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School of Business and Management

Supply Management

MASTER'S THESIS

SUPPLIER RISK MANAGEMENT IN MANUFACTURING INDUSTRY

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ABSTRACT

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The purpose of this master thesis is to identify the key supplier risks that manufacturing industry companies deal with and the best means for managing such risks. The study has been conducted as a qualitative case study for a case company and for the company's need to understand its current supplier risks and supplier risk managing means, as well as to find areas for further development. The research material was collected through semi-structured interviews, observation, existing case company documentation and online questionnaire.

The study findings show that suppliers' operational performance, financial, dependency and sustainability risks are the main supplier related risks in a manufacturing industry. Moreover, the findings revealed that supplier risk management takes place through different Supply Management practices, depending on the nature of the risk. Risk management is a multi-decision process which involves several phases to identify, assess, plan and implement management techniques, and monitor the supplier risks. The risk management process phases can be used in isolation without linearly following the process as a whole. The study also shows that the best means to manage supplier risks in manufacturing industry include dual (or multi-) sourcing, inventory buffers, supplier selection under risk considerations, auditing and strategic supplier relationships, where effective communication, mutual trust, risk- oriented culture, high level of visibility and strategic coherence are the main success factors to an efficient supplier risk management.

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Tämän pro gradu -tutkielman tarkoituksena on selvittää ne toimittajariskit, joita valmistusteollisuuden yrityksissä pääasiallisesti esiintyy, sekä toimittajariskien parhaiden hallintakäytäntöjen tunnistaminen. Tutkimus on toteutettu laadullisena tapaustutkimuksena kohdeyritykselle, heidän tarpeeseensa saada selvitys yrityksen nykyisistä toimittajariskeistä ja toimintamalleista niiden hallitsemisessa sekä löytää kehityskohteita toimittajariskienhallintaan tulevaisuudessa. Tutkimusaineisto kerättiin puolistrukturoiduilla haastatteluilla, havainnoinnilla, kohdeyrityksen dokumentaatiolla ja kyselyllä.

Tutkielman tulokset osoittavat, että toimittajien toiminnallinen suorituskyky, taloudellisuus, riippuvuus ja kestävyys ovat tärkeimmät toimittajiin liittyvät riskit valmistusteollisuudessa. Tutkimus paljasti myös, että toimittajariskienhallinta tapahtuu eri hankintajohtamisen käytänteillä riskin luonteesta riippuen. Riskienhallinta on monipäätöksistä ja siihen liittyvä prosessi sisältää useita vaiheita riskien tunnistamisesta niiden arviointiin, sekä hallintakeinojen suunnittelusta ja täyteen panosta niiden seurantaan. Riskienhallintaprosessin vaiheita voidaan käyttää erikseen seuraamatta lineaarisesti prosessia kokonaisuutena. Tutkimus osoittaa myös, että parhaita toimittajariskien hallintakäytänteitä valmistusteollisuudessa ovat hankintojen hajauttaminen, varastopuskurit, toimittajien valinta riskinarvioinneilla, auditointi ja strategiset toimittajasuhteet, joissa tehokas viestintä, keskinäinen luottamus, riskikeskeinen kulttuuri, korkea näkyvyys ja strateginen yhtenäisyys ovat menestystekijöitä tehokkaaseen toimittajariskienhallintaan.

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1 INTRODUCTION

In recent decades, supply chain and purchasing trends, such as increased initiatives for outsourcing and lean manufacturing as well as increased product variety and globalization, have led companies to complex, dynamic supplier networks and business environment. As a result of these, companies are increasingly more dependent on their suppliers and sensitive for supplier related risks which is why supplier risk management (SRM) has gathered an increased attention from supply managers. (Wu & Blackhurst, 2009, 44) Zsidisin, Panelli and Upton (2000, 187) stress that SRM is vital for companies' long-term survival and competitive edge.

SRM considers the risks of which unit of analysis is supplier (Sarker, 2019b, 326). Traditionally companies used to manage supplier related risks by reactive buffering means but these days more strategic and proactive risk means are preferred. Regarding SRM, two well-known approaches exist. These approaches are 1) proactive supplier risk management, in which potential losses are aimed to identify before their occurrence and thus actions are taken to prevent risk events before their occurrence, and 2) reactive supplier risk management, in which the actions are taken after a materialized risk event. (Sodhi & Tang, 2012, 159) Proactive SRM can be derived through supplier selection and evaluation under in-depth risk considerations or through a systematic SRM process system which includes four phases; risk identification, risk assessment, risk mitigation planning and implementation, and risk monitoring. Micheli, Cagno & Augusto (2009, 167) suggested that the best SRM performance can be achieved by implementation of supplier risk considerations in supplier selection (SS) phase to avoid selecting risky suppliers and by continuous risk review through SRM process to mitigate and exploit potential supplier risks arising from the existing portfolio of suppliers. Typical reactive SRM means are use of safety stock and lead time buffers (Zsidisin et al., 2005, 48).

Over the last decades, SRM has become more popular topic on literature too and many different types of supplier risks and management means have been discussed by researchers. However, Ceryno et al. (2013, 147) and Sarker (2019a, 460) state that the literature is still lacking properly documented case studies describing SRM in different cultures and industries. According to them, empirical data obtained through studies and thorough interviews with managers and stakeholders in the supply chain literature is still deficient.

This thesis aims thus to improve the understanding of supplier related risks and SRM practices by providing a professional case review to the topic in manufacturing industry company. Supplier risks in the case company have been taken into account in some level, but their proactive management is still at a deficient level. Therefore, in addition to give more knowledge on SRM in manufacturing industry, this thesis aims also to analyze the case company's current state of SRM and provide managerial implications for the case company based on the literature, study findings and best practices found.

1.1. Research questions and objectives

This study aims to fill a gap between the study framework based on existing academic literature and research on supplier related risks and SRM, as well as provide empirical evidence of the previous in a real business environment. As SRM has been recognized to improve companies' both, long-term and short-term performance as well as competitive advantage, the main research objective of this study is to discover the key supplier related risks in manufacturing company and the best means to identify, assess, mitigate and monitor them. Based on the objectives set out for this research, the main research question is structured as below:

What are the key supplier related risks in manufacturing companies and how can they be managed (identified, assessed, mitigated and monitored)?

In order to find an answer for the main research question, supporting research questions are placed too. The secondary questions and thus objectives are threefold: first, to find out to what extent companies face supplier risks and how they can be recognized and prioritized, secondly, introduce SRM means and techniques that companies may adopt to manage these risks, and finally, define the best practices, benefits, barriers and challenges for SRM. Desired outcomes are the potential benefits and target initiatives for SRM, whereas challenges inhibit companies to overcome possible and foreseen barriers for successful SRM implementation and achieving its desired outcomes. The first, second and third research sub-questions are formulated as below;

- **Research sub-question 1**: How can supplier risks be identified and prioritized?
- **Research sub-question 2**: What are the best means for supplier risk management?
- **Research sub-question 3**: What are the desired outcomes and challenges for supplier risk management?

1.2. Conceptual framework

This chapter describes the structure of the conceptual framework built up for the study and thereby presents the study outlines and limitations. The conceptual framework is illustrated in Figure 1, in which the relations of the study topics are visually presented. The framework strives to provide an overview of the position of the examined topic in the field and it has been limited to supplier risk management, and risks which are related to upstream supplier network source characteristics, more precisely, supplier risks.

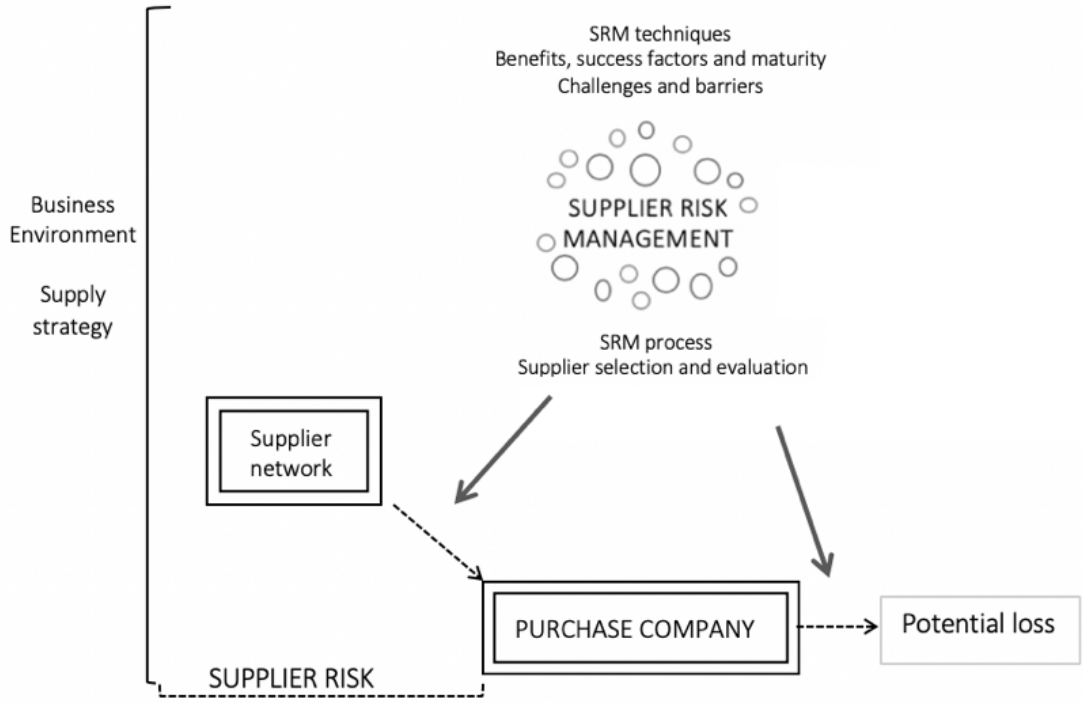

Figure 1. Conceptual framework of the study

As shown in Figure 1, companies may approach SRM with different proactive or reactive techniques and implementation of SRM has its benefits and success factors as well as challenges and barriers. The management of supplier risks is limited to be derived through

risk management process system (SRM process), and supplier selection and evaluation phases which are looked over the point of view of a purchasing company. In addition, purchasing company's business environment and designed supply strategies influence the extent and way SRM is considered as well as the set of supplier risks the company may deal with. Supplier risk management aim to prevent supplier risks from materializing as well as minimize the potential losses of materialized risks. The main objectives of SRM are thus shown by arrows.

Wide range of supply chain and supply management literature referring to supplier risks and their management, private consulting companies' studies and presentations were utilized to build the study framework. The framework includes, for instance, the following supply management research: utilization of SRM process and risk oriented SS toward management of supplier risks conducted by Micheli, Cagno and Giulio (2009); Situational factors influencing SRM conducted by Giunipero and Eltantawy (2004); SRM through supply management activities by Sarker (2019a); Risk management in supplier networks by Hallikas et al. (2004); Supplier risk assessment case study by Govindan and Jepsen (2016); and a study of SRM from an agency theory perspective by Zsidisin and Ellram (2003). When it comes to private consulting studies, PwC's Supplier Relationship Management (2013a) and Global Supply Chain and Risk Management (2013b) study findings were utilized for the framework. The framework also includes Kraljic's (1983) purchasing segmentation matrix which is widely cited in literature as it aims to identify one's strategic suppliers and purchasers based on their risk and importance and thereby recognizes SRM effort priorities.

1.3. Limitations

There are some limitations to this research that need to be noticed. Firstly, this thesis is limited to reviewing only the risks and risk management related to the disruptions in the upstream supplier network, more specifically, supplier risks and supplier risk management. Therefore, downstream risks as well as other kinds of risks, such as product or market risks are left from this study as the unit of analysis is suppliers rather than, for instance, raw materials. Also, the internal supplier risks are given more attention. Secondly, due to the collection of data from one case company representing a single phenomenon, the result generalizations should be considered in light of potential limitation. The case company is quite young, rapidly growing, mid-size enterprise and not the one with the highest nor the

lowest purchasing power in its industry which may influence the way and extent SRM is considered in the case company. The considerations may differ between purchasing companies depending on their industry, purchasing power, supplier network and designed strategy, ownership structure, size and business environment, and therefore it may be difficult to imitate the results of this research to all manufacturing companies practicing SRM. Every company has its own kind of typical supplier risks even though a general pattern in the types of supplier risks can be recognized. In addition, the case company's supplier network, especially the first tier- suppliers have a centralized geographical location as they are mainly located in Finland and countries close to it. The supplier company representatives were not interviewed, and thus the results reflect the case company's approach and insight to topic.

The study is concentrated mainly on the recent findings in the SRM area as well as on concepts built during recent decades while the risk management of supply chains has received many studies from researchers and practitioners from different industries and perspectives. The limitations of this thesis include the present leaving out of consideration of the past and future. SRM has developed along with trends and purchasing development from tactical to more strategic purchasing. As mentioned, only a few decades ago when purchasing was more tactical, SRM was relying more on buffer strategies whereas these days more proactive SRM approach is desirable. Some key topics of this thesis, including supplier risks and SRM, are dynamic and thus the validity of this study should be viewed for the moment. As a result, what are considered as supplier risks and best-in-class SRM today, might differ within time as supply chain trends, technology, regulation and business environments change the operations of purchasing companies.

When it comes to the limitations of the literary study background, supply management process, category management, formation of supply strategy, supplier performance and quality management, as well as types of supplier networks are not looked into in this thesis. However, supply strategy selection is somewhat discussed when single and multi/dual sourcing are being compared as well as in the context of Kraljic's purchasing portfolio matrix.

1.4. Definitions of the key concepts

As the earlier illustrated conceptual framework suggests, this study includes a few key concepts that are important for the reader to consider. The key concepts are business environment, supplier risk, supplier risk management, supplier network, supply strategy and resources. These concepts are strongly present in the literature review part of the thesis in which they are introduced in contexts.

Supplier risk management (SRM) is a systematic approach to determine the best series of action under supplier related uncertainty by identifying, assessing, mitigating and monitoring supplier risk issues. To manage supplier risks, the purchasing company also cautiously select low-risk suppliers and audit their suppliers on a regular basis to identify risk-prone suppliers. (Leung, 2019) Most supplier risk management means require direct interventions involving suppliers, and Sarkis (2019, 326) states that since the suppliers are controllable, supplier risks also become controllable to some extent.

Supply Strategy includes all the company's objectives and activities associated into its suppliers, commodities, supply markets, internal customers, strategic supply employees or top management. (Moser, 2006, 56) The elements of supply strategy are companies' make or buy- decision, centralization and decentralization of purchasing, location and size of supply base, and supplier relationships (Ahtonen & Virolainen, 2009, 276). According to Lintukangas, Kähkönen and Virolainen (2013, 398), supply strategy should be integrated into company's other strategies. Supply strategy may differ from a purchasing situation to another, depending on, for instance, the purchase.

Business environment includes the internal and external factors that surrounds companies affecting their decisions, strategies, process and performance of the company on the supply market (e.g. supplier risks, level of purchasing and negotiation power, level of attractiveness as a customer). The business environment consists social, technological, economical, legal and political factors, and thus includes factors such as suppliers, competition, owners, improvements in technology, regulation and supply chain trends. Business environment provides opportunities as well as threats to the company (Eruemegbe, 2015, 479).

