and which is done under certain circumstances. He claims that decisions may be informal and therefore done routinely without much consideration, or formal, requiring deeper contemplation. Both types of decisions occur daily within the organizational context. A decision-making process involves selecting the most suitable option while accounting for relevant factors (Al-Tarawneh et al., 2012). According to Al-Tarawneh et al. (2012), decision-making contexts differ in their significance, with more critical decisions generally demanding greater reflection and analysis. Qlueck (1977) highlights that managerial decisions significantly shape organizational activities, emphasizing that decision-making is inherently thoughtful and

deliberate. Both studies are broadly aligned in viewing decision-making as a structured and conscious process.

Organizational decisions play a vital role in determining a company's future direction and success. Effective decision-making can foster growth, while poor choices may lead to serious setbacks or even bankruptcy. Managers, as highlighted by Mintzberg (1973) and reaffirmed by Salas et al. (2010), spend a substantial part of their work while making decisions, which comes naturally with the higher responsibilities they are often faced with. However, companies are often guided by established procedures and frameworks to support their responsibilities (Al-Tarawneh et al., 2012).

Lunenburg (2012) points out that decision-making processes tend to be more complex in large organizations than in small and medium-sized enterprises (SMEs). In large firms, its multiple departments, management layers, and geographic divisions often complicate decision-making. In contrast, SMEs typically involve fewer people, allowing for more streamlined and centralized decisions. Additionally, cultural factors significantly influence decision-making structures. For instance, Hofstede's (1982) research highlights that Western organizations often adopt flatter, more decentralized structures, promoting shared decision-making. On the other hand, Eastern organizations tend to be more hierarchical, with decisions flowing from top management to lower levels (Watanabe, 2017). Overall, decision-making processes can differ vastly based on a number of factors.

For companies to navigate their various decision types, De Smet et al. (2017) propose a four-category model (Figure 3) based on a decision's scope, impact, and familiarity. "Big-bet" decisions have broad scope and are high-impact and infrequent, requiring substantial analysis due to their complexity. When the decision still has a broad scope and impact, it is a "Cross-cutting" decision, which compared to big-bet, occur more regularly and demand cross-functional coordination. On the other scale, when the impact and scope are narrow, the decision can be an "Ad hoc" decision, which are less frequent and context-specific, while "Delegated" decisions are routine and can be assigned to specific individuals or teams. This

framework helps organizations tailor their decision-making approach according to the nature of the decision.

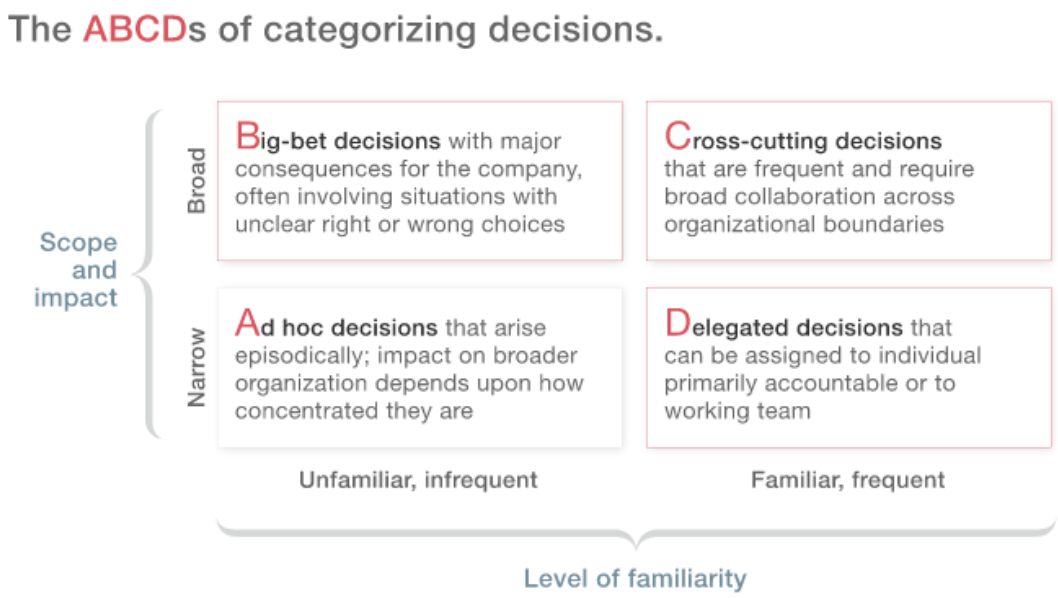

Figure 3 The ABCDs of Categorizing Decisions (De Smet et al. (2017))

As previously noted in this study through the work of various scholars, De Smet et al. (2017) similarly argue that decision-making processes in large organizations are often inefficient due to unclear responsibilities, excessive involvement of people from different levels and departments in the organizations, and overwhelming volumes of information. They suggest that categorizing decisions into four distinct types and applying appropriate strategies for each can significantly enhance the overall effectiveness of organizational decision-making.

Corporate social responsibility (CSR) is increasingly prioritized by stakeholders, as emphasized by Antunes et al. (2016) and Bocken et al. (2017). Consumers now expect businesses to consider environmental and social impacts in their strategies, pushing sustainability to the forefront of supply chain management. Nonetheless, challenges such as limited transparency and investment requirements hinder sustainable practices. Decision-making structures should align with company strategy while being adapted to project complexity, such as in wind turbine initiatives. As various decisions within SSP may appear

minor in isolation but collectively shape supply chain outcomes, selecting appropriate evaluation tools and frameworks is crucial. Methods such as the weighted point and cost-ratio approaches (Brard & Taherdoost, 2019) support this effort.

All in all, while no universal models for managerial decision-making exist due to organizational diversity, firms can improve outcomes by planning ahead, employing suitable evaluation tools, investing in sustainable practices, and fostering transparent, trust-based supplier relationships. Effective communication, decision categorization, and clear role definitions enhance organizational responsiveness and reduce risk in supplier selection.