Uncertainty relates to the unpredictability of environmental or organizational variation that effect company's performance or to the inadequacy of information about these variables. Impact deals with the potential and unanticipated costs generated by the disruptive events. When uncertainty and impact are combined, the result is risk. (Zsidisin, Ragatz & Melnyk, 2005, 48)

Supplier network can be seen as a set of suppliers of a purchasing company's supply chain (Moser, 2006, 20) which may consist various nodes (supplier tiers) and arcs (supplier relationships) (Käki, Salo, Talluri, 2015, 273). Supplier network aim to add value for purchaser through the manufacturing and delivery of products. The first-tier suppliers supply materials to the manufacturer, and the second-tier suppliers to the first-tier suppliers, and so on. (Ding, Raghavan & Pollard, 2007, 515)

Resources can be seen as company's strengths, which consist of its' assets, capabilities, organizational processes, company attributes and knowledge enabling the company to create and implement value-creative strategies. The company attributes construct of 1) physical capital resources, including technology, equipment and company's plants 2) human capital resources such as training, experience, intelligence and relationships and insight of individual managers and employees in a company 3) Organizational capital resources, including company's formal reporting systems and internal informal relations, as well as external relations within and between its' business environment. (Barney, 1991, 101)

1.5. Structure of the study

This thesis is going to follow a linear-analytic structure (Yin, 2009, 176) which is the most common case study report structure. The thesis is outlined to five main chapters as illustrated in Figure 2. The first chapter includes an introduction part in which the research background, research questions, objectives and limitations are briefly presented. Moreover, the key concepts are defined to support the structure of conceptual research framework. The second chapter is devoted to a literature review which deals with the thesis topic and provides a literary framework for the research. The literature review has six sections including review of types of supplier risks, supplier risk management process as well as supplier selection and evaluation. Afterwards supplier risk management techniques are extracted from the literature

and eventually SRM benefits, success factors, maturity, barriers and challenges are looked into.

Figure 2. Structure of the study

After the literature review framework, the empirical part is followed. The third chapter outlines research methodology, collection and analyzation process of the empirical data. In addition, the case company is introduced in the same chapter to improve the understanding of the starting position for the results which are followed next. The study findings and results gathered from the case company are presented in the fourth chapter whereas the fifth chapter focuses on a discussion between the study findings and literature review framework covering answers to the research questions, managerial implications, validity and reliability, as well as further research suggestions.

2 SUPPLIER RISK MANAGEMENT

Supplier risk management (SRM) aims to identify, evaluate, and prioritize events and suppliers which involve risk and to minimize or mitigate such undesired events (Hubbard, 2009, 46). In other words, SRM is an effort used to prevent supplier failures before their materialization, stop them when they materialize, decrease their adverse consequences and recover the operations after negative consequences. By monitoring and controlling supplier risks, their adverse impact in unfortunate events can be reduced while also realization of opportunities maximized. The object of SRM is thus to ensure smooth flow of the considered operations and provide more secure company performance against supplier failures. (Antunes & Gonzalez, 2015, 218) Many researchers propose that risk management needs to be approached by following a formal and structured process to identify, assess, reduce and monitor a risk (Khan & Burnes, 2007, 202; Kern at al., 2012, 64). However, Sarker (2019a, 434) sees such process very holistic, one-level and time-independent view for SRM which isn't often realized within companies. A case study conducted by Sarker (2019a), revealed that supplier risks are often managed through different supply management practices.

Whereas some authors suggest the structured risk management process, some suggest that supplier risk should be reduced at the beginning of the purchasing function by excluding unstable and risk-prone suppliers from the company's supplier portfolio. This can be realized by considering suppliers' risk levels in the supplier selection (SS) and evaluation process. A study conducted by Micheli et al. (2009, 175-176) thus shows that supplier risks can be dealt with either focusing more on SS or on the process of risk management. However, they stressed that risk factors should be explicitly considered in SS approach and thereby allowing risk management in case SRM process is not extensively placed. Their conclusions explained that SS and SRM shouldn't be seen as mutually exclusive options, but instead built up on the same criteria and afterwards coordinated as a combination. A case study of Ritchie and Brindley (2007, 314-316) pointed out that each supply chain and its risk drivers are unique and therefore are the management strategies. Tse and Tan (2012, 56) added that when it comes to supplier risks and their management, the risk management requires more interventions that involve upstream suppliers and thus SRM and its techniques should not be limited inside of the of company itself but rather beyond it.

Besides SRM process and supplier selection and evaluation, supply management practices, for instance, long-term buyer-supplier relationships, single and dual (or multiple) sourcing, supplier integration and development, and robust supply strategies are seen to counter balance to supplier related risks. Many authors have highlighted (Tang, 2006a, 482; Gualandris & Kalchschmidt, 2014, 460; Zsidisin, 2003b, 14) the importance of the supply management process for the management of supplier risk arguing that risk management needs be incorporated within the supply management process.

This chapter aims to build a literature review on supplier risk management based on risk management process and supplier selection and evaluation. In addition, the most cited techniques for supplier risk management are being introduced which after challenges, barriers, benefits and best practices for SRM are given a look.

2.1. Types of supplier risks

Existing literature doesn't exploit well the differences between supply and supplier risk which often results a confusion regarding the definitions. (Govindan & Jepsen, 2016, 344). Literature offers many definitions and risk types of which some of the risks are defined as supply chain risks, whereas some as supply risks and others as supplier risks. However, supplier risks are part of supply risks that again are part of supply chain risks. Zsidisin (2003a, 222) has defined supply risks as "*the probability of an incident associated with inbound supply from individual supplier failures or the supply market occurring, in which its outcomes result in the inability of the purchasing company to meet customer demand or cause threats to customer life and safety*." Thereby, supply risk, as any other kind of risk, has its sources as well as outcomes. Zsidisin (2003a, 222) suggests, that supply risk may arise from market or supplier factors, whereas Micheli et al. (2009, 167) categorized supply risks in three groups based on their source; product-related, market-related, and supplier-related supply risks. According to Govindan and Jepsen (2016, 344), supplier risk is a risk brought by first-tier suppliers effecting the supply chain as a whole and therefore the risk doesn't only include the operation disruptions of suppliers', but other supply chain risks influenced by suppliers as well. Jung, Lin and Oh (2011, 610) defined supplier risk from the perspective of a purchasing company and suggested that supplier risk, one source of supply chain risk, can be defined as an unforeseen event that materializes from an upstream supplier and consequences its' downstream supply chain. Table 1 presents the number of supplier

risks collected from literature that follow the definition of supplier risk given by Jung et al. (2011, 610).

Supplier risks	Definition	Reference
Supply quality risk	Suppliers' lack of knowledge on identifying, assessing, and managing supply risk associated with quality	Zsidisin et al. (2016)
Yield uncertainty	The yield of supplier is not reliable	Chen et al. (2015)
Unreliable supplier	Suppliers are unreliable	Tiwari et al. (2015)
High dependence on suppliers	Buyer company has a dependency on suppliers	Nguyen et al. (2017)
Innovation capability	Suppliers are not innovative enough	Sarker et al. (2016)
Bankruptcy risk	Suppliers' financial volatility	Valverde (2015)
Delivery performance ability	Suppliers are not able to deliver on time and at right quantity	Hallikas et al. (2002)
Supplier capacity constraints	Suppliers do not have the capacity to meet the buyers' demand	Zsidisin et al. (2000)
Technology risk	Suppliers are not technologically capable	Gualandris and Kalchschmidt (2015)
Trust	Buyers do not trust suppliers	Sinha et al. (2004)
Sustainability	Suppliers have sustainability issues in their premises	Foerstl et al. (2010)
Product design risk	Suppliers are not able to quickly adapt to design changes or is incapable of incorporating design changes	Govindan & Jepsen (2016, 346)
Competitive risk	Suppliers are unable or unwilling to reduce costs/prices in order to keep prices competitive	Govindan & Jepsen (2016, 346)
Nature of source	Suppliers who are the sole source or single source for the purchasing company	Christopher et al. (2011)

Table 1. Types of supplier risks (modified Sarker, 2019b, 318)

As seen from the Table 1, numerous supplier related risks exist and given risk classification of Nishat Faisal (2009, 47), physical, financial, informational and relational supplier risks can be recognized. According to Tang and Musa (2011, 30) informational risks are uncertainties in accuracy, system security, intellectual property breaches and its utilization that can hamper the information sub-chain in buyer-supplier relationships. When it comes to manufacturing companies, most cited supplier risks relate physical sub-chains and suppliers' performance factors, such as capacity problems, late and faulty deliveries and quality issues. According to Jung et al. (2011, 614) manufacturing companies typically deal with supplier risks related to quality, delivery, cost and technology.

Jüttner, Peck and Christopher (2003, 6-7) suggested that risks can be categorized as either internal or external risks. With respect to the given categorization, internal supplier risks are related to a certain supplier and may appear from, for example, issues in quality, equipment or labor, bankruptcy, demand volatility, information sharing resulting from the vertical

integration of the link, discounts, capacity, and price fluctuations. The probability of internal supplier risks can be very high while their consequences can be very low. External supplier risks again may arise from, for instance, natural disasters, economic crisis, terrorist attack, political and economic instability. Even though the probability of external supplier risks is typically lower, their consequences can be very high. (Hamdi et al., 2015, 766) According to Sharma and Bhat (2012, 354), supplier related risks reside also in purchases, sourcing, and supplier relationship. In similar vein, Manuj and Mentzer (2008, 138) see that supplier risks reside in suppliers' reliability and security as well as companies' strategic decisions on make or buy, single versus multi-sourcing, and centralized versus decentralized sourcing.

According to Nassimbeni (2006, 704), management of global sourcing is generally more complicated due to wider economic, financial, information and material flows which are under a higher exposure to all types of supplier risks, environmental factors and cultural differences. Regarding to global sourcing, outsourcing of activities or products may be also a risk itself and contribute to different business risks due to a lack of decision-making and used risk management practices. According to Hallikas and Lintukangas (2006, 488) risks, such as poor quality, late deliveries, and any kinds of potential responsibility problems of an upstream supply chain may cause high risks to the company brand hurting its reputation. According to Lonsdale (1999, 176), the key sourcing risks are related to the improper outsourcing decisions in which the purchasing company's core resources and capabilities ensuring the company's competitiveness are being outsourced as well as high level of supplier dependency. A case study conducted by Zsidisin & Henke (2019, 431), suggested that dependency risk often materializes due to a sole sourcing or single sourcing situation, high volume need from certain suppliers or because suppliers act as contract manufacturers and supply specified products only for the purchasing company. Dependency on suppliers is typically referred to as a sourcing risk.

2.2. Supplier risk management process

Companies have used to follow traditional buffering practices to avoid risks current in their suppliers by using multiple sources for strategic products and safety stock. However, these days such buffers are seen insufficient reactive SRM means which may decrease company's operational performance and its sustainable competitive advantage. (Giunipero & Eltantawy, 2004, 699) New strategies involve a formal and structured risk management process,

including identification and assessment of potential losses by understanding risks' probability and impact. The main supposition in risk management process is that a group of people will start identifying all the possible risks by creating a process map of the supplier network or use a risk catalogue. Later, the identified risks are assessed by an assessment method and based on the risks' prioritization values or assessment scores, suitable risk management actions are taken. (Sarker, 2019a, 421)

Risk management process, illustrated in Figure 3, includes typically four phases of which are also followed in SRM. The process includes four phases; risk identification, risk assessment, planning and implementation of risk management actions and risk monitoring. (Berg, Knudsen & Norrman, 2008, 305; Hallikas et al., 2004, 52; Harland, Brenchley & Walker, 2003, 51; Kern et al., 2012, 64) However, as a fifth phase, Zsidisin and Ritchie (2009, 5) introduced "organizational and personal learning including knowledge transfer" which stands for sharing the experiences of the management process within the company's internal and external stakeholders. The extension points out that the process should be viewed with continuous improvement through experiences shared between the actors included in risk management.

Figure 3. General risk management process (Hallikas et al., 2004, 52)

The SRM process described in this chapter is shown in Figure 3. The phases can be taken as many times as needed to generate new information to the company and to collect more operational knowledge for future risk coordination. Received risk monitoring and mitigation results, however, affect the process of decision- making, introduced risk management strategies and tools which may vary notably depending on the company's present situation, business environment and supply strategy.

2.2.1 Risk identification

The first step in SRM process is the identification of possible risks. Risk identification involves an extensive and analytical determination of potential supplier risks associated with the given purchase or supplier. Risk identification constructs of characterization of risk drivers, risk sources and potential consequences. (Ceryno et al., 2013, 141) Proposed by Jüttner et al. (2003, 17), risk drivers can be viewed as how certain supply chain trends and competitive pressures might positively or negatively influence the vulnerability of the company and its upstream supply chain. Literature deals with many different supplier risk drivers, such as globalization, outsourcing, reduction of the supplier base, focus on efficiency, partnerships and other close relationship as well as centralized distribution and production. (Jüttner et al., 2013, 17) Identifying of risks enables the decision-makers to become conscious of events that cause uncertainty in the time being or in the future which allows management of these sequences of events in a proactive way. (Hallikas et al., 2004, 52) When it comes to supplier risks, Craighead et al. (2007, 134) stressed the importance to identify critical supplied items and their suppliers, such as items that are purchased from a single supplier, to become aware of the critical nodes in the supplier network.

Risk identification is finalized by combining the risk sources with their potential consequences. (Breuer et al. 2013, 333–334) Risk consequences are the focused supply chain outcome variables effecting on a company's ability to, for example, continue its operations or get the end products to market (Jüttner, 2005, 121). Such negative consequences can be seen in outcome measure of a company as decreased sales, financials, product quality, corporate image and reputation as well as increased costs and delays in customer deliveries (Jüttner et al., 2003, 7).

A typical approach in the risk identification process, is first to illustrate a number of risk or supplier categories. Categorization of risks and suppliers aim to ease identifying the individual risks within a category. (Govindan & Jepsen, 2016, 342) Literature proposes several supplier risk categories such as Jüttner (2005, 123) divided supplier risks in to operational, environmental, and financial risks. A framework of Chopra and Sodhi's (2004, 54) in turn contained nine main risk categories; delays, systems, forecast, intellectual property, procurement, receivables, inventory, and capacity. Some types of supplier risks were presented in Table 1, and therefore they are not discussed more in this context.

Many researchers, including Jereb et al. (2011, 35-36) emphasize that risk identification should be treated as the most important phase in the risk management process, because ignored risks cannot be managed later. Therefore, risk identification should be done as precisely and broadly as possible to be able to identify potential risks during avoidance of ignoring the most crucial risks. Risk identification can be accomplished by utilization of reactive and proactive tools and techniques to ease the process. Reactive methods, such as reviewing data of the same or similar accidents materialized in past, are limited to come upon on risks after their occurrence, while proactive methods aim to recognize risks before their occurrence (Scholten, Sharkey Scott & Fynes, 2014, 216). Proactive methods consist of, for instance, the failure modes and effects analysis (FMEA), feedback, supplier audits before SS, brainstorming and observations (Simba et al., 2017, 7). After identified risks, the probability and impact of these risks are determined in the risk assessment phase.

2.2.2 Risk assessment

Risk assessment intends to analyze and prioritize the earlier identified risks (Bandaly et al., 2012, 265). Assessment and prioritization of risks are necessary so that company's limited resources and capabilities to mitigate the critical risks can be allocated effectively. High risks such as a key product supplied by a single supplier may need more mitigation efforts due to the higher possibility of a risk, whereas less critical product may not need mitigation at all. (Kumar, Himes & Kritzer, 2014, 879). Therefore, Sharma & Bhat (2014, 67) stress that all risks require separate assessments to avoid taking an insufficient or wrong mitigation technique and strategy.

The process of risk assessment typically starts by considering the impact and probability of a given supplier risk which are the standard scales of risk prioritization. Nguyen et al. (2017, 69) see supplier risk as a function of two factors; the probability of disruption event from the supplier side and its impacts on the purchasing company in terms of potential losses, such as decreased profitability and productivity, if materialized. The two scales of supplier risk can be approached either based qualitative or quantitative assessment methods, as well as their combination. Some authors (Hallikas, Virolainen & Tuominen, 2002b, 53; Tummala and Schoenherr, 2011, 478) use a 1 – 4 scale whereas some (Hallikas et al.,2004, 53) use a 1 – 5 scale in which each number corresponds to a verbal assessment definition. For instance, when defining the level of impact, the values of 1, 2, 3, 4, and 5 represent verbally low,

medium, high, very high and catastrophic impacts. Zsidisin (2003b, 21) in turn uses only two verbal assessment levels, high and low. Semi-quantitative assessment scales introduced by Hallikas et al. (2004, 53) are illustrated in Table 2. According to them, use of risk assessment scales improve a company's understanding of its business environment while offers a supportive mean for the company's overall management and indication of avenues that require more information gathering or investigation. To be able to prioritize and recognize the most critical risks, Tummala and Schoenherr (2011, 478) introduced a Risk Exposure Value of Risk Factor. The basic idea is that the higher the risk exposure value, the higher and thus prioritized the risk is and vice versa. The value can be calculated by multiplying the risk impact by the risk probability; Risk Impact Index * Risk Probability Index = Risk Exposure Value.