2.3. Supply Chain Risk Management

Supply Chain Risk Management (SCRM), as illustrated in Figure 4, is an area where Supply chain management and risk management meet. As established previously, risk management should be integrated in every part of the supply chain management process as it can only bring value to the company, if it is well implemented and regularly used within the day-to-day practice.

Figure 4 Supply Chain Risk Management (SCRM)

To be successful in the increasingly complex and unpredictable environments, companies must effectively balance their operational strategies with supply chain management. An organization's capability to manage risks through resilient and stable supply chains is a reflection of its strategic planning, management, and system design. A critical indicator of a

company's risk preparedness is the extent to which it has implemented Supply Chain Risk Management (SCRM) strategies. These strategies encompass both routine and extraordinary supply chain risks, utilizing continuous risk assessment to reduce uncertainty and. The approach incorporates various risk management tools to address uncertainties affecting logistics, product availability, and supply chain resources. It can be applied either independently by the buyer company or by collaborating with the other firms that are part of the same supply chain.

Ho et al. (2015) developed a conceptual framework of supply chain risks seen in Figure 5. As per their research, supply chain risks are categorized in either micro- or macro-risks, also referred to as catastrophic and operational by Sodhi et al. (2012). Ho et al. (2015) define macro-risks as infrequent but potentially severe external events or conditions that may negatively affect organizational performance. These include natural disasters such as earthquakes and extreme weather events, as well as human-induced occurrences like warfare, terrorism, and political instability. In contrast, micro-risks are more frequent and stem from internal operations or interactions within the supply chain network. Although generally less severe than macro-risks, micro-risks can still significantly disrupt business processes.

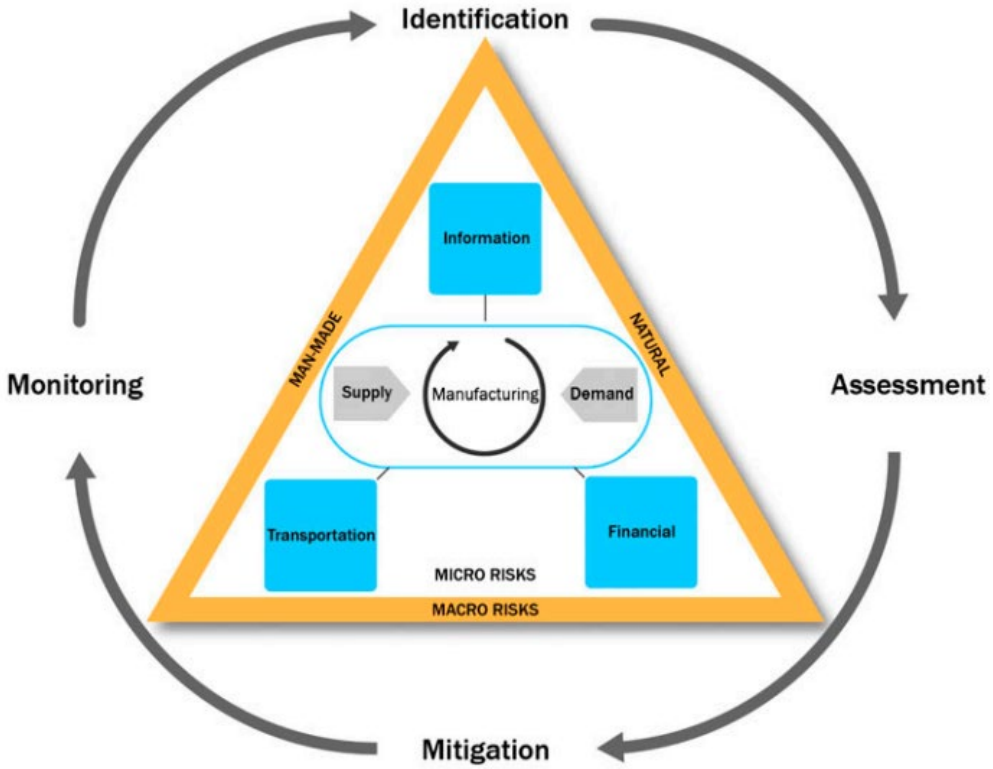

Figure 5 Conceptual framework of supply chain risks (Ho et al., 2015).

Micro-risks can be categorized into four different types, demand risk, supply risk, manufacturing risk, and infrastructural risk. Demand and supply risks usually arise from disturbances occurring downstream and upstream within the supply chain and often directly impact coordination with customers and suppliers (Ho et al. 2015). Furthermore, manufacturing risk encompasses internal disruptions that hinder a firm's ability to produce goods and services efficiently, affecting both quality and delivery timelines. In addition to these, Ho et al. (2015) point out that that key operational systems such as information technology, logistics, and finance are integral to maintaining supply chain integrity. Disruptions in these infrastructures can cause significant complications, hence, risks related to these areas are collectively classified as infrastructural risks.

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2.3.1. SCRM Process

In their research Ho et al (2015) found that over the past decade, various qualitative and quantitative approaches have been developed and implemented to address risks within supply chain management. According to their study, most approaches include the following four steps of the SCRM, risk identification, risk assessment, risk mitigation and risk monitoring, which were also illustrated in Figure 5.

Risk identification constitutes the foundational stage of the supply chain risk management process. It involves systematically recognizing potential threats that may adversely affect the flow of goods, services, or information within a supply chain. The primary objective of risk identification is to detect both internal and external risks early enough to enable timely assessment and mitigation. According to Gaudenzi & Borgesi (2006), risk identification methods are categorized into qualitative, quantitative, or hybrid approaches. Qualitative techniques include brainstorming, expert interviews, checklists, and scenario analysis, which allow managers to draw on experiential knowledge to recognize a wide range of risks. Quantitative tools on the other hand, such as the Analytic Hierarchy Process (AHP), statistical models, and simulation, provide structured and data-driven approaches to risk recognition. Hybrid models include attributes from both tools; hence they aim to combine the depth of qualitative insights with the rigor of quantitative analysis for more accurate results.

Risk identification goes beyond listing potential hazards, as it also involves identifying the root causes and causalities within the supply chain that could amplify uncertainty. As suggested by Blos et al. (2009), tools such as vulnerability maps and knowledge-based systems can facilitate a more nuanced understanding of risks, particularly in global and complex supply networks. The increasing complexity of supply chains and the growing availability of data have led to new developments in digital risk identification tools. However, despite technological advances, their study also indicates that most existing methods focus primarily on identifying risk types rather than quantifying their potential impacts. All in all,

effective risk identification is critical for proactive SCRM. It allows organizations to build resilience by preparing for potential disruptions and supports strategic decision-making across all levels of the supply network.

It is the reality that supply chain risks are often highly diverse, complex, and stem from a wide range of sources. To enhance understanding of their origins and potential impacts on the organization, it is essential to systematically categorize these risks. In a study conducted by Elkins et al. (2004) identified a substantial number of such risks and classified them into four principal categories: Financial, Hazard, Strategic, and Operational Risks. This classification framework facilitates more structured analysis and management of risks across different dimensions of the business. There are other opinions as to how to categorize risks, but overall, it should depend on the specific company and the circumstances they are in. As illustrated in Table 1, supply chain risks can also be categorized based on the degree to which they can be influenced or controlled. (Helmond, 2022).

Table 1. Different risks in supply chain (Helmond, 2022)

Risk category	Type of risk	Description
External risks	Demand Risks	Caused by unpredictable or misunderstood customer or end-customer demand
	Supply Risks	Caused by interruptions to the flow of products, whether raw materials or parts, within the supply chain
	Environmental Risks	From outside the supply chain; related to economic, social, governmental climate factors, including terrorism
	Business Risks	Caused by factors like a supplier's financial or management stability, or the purchase and sale of supplier companies
	Physical plant Risks	Caused by the condition of a supplier's physical facility and regulatory compliance
	Supply Risks	Caused by interruptions to the flow of products, whether raw materials or parts, within the supply chain
	Environmental Risks	From outside the supply chain; related to economic, social, governmental and climate factors, including terrorism
	Business Risks	Caused by factors like a supplier's financial or management stability, or the purchase and sale of supplier companies
	Physical Plant Risks	Caused by the condition of a supplier's physical facility and regulatory compliance
Internal risks	Manufacturing Risks	Caused by disruptions of internal operations or processes
	Business Risks	Caused by changes in key personnel, management, reporting structures, or business processes
	Planning and Control Risks	Caused by inadequate assessment and planning, leading to ineffective management
	Mitigation and Contingency Risks	Caused by not putting contingencies or alternative solutions in place in case something goes wrong
	Cultural Risks	Caused by a business's cultural tendency to hide or delay negative information, leading to slower reaction times

The second stage in the SCRM process is risk assessment, which involves evaluating the

probability of the identified risk to occur, and the potential impact they might have on supply chain operations. Effective risk assessment enables organizations to prioritize risks, allocate resources efficiently, and formulate appropriate mitigation strategies (Wagner & Bode, 2008). Various methodologies have been developed for assessing supply chain risks, including both qualitative and quantitative approaches. Quantitative tools such as the Failure Mode and Effects Analysis (FMEA) and probabilistic risk assessment provide numerical estimates of risk probability and severity (Sodhi, Son, & Tang, 2012). These methods help decision-makers rank risks and determine their relative importance. On the other hand, qualitative methods, such as risk matrices or expert judgment panels, offer valuable insights in situations where data is limited or uncertainty is high (Ho et al., 2015).

Risk assessment also incorporates scenario analysis and simulation techniques to anticipate the effects of disruptions within the supply chain. By understanding the potential consequences of different risk scenarios, organizations can develop more robust contingency plans. Overall, a systematic and thorough risk assessment process is essential for enhancing supply chain resilience and supporting informed strategic decision-making.

The third stage of risk mitigation is also a fundamental part of the SCRM process, aimed at reducing the probability and impact of disruptions through proactive planning and strategic measures. Once risks are identified and assessed, organizations have to develop and implement strategies for minimizing their adverse impact. Effective mitigation involves a combination of avoidance, reduction, transfer, and acceptance strategies, tailored to specific risk types and their assessed severity (Tang, 2006).

Common risk mitigation approaches include supplier diversification, dual sourcing, increasing inventory buffers, and developing flexible logistics networks. For instance, sourcing from multiple suppliers across different geographic locations can reduce vulnerability to regional disruptions (Chopra & Sodhi, 2004). Additionally, investing in technology and real-time monitoring systems enhances visibility and responsiveness across the supply chain, enabling faster recovery from potential disruptions (Pettit, Croxton, &

Fiksel, 2013).

Collaboration with supply chain partners is also critical for effective risk mitigation. Sharing information, coordinating response plans, and jointly developing contingency measures help build trust and enhance resilience. Ultimately, a well-structured risk mitigation strategy not only protects supply chain performance but also provides a competitive advantage by enabling organizations to respond swiftly and effectively to unforeseen challenges.

The final stage of SCRM, risk monitoring is an activity that should occur in an ongoing manner throughout the whole business relationship with the vendor. It ensures identified risks remain under surveillance and emerging ones are detected promptly. Unlike risk assessment, which typically occurs at a specific point in time, risk monitoring is continuous and dynamic, enabling organizations to adapt to emerging threats and developments in their operational environment (Waters, 2011). According to Brintrup et al (2018), effective risk monitoring involves the systematic tracking of key risk indicators, performance metrics, and environmental changes that may affect the supply chain. The integration of digital technologies, such as real-time data analytics, Internet of Things (IoT) sensors, and predictive algorithms, has significantly enhanced the capacity of firms to monitor risks across global and complex networks (Brintrup et al., 2018). These tools allow for early warning signals and more informed decision-making in response to potential disruptions.