Impact assessment scale

Rank	*Subjective estimate*	*Describtion*
1	No impact	Insignificant in terms of the whole company
2	Minor impact	Single small losses
3	Medium impact	Causes short-term difficulties
4	Serious impact	Causes long-term difficulties
5	Catastrophic impact	Discontinue business

Probability assessment scale

Rank	*Subjective estimate*	*Describtion*
1	Very unlikely	Very rare event
2	Improbable	There is indirect evidence of event
3	Moderate	There is direct evidence of event
4	Probable	There is strong direct evidence of event
5	Very probable	Event recurs frequently

Table 2. Impact and probability assessment scales (Adopted from Hallikas et al., 2014, 53)

Once the identified risks have gone through the assessment, it is practical to demonstrate them as a risk diagram (see Figure 4). The advantage of risk diagram is that it provides a comprehensive check on all risks and enables to make the most critical risks visible. In addition, risk diagram signifies if a decrease in probability or impact reduce the risk itself. (Brindley, 2017, 59). The position of a plot or a cell can then be utilized as an indicator for a risk level of a particular event. Therefore, an event with an estimated high impact and probability would be inhibited in the upper right corner on the risk matrix. Numerous

illustrative risk assessment tools can be utilized as, for example, Norrman and Jansson (2004, 449) used a traffic light analysis in which colors highlight different magnitudes of risks illustrating the prioritization of different risks.

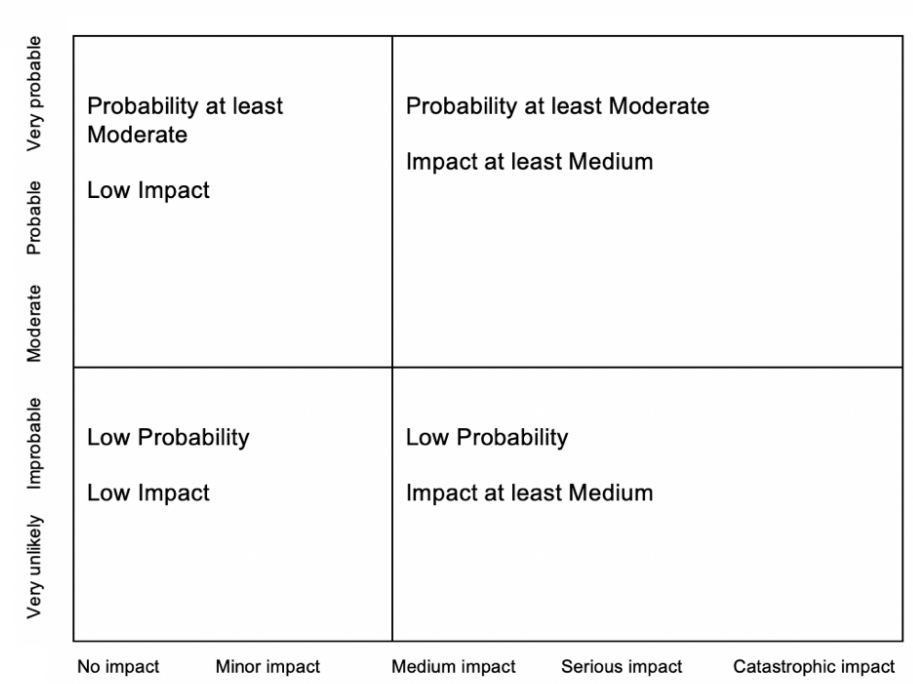

Figure 4. Risk Diagram (Adopted from Hallikas et al., 2004, 53)

As mentioned, Craighead et al. (2007, 134) highlighted the importance to identify and assess critical purchases as well as their suppliers when it comes to SRM. This is due to the note that supplier network design characteristics including network complexity, network density, and node criticality may influence the harshness of disruptions in supplier network and thus increases the impact or probability of supplier risks (Craighead et al., 2007, 149). According to Govindan & Jepsen (2016, 354) supplier risk assessments should be approached by selecting and ranking suppliers based on their risk levels and then categorize suppliers into different risk groups depending on their level of performance or risk. In their research a supplier risk assessment and monitoring methodology was followed a multi-criterion scoring procedure to create risk profiles and categories for purchased items and suppliers. Furthermore, Govindan & Jepsen (2016, 343) suggested use of Kraljic's purchasing portfolio model (Kraljic, 1983) for supplier risk assessment as the model classifies products as well as suppliers into four categories defining the recommended strategies towards suppliers. Kraljic's purchasing model will be introduced in chapter 2.3.2.

2.2.3 Risk management actions

After a risk has been identified and assessed it can be managed. Thus, the third phase in risk management process is the actual risk management in which appropriate mitigation strategies are planned and implemented. Risk mitigation focuses on defining strategies that aim to reduce either the risk impact or probability, or both. (Sodhi et al., 2012, 6) Literature provides many examples and categories of these risk mitigation strategies which Jüttner et al. (2003, 19) grouped into four categories; avoidance, control, cooperation and flexibility. More specifically, Hallikas et al. (2001, 54) proposed the following risk management strategy categories:

- Risk transfer and sharing
- Risk acceptance and taking
- Risk elimination and avoidance
- Risk reduction and mitigation
- Further analysis of individual risks

According to the given categories of Hallikas et al. (2001, 54), risk transfer involves a part or the complete risk transfer to some other party. An example method of risk transfer is buying an insurance in which an insurance provider accepts the risk of a company. Risk transfer may also be done by setting up a contract with a supplier. Risk sharing or transferring doesn't usually diminish the risk completely, but it shares weights of the risk. (Hallikas et al., 2001, 54) The second category, risk acceptance, means accepting the identified risk without taking any actions to prevent the risk's probability and its' the potential losses. Even though, taking a higher risk may result the company short-term advantages, it may most often hamper company's long-term performance. (PwC, 2013a, 17) Therefore, acceptance approach is recommended for risks which potential materialization wouldn't create the company high losses, but their management would rather be more costly to manage than to accept (cost/reward trade-off). In addition, risk acceptance is necessary in situations where no available risk means exist, or every possible action is established already to mitigate the risk, and as a result, the company just have to accept it. (Hallikas et al. 2001, 53–54) Furthermore, Svensson (2002, 119) uses the term "calculated risks" to refer to the risks a company takes in order to increase competitiveness, decrease costs, and improve or maintain profitability. The third category, risk reduction, involves actions and techniques which are

conducted for the risk in order to decrease the potential loss associated with it. Risk reduction is the most common management method and the types of reduction methods will be introduced later, in chapter 2.4. Risk avoidance in turn means decreasing the probability of a risk to zero or establishing a mitigation technique that prevents the possible consequences of materialized risk. Generally known best practice for risk avoidance is banning the activity. (Hallikas et al., 2001, 53–54) However, banning the risk may generate new risks.

Before selecting a strategy for risk management actions, all the supplier risks facing the company must be evaluated against the strategies available to the company. Risk management techniques and strategies will be reviewed in more depth in chapter 2.4 in which the most-cited techniques for SRM are introduced. Chopra and Sodhi (2004, 56) stress that to success in risk management mean planning and implementation, an analysis of risk cost/reward trade-off according to the company's risk appetite and defined acceptable risk level must be undertaken. To finish the SRM process, companies must move to the risk monitoring.

2.2.4 Risk monitoring

The company and its business environment are dynamic by their nature, and therefore the status of risk may also change over time (Hallikas et al., 2004, 54). A close monitoring of the possibilities of severe risk events is an important phase in the risk management process (Norrman and Jansson, 2004, 449). Risk monitoring qualifies the progress of mitigation actions while corrects deviations and enables identifying of new preventative actions as well as new possible risks (Xie, Tummala & Schoenherr, 2011, 480). As in the previous process phases, it is not necessarily profitable to monitor all supplier risks. Curkovic et al. (2013, 25) stress that companies should prioritize the suppliers and risks that require risk monitoring as the process is time-consuming process and companies' resources are limited. Therefore, monitoring should be implemented to the suppliers and risks with the highest priority (Xie et al., 2011, 478). Also, the concept of residual risk is sometimes used in risk management. Residual risk relates to a given event and its remained risk level after risk management activities strived to decrease the probability and impact of the event have already been placed. (Sodhi and Tang, 2012, 37). Norrman and Jansson (2004, 449) stressed the importance of monitoring the residual risks that don't meet the company's acceptable risk level.

The identified risk factors can be monitored by analyzing the potential changes in their probability or impact. To identify new increasing risks, companies must monitor, for example, changes in their business environment, supplier network and supply strategies which after the risk assessment must be reviewed accordingly. (Hallikas et al., 2004, 54) Some of the supplier monitoring activities that companies utilize, include supplier's site visits, supplier's process assessments and supplier performance measurement systems. Moreover, supplier questionnaires, benchmarking, on-site capability evaluations and assessment of financial risk act as possible monitoring tools for supplier risks. (Curkovic et al. 2013, 25)

2.3. Supplier selection and evaluation

Supplier selection (SS) is a process in which companies identify, evaluate, and contract with suppliers. The SS decision has become one of the most important decision for purchasing companies (Hsu et al., 2006, 213) due to increased initiatives for outsourcing resulting higher dependency on suppliers (Narasimhan & Talluri, 2009, 116). Improper SS has direct and indirect consequences to company's performance (Chan and Kumar, 2007, 417) and even slight improvements in SS practices can influence positively the company itself and its downstream supply chain (Scott et al., 2015, 227). According to Giunipero and Eltantawy (2004), supplier risks are highly related with risks arising from poor supplier selection. Therefore, companies should take the supplier related risks and uncertainties into account from the beginning of making purchasing decisions, as well as define the supplier risk techniques and incorporate them into the SS process to mitigate supplier risk. (Chen & Wu, 2013, 636; Kull, Oke & Dooley ,2014, 493-494) The primarily objectives of SS process, from the perspective of a purchasing company, are to decrease supplier risk, maximize overall potential value of suppliers, and to develop close long-term relationships suppliers (Hamdi et al., 2014, 766).

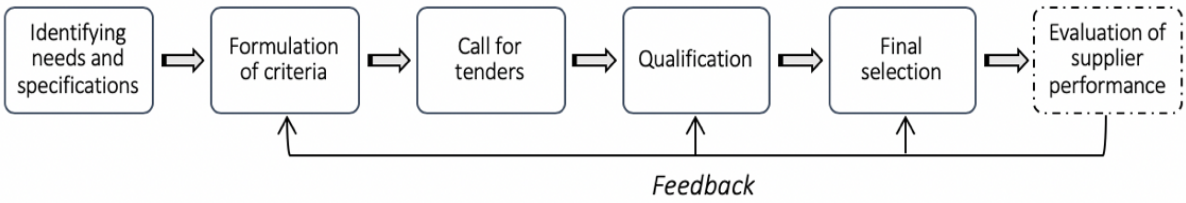

Figure 5. Traditional supplier selection process (modified De Boer, Labro & Morlacchi, 2001, 79)

In the above Figure 5, the general SS process is illustrated. Selecting suppliers generally starts with identifying purchase needs which after evaluation criteria for potential suppliers is set accordingly. Then potential suppliers are being tendered and the final supplier selection is made after reviewing the information submitted by supplier candidates. However, similarly to the SRM process, SS process can be taken also several times and the final selection is then made from a group of qualified supplier candidates. Moreover, Igarashi, De Boer and Magerholm Fet (2013, 248) suggested that the process should include a post-selection evaluation of the selected supplier's performance in which information would be obtained to make improvements. Zhu and Geng (2001, 35) refer to the performance evaluation phase as "monitoring suppliers". Next the structure and content of SS process is introduced.

2.3.1 Supplier selection criteria

The purchasing company starts the SS process by identifying the criteria it requires to use when selecting and evaluating suppliers. In addition to the suppliers' offered purchase price, SS should be based on a greater range of evaluation criteria including, for instance, company's required quality of products, supplier's parameters and capabilities as well as criteria based on suppliers' strategic alignment with the purchasing company. (Virolainen, 1998, 680). Literature proposes numerous different criteria attributes for supplier evaluation. For example, Dickson (1966), a pioneer investigator of the buyer-supplier relationships, provided 23 attributes that can be used when evaluating suppliers (Abdollahi, Arvan & Razmi, 2015, 680). A study of Singh and Singh Ahuja (2014, 288) concentrated on the importance of just-in-time (JIT) deliveries and their empirical findings emphasized the importance of suppliers' quality and delivery time. Goffin, Szwejczewski and New (1997,

423) compared so called traditional and modern business environments and found out that a few decades ago SS was based more on price, quality and speed of delivery but these days the selection includes more diverse indicators such as suppliers' technological and financial capacity, after sales service, strategic considerations as well as cost and quality. Similarly, Sarkis and Talluri (2002, 20) suggested that as purchasing has become more strategic including partnership formation with suppliers, the selection attributes should include both, suppliers' strategic and operational capabilities. The supplier selection attributes originally provided by Dickson (1996) are shown in the below Table 3.

Rank	Attribute	Rank	Attribute
1.	Quality	13.	Management and organization
2.	Delivery	14.	Operating controls
3.	Performance history	15.	Repair service
4.	Warranties and claim policies	16.	Attitude
5.	Production facilities and capacity	17.	Impression
6.	Price	18.	Packaging ability
7.	Technical capability	19.	Labor relations record
8.	Financial position	20.	Geographical location
9.	Procedural compliance	21.	Amount of past business
10.	Communication system	22.	Training aids
11.	Reputation and position in industry	23.	Reciprocal arrangements
12.	Desire for business		

Table 3. Dickson's supplier quality evaluation criteria (Pham, 2015, 6)

It should be, however, noted that each company should set the criteria that is the most suitable for its supplier expectations and then rank the criteria based on the importance requirements. In general, suppliers who are able to offer products or services that match or exceed the needs of the purchasing company are seen to be the most effective. According to Micheli et al. (2009, 175), risks and the possible interventions have seldom been particularly considered in SS. However, business environment these days is highly dynamic and thus Micheli et al. (2009, 175), suggest that risks must become drivers for the companies' supply decision making and measures to achieve a sufficient supply performance. Therefore, the selected criteria should also include risk factors and the suppliers should be evaluated based on different dimensions of supplier risk.

2.3.2 Supplier selection classification

All supplier selections shouldn't be treated equally as they may differ in terms of complexity and criticality. Therefore, it is important to distinguish SS situations for which Robinson, Faris and Wind (1967) introduced three typical scenarios that differ each other by the complexity of purchasing based on the level of uncertainty related to the purchase and the accompanying SS. The scenarios are new task situation, modified rebuy and straight rebuy. According to De Boer et al. (2001, 78) new task situation is the most complex purchasing situation for companies as high level of uncertainty is included into it. A modified rebuy in turn is less complex because known suppliers are used to supply a new purchase, whereas the simplest task is a straight rebuy. In case of straight rebuy, the purchasing company has a full visibility on the needed information related to both, the purchase and its supplier, and thereby an order can be simply placed according to existing supplier contracts and agreements. (De Boer et al. 2001, 78). The three different purchasing situations originally introduced by Robinson et al. (1976) are presented in the below Figure 6.