Moreover, establishing communication channels with supply chain partners and stakeholders is essential to share insights and collaboratively address risks. Periodic risk reviews and scenario analyses should also be incorporated to reassess risk profiles and adjust mitigation strategies as needed. Ultimately the act of risk monitoring not only supports sustainability but also promotes a proactive and agile supply chain that can swiftly respond to both anticipated and unforeseen disruptions.

3. METHODOLOGY

This chapter introduces the methodological choices of the thesis by discussing the research strategy and method of empirical study. There will be a general description of these choices, as well as case and data selection and collection. The analysis is also described in detail. Towards the last part of chapter the validity and reliability of the research is discussed, and it is described which sort of efforts were made to enhance the validity and reliability of this study.

3.1. Research strategy and method

A single case study was selected for this study. Case studies are commonly used due to their suitability for handling complex topics and the ability to bring out aspects that might have otherwise gone unnoticed (Yin, 2009). For this paper a case study was an optimal choice since it enables the use of several different sources of data such as interviews, observations and other forms of available materials. This enables us to achieve a deeper level of understanding of how the case company's risk management strategy currently is, and it supports the goal of finding out all the best practices that are already used or could be used in the future within their supply chain management.

One of the weaknesses of a single case study is the fact that the findings cannot directly be applied to other companies, however, it will allow an in-depth investigation within the case firm. As the paper is done in collaboration with the case company, it is naturally in the company's interest to benefit from it as much as possible. Therefore, a single case study is selected as the research strategy in this paper.

From the two data collection methods, qualitative method was concluded to be more suited for the purpose of this study as it allows the use of multiple different forms of data, instead of the qualitative method, which utilizes more numerical data. In addition to the high number of secondary data (existing material such as raw data and documentation), there is also plenty of potential for primary data, i.e. data collected via the efforts of the researcher. The primary

data for this research was gathered with conducting semi-structured interviews and by observations from, for example, company meetings and organizational updates which the researcher was able to join due to their job position at the case company.

3.2. Case selection and data analysis

A case in this study means the two teams closely operating with the company's manpower suppliers in a global wind turbine manufacturer's procurement and supply chain departments. The research focuses on the risk management practices within these departments in an area that the company refers to as the NCE region. The case company is the global wind turbine manufacturing and installation company Vestas Wind Systems A/S, and the people interviewed for the study are in different kinds of roles that contribute to supply chain management.

3.2.1. Case selection process

The researcher is an employee within the case company and hence decided to offer to write a case study for a selected topic for the company. The research topic was defined in cooperation with the managers of the researcher and was based on the need to acquire more knowledge on the current state of the company's risk management practices within the region. The company had been faced with multiple macroeconomic, operational, commercial and regulatory challenges to which they have had to adapt in recent years. A need to observe and analyse the relatively recently applied risk management practices emerged to evaluate their effects on the overall performance of the supply chain.

3.2.2. Data collection

The primary data for this study was gathered via semi-structured one-on-one interviews with supply chain professionals working within the Onshore Construction Procurement and Supply chain departments operating within Northern and Central Europe region. All

interviewees are frequently working with supply chain management within their everyday work and have titles varying between Purchasing Manager and (Senior) Purchasers and Supply Chain Coordinators. The average duration of their employment within the case company is 4 years. There were 5 interviews in total carried out over a period of two weeks.

All the interviews were organized as online interviews via Microsoft Teams and since all parties agreed to have video on during the meeting, the researcher was allowed to analyze their facial expressions and tone of voice quite well throughout the interviews. Due to the case company being the researcher's employer as well, there is some shared work experience between the researcher and some of the interviewees. This might have affected the interviewees' openness towards the researcher, and they might have shared more information with them than they would have without the existing connection. The duration of the sessions varied between 30 and 50 minutes with an average length of an interview of 45 minutes. Each interview was held in English as it was the only common language between Finnish researcher and the international set of interviewees. The interviews were recorded and later also transcribed by the researcher in order to gather all information from the sessions and to facilitate the analysis in the best possible way.

All the interviewees had received a copy of the same interview questions (which can be found in **Appendix 1**) before the interview together with a short description of the case study and the names of the supervisors of the research. As the interview was semi-structured, it allowed the session to follow a clear guideline, however, it also allowed a free flow of conversation and for the interviewee to elaborate on topics they found most crucial.

3.2.3. Data analysis

Data analysis in this study starts with the case company description and the case topic is further elaborated on. The collected primary and secondary data is analyzed by reflecting on the previously introduced theoretical frameworks and methods. When it comes to the validity of the analysis, it is necessary to note that the researcher is employed by the case company,

which might have led to some bias, for instance, regarding the secondary data selection. Researcher was, based on their prior experiences within the work, able to select the interviewees and the materials that they chose as part of this study. The case also focuses on a topic that is still ongoing, which means that the effects are not fully realized yet. Regarding reliability, as stated by Saunders et al (2016), semi-structured interviews cannot be repeated exactly the same way since the situation develops constantly and there will never be exactly similar circumstances to facilitate a new study. Long term reliability is hard to prove also due to this exact reason, however, the aim is to increase reliability by carefully describing the data collection and by stating all sources of data.

4. FINDINGS

In this chapter the findings of the empirical research are presented. First, the company is analyzed thoroughly by the current literature around the topic presented previously, i.e. a within-case description. The data for the first section of this chapter is secondary data, collected from the available material on the company's background, current financial status as well as future prospects. Secondly, the findings from the primary data, i.e. the interviews, are analyzed. Lastly, the results of the analysis are summarized.