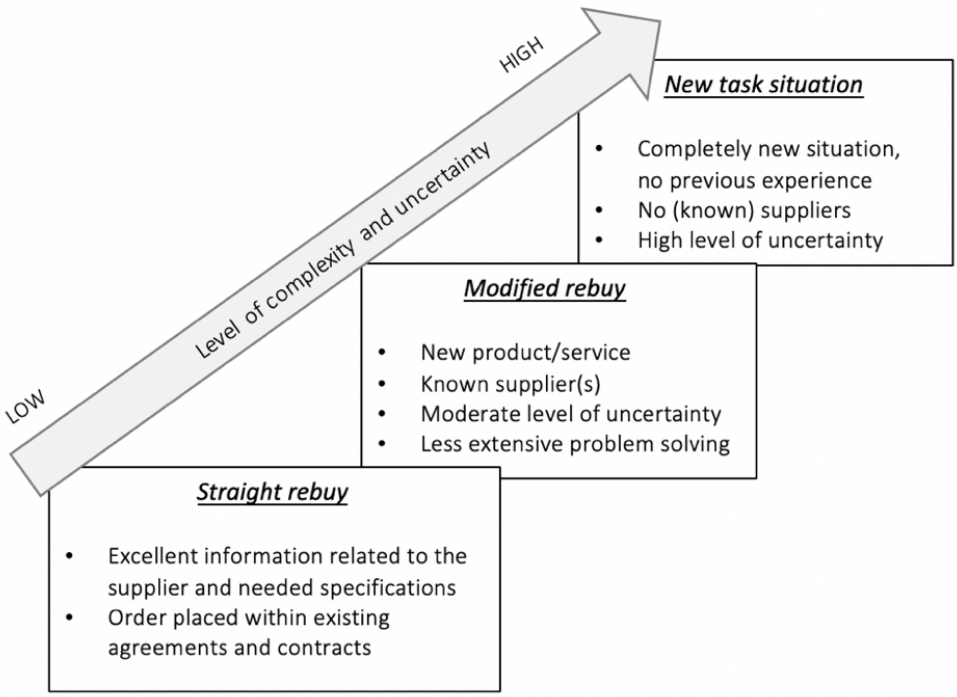

Figure 6. Classification of purchasing situations (modified De Boer et al. 2001, 78.)

The differentiation of purchasing situations facilitate to incorporate diverse uncertainty levels relating the purchase and its associated SS. However, the classification doesn't take into account other dimensions of complexity, such as number of suppliers and required criteria involved in the selection. The portfolio supplier approach introduced by Kraljic (1983, 111), however, also deals with the context of purchasing and views two additional factors which are profit impact and supply risk. The portfolio helps companies to design the most suitable supply strategy for the segmented items depending on their 1) strategic importance in terms of the value added, share of total costs and the impact on profitability; and 2) complexity of the supply market in terms of supply scarcity, pace of technology and/or materials substitution, entry barriers, logistics cost or complexity, including monopolies or oligopolies. These factors can be used to identify strategic, bottleneck, leveraged and routine purchases depending on their high or low impact on the two factors of profit and risk (De Boer et al. 2001, 78). The four different item segments are presented below in the Figure 7 with some given keywords of the suggested purchasing strategies toward them.

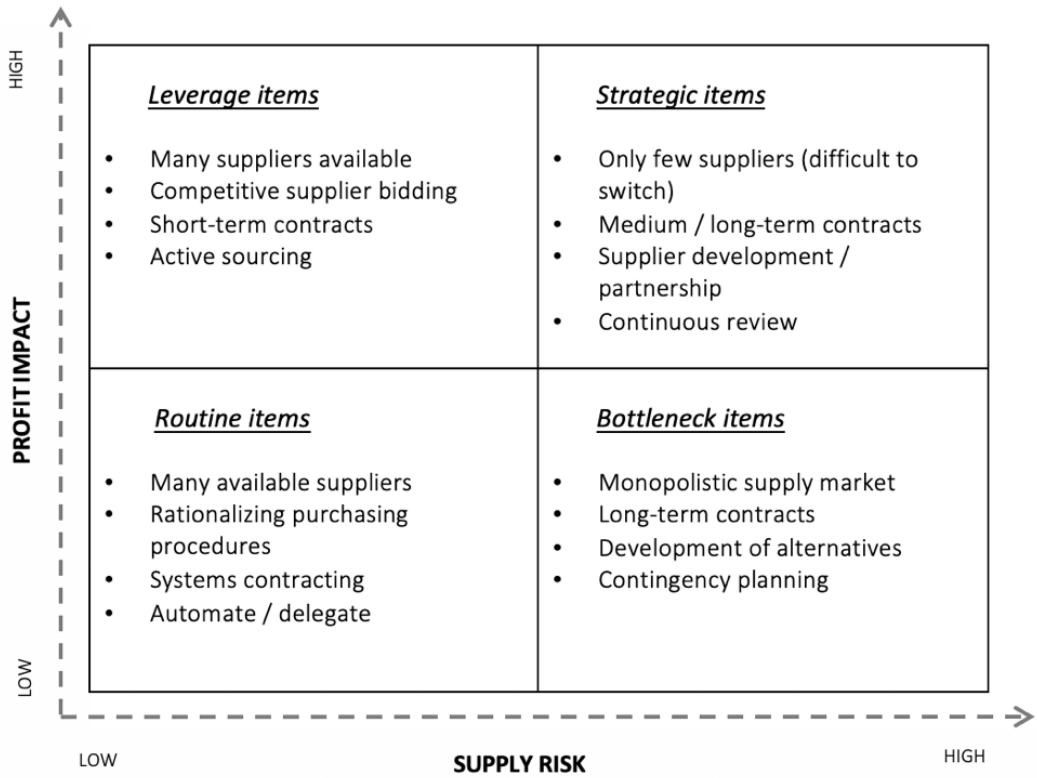

Figure 7. Purchasing portfolio matrix (modified from De Boer et al., 2001, 78, originally from Kraljic, 1983, 111)

The Kraljic's purchasing portfolio also takes into account the power and dependence levels explaining how the purchasing company's purchasing power influence the dependency relation and buyer– supplier relationship nature. Incorporating the portfolio model into the SS phase, the complexity of the SS with regard to the number of available suppliers as well as the significance of the selection can be considered. In addition, the item profile characteristics facilitate to understand the possible risk factors that can be utilized when determining pre-assessment criteria in SS. (Kull et al., 2014, 493-494)

In addition to the presented models of Robinson et al., (1967) and Kraljic (1983, 111), considerations of single versus multiple sourcing can be merged into a prescriptive framework for SS (De Boer et al., 2001, 81). Such a framework provides a good overview of typical SS situations and for managing the SS process. When it comes to new task situations (new suppliers), SS includes more complexity due to deficient level of historical data or lack of available information of previously used criteria (De Boer et al., 2001, 77). Cigolini and Rossi (2010, 5) stated that in addition to gathering historical performance data from supplier candidates, it is also crucial, if not more, to make observations of their behavior to find out whether the supplier is willing to share information and invest relationship-specific assets as well as check the supplier's strategic coherence with purchasing company. However, assessment of supplier's operational compliance is often more accessible than assessment of supplier's behavioral compliance because the first can be assessed without engaging to buyer-supplier relationship whereas the former requires often an entering into a relationship with suppliers so that their behavior comes visible. However, interactive methods such as site visits and direct meetings may revel some information about the supplier behavior. (Giunipero & Eltantawy, 2004, 708) When it comes to selection of strategic supplier, Grondys (2015, 92) proposes that stressing factors such as supplier's durability, stability and the possibility of a long-term partnership.

2.3.3 Final selection and approval

Selecting the supplier and reaching an agreement is most often seen as the last step in the SS process. When it comes to SRM, available information should be utilized to evaluate the performance of each candidate supplier and quantify their risks for SS and order allocation (Hong and Lee, 2013, 71). Hong and Lee (2013, 71), classified supplier candidates in their study into three groups by using expected profit and supply risk score. These groups were;

preferred suppliers, approved suppliers and avoided suppliers. According to Sollish & Semanik (2007, 57-58) selection of the right supplier requires 1) Evaluating supplier offers- to ensure that all aspects of the purchasing company's needs are being optimized and the risk level of the supplier is in required level; 2) Responsiveness- to check and rate supplier's real suitability based on their offer. This includes rating production lines with the quality criteria required through, for example, supplier visits, references, discussions, product audits, questionnaires and analyzation the suppliers' responses to the buyer's questions to ensure that the supplier has understood the signification of requirements and the possibility of supplier to provide innovative solutions and services, and 3) Capability- purchasing company must determine which supplier candidate is the best qualified for the purchase and contract.

Taherdoost and Brardt (2019, 1030) pointed out that companies' supplier selections are different due to used criteria attributes, methods, expectations and industry. Therefore, final SS doesn't follow a structured process even though there are some generally used models for SS (Sarkis & Talluri, 2002, 19). Regarding to the final approval and decision process of supplier selection De Boer et al. (2001, 82) suggested four different decision methods:

- Linear weighting mode
- Total cost of ownership (TCO)
- Mathematical programming models
- Simulation models

The first method, linear weighting, criteria attributes are assigned with weight and based on the total ratings, supplier with the highest rating is selected. The second, TCO, aims to take into account all the quantifiable costs that can emerge during the lifecycle of a purchase and SS is made according to the one with lowest score of TCO. In mathematical programming models, in turn, the final SS decision is based on the lowest possible cost. Finally, in simulation models, uncertainties related to SS are tried to be modelled (De Boer et al. 2001, 82-83), and regarding to supplier risks, supplier with the lowest risk should be selected (Chen & Wu, 2013, 642). When it comes to SS under SRM, Giunipero and Eltantawy (2004, 703) stress that final supplier selection should be based on suppliers' TCO.

After suppliers are selected, the contracts must be agreed (Basmadjian, Müller & De Meer, 2015, 583). In which detailed and risk-oriented considerations are included in the contract policies. These include, for example, responsibility issues, code of conduct, product quality and subcontractor requirements. Hallikas, Lintukangas & Grudinschi (2019, 265) added that contracts under SRM require also a mention of sanctions regarding contract violations.

2.4. Supplier risk management techniques

As many types of supplier risk types exist, so do the techniques by which such risks are managed. Authors have identified numerous techniques for managing supplier risk. Even though their focus varies, most of these techniques relate to broad categories of supplier relationship management or strategic/proactive purchasing, which in turn overlap with each other. Sarker (2019b, 320) points out that many of the techniques for SRM require direct interventions that involve suppliers. For example, Tse and Tan (2012, 56) suggested visibility in the supplier network to tackle supplier quality risks which again requires deep integration with the suppliers.

Similar to proactive and reactive approaches, SRM technique approaches can be also classified into redundancy and flexibility categories depending on how they decrease uncertainty. Redundancy approaches reactively centers on limiting or mitigating the undesired consequences of a risk by increasing an availability of a product which means keeping some resources aside for use in disruption. (Sheffi & Rice, 2005, 44). The most typical forms of redundancy risk techniques include increasing strategic inventory, holding safety stock, maintaining multiple suppliers, and adding capacity. (Sheffi & Rice, 2005, 44; Zsidisin & Ellram 2003, 23). Flexibility approaches in turn focus on proactively creating organizational and interorganizational capabilities to improve continuity of supply and to react supplier risks quickly (Zsidisin & Wagner, 2010, 3). Buyer-supplier collaboration and integration, information sharing and efficient communication, decreasing supplier base complexity and better responsiveness are common flexibility approaches for risk mitigation. (Zsidisin & Ellram 2003, 23; Hallikas et al. 2004; Choi & Krause, 2006, 649)

The most widely-cited techniques for managing supplier risk include use of safety stock, building long-term and integrated supplier buyer relationships as well as single/dual sourcing. In addition, Tang (2006b, 38) introduced different robust supply strategies that

intend companies to manage regular fluctuations efficiently under normal circumstances and to increase companies' capability to sustain its operations in more severe supplier disruptions. Next, the most cited supplier risk management approaches are given a more in-depth look.

2.4.1 Inventory buffers

Many researchers, including (Lee & Billington 1993; Lee, Padmanabhan & Whang 1997) have studied management of inventory to buffer against supplier risk. As mentioned, the traditional SRM has generally included the use of safety stock and lead time buffers against risk and uncertainty in the supplier network. These days such techniques are less attractive due to an increased focus on agility and responsiveness of supply chains (Zsidisin et al., 2005, 48), but are still commonly used especially among SMEs (Thun, Drüke & Hoenig, 2011, 5511). Inventory buffers have received lots of critique due to their nature which increases the company's internal costs for physical stock space, potential obsolete stock, and capital investment in inventory (Lee and Billington 1993, 835). Furthermore, Zsidisin and Ellram (2003, 18) see buffer techniques as an outcome-based approach to deal with supplier risk as they neither reduce the probability of a severe event nor proactively solve its root causes.

Zsidisin and Ellram (2003, 18), however, suggest that supplier failure and performance risk can be greatly decreased by using internal safety stock specifically if the inventory is located in-house, or close to the production facilities. In addition, companies may require its suppliers to hold finished goods inventory in which the supplier is responsible for the inventory management and storage. However, the cost of external or internal inventory buffer arrangements is often passed on to the purchasing company in the form of a higher purchasing or increased internal inventory level and aren't thus driving cost-efficiency. (Zsidisin & Ellram, 2003, 18-19) Therefore, inventory buffers act as a reactive SRM mean for especially product unavailability or transport related risks. Tang (2006b, 38) proposed different robust strategies including utilization of strategic stock which will be looked into more in-depth in chapter 2.4.4.

2.4.2 Long-term and integrated supplier relationships

In order to manage supplier risk in a proactive way, purchasers have been moved to adopt closer relationships and higher level of collaboration with their key suppliers. In an increasing trend, key suppliers are expected to provide solutions and compliment or enhance the purchasing company's core competencies which has led to the situation that suppliers are treated as extensions of the purchasing company's operations and products. (Giunipero & Eltantawy, 2004, 703) As a result, the importance of upstream supply chain integration and supplier development has arisen, and many authors see supplier relationship management as a key to risk management. (Christopher & Jüttner, 2000, 21)

Long-term and integrated buyer-supplier relationships are expected to add value for both parties formulating a so-called win-win phenomenon (Giunipero & Eltantawy, 2004, 703) and increasing the supply chain flexibility (Narasimhan & Talluri, 2009, 117). Integrated supplier relationship is based on the collaborative objectives, performance measurement, and joint development strategic planning activities. In addition, Zsidisin & Ellram (2003, 25) suggest that such relationships reduce conflict and allows better information-sharing which decreases the risk of opportunism. Alvarez, Pilbeam & Wilding, (2010, 178) also imply that supplier related trust risks require forming close relationships with suppliers.

According to Dyer and Singh (1998, 662), supplier development activities and strategic alliances have a positive impact on companies' supply performance because of the investments in relation-specific assets, substantial knowledge exchange and sharing, valuable and scarce resource combination as well as more effective governance structure. Investments in supplier development can be seen as any effort by a company to integrate with suppliers and improve their performance or capabilities (Krause, Handfield & Baverly, 2007, 529). Investments with the goal of integration and mutually beneficial situation include sharing demand and capacity related data, improvement of shared-processes, sharing knowledge and competences, technical support and training, are made by companies to create a mutually beneficial situation which may be seen as decreased costs, improved quality and flexibility, and increased delivery reliability. (Gualandris & Kalchschmidt, 2013, 466) Narasimhan and Talluri (2009, 116) state that purchasing companies must invest in supplier companies to develop suppliers' capabilities as otherwise continually evolving purchasing demands may create supplier capability lagging later on. Without investments,

supplier performance regarding to cost, quality, delivery and flexibility can decrease and cause several supplier risks to the purchasing company and its downstream supply chain (Narasimhan & Talluri, 2009, 116).

However, literature offers a conflict whether building long-term and integrated relationships with suppliers decreases or increases risk. Zsidisin and Ellram (2003, 24), and Christopher and Peck (2004, 9) all maintain that such relationships effectively manage supplier risk. In addition, research conducted by Hallikas and Lintukangas (2016, 492) pointed out that the highest correlation with companies' risk performance was found with their collaboration with suppliers. On the contrary, Smeltzer and Siferd (1998, 44), Pilling and Zhang (1992, 7) and Lonsdale (1999, 179) all argue in favor of that long-term relationships can increase risk by creating a situation in which the purchaser becomes too dependent on one supplier. Dependency risk implications are that a purchaser may get contractually bound to certain suppliers and creating a lock-in situations (Wagner and Bode, 2006, 305). Dependency risk increases transactions costs in the supplier relationships (Hallikas, Virolainen & Tuominen, 2002a, 3524) and decreases a buyer company's negotiation power (Wagner and Bode, 2006, 309) which makes the switch of supplier more difficult.