4.1. Case Description

In this chapter the case company Vestas Wind Systems A/S and the Procurement departments are presented to provide a better understanding on their business and how the company is currently operating. The reason for selecting this specific company as the case for this study is also explained.

Vestas Wind Systems A/S was founded back in 1898, however, its current name the company got only in 1945 when the founder Peder Hansen established VEstjysk STaalteknik A/S. As the name was considered too difficult for daily use, especially when considering the foreign markets, it was eventually shortened to Vestas. Along this change, Vestas started manufacturing household appliances, which included mixers and kitchen scales. A pivotal shift occurred in 1971 when the company developed a new technology that turns wind into electricity, and with the coming oil crisis, this was an excellent opportunity for the business. In 1979 Vestas supplies the first functioning wind turbines with a rotor diameter of 10 m and a capacity of 30 kW. This marked the beginning of the company's transition toward designing increasingly larger and more efficient wind turbines, laying the foundation for the business model it still follows to this day (Vestas Wind Systems A/S, 2025).

Today Vestas Wind Systems A/S is the leader in sustainable energy solutions with its core business in designing, manufacturing, installing, developing, and servicing wind energy and hybrid projects around the globe. With its head quarter still located in Denmark, Copenhagen,

Vestas is employing over 29 000 employees all over the world and operates manufacturing plants in 16 countries while also having installed wind turbines in 88 countries together contributing to over 189 GW of installed capacity. (Vestas Wind Systems A/S, 2025).

The core of the company's business model consists of four divisions, offshore wind, onshore wind, service and development. As onshore and offshore businesses vary greatly by turbine technology, construction methods and processes, the split into two market segments is necessary. Vestas is the market leader within the onshore wind market with its 40-year expertise in designing and developing the turbines and by providing competitive onshore wind solutions and with over 170 GW of installed capacity by Q1 2025. The offshore business was started a bit later, in 1995, which has since experiences rapid growth, however, has not reached the same level of installed capacity as onshore business with just 10 GW as of Q1 2025. When it comes to the service solutions, Vestas is again the market leader with over 155 GW under service, however, this area has not been profitable for the company until

Since 2020, there was a decrease in order intake of 8,7% until 2021. There were a few causes behind the decline, for instance, increased costs of raw resources, inflation and instability of the supply chain. By the end of the year 2024 the company's financial state has stabilized with revenue reaching 17,3 M€ and order intake increasing up to 19,2 Bn€ from the prior year's 18,5 Bn€. (Vestas Wind Systems A/S, 2025)

Vestas' organization can be structured in a two-dimensional matrix; the seven global functions and the five regions. The seven global function areas represent the firm's focal disciplines: finance, sales, service, technology & operations, people & culture, digital solutions, and lastly, development. An executive management team was formed to lead all these areas within the different regions. The second dimension divides the organization into five geographic regions: Mediterranean, Latin America, Northern America, Northern & Central Europe, and Asia Pacific.

The paper is conducted in collaboration with the procurement department in Northern and Central Europe (NCE) region and moreover, with focus on the manpower suppliers used in the wind farm construction projects within this region. The NCE region is split into regional departments North and Central, where the Northern part consists of The Nordic and Baltic countries, the UK and Ireland, Benelux, Poland, Czech Republic, Slovakia and Hungary, whereas Central only includes Germany, Austria and Switzerland. This division is based on the number of turbines built in each region, where the high number of turbines built in Germany requires much more resources to be concentrated within that region.

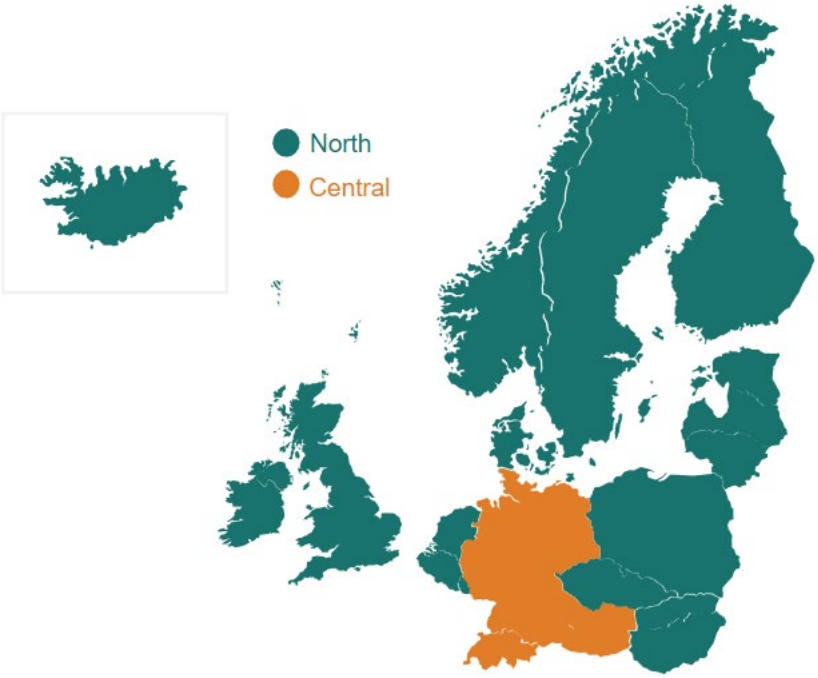

Figure 6 Vestas NCE regional division (Vestas Wind Systems A/S, 2025)

The role of procurement and supply chain management in new wind park projects is essential. Once a project is sold to a customer it is handed over by the Vestas Sales team to the project team responsible for arranging and overseeing the installation phase. Together with the relevant support functions the project team is accountable for the comprehensive planning, procurement of components and services, as well as the construction and installation of wind turbines. The duration of the project depends on the size of the wind park, typically consisting of approximately a year for planning the construction operation as well as arranging the

required procurements, followed by around 6 months for installation and testing their performance.

One of the support functions for the project installation are the procurement and supply chain functions, whose primary responsibility is to negotiate the terms and conditions for the frame agreement with the main subcontractors that are used in the construction of the wind farm, agree on the scope, budget and schedule for the works. Within the case group, their focus is on handling suppliers that mostly provide the manpower and equipment required for crane handling, installation activities, grouting of the foundations, electrical works and statutory inspections. Key challenges for the teams are to ensure there are agreements in place with each supplier in a timely manner so as not to cause any delays with the construction as that usually leads to extensive costs. Consequently, the procurement team must proactively monitor progress and seek alternatives to mitigate any deviations from the planned execution. This requires ongoing, coordinated communication with both internal departments and external stakeholders.

As stated, the case revolves around the procurement of manpower subcontractors, crane handling, installation activities, grouting, electrical works and statutory inspections. Among these, subcontractors providing crane services are the costliest, due to the high cost of the equipment. Fitter i.e. the installation companies almost reach the same level in cost, as they also often provide a number of heavy equipment for rent, that are used in the site operations, in addition to the high manpower costs. That is to say, there is a lot of money involved with using these suppliers, hence, risk management should play a central part in the procurement department's overall strategy.

Upon successful grid integration, the project is formally transferred to the customer. If a service agreement is in place, Vestas' Service department assumes responsibility for the ongoing maintenance of the turbines. The turbines are intended to operate efficiently for 25–30 years, offering significantly lower operational and maintenance costs compared to fossil fuel-based power plants. Afterwards, the procurement team's support will continue towards

the Vestas Service organization, where supplier's input is sometimes required to be able to fulfil the increasing requirements for technical support from the clients.

4.2. Case Analysis

In this chapter the focus is on the results of the interviews as the collected primary data, and on analyzing them against the literature and models established in the literature review. First, the procurement department's activities related to supply chain management is analyzed with special focus on their supplier selection process. Thereafter the same is done regarding risk management, moreover, what kind of practices the department has adopted when it comes to the four stages of the supply chain risk management framework defined by Ho et al. (2015) and also earlier presented within the theoretical part of the paper: risk identification, assessment, mitigation and monitoring. Lastly, their supply chain risk management strategy and future plans are analyzed.

4.2.1. Stream 1: Supply chains

It is apparent that one of the critical aspects in the supply chain management is the supplier selection process in its entirety. The efforts put into this phase can determine whether the selected supplier relation is a success or failure. This was also recognized by the procurement team, and as stated by multiple interviewees, they are aiming to be proactive when it comes to new supplier selection by a careful evaluation of the supplier and its suitability for the specific construction project.

"*I am involved in the process of selecting suppliers, mostly fitters for construction projects. We consider the selection for example from cost perspective and strategic perspective. It's important to consider if the supplier is suited for the project at hand, factoring in the geographical location so the logistics of moving around multiple people, if their capacity will match the project need, training requirements that can vary between countries, and of course the costs.* (interviewee 3)

The view on the importance of supplier selection process was also emphasized by interviewee 4.

"Whenever there's a new supplier, we have heavy focus on the assessment of the vendor. We look at for instance the ownership structure. Private equity rather than foundation owned companies for example might quickly change the owner and their strategy. It is important to be aware of such possibilities and this sort of details to be able to prepare for possible changes"

As established earlier, according to Beil (2009), it is often beneficial for large enterprises to form their procurement process at a cross-functional level. This is the case at Vestas NCE since their procurement process involves employees from several departments, not only Procurement but Construction and Service departments as well. As stated by interview X below, one of the issues Vestas Procurement NCE is facing is the lack of collaboration between different departments, for example, when it comes to preparing for changes.

"We sometimes face legislative changes that may lead to sudden changes within the supply base. For example, once due to a slight legislation change, some of the fitter companies were unable to provide resources to that market [Belgium] which forced us to quickly rethink the business case. The legislation change was not known beforehand, and we were informed about it by the supplier" (interviewee 3)

On the other hand, in some cases there is an efficient collaboration established between functions, for instance, to again refer to the legal department, they are in close contact whenever negotiations the terms and conditions on the frame agreements between Vestas and the subcontractors.

"We of course get support from our legal department and from the execution or planning team when negotiating the frame agreements and especially the more specific points" (interviewee 4)

It seems that the relationship relies heavily on the communication between Vestas and the supplier, which on one hand is a positive sign, as was also apparent in the current literature where enhancing the buyer-supplier relationship was emphasize. However, when it comes to

potentially very costly outcomes, it would be preferable to be able to have a system in place that would allow the team to gain awareness of e.g. any legislative changes when they happen and not when they are in danger of negatively affecting a project's schedule.

4.2.2. Stream 2: Risk management

When discussing the primary risks for the supply chains within their region and commodity, the interviewees were quite aligned with their views. Perhaps the most crucial factor in risk mitigation that they do is related to managing the capacity and the related negotiation power. The need to not have mono-source subcontractors means that Vestas has more bargaining power when it aims for a multi-source supplier base. It might be costly to allow such a situation to occur, where Vestas would highly depend on just one dominating subcontractor for a commodity e.g. within the NCE region. Therefore, the importance of a balanced supplier portfolio was highlighted.

"One of the most important risks is to not have a single source supply to not rely on one company too much. It is general practice in procurement. It's never a good set-up if you have only one supplier for one product or service or whatever because then your negotiation power is actually quite low, you know, because you rely 100% on one company. So this is definitely something what we have in our control." (interviewee 2)

The second risk that came up most was the question of capacity and how to reduce risk of having over- or underestimated the capacity of manpower that is required in a project. The risk of loss of production due to lack of skills of subcontractors was also pointed out and specified that it can specifically be the case when it comes to the newer turbine models such as the Enventus turbines that are currently mostly installed in Finland and Germany within NCE, and less so in the other countries in the region.