2.4.3 Single vs. multi-sourcing

The strategic importance of single or multiple sourcing has been discussed largely in the literature and seen as being a critical part of companies' strategic sourcing decisions. According to Costantino & Pellegrino (2010, 28), proactive management of supplier uncertainties requires a correct supply strategy in which the decision of the number of simultaneous suppliers for the same product, which is strategically important in dynamic and risky business environments. Most studies have focused on analyzation of the advantages and disadvantages of the two supply strategies, which are summarized in Table 4.

	Single sourcing		Multi-sourcing
+	Partnership allows cooperation, shared benefits and long-term relationship based on high levels of trust	+	Alternative sources of materials in case of delivery disruption by a supplier
+	Decreased risk of opportunistic behavior	+	Reduced probability of bottlenecks due to insufficient production capacity to meet peak demand
+	Large commitment of the supplier that is willing to invest in new facilities or new technology	+	Increased competition among suppliers leads to better quality, price, delivery, product innovation and buyer's negotiation power
+	Lower purchase price resulting from reduced production costs, due to better knowledge of the manufacturing process by supplier and achieved economies of scale	+	More flexibility to react to unexpected events that could hamper supplier's capacity
-	*High dependency between the buyer and the supplier*	-	*Reduced efforts by supplier to match buyer's requirements*
-	*Increased risk of supply interruption, especially for asset specific products*	-	*Higher transaction costs for the buyer company (greater number of orders, phone calls, records etc.)*
-	*Increased vulnerability of supply*		

Table 4. Advantages and disadvantages of single- and multi-sourcing (modified Costantino & Pellegrino, 2010, 28)

As can be noted from the Table 4, there is a conflict in literature whether single or multi-sourcing is riskier than another. For example, Treleven and Schweikhart (1988, 104) argue that single sourcing is a safer strategy for companies in terms of supplier risks, as it allows better and more efficient communication due to a limited number of suppliers. Zsidisin et al. (2000, 196) and Kraljic (1983, 114) in turn state that single sourcing can lead to too high-level dependence on one supplier, with a risk that the supplier could take an advantage on its power position and situation. The "monogamist" collaboration in single sourcing obviously forms a higher dependency on supplier resulting increased supply uncertainty for the purchasing company (Costantino & Pellegrino, 2010, 28) although single sourcing involves many known advantages as well. Blome and Henke (2009, 132) for instance suggested single sourcing practicing for companies that fear a supplier innovation capability risk. Single sourcing enables companies to develop and build key supplier relationships and involve suppliers in product development and minimization of costs. In addition, Wagner and Bode (2006, 309) point out that single sourcing seems to be less threatening than general dependence on some suppliers due to its closer buyer-supplier relationship associated with

long-term commitment, open communication, mutual trust, and joint activities which may decrease some of the supplier risk.

Differently from single sourcing, the multi-sourcing strategy provides alternative sources of materials if one supplier fails. The power of the supplier over the buyer is decreased as the purchasing company can allocate its order requirements among multiple suppliers. Multi-sourcing is optimal especially when there is asymmetric information about the supplier's cost structure or in case of high possibility or historically occurred supply disruptions. Multi-sourcing brings flexibility as it decreases the risks and costs associated to supply interruption. (Yu, Zeng & Zhao, 2009, 791). Because of such benefits, companies often choose to retain a dual source (or multi-source) to eliminate supplier performance risks. In dual sourcing case, a very large part of the demand is generally supplied by one supplier while the other supplier is supplying a smaller part to keep the relationship alive and ready for switching. (Hallikas et al., 2002b; Khojasteh, 2018, 101). Khojasteh (2018, 101) suggests that multi-sourcing should be considered especially for critical parts and materials as single-sourcing may be too dangerous.

Blome and Henke (2009, 131) highlight the importance of supplier reliability and dependency on suppliers as critical factors in SRM. They state that, buyer-supplier relationship is generally deeper in single-sourcing which lowers the supplier risk, but at the same time higher dependency can create more serious consequences if the supplier risk materializes. Using multi-sourcing strategy may lead, however, to placing lower volume orders per supplier due to order allocation hampering the purchasing company being a top customer for any of its suppliers. Thereby, supplier risk can be higher in multi-sourcing case even though alternative suppliers make the company less dependent on any particular supplier. Blome and Henke (2009, 131) conclude that neither single- nor multi-sourcing will automatically lead to lower supplier risks, as the risks seem to vary depending on reliability of supplier and relationship.

2.4.4 Robust supply strategies

As mentioned, some authors suggest more strategic and proactive approaches for SRM though supply management arrangements. There are different supply strategies that can robust company's supply operations and improve its overall capabilities to manage supply

under normal circumstances as well as improve the organizational capabilities to sustain operational performance in case of supplier disruption. Tang (2006b, 38) proposed nine different robust strategies of which the following are supply-related; postponement, strategic stock, flexible supply base, make- and buy and flexible transportation. In addition to the previous, (Zsidisin & Henke, 2019, 395) suggest standardization of purchased items which allows the company more supplier options to rely in disruption cases.

Postponement strategy enables a company to produce a generic product based on the total planned demand of all products, and later customize the generic product once the demand of all products is confirmed. Therefore, postponement strategy exploits product and design concepts to delay the final product differentiation phase acting thereby as a tool for mass customization. The postponement strategy increases company's performance as regular demand fluctuations can be better handled, and more importantly, postponement decreases the recovery time after a materialized supplier disruption as it offers a contingency plan by which the supply chain gets more easily back to its normal operation after a materialized disruption of supply. (Tang, 2006b, 38) Another robust strategy is a utilization of strategic stock. As mentioned earlier, the recent supply chain trends have made reactive inventory buffers less attractive to use these days. However, instead of reactive buffering, a company may consider more proactive buffering and store some inventories at specific strategic locations and share them with other supply chain partners. Strategic stocks allow a company to exploit extra inventory in the affected region or in case of wider supply disruption. (Tang, 2006b, 38)

Tang (2006b, 39-40) also suggest that flexible supply base, transportation and in-house production act as robust supply strategies. Flexible supply base enables a company to manage normal demand related fluctuations and sustain continuous material supply in case of serious and materialized supply disruption. Flexibility can be increased by producing certain products or some portion of products in-house and outsourcing other or the remaining portion of products to other suppliers to make the supply more resilient and flexible as company is able to shift production quickly should a supply disruption occur. Flexible transportation contains, for example, use of multi-modal transportation and multiple routes. In addition, Tang and Tomlin (2009, 164) proposed that as a long lead time often makes an upstream supply chain more vulnerable to disruptions, uncertainty and risk exposure can be

reduced by shortening the lead time by redesigning the supplier network. Chopra and Sodhi (2014, 61) in turn explain that regionalizing upstream supply chains and establishing them with close sources to customers for each region, companies can hedge the needed items, receive a lower response time in case of disruptions and also reduce costs related to logistics. The more regional or local the source, the faster the reaction time in case of disruptions (Ellegaard, 2008, 430-431).

2.5. Benefits, success factors and maturity

Recent studies have indicated that the financial impact of materialized supplier risks can be enormous (Norrman and Jansson, 2004, 454). Therefore, SRM aims to have a cost-avoidance perspective while being an enabler to many value-adding activities increasing customer satisfaction with along. End-customers these days expect receiving their services and products at the right place at the right time and in the right quality and quantity which results challenges to the resiliency of the supplier networks and purchasing companies (Christopher and Peck, 2004, 1). In addition, SRM practices, if managed in a balanced and coordinated fashion, improve companies' efficiency and the results improving competitive advantage (Gualandris & Kalchschmidt, 2014, 471). According to Giunipero and Eltantawy (2004, 701) competitive advantage can't be achieved through the inefficiencies related to traditional buffering strategies as they generally lead to higher transaction costs, long purchase order cycle times and poorer productivity. Therefore, they stress that risks should be approached proactively through SRM process. In addition, SRM may allow companies to effectively forecast and overcome supplier risk, while taking advantage of problems that affect competitors' supply chains (Sheffi & Rice, 2005, 47).

Pfohl et al. (2010, 40) state that risk management doesn't work only by utilizing a number of risk techniques but instead it should be seen as a philosophy that should be rooted within the company and its supplier network. Therefore, the development of general SRM strategies and capabilities is suggested to lead to better SRM performance. (Berg et al. 2008, 290) SRM performance refers to the company's ability to avoid different types of supplier risks by utilizing supply management. (Hallikas & Lintukangas, 2016, 491) According to PwC (2013a, 42) the highest SRM performance is achieved once a full visibility on relevant supplier risks exists and proactive mitigation technique to them is developed in collaboration

of suppliers. In addition, different risks and suppliers should be segmented, and implementation of risk management strategy targeted individually on the certain segments.

Tse and Tan (2012, 51) emphasized that high visibility and information sharing are the success factors of SRM. According to them, visibility and information sharing may improve the decision-making, material quality and traceability while reducing the probability of supplier risk. Smeltzer & Siferd (1998, 44) and Giunipero & Eltantawy (2004, 711) in turn stated that effective SRM needs constant monitoring and auditing of a supplier's processes to ensure that required standards are met. Their study findings revealed that auditing and certification of suppliers significantly improve the complete process and end-product quality. PwC (2013a, 31-32) distinguished six factors that enhances the SRM approach as well as companies' risk management performance: 1) Risk management processes, structures and systems, 2) supplier flexibility and redundancy, 3) strategy alignment with suppliers, 4) upstream integration covering information sharing, visibility and collaboration, 5) lower process and product complexity, and 6) data, models and analytics to identify supplier risks.

In addition to the above-mentioned factors, Berg et al., (2008, 295) suggested that developing a company's internal competencies in SRM increases the positive effects of applied SRM mitigation techniques. Similarly, Smeltzer and Sifered (1998, 45) highlighted the importance of employing qualified purchasing employees to reduce risks because skilled employees were seen to have the needed competencies to manage risks. A study conducted by Giunipero and Pearcy (2000, 12) revealed that employees' skills in interpersonal communication, ability to make decisions, ability to work in teams, and negotiations skills are needed to support efficient risk management because SRM requires coordination of the supply chain relationships. However, Giunipero and Eltantawy (2009, 711) added that practicing SRM on a regular basis requires top management support and interest.

As mentioned, successful SS and evaluation process requires incorporating of risk factors to the assessment criteria and supplier evaluation phases. PwC (2013a, 32) and, for example, Hallikas & Lintukangas (2016, 492) suggest that risk management should be performed in cooperation with strategic suppliers and high-risk profile suppliers to avoid missing critical risks. Furthermore, Hallikas et al. (2004, 55) introduced a risk management process in

context of network environment which has the same phases as the earlier introduced SRM process, but in addition to the introduced phases, network process has a phase in which companies manage risks in collaboration. Thus, each company is responsible for its own risks, their identification and assessment, but there is an additional round of mutual risk investigation which should be continuous. Lastly, Giunipero and Eltantawy (2004, 710) summarize that more SRM considerations are especially needed in cases the purchasing situation is novel, it includes crucial high-tech items, its production requires high security level or its probability to deliver high risks to end-customers is high. In such scheme, purchasing company should introduce early supplier involvement, distribute and evaluate SRM plans, establish operational integration and communication with supplier.

As mentioned earlier, some authors suggest that SRM should be included into supply management practices, including PwC (2003b, 12) which study stress that supply management and risk management processes go synonymously completing one another. Moreover, PwC (2003b, 13) has introduced a maturity framework tool to evaluate companies' capabilities and competencies toward SRM. At lower maturity levels both processes, supply management and SRM are separated and used in isolation, but at higher maturity levels the processes are integrated. To be able to build up and utilize capabilities to manage supplier risk completely, a high level of supply chain sophistication is needed. There are four levels of supply and risk management process maturity illustrated in Figure 8: 1) Functional supply management and ad-hoc risk management 2) Internal supply chain integration and planned risk buffers 3) Supply collaboration and proactive SRM 4) Dynamic supply and fully flexible SRM. According to the research findings of PwC (2013b, 13), most companies' SRM is still on an immature level (level 2) whereas only nine percent of the respondents were on the highest level of the SRM maturity.

	Supply management	SRM	
Level 1	**Functional** -Internally and externally disconnected supply processes -Absence of coordinated efforts with suppliers -Performance is measured separately based on functional -Key Performance Indicators (KPIs) but absent integrated plans	**Ad-hoc** -Ad-hoc SRM techniques and processes -No risk governance structure and poor visibility into sources of supplier risks. -No planning of redundancy buffers towards potential disruptions	Less mature
Level 2	**Integrated** -Information sharing and common supply planning activities between internal business functions -Key resources and performance objectives are jointly managed with supplier	**Buffer planning** -Positioning of redundancy buffers based on a common, cross-functional plan -Basic risk governance processes -No visibility into emerging changes and patterns outside the company domain	
Level 3	**Collaborative** -Visibility, information sharing and integration of key activities with suppliers -Information sharing is extensive, and visibility is high -Key activities such as product design or inventory management are integrated with suppliers -Supply chain rationalization to reduce complexity	**Proactive** -External information sharing and visibility is exploited to set up sensors and predictors of change and variability to proactively position response mechanism. -Business continuity plans -Supplier resilience monitoring -Quantitative risk management	More mature
Level 4	**Dynamic** -Alignment on key customer value dimensions across the extended enterprise -Supply chain segmentation to match multiple customer value propositions -Identification of emerging value chain patterns in complex dynamic environments -Ability to adapt the supply chain to frequent changes in the value chain	**Flexible** -Investment in supplier flexibility -SRM supported by real-time monitoring and analytics - Supplier segmentation is performed and SRM strategies are segmented based on supplier profiles and market- product combination characteristics.	

Figure 8. SRM capability maturity classification model (Modified PwC, 2013b, 13)

2.6. Challenges and barriers

SRM brings along many benefits but there are also some challenges that need to be acknowledged so that the desired outcome of SRM can be achieved. Although companies are increasingly becoming aware of the supplier risks that can hamper their organization, only a few are able to implement sufficient actions to allow the processes and approaches to cope with these risks (PwC, 2013a, 35). According to Chopra and Sindra (2004, 54) managing risks may be difficult due to the interconnection of individual risks which may make the selection of sufficient risk actions and mitigation strategies difficult resulting taking ones that can end up worsen another. As an example, in a lean supply chain the inventory levels tend to be lower while the materialization of the supplier risk is higher.

As mentioned, many techniques proposed for managing or reducing supplier risk are being introduced in literature. However, there are some downsides that many of the techniques

offer. For example, some people may see one technique to reduce the risk while others see it to increase the risk. Literature doesn't advise the decision-making process for selecting the best SRM technique to deal with certain risks and therefore, decision-making to choose the best risk technique among a number of possible alternatives can be a difficult for companies as well as their supplier network. (Vanany, Zailani & Pujawan, 2009, 28) The real challenge of supplier risk management therefore is that there is no "one fits for all"- strategy for protecting companies' supply chains which highlights the importance of managers good knowledge of the best working mitigation strategies against given risks. Therefore, SRM challenges also include a high level of subjectivity in decision-making.

Chopra and Sodhi (2004, 56) state that probably one of the main challenge companies deal with SRM is managing risks without eroding profits. Such situation is called cost/reward trade-off in which the costs of the supplier risk management and mitigation goes beyond the received reward. According to Surowiec (2015, 238), the SRM challenges arise from companies' fragmented approaches, lack of integration, inter-firm rivalry, difficulties in the measurement, availability of information and insufficient information systems. Furthermore, Surowiec (2015, 238) argues that challenges and thus potential barriers of SRM mainly derive from companies' lack of resources and skills. According to a study of PwC (2013a, 31), the most common challenges that companies face toward SRM are lack of a complete overview of all risk sources, SRM is rather reactive approaches and ad-hoc actions than proactive, and supplier risk prioritization and actions are lacking. In below Figure 9, the previous mentioned challenges are illustrated with their best practices.