"We do have a planning department that I assume is mitigating operational risks, for instance by trying to prevent that we have too little capacity from our suppliers or that they

lack the needed skills. They try to foresee the future demand and plan accordingly" (interviewee 5)

"We have geopolitical risks in mind, of course, legislative risks, but biggest risk is measured with the costs caused by lack of capacity. Realizing that there is not enough resources to supply the demand, which ultimately might end up in disruptions in the supply chain" (interviewee 1)

"Considering the seasonal nature of wind farm construction, any delays within the supply of manpower resources during the high season in Q2 and Q3 will end up affecting being a huge mess to coordinate. It's also the same, if during the ow season there is no work to be offered, it might lead to frustrations among the suppliers and their employees wanting to leave the industry for more stable positions" (interviewee 2)

The contractual risks were also brought up, as they are often ones that can be time consuming to resolve and usually have to do with proactively mitigating the risks by negotiating a terms that are as favorable for Vestas as possible.

"In general, you could say we are on top of the contractual risk within procurement. The frame agreements are usually for five year periods, during which the agreed terms and conditions apply, e.g. regarding the payment terms, liabilities, insurances, delay penalties etc. We of course try to push the risk to the supplier as much as possible and they push back, so we need to meet somewhere in the middle. There's inherently some level of risk involved." (interviewee 3)

Risk monitoring was a topic which was heavily emphasized by the interviewees, and which is also highlighted as an essential part of CHRM by Ho et al. (2015). The procurement team monitors the quality of the suppliers' works continuously and, for example, measure their safety performance by certain KPI's, which allows them to make clear outlines for the level of risk that is allowed in certain cases, and to take action when required.

"We are monitoring the suppliers' quality and safety performance to mitigate risk with a Supplier comparison factor tool. For example, whenever we see the supplier's performance decrease in the QHSE area, so e.g. quality, safety, or capacity, we take actions to mitigate future risk by reducing that supplier's share of the supply and do less business with them until they are able to showcase that they are back up to our HSE standards."(interviewee 4)

One of the interviewees also argues that cost is often easily focused on too much when discussing risk management, as by reducing costs the company might sometimes in fact be faced with higher risks and therefore also increased costs.

"Most of the times costs are the most important aspect and you focus too much on costs that you might also be turning a blind eye on risks." (interviewee 1)

4.3. SCRM Strategy

There is a focus on creating a procurement strategy, which the team refers to as "commodity strategy" based on the set of subcontractors that belong to their scope of responsibility. It appears that the opinion on this differs slightly between the managerial and operational level, as the interviewee working in the management team

"I am involved in creating and implementing the commodity strategy at the moment. This is something that is quite surprisingly still pretty new here in procurement department. We don't really have an official supply chain risk assessment strategy in place, but are developing one at the moment, but it's not developed from a, let's say, scientific background.. " (interviewee 4)

"We adapted it to our needs because each and every commodity [supplier] has different, slightly differing needs. So far it has proved to be a good tool to monitor the suppliers and weighing them. We analyze, evaluate and take actions" (Interviewee 5)

Whereas on the contrary, interviewee 2 did not recognize that there would be a clear strategy related to risk management in place at the moment, which would suggest that the strategy currently planned is still in its initial stages and has not yet been broadly communicated to the whole department.

"We are aware of changes that might affect the supply chain, but as of now, we are not taking active decisions to mitigate that risk, I would say" (interviewee 2)

The procurement department has, among the previously mentioned commodity strategies, started to also classify their suppliers into three different segments: strategic partners, critical suppliers and transactional suppliers (interviewee 5). Based on the risk level of the supplier, they are divided into these segments and are used within certain countries and in the selected projects accordingly. Even though the segments were not defined further by the interviewee, this would still indicate that there are some efforts in categorizing risks and evaluating the suppliers based on the risk levels.

This is followed by the interviewee's description of the new strategy being developed, in which they utilize some basic risk assessment tools such as SWOT and Porter's 5 forces and some other very simple methods.

"*We are hoping that starting to use these tools and really incorporating the use within the work - not just on an idea level – will help us open our eyes to some risks and to form a better strategy and sort of professionalize our strategy creation and implementation within the procurement department and ultimately as a company" (interviewee 5)*

There seems to be a bit of a gap between the message delivered by higher management and what is actually happening in practice, when it comes to the risk management strategy. As claimed by one the interviewees, even though the strategy development is at its early stages within their region, it still seems to be more advanced than in the same function within other geographical regions. They mentioned the existence of some risk mitigation tools mentioned in some organizational level communication, however, there is a lack of some clear, easy to use methods that could be applied to supply chain management as well.

"There is a huge gap between what is preached on higher management level and what we are doing currently in our region, and yet we are still the most advanced I'd argue. There is a lot of information available on risk management, but when looking closer e.g. the reports or strategy plans, the risk mitigation practices are mentioned on a high level, and there are no practical tools mentioned. Even though there is a lot of room for improvement, we are on a good path with the commodity strategy creation and implementation" (interviewee 3)

On the other hand, it does seem that even though there is no clear and comprehensive supply chain risk management method in use currently, there are a lot of ongoing activities that separately aim for reducing risk, mostly through a very hands-on approach. For example, according to interviewee 2, the NCE region holds supplier performance meetings in which the higher-level management, including the vice president and the head of construction, joins the subcontractors' representatives to provide feedback on their performance and vice versa. This shows a great interest in managing the supply chains, aim for developing and enhancing collaboration and willingness to invest in improved solutions.