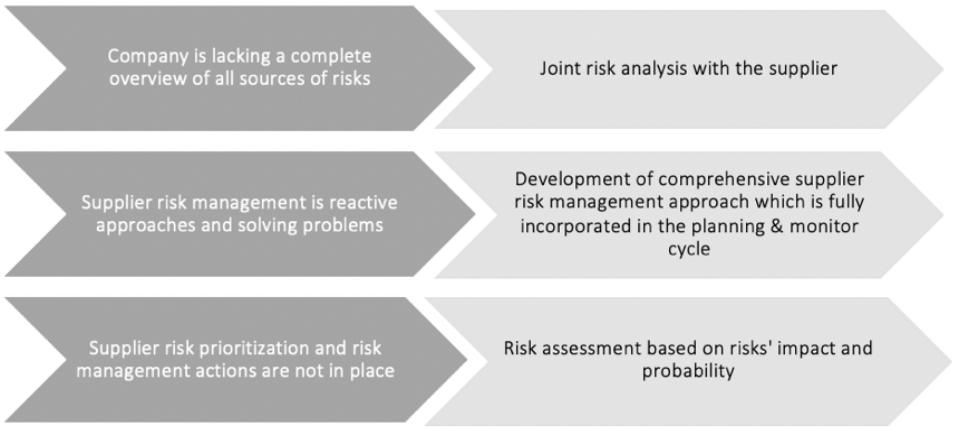

Figure 9. The key SRM challenges and their best practices (Modified PwC, 2013a, 31)

Curkovic et al. (2013, 25) note that SRM process is time-consuming process which requires risk prioritization. A study of Thun et al. (2011, 5511) revealed that SMEs primarily concentrate on using reactive risk means including utilization of safety stock and overcapacities rather than proactive risk means such as selecting high quality suppliers or JIT deliveries. On the contrary, large companies are more likely to deal with risks proactively (Sarker et al., 2019, 453) by reducing the occurrence probability of supplier failures and thereby systematically managing supplier risks not to materialize. This difference between the use of supply risk management means was due to large companies' better availability to invest in capital-intensive risk means such as development of strategic supplier or tracking and tracing. It can be thus noted that SRM requires investments also in monetary terms which may be a challenge or even a barrier for some companies. (Thun et al., 2011, 5511)

3 RESEARCH METHODS

The research framework introduced in chapter 1.2, has progressed to the practical part, which is the empirical study on supplier risk management. The study methods, results and the analysis of the results are presented in the next chapters. This chapter, however, presents the methodology that was used in the data collection and data analysis, the research process and introduction of the case company. The introduction of the case company is given to get a better understanding of the company's nature affecting the ways SRM is considered.

3.1. Research methodology

The research issue illustrated in this thesis, is what supplier risks are related to manufacturing companies and how the risks are managed (identified, assessed, mitigated and monitored) in the case company. In a wider context, the case illustrates what supplier risks are related to manufacturing industry and how manufacturing companies can manage their supplier risks. The empirical part of the thesis is conducted as a case study following qualitative methods. Yin (2009, 18) defined case study as "an empirical inquiry that investigates a contemporary phenomenon in-depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident." Case study research allows the researcher to look at the phenomenon in context and when it comes to business research, that means collecting evidence about that phenomenon where it actually takes place, for instance, in a company, industry or country (Farquhar, 2012, 5). Thus, case study is suitable for answering questions that start with why, what and how (Saunders, Lewis & Thornhill, 2009, 146). In addition, a case study may be based on one case (a single-case study), or on several cases (a multiple-case study) (Swanborn, 2010, 21). Farquhar (2012, 5) suggests that by circumscribing the area of a study to a small number of units, the case study researcher is able to look deeper at a topic of interest or phenomenon. In order to get an in-depth understanding on the thesis topic, the research is limited to concern a single case.

When answering to the why, what and how questions in case study research, an important tactic and case study research characteristic is to use separate different data sources (Saunders et al., 2009, 146). Data sources may include primary as well as secondary data sources which consist of, for instance, internal documentation, industry reports (secondary) and interview data (primary). Utilization of different data sources or data collection methods

enable stronger research findings because when investigation from different perspectives induce a more solid for foundation for the findings as well as more supported arguments for knowledge contributions. (Farquhar, 2012, 6-7)

Data used for the collection of case study research can be qualitative, quantitative or a combination of both types. (Farquhar, 2012, 10) However, Corbin and Strauss (2008, 11) suggest that qualitative research method suits well with research that aims to gather useable information and point out practical issues of the object. In similar vein, Robson (2002,178) state that the idea behind qualitative research is to focus on representing real life occurrences. Yin (2009, 9) proposes that case studies explain, describe, illustrate and enlighten and according Saunders et al. (2009, 323) qualitative method fits with the research questions that require explanatory answers. Due to the facts, a qualitative research design for this single case study is chosen as not much is known about the phenomenon and there is a need for in-depth analysis.

Yin (2009, 106) suggests that a single case study based on the interviews provides insightful background, consequence and reason explanations based on the questions that cannot be answered with yes or no responses, which leads to deeper understanding of the research problem. Therefore, to get a better view for the the nature of supply risk management of manufacturing companies, the primarily data is collected by interviewing and questioning the key purchasing personnel in the case company. The interview questions were formulated in a semi-structured form, in which the researcher had a set of questions to be covered in the interview, but there is flexibility in how and when the questions are put and how the interviewee can respond. (Edwards & Holland, 2013, 29) The interview questions were determined in advance to align them with research questions. Semi- structured interviews were utilized as the main data collection method, as it is considered as the best way to acquire rich and in-depth data for the empirical study. In addition to the interviews, other data collection methods were utilized including company documentation, questionnaire and observation.

3.2. Data collection and data analysis

As explained, the empirical data was collected by an online questionnaire, internal company documentation, observation as well as interviewing and questioning the case company's

purchasing personnel to achieve a throughout understanding of the present supplier risks, the benefits and challenges related to their management as well as the currently supported SRM practices and processes. The data collection started by getting familiar with the existing documentation which after an online questionnaire was sent to nine case company's purchasing professionals. Interviews were conducted for five purchasing professionals who are working closely with the key suppliers and are thus treated as the supplier leads in the case company.

The company documentation used in the data collection and analysis included supplier evaluation, approval and monitoring policy template, supplier audit checklist template and reports, spend analysis and purchasing portfolio as well as supplier country risk excel for which all the author had a direct access. The documents provided information on supplier criticality assessments, supplier risk profile assessments, the case company's supplier selection and evaluation policies, supply chain failures and supply strategies. The case company's representatives provided additional information about the utilization and data of the documents as requested.

The semi-structured interviews were conducted to five case company purchasing professionals working closely with key suppliers. The professionals interviewed were chosen on the basis of who knows the case company's suppliers and its supply function the best. Most of the interviewees work as strategic buyers in the case company who are seen as supplier leads. The interview questions and themes were formulated to follow the research objectives but had still space for other topics related to supplier risk management. The interviews were conducted face-to-face in case company office which allowed a possibility to ask additional or complementary questions when needed. The empirical data was collected during November-December 2019. The interview lengths varied from 33 minutes to 58 minutes, covering the Appendix 2. interview questions. However, not all the interviewees were asked the whole interview questions list as all questions were not relevant or valid for some of the respondents. The case company and the interviewees remain confidential in this thesis and all parties were informed about this in the beginning of the questionnaire and interview.

The interview data was analyzed by finding patterns in the responses and making conclusions of them. Averages of questionnaire responses were calculated from number

scale questions to achieve a general understanding how interviewees see the SRM importance to the case company, its current SRM performance maturity, SRM tools and manuals as well as level of SRM competencies. The interview data was further analyzed to understand better some of the questionnaire results and to get familiar with the current state within the company and to find possible further development SRM avenues.

The interviews were audio-recorded and transcribed as it was seen useful both during the interview itself and after it. Recording enabled the author to focus on the listening and following up the interview as well as its reliable interpretation when analyzing the interview outcome and data. In addition, recording enabled the use of translated word for word quotes in the analysis and discussion of this research. Translation of the interview material can have an impact on the reliability of the research, as during the translation the original meanings and perspective could have been adopted. However, the word by word quotes were rechecked by the interviewed professionals to ensure the mutual understanding of the message between the author and interviewed.

3.3. Case company

The case company of the thesis is a medium sized and Finland-based furniture manufacturing company found in 2010. The manufactured products are sold globally to wholesalers and directly to end-customers in b2b sector, and the company is a market leader in its industry. Almost 90 percent of the company's turnover comes from exports and thus the case company manufacturers end-products in a value chain that serves to end-customers worldwide. Even though the sales are global, the products are manufactured at and also shipped from the company's factory located in Finland. The case company's global customer markets mean that the company is exposed to global competition and under pressures to surpass lower income country companies. However, the case company has enjoyed a strong growth in recent years and at the moment, the case company employs approximately 350 people out of which two thirds are officers and the rest manufacture the products. The sourcing department, which is responsible for the company's supply management practices and thus the primarily responsible department for supplier related risks, includes nine employees. Materials management department includes operative purchasing, supply planning and inbound logistics and is in turn responsible, for instance, for creating purchasing orders,

estimating and checking the delivery schedules and quantities from suppliers and daily communication with suppliers.

The case company needs to purchase all its needed items from domestic or global suppliers as only the most value adding phase, module manufacturing, has been left in-house. The case company's end-products are relatively complex and thus many of the purchased items also need some level of customization from suppliers. For some items the upstream supply chain may include multiple supplier tiers, whereas some suppliers manufacture the components directly from raw materials. Moreover, the company's upstream supply chain varies depending on the item specifications and location of the supplier. These mentioned factors together make the case company and its suppliers an attractive entirety to investigate from the theoretical as well as managerial perspectives when it comes to supplier risks and SRM.

The case company's is quite young and thus so is its purchasing department. Even though the case company has recently taken some progress in paying more attention to supplier related risks and their management, SRM is still at a deficient level. The case company stated that some of the materialized supplier risks could have been avoided if more systematic and proactive SRM would have been in place. Supplier risks are mostly managed through supply management practices which is in the case company typically cross-functional. Due to trade secrets and confidential information, the company as well as interviewed professionals will remain anonymous and will be referred to as the *case company* or *interviewees* in this thesis. Due to same reasons, for example, suppliers, material descriptions, monetary data and customer information will not be used in this thesis.

4 EMPIRICAL FINDINGS

This chapter focuses on explaining the research findings of this thesis. The findings are based on the case company' purchasing documentation, author's observation, online based questionnaire and semi-structured interviews with purchasing professionals working closely with key suppliers. Farquhar (2012, 90) suggests that the empirical data should be analyzed through categorizing the findings to be able to explain the data in any meaningful way while increasing the research reliability. Due to that, the research findings are categorized according to the key themes of the thesis and research questions: 1) Business environment and supply strategy, 2) Supplier risks and attitude towards SRM, 3) Supplier selection and evaluation, 4) Supplier risk management process, 5) Challenges and barriers for succeeding in SRM, and 6) Benefits, SRM maturity and further development. The SRM process again is further categorized into the most significant supplier risks as it was found out to differ depending on a supplier risk.

4.1. Business environment and supply strategy

The case company purchasing professionals see that supplier risk management plays a very important role in the company even though still quite limited resources and investments are directly allocated in to it. On a scale of 1-10, one being "*low*" and ten being "*high*", the respondents rated the SRM importance to be 9. Materialized supplier risk events were said to have a significant impact on the company's business performance, if, for instance, a manufacturing process is disrupted or if the purchased components are not delivered due to supplier failures. In the worst-case scenario, a materialized supplier risk may shut down the company's manufacturing operations resulting undesired losses for the case company. Therefore, the case company confirmed that an appropriate SRM would positively influence business performance and continuity as well as can even allow the company to win new customers or market share. Most respondents said to work for SRM on a weekly basis.

According to the interviews, company's suppliers were seen to be generally in a good light fostering collaboration and good service for the case company as well as some level of participation in SRM. However, the interviewees emphasized the company's high-quality standard requirements for purchases and level of special features for the needed for them to make their upstream suppliers sensitive to risk exposures and thus also the case company

risk-prone to many supplier failures. In addition, case company's very rapid growth rate, increased supply volumes and short product lifecycle have set pressures for the suppliers' capabilities and production capacities. The competition in the industry on which the case company operates, was said to be highly competitive and companies compete both in the product market and innovation development.

Supply strategy of the case company varies from one purchasing situation to another, depending on the criticality of purchased item, degree of needed specifications, case company's purchasing power and experience on the purchase as well as supplier. The case company delivers supplier segmentation through Kraljic's matrix and spend analysis. Use of the matrix provides the company to identify the most critical purchases and thus a way to distinguish different types of supply strategies which maximize buying power while minimize supplier related risks. When it comes to the strategic (high profit impact/high supply risk) purchases, the case company's supply strategy leads heavily on dual and/or multi-sourcing. Dual sourcing was seen to increase the needed resources to manage the supplier relationships and decreasing cost efficiency, but the interviewees stressed that such strategy is necessary for the company as well as its suppliers. By dual sourcing strategy, the case company ensures the supply continuity in case of one supplier exposures for significant risks and ensures the overall required supply volume needed in the first place. As a rule, in dual sourcing case, 70 percent of the case company's demand is typically supplied by one supplier with the other supplying 30 percent to keep the relationship going and ready to be switched at any time. In most high spend and high importance component segments single sourcing wouldn't be even possible because of the big purchasing volumes. One interviewed professional also reasoned the dual sourcing strategy from the point of view of the suppliers: "*Dual sourcing strategy also serves our suppliers because our volumes are already so high that few suppliers even would like to supply us alone because that would be a high risk for them if our demand would collapse. Dual sourcing thus acts as a shared risk.*"

Even though dual or multi-sourcing was seen the best supply strategy in most product categories, single sourcing was seen a better supply strategy for purchases that require supplier's involvement in product development, and supplier's investments in equipment or new technology. Also, purchase categories that doesn't have a high enough volume for two suppliers were seen to be better sourced from a single supplier to secure cost efficiency. In

some single sourcing situations, the number of the approved suppliers available was seen to be limited which also strengthen the use of such strategy in some purchase categories. Purchasing of leverage items (high profit impact/ low supply risk) is delivered through use of the case company's full purchasing power, substituting products or suppliers, and placing high-volume orders. Bottleneck items (low profit impact /high supply risk) include overordering when the item is available (lack of reliable availability is one of the most common reasons that supply is unreliable) and looking for ways to control suppliers. Purchasing of non-critical items (low profit impact /low supply risk) are in turn approached more in a tactical approach, using price bidding for standardized products, monitoring and/or optimizing order volume, and by optimizing inventory levels.

The purchasing professionals, in all product categories, stated that sourcing items and components from domestic suppliers is less risky than sourcing from foreign suppliers. Especially for the purchases that are sensitive for quality failures during transportation close sourcing was seen as a safer option. "*Every transfer of a component is a risk*" stated one interviewee meaning that the shorter the distance from a supplier to the case company's factory, the less supplier related quality uncertainty is included to the purchase. Other advantages of domestic sourcing were seen to be shorter lead times and mutual cultural alignment. Due to these factors, the case company's supplier base of strategic items is mostly located in Finland and countries close to it such in Baltic countries, Russia and Sweden. Some routine and leverage items are also purchased from Poland and for example, the UK.

The case company's leading position in its industry has made the company increasingly a bigger player and desired customer in the supply market, meaning that its purchasing power was seen to be quite high in most of the critical part segments. According to the interviewed professionals, the company is typically in the top five or ten largest customers of their key suppliers which was seen to reduce the severity of supplier risks. However, the case company's purchasing power depends on the size of supplier. Therefore, for some key suppliers the case company is the most important customer. In addition, the interviewees saw that their industry in general is a very interesting and unique one, and therefore attracts suppliers.

4.2. Supplier risks and attitude towards SRM

To understand the supplier risks and their management in the case company, it is important to find out how the both, supplier risks and SRM are generally understood within purchasing professionals in the company. In the questionnaire (Appendix 1) the respondents were asked to define supplier risk and SRM in their own words and based on their own experience. The responses showed that the overall understanding of supplier risks and SRM was mostly in line within the purchasing professionals and thus the company has a common consensus about both of the concepts. Supplier risks were seen to cover all the failures of supplier that negatively influence the case company's performance and operations both, in long and short-term. Thus, the source of supplier risk was seen to be the supplier failure itself and outcome being undesired side effects to the company's performance resulting potential losses. SRM in turn was seen an anticipation and preventative actions for the possible supplier failures and company losses. Therefore, the professionals see SRM to be approached in a proactive manner.

The case company's supplier risks are drawn against the interviews with the respondents and online questionnaire. According to the questionnaire results and interview outcomes, the following risks were recognized in the case company's supplier network;

- Capability risk including **suppliers' production capacity**, technology and innovation risks
- **Performance risk**, suppliers' poor product quality and late deliveries
- **Supplier financial risk**, supplier's payment difficulties or even bankruptcy
- **Dependency risk** due to high purchasing volume dependence on suppliers, single sourcing situation and dependence on suppliers due to their production of customized products only for the case company
- **Sustainability risk**
- Competitive risk referring to the suppliers' ability to stay competitive, suppliers are unable or unwilling to reduce costs/prices in order to keep prices competitive

From the above-mentioned supplier risks, financial, quality and delivery performance, insufficient volume capacity and dependency risks were repeated in many responses and interviews as being the most current but also severe risks which have materialized in the

case company during its existence. These risks were partly seen to be as a result of the case company's deficient and short rather than long-term perspective focused supplier selections, high growth rate and short-product cycle. The case company's growth rate has caused pressures and difficulties for its suppliers as increasingly higher volumes are needed which require flexibility from the supplier to scale along with the case company's demand. One of the interviewed professional stated that a supplier's poor or unstable financial condition may act as a root cause for supplier related operational performance risks, and thus, the financial risk should be given a lot of attention. The respondents also mentioned that suppliers' high labor and material costs as well as political situations such as Brexit and exchange rates increase uncertainty within certain suppliers, but these possible risk sources were seen to relate primarily to market factors and thus are not further looked into in this context. Supplier sustainability risk was also mentioned several times as being a severe risk for the case company as it would have a high impact on the company's image and reputation. Moreover, sustainability is increasingly important for the case company as the external expectations on it are continuously higher and as transparency becomes more prevalent.

Supplier's quality part risks were seen to be one the most frequent and thus "normal" risks partly due to the case company's high requirements for supplied products. As one of the interviewees mentioned, in some products, even a slight quality defect means that it no longer complies with the case company's quality standards. The interviewee continued saying that most of their suppliers' customer base consist of construction sector companies for who the quality requirements aren't as strict as for the case company and thus suppliers' vision of quality may in some cases differ from the case company's. One of the interviewees also recognized that use of dual sourcing for certain products cause quality risks as the products of two different suppliers are not compatible with each other.

Outcome consequences of supplier risks for the case company were said to be difficulties to achieve the business objectives, financial losses, bad reputation, delays in customer deliveries, disrupted or totally shut down in-house manufacturing process, loss of competitive advantage and weaker position on the marketplace. Therefore, it is important to a company's success to understand the sources of supplier risks, and proactively manage them. The primarily SRM initiatives in the case company relate to the prevention of their key supplier risks introduced and their negative consequences. SRM initiatives were said to

focus primarily on product quality, meeting the regulations and rules, ensuring capacity, customer satisfaction, cost efficiency and lean manufacturing processes. In addition, efforts in SRM were paid to create value, protect intellectual knowledge and competitive advantage.

4.3. Supplier selection and evaluation under SRM

According to the interviewees, supplier risk considerations typically start from selection and evaluation of new suppliers and thus majority of the interviewees saw SS as a base of SRM. The interviewed professionals also said that some supplier risks, mainly supplier's failures in capacity and performance flexibility, have resulted from the case company's poor supplier selections. They continued, that such risks could have been largely avoided in case possible supplier risk factors would have been considered more proactively before approving certain suppliers in the company's supplier portfolio. However, the case company's business growth has been so fast, and the maturity of the case company's supply processes were not seen to be in a sufficient level enough to proactively identify all the possible uncertainties and risks in SS phase. The case company's supplier base constructs of 85 active suppliers of which top 30 suppliers form approximately 97 percent of total purchased volume of the case company. The case company's objective is to keep the supplier base limited, but the rationales are that the company also aims to be innovative and cost-efficient. In addition, the case company wants to increase its market presence and ensure its current market leader presence in the future as well and thus, having new suppliers in the portfolio of existing suppliers is important for the company. However, the interviewees said that when it comes to new purchase needs, such as purchasing a new product, they most often prefer modified rebuy situations rather than new task situations if an existing supplier meets the set product objectives and specifications as well as is capable for the situation. The degree of novelty, both in product and supplier, were most often seen to require more resources due to higher uncertainty and supplier risk.

The respondents said that the goal of a good SS is to find an appropriate supplier who can supply the case company with the right quality products in a cost-efficient, sustainable and cooperative way, in the right quantities and time. The process and participants of supplier selection varies depending on a purchased good and situation; while for some products the process can be a plain record of actions conducted by a strategic buyer, for another product

it can change into a highly complex framework in which many actions are conducted by different business departments. In general, the company's sourcing department is responsible for evaluating cost, deliverability, and productivity of the SS whereas the main responsibilities of quality department include assessing the quality of new suppliers; and the R&D department evaluates the technology and general product suitability level. The quality of service provided by suppliers, for instance confirmations of purchase orders, is pursued through suppliers' commitment on the case company's delivery policy. Due to the cross-functionality in SS, the case company representatives stressed the importance of clear governance structure of responsibilities and roles, as well as efficient internal communication and collaboration in supplier selection and evaluation too. Communication and collaboration were said to foster the identification and prioritization of possible risk factors in SS phase.

The typical SS process in the case company starts from an identification and decision of the need for supplier selection which can be initiated by anticipating future purchase needs. Most often, the R&D department may have some initial specifications regarding the material type, processes, or services needed for the purchase. Even if the specifications wouldn't have specified details in the beginning of the process, the specifics are accurate enough to initiate the process for finding a potential supplier. Based on the preliminary specifications, the sourcing department drives market research for the available suppliers which can be carried out via internet sources, references and existing knowledge and contacts. As mentioned, the case company avoid risky and long-distance country sourcing and thus local or near sources as well as few-tier supplier networks are preferred. After the found suppliers are being contacted and pre-qualified, bidder's list is being drawn up and request for quotation is done, suppliers are evaluated and finally contracted.

Although the suppliers' offered price plays an important role in SS, the interviewees highlighted the importance of looking at the TCO instead of only the price itself. For that reason, the case company has defined supplier evaluation, approval and monitoring policy which aims to pre-assess and ensure that the suppliers they are working with are stable and that they meet the case company's supply requirements. Thereby, the policy aims to minimize the supplier risk to the case company's organization and its' customers. The policy is created for the purpose of approving new suppliers, when purchasing new components

from existing suppliers, and for the purpose of continuous monitoring of suppliers' performance. However, the interviewees said that the policy is mostly used when approving new suppliers rather than evaluating the existing ones. The evaluation, approval and monitoring policy is based on about 15 supplier criteria attributes to evaluate suppliers' technical and commercial, operational and strategic factors ranging from financial credit-worthiness, customer references, to also on-time deliveries, environmental management, quality management system and its functionality. In addition, environmental and responsibility aspects at supplier premises are included in the criteria attributes. Supplier audits and production site visits were said to play a critical role, when focusing on the previous aspects.

The supplier pre-assessment criteria outcome is considered in qualitative methods and thus a quantitative scoring is not conducted in the case company. However, the interviewed professionals recognized a need for a numerical supplier criterion scoring as it was seen to ease the supplier assessment in the selection process and thus also act as a risk management mean for supplier related risks. In addition, one interviewee said that the supplier criteria attributes should be prioritized so that, for example, the five most important criteria could be checked in every supplier selection and thereby decision making, and evaluation of supplier candidates would be easier and less subjective. According to the representatives, the supply strategy as well as category of the supplier being selected influenced the length of the selection and evaluation process, resources and effort need to it as well as prioritization of the supplier criteria attributes. For example, selection and evaluation of strategic (high importance/high spend) suppliers require more effort and, in such situations, the supplier criteria include more strategic and long-term performance considerations too. In addition, in complex purchases such as high technological or specified products, supplier evaluation requires prototyping of samples obtained from the supplier and pre-production run in case company's manufacturing. Prototyping and preproduction were said to enable more careful supplier assessment before making an agreement for the supplier relationship.

The interviewees highlighted the importance of supplier audits and production factory visits when evaluating the existing suppliers as well as in selection of new suppliers. Therefore, most suppliers, especially the high spend and high importance suppliers in the case company are evaluated by audit visits to gather additional and more in-depth information, and

observation about the supplier as well as its premises. Such visits are conducted mainly by the purchasing professionals and supplier quality engineers. Auditing is carried out with a separate case company's Supplier audit document which includes a checklist of matters that need to be investigated. The checklist aims to ensure the supplier's suitability while providing a permanent record of the visit and the reasons for decision reached. The checklist used by the case company includes six evaluation targets which are sub-divided into more specific evaluation subjects. The checklist includes evaluation targets related to the supplier's purchasing and sourcing as well as its suitability to the case company's sourcing process, responsibility, product quality, pre-production and production, as well as suppliers' quality management. The suppliers are ranked based on their performance score in each sub-criteria object based on the applicable numerical value given to the area. Numerical values are used to calculate the total score of a supplier to get a perception of the strengths and weaknesses of the supplier as well as to get an aid in the finalizing the final performance status of supplier. However, some of the interviewees said that the scoring is not fully utilized but the audit checklist was seen to be useful to recognize uncertainties and potential risks which could have been ignored without a such list. Thereby, the auditing checklist was seen to identify supplier risks as well as the riskiest parts of certain suppliers' performance and processes creating a kind of supplier risk profile.

The supplier audits are carried out once or twice a year to the first-tier suppliers and the representatives stressed especially the advantages of auditing to get familiar with the suppliers' premises as well as general cleanliness and order. Therefore, the audits and supplier visits were seen to increase transparency within case company's upstream supply chain while also allowed information gathering based on observations. However, the interviews revealed that the case company doesn't conduct audits to their second- or third-tier suppliers but the case company's code of conduct requires their first-tier suppliers to audit their suppliers. Interviewees considered that observations during audits are important especially when it comes to investigation of the supplier's culture and values in practice. One of the interviewees highlighted that the values the case company brand represented, their suppliers and employees needed to represent too: "*We aim to select reliable and good performance suppliers who take care of their employees and commit to our values*"

The case company is to an increasing degree dependent on supplied products that require high level of co-design with suppliers and careful selection of supplier before deciding productions technology tools for such items' production process. In addition, some of such technically demanding product categories are single sourced and need to be approached in more proactive way by identifying, assessing and managing supplier related risks before suppliers are being selected and an agreement made for the supplier relationship. Therefore, the case company has taken improvement toward risk-oriented pre-assessment for new suppliers which was said to provide encouraging improvement results. For example, one interviewee said that utilization of value stream mapping has been able to increase visibility to upstream supply chain and identify, for example, a supplier's lack of capacity which was revised by extra investments by the supplier. When the case company is knowledgeable of the end-customers' requirements and needs, it has better capabilities to handle risks, especially when risks are associated with product quality and upstream supply chain process delays. Parts of the supplier selection and evaluation under proactive SRM were said to be weekly follow-up meetings with supplier, build of supplier risk profiles, documenting assessment gaps and supplier action plans. However, a proactive approach for supplier selection and evaluation was said to be still in its infancy and therefore difficult to further investigate or analyze.

4.4. SRM process

The case company doesn't have a centralized risk management function in the organization and thus supplier risks are mostly managed by the sourcing department together with other business functions, such as quality management, production, materials management and R&D. Thereby, SRM in the case company is cross-functional and supplier risks are partly managed at different business unit levels. In addition, SRM is conducted through processes of supply management. Risk management process in the aggregate terms has not received much consideration as a formal process in SRM but instead, some elements of the process are used in isolation. Supplier risk identification, assessment, mitigation and monitoring in the case company use different techniques depending on the type of supplier risk. However, common to all supplier risk categories is that the case company respondents said to mitigate supplier risks by cooperating with good market players, suppliers with long history and reputation, as well as high quality and reliability. Participation in certification system,

specifically under the quality management standards was seen to increase the supplier reliability. The respondents said that their key suppliers are considered riskier and more SRM activities towards them is intended. For instance, if case company's manufacturing cannot continue without a certain product or in case of single sourcing situation, it was given more SRM considerations whereas the less critical supplies and suppliers to continuity were given less SRM considerations.

As explained in the chapter 4.1, the key supplier risk categories in the case company includes financials risks, performance risks, sourcing risks and sustainability risks. The interviews revealed that the management of each of the supplier risk categories differ from one another and the tools and manuals that facilitate SRM were said to be absent or deficient. Supplier related sustainability risks are mostly managed by the case company's *Development and Corporate Responsibility* department of which representatives didn't participate in this research. Therefore, SRM process for sustainability risks wasn't possible to thoroughly investigate. However, the conducted interviews revealed that the case company's code of conduct and supplier audits plays a critical role in management of sustainability risks and furthermore, the sustainability risks are managed by local sourcing. Next the SRM process of the financial, performance and sourcing supplier risk categories in the case company are explained based on the interview data. Table 5 summarizing the case company's SRM is concluded at the end of this chapter.

4.4.1 Financial risks

The case company aims to ensure that their suppliers have solid financial performances before being selected. Supplier financial risk is identified, assessed and mitigated mostly when selecting new supplier by the sourcing and financial department. The supplier related financial uncertainty refers to such as poor cash flow, credit line constraints, capital shortages, supplier's payment difficulties to its supplier or even bankruptcy plan which could result a financial risk and thus supply shortages or supply shutdown to the case company. Supplier selection criteria includes attributes, such as *supplier financials and ownership structure*, and *development and investment plans* which stand for identifying and assessing supplier's financial performance and stability. When it comes to suppliers based in Finland, the case company also identifies supplier's financial health from a credit report database provider, Asiakastieto. For international suppliers, country-specific and thus similar

databases are used which provide credit classifications and reports to indicate the probability of suppliers to get a payment default or go bankrupt in the future years. By checking the suppliers' financial performance over several years, the case company can predict the future bankruptcy risk from suppliers. However, the risk assessment can in some cases be relatively hard because the creditworthiness scores are based on ex-post financial data. Identification and assessment of the supplier's financial risk is done by sourcing department in cooperation with the company's financial department.

The mitigation of such risk is not selecting or not including a financially risk-prone supplier as a new supplier to the case company's supplier base. In addition, the case company has committed to prompt payment practices as part of fostering their suppliers' financial wellbeing. The reason for this risk being identified, assessed and mitigated mostly by the sourcing department is that the department is responsible for supplier selection and inclusion of new suppliers in the existing supply base. The case company has acknowledged that some of its suppliers have been and few are still at a weak level with their financial performance and thereby consistent monitoring of suppliers' financial health is seen to lead to lower ongoing supplier risk. Monitoring of supplier financial risk relies mostly in checking the credit report databases such as new financial data available each year, or changes at supplier's future outlook. The case company sourcing professionals also said that suppliers' financial status is often questioned and followed in supplier meetings in which accurate, updated and relevant information of potential financial issues is questioned from supplier. Following the supplier's growth, level of investments and customers may often reveal the supplier's financial performance as well, and thus supplier's development degree was said to be analyzed too on a regular basis.