5. DISCUSSION

The purpose of this study was to study the impact that different risk management practices have on the company's supply chain efficiency. The thesis started off by describing supply chain management and the related risk management practices generally used in large organizations. Decision making processes under circumstances that often force the company to operate in uncertainty were discussed. Supply chain risk management was discussed in the light of dynamic business environment in which the case company is operating in and how it has been able to adapt to the ever changing requirements. Additionally, the scientific literature on supply chain risk management within construction business was thoroughly discussed and it was concluded that the industry is a quite well researched topic in literature, however, in light of the fairly recent green energy transition, further research is needed.

Then the field of supply chain risk management practices was discussed as it provided a good framework to study the impact of the management activities of the case company on the overall supply chain efficiency. The focus was not only in finding the key practices that contributed to the success of the supply chain but also in recognizing the less relevant practices and the ones that had completely gone unnoticed by the company. The models and tools presented in the end of the literature review served as a basis for the empirical research.

It was found that the procurement department within the NCE region is actively engaging in some risk management practices, however, they lack an overall supply chain risk management strategy. It was clear that some sort of an improvement is to be expected in the near future as it has been an area of focus for the management team for some time now, however it is not at a stage yet that it would have been communicated to the entire department. There also is a need for some comprehensive and effective tools that could easily be adapted to each commodity's specific needs and requirements and that might be utilized for risk identification, assessment, mitigation and monitoring.

The best risk management practices could, based on the analysis, be stated as the risk identification ability, as it was apparent that managing the risk starts with first being aware of it in the first place. Secondly, there are some efficient risk monitoring tools used within the department, which is essential for a supply chain that consists of a quite fixed set of suppliers that are used often and in multiple different countries and projects. It is a crucial asset for the company to be able to gather relevant data on the performance of its suppliers, to measure their success, and eventually make the purchasing decisions based on that.

5.1. Theoretical implications

The thesis expands the supply chain risk management research, which is already a widely researched topic. However, this study concentrates in the field of renewable energy business which is a comparatively new field that requires more research in the context of managing risks under uncertainty,

The main theoretical contribution of the thesis is the research done to examine the risk management practices in the process of improving a supply chain management strategy in a rapidly changing environment. The study provides some implications for future research for instance for case-companies also operating in the manufacturing and construction business.

5.2. Managerial implications

The research and its findings provide some managerial considerations to consider. There is a clear need for more streamlined methods and tools for the procurement teams operating in the NCE region to manage supply chain risk. As it seems, the current approach is more reactive than proactive, as although there are some essential efforts to mitigate risks, there is still plenty of room for improvement.

For future implications, the management might benefit from diversifying the teams developing the strategies not only in supply chain management but in other functions as well.

As became apparent from the interviews, there is a vast amount of practical knowledge on how things work due to the employee-base being largely people with their background in engineering. However, it would bring a lot of value to include people with, for example, experience within strategy work and with business background. Bringing in some theoretical knowledge might possibly lead to finding some very useful models and tools that can be implemented to the day-to-day work of supply chain management. Furthermore, closer collaboration across functions and different departments is likely to enable smoother knowledge sharing, if provided the right tools. Hence, investing in efficient means of communication is essential.

5.3. Suggestions for future research

There is plenty of research about supply chain risk management and decision-making, however, there seems to be a research gap in the study on supplier performance assessment under different sort of circumstances and risk management related to the process. Further research on the subject is needed to better understand how organizations could more effectively mitigate the risk related to not assessing its suppliers in an on-going basis.

One of the most interesting aspects is sustainability, particularly the growing expectation for companies to demonstrate greater transparency within their supply chains. Further research is needed to explore how organizations can more effectively assess their potential suppliers. Advancements in this area may result in heightened pressure on suppliers across various industries to adopt more environmentally and socially responsible practices, especially if transparency requirements continue to expand.

As established, modern technology and the use of metadata are becoming increasingly important tools not only for large corporations but also for small and medium-sized enterprises in their decision-making processes. While extensive research exists on metadata usage in customer relationship management, its application in supply chain management remains relatively underexplored. Systematic and comprehensive supplier monitoring could

yield a significant amount of valuable information. Despite the growing reliance on technology in business operations, much of its potential in this area remains untapped. Therefore, this topic presents numerous opportunities for future research within the field of supply chain management.

5.4. Limitations

The research is done on one case company which makes it a micro-level study and can therefore not provide a vast macro-level analysis on the subject. Hence, the thesis only provides insight into the practices within the case company in the specific field. A broader analysis would be possible by researching multiple case companies within the field. Thus, the perspective in this study is quite narrow, although in depth.

Furthermore, the researcher is an employee at the case company, which may have resulted in some biased takes on the subject when, for instance, performing the research interviews as there is an existing familiarity. Drawing from their previous professional experience, the researcher was able to identify interview participants and select the materials for inclusion in the study. The case also studies an ongoing issue, meaning that its full implications have yet to materialize. In terms of reliability, Saunders et al. (2016) emphasize that semi-structured interviews cannot be replicated in an identical manner, as the evolving nature of the context ensures that conditions will differ in any future study. This inherent variability makes it difficult to demonstrate long-term reliability. Nevertheless, efforts have been made to enhance the reliability of this research by providing a detailed account of the data collection process and clearly citing all data sources used.

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APPENDICES

Appendix1. Research questions

Onshore Construction Procurement department in the NCE region:

Background information: Master's thesis in Strategic Business Development at University of Vaasa, FI. Written by Marko Kohtamäki as Vaasa University supervisor.

Case: This study is to assess the Impact of Risk Management Practices on Supply Chain Efficiency

- Is there a supply chain risk assessment strategy in place at Vestas? Which stages does it include?
- How are risks classified at Vestas? Are there different categories identified?
- Is risk management implemented in practice? How?
- What do you consider the best practices in risk management?
- What kind of risk management practices are used? Which tools are central?
- What do you consider as primary risks for Vestas when it comes to the supply chain?
- Does Vestas have a more proactive or reactive take on risk management?
- Which areas still need to be improved/developed?
- Is there anything else you would like to share related to this topic?