4.4.2 Performance risks

In the case company, risks such as part quality risk, capacity and delivery risk were considered as key performance risk from suppliers. Even though such risks are tried to take into consideration in the SS phase, the realized performance risks from suppliers are mostly identified, assessed and mitigated during delivery and inspection of the purchased items, at the case company's factory. Risk management of supplier performance risks is carried out with several business departments as well as in cooperation with suppliers. The respondents

said that suppliers' participation level and method varied between the suppliers. For example, suppliers' governance structure influences the quick decision- making and response layers as well as the existence of quality department. According to one interviewee, suppliers with a separate quality department were able to provide more in-depth data and determine the root cause of materialized risk in more detail.

Supplier quality risk refers to the products and components that don't fulfil the quality requirements of the case company. Such risks are most often identified in the case company during inspection of goods or manufacturing the modules. The assessment of such risk is typically done by quality department by visually checking to find out whether the risk is a random quality error or serious, recurring quality risk. In some cases, a quality risk was said to be assessed by technically testing the item. Management technique of supplier quality risk depends on the quality risk's nature. However, the interviewees said that most often quality risks are mitigated by raising quality claims with the supplier as well as auditing the suppliers to recognize areas for improvement and corrective actions, response and resolution processes. In addition, the case company has increasingly begun to include standards and quality requirements in supplier contracts. Terminating the contract of non-performing suppliers and not giving further orders to them was seen as a last resort mitigation technique option. Quality risks were said to be monitored by checking and following the percentage of defected components per components received and number of quality complaints raised against a supplier in which supplier key performance indicators (KPIs) were being used. The suppliers were said to participate in the quality risk management by checking the goods at their premises before delivering them to the case company in case of earlier identified, residual quality risks.

The individual delivery performance failures, such as late deliveries, are typically identified by the operative buyers who are the ones that create, and place POs based on the company's needs and receive order confirmations from suppliers. They also communicate with suppliers on a daily basis about the deliveries and possible schedule changes. In the event of possible serious risk of late delivery, such as critical item shipment, the information about the delivery risk most often runs within the company which after assessment and management actions are being considered. However, generally used technique to identify and assess such risk is to review it against the key performance indicators (KPIs) set for the suppliers. The

interviewees also said that weekly or monthly follow-up meetings with suppliers allow delivery risks to be identified based on their suppliers' KPI data on the on-time deliveries. Thus, the assessment of delivery risks is done by checking the number of times the suppliers have met the on-time delivery requirements. Mitigation of delivery risk include utilization of safety stock, which is located close to the case company's factory. Utilization of safety stock allows the continuity of manufacturing operations in cases of short-term shortages due to supplier's late delivery. In addition, the stock enables the case company to "buy time" to come up with a solution in case of more detrimental disruption to their incoming supply. Similar than in mitigating a quality risk, terminating the contract of supplier was seen to be a mitigation option as well even though it wasn't a desirable option. Monitoring of delivery risks is done by checking the level of KPIs, the number of times that suppliers met the on-time delivery requirement, and by regular internal and external meetings. For example, the case company has a weekly meeting between the business departments which enables information sharing between the inbound logistics, materials management and sourcing departments. Such meetings were seen necessities to achieve a better visibility on suppliers' delivery performance level and possible problems as well as development.

The supplier capacity risks are identified and assessed in annual supplier evaluations, supplier visits and weekly/monthly follow-up meetings with suppliers. During the supplier evaluations, the case company purchasing professionals ensure that the capacity of the supplier is sufficient enough to meet the long-term needs of the case company. Capacity is considered through the utilization rate of the suppliers' production capabilities, including labor, material and equipment. The assessment of the suppliers' sufficient capability is done by approximate yearly and monthly forecasts of the case company's demand. The representatives said that the yearly estimated forecast is updated every month and forecasts are shared with the suppliers. The assessment of the capacity is done through the supplier's capability to meet the required demand; in case the supplier is not able to fulfil the capacity needed, the capacity bottleneck must be mitigated. Such risks are mitigated by dividing the case company's overall requirements among multiple suppliers and by market research to find new suppliers. The case company also aim to mitigate such risks by giving their suppliers a time-phased volume forecast which is updated on a monthly basis. Supplier's capacity is monitored through their performance and ability to fulfill the case company's orders.

The performance of suppliers, accuracy of deliveries and product quality issues, is monitored in the case company by a measurement in KPIs. Performance of suppliers is monitored by different business functions as well as in cooperation with suppliers. According to the interviews, some of the case company's key suppliers are also participated in the monitoring phase of the risks by their own KPI reporting and communication of it with the sourcing and quality department. The performance is assessed on a monthly basis and summary of this is reported in KPI reporting of sourcing department. The performance measurement results, such as delivery accuracy and quality issues, are also shared with the key supplier on a regular basis and thus regular, scheduled meetings between the case company and its suppliers were seen an important avenue through which supplier performance is monitored while also enabling building, developing and maintaining an effective relationship between the case company and suppliers. The company representatives said that a clear measurement and monitoring of performance against agreements and strategy/expectations was seen as critical element of SRM.

4.4.3 Sourcing risks

As explained in chapter 4.2., the recognized sourcing risks includes purchasing volume dependence on suppliers, dependence on suppliers due to their production of specified products for the case company or single sourcing situations. Sourcing risk from suppliers is identified, assessed and mitigated during the sourcing of products from the existing portfolio of suppliers by the sourcing department as the department is responsible for making decisions and implementing supply strategies for certain categories of products/components and suppliers in the case company.

Sourcing risk in the case company is identified and assessed in two ways. Firstly, sourcing risk identification and assessment is done by executing a spend analysis of the suppliers and purchases, which indicates the supply volumes in monetary value terms purchased from certain suppliers and overall spent to a certain product category in a fiscal year. The spend analysis also indicates changes in purchase spending over time and therefore addresses situations in which too high level of dependency is at risk of materializing. Secondly, usually after the completion of the spend analysis, purchased goods are illustrated by using Kraljic's (1983) matrix, which gives an indication of the supply market of the purchases. The Kraljic's matrix helps the company to identify and assess the sourcing risks by the nature of sources

(single source, dual source, multi-source), the nature of the buyer–supplier power relationship, as well as criticality and the supply market scarcity of the products. By the matrix product categories and spend, sourcing risks and mitigation plans are checked, changes are done in case needed, and a risk mitigation owner is decided. The spend analysis and Kraljic's matrix is updated once a year when the figures for the financial year are available, and thus, sourcing risks can be seen to identified, assessed, managed and monitored once a year.

The interviewees mentioned that the suppliers or products which are in a danger of actual or impending over-dependency are tried to be further mitigated. Mitigation techniques that are used to prevent and decrease the sourcing risks are to keep and/or start dual sources instead of single sources, keep inventory buffers for critical items, ensuring supplier capacity, conducting market research for new suppliers and practice local sourcing. Inventories include agreements of VMI in suppliers' location, in-house safety stock and use of strategic stock closer to high demand markets. For example, the case company has a high demand in the United States and thus strategic stock is held in the country. Such mitigation techniques are used to decrease the dependency the case company has on its suppliers and ensure customer order fulfill in case of shortage or materialized supplier risk. Sourcing risk monitoring is incorporated into annual or quarterly supplier review meetings in which changes in total spend at the supplier and supplier segmentation are followed.

Supplier risk	Explanatory factors	Identification	Assessment	Mitigation	Monitoring
Financial risk	*Responsibility*	Sourcing & Finance department	Sourcing department		
	Phase	During new supplier selection			Sourcing from suppliers
	Method	-Supplier selection and evaluation policy -Financial database	-Checking the suppliers' financial performance over several years	-Not selecting financially unhealthy supplier	-Following the supplier's growth and development -Checking the credit report databases annually
Delivery risk	*Responsibility*	Sourcing department, Material management department	Sourcing department		Sourcing department
	Phase	When receiving order confirmations from supplier, during delivery			-Regular internal and external follow-up meetings
	Method	-Confirmed delivery date on placed PO -Check delivery accuracy against the key performance indicators (KPIs) set for the suppliers -Supplier notice		-Utilization of safety stock -Placing POs early -Terminating the contract of supplier -Use of alternative transportation solution	-Checking the level of KPIs, the number of times that suppliers met the on-time delivery requirement -Suppliers' own KPI reporting
Product quality risk	*Responsibility*	Sourcing department, Quality management, Production, R&D			
	Phase	Inspection of goods or manufacturing the modules			
	Method	-Visual or technical notice of deviation	-Visual check or technical testing	-Raising quality claims - Terminating the contract of supplier Supplier audits -Quality requirements in supplier contracts	-Checking and following the percentage of defected products per products received and number of quality complaints raised against a supplier (KPIs) -Suppliers' own KPI reporting
Capacity risk	*Responsibility*	Sourcing department			
	Phase	Annual supplier evaluations & during sourcing from suppliers			
	Method	-Checking the utilization rate of the suppliers' production capabilities (including labor, material and equipment)	-Supplier's capability to meet the required demand	-Order allocation -Market research for new suppliers -Giving suppliers a time-phased volume forecast	-Supplier performance and ability to fulfill the case company's orders
Dependency risk	*Responsibility*	Sourcing department			
	Phase	During sourcing from suppliers			
	Method	Performing a spend analysis to indicate the total volume in monetary value terms purchased from a certain supplier and spent to a certain product category in a fiscal year (→ changes in purchase spending over time and aims to identify situations in which over-dependency is at risk of occurring Use of Kraljic's matrix to identify and assess the sourcing risks by the nature of sources and the nature of the buyer–supplier power relationship, as well as criticality and the supply market scarcity of the products		Decreasing the level of dependency on suppliers by dual sourcing, market research to find alternative suppliers and/or products, local sourcing, ensuring supplier capacity, keep inventories (VMI)	Annual or quarterly supplier review meeting in which changes in total spend at the supplier and supplier segmentation are followed

Table 5. Summary of the case company's SRM process

4.5. Challenges and barriers

One of the questionnaire questions was about the case company's overall satisfaction with the current state of SRM performance in their organization on a 1–10 scale, 1 being "*completely dissatisfied*" and 10 being "*completely satisfied*". The case company representatives rated the company's current SRM performance as being 5,5. Therefore, challenges and barriers were recognized, and further development and improvement were said to be desirable so that the company could fully achieve the benefits of SRM.

The questionnaire respondents identified several challenges and barriers in implementing SRM in the case company. The main challenges and barriers included the followings: Lack of trust with supplier, Supply focus is on competitive approach rather than collaborative approach, High level of dependency on supplier, Lack of information sharing (internally & externally), Lack of sufficient technology and tools, and Lack of SRM competencies and skills. These statements are illustrated in Figure 10, which shows that the biggest challenges and thus barriers in the case company is lack of SRM competencies and skills as well as lack of sufficient technology and tools. In addition, lack of information sharing both, internally and externally, and high dependency on supplier were seen to have a high influence on challenging SRM.

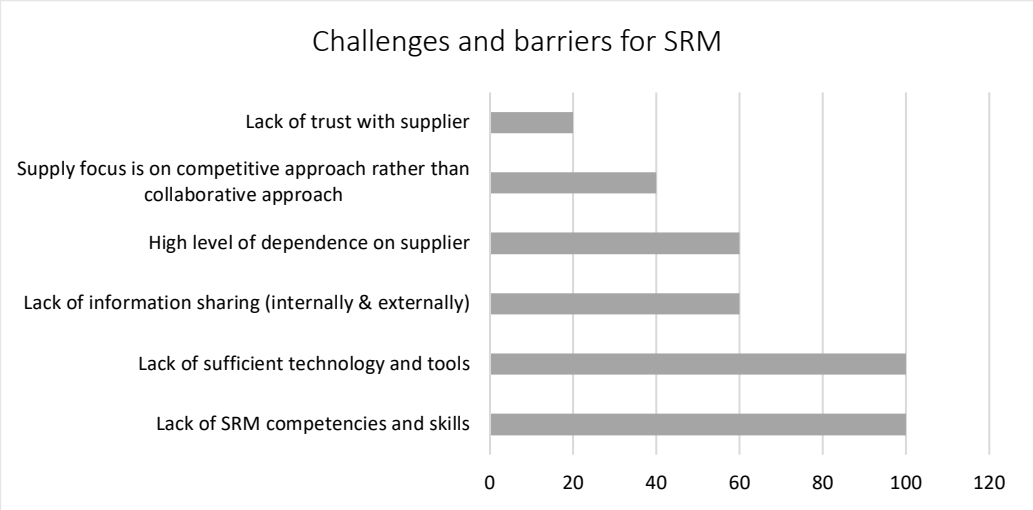

Figure 10. Challenges and barriers for SRM

SRM competencies were perceived as deficient largely due to unclear and unsystematic SRM system, processes and structures within the case company as well as lack of resources and time. Due to an absent SRM system, the case company's SRM was seen to be heavily reliant on employee competencies and decision-making skills. One of the interviewees stated: "*Both are needed, the competencies of the employees working for SRM as well as system to drive SRM*". Without the SRM system, decision-making was seen to be subjective. The respondents suggested that the case company's competencies and skills towards a better SRM could be improved by establishing a clear supply management process in which SRM would be implemented in too. To succeed in the SRM, the respondents suggested a creation of a manual which includes a clear governance structure with responsibilities and process steps for the management of supplier risks. Also training for better risk identification and assessment techniques, manufacturing methods and better abilities to understand suppliers' financial aspects were seen to be needed.

The respondents evaluated the case company's current SRM tools and manuals being poor for their informative and practical needs as the average questionnaire score was 4,2 on a scale on a 1–10 scale, 1 being "*completely dissatisfied*" and 10 being "*completely satisfied"*. Even though the company has created some tools and policies related to SRM, such as Kraljic's matrix, auditing checklist, excel based tables and supplier policies, the respondents experienced that a comprehensive and proactive SRM supportive tool is needed as the currently used tools were seen to be fragmented and limited to execute SRM in a proactive way. In addition, the respondents said that some of the policies were not monitored after supplier had committed to them, for example the company's code of conduct. The case company professionals also said that the case company isn't leveraging technology at its fullest and, for example, IT was seen as a good and efficient method to obtain actual performance assessment and better visibility. For example, the case company's IT system isn't compatible with their key supplier's IT system which was seen to decrease the visibility of information exchange. However, the case company representatives were able to follow their suppliers' VMI stock levels. To identify and assess supplier risks, respondents suggested applying standardized supplier risk tools through the organization which would bring together the requirements of different departments and comprehensively cover the various supplier risks and numerical scales of their importance (case company's risk appetite).

The results also revealed that the SRM challenges and barriers in the case company don't in turn relate to the company's focus on SRM costs rather than benefits, lack of interest and support from top management, Supplier's unwillingness to involve in SRM or Lack of strategic coherence. However, even though lack of SRM support and interest from the top management was not seen a challenge or barrier within the questionnaire results, the statement was raised as one during the interviews. Interviewees explained the case company's current state of SRM by top management's interest and focus on downstream supply chain, such in sales, rather than in upstream supply chain. The interviewees saw that generally the importance of supply was undervalued within the company and mentioned that ability to respond effectively to supplier risks require the availability of resources and the willingness to apply them. As one interviewee stated: "*Supplier risk management, and risk management in general, should be a part of purchasing professionals' daily work*". Therefore, SRM should be rooted in the company's purchasing culture which requires managerial interest and support for SRM. Some interviewed professionals also saw that the case company's rapid growth has resulted challenges to proactively manage supplier risks as the focus has rather been on ensuring the security of supply continuity by series of ad-hoc actions, and decision-making after materialized supplier risks. Lack of resources was largely recognized as challenge and barrier as well.

4.6. SRM desired outcomes, success factors and best practices

The case company sees its suppliers as outsourced resources that should be managed similarly than the case company. Interviewees stated that they wish to maintain integrated and long-term relationship especially with their key suppliers in order to get assist in dealing with uncertainties and to get ware of risks as soon as they become apparent for the supplier. SRM was also seen to drive mutual benefits with their suppliers as reduced and avoided risks can be seen, for example, as saved costs and better performance of the supplier as well. It was recognized that a proper SRM would reduce the frequency of supplier risks and improve both, the company's short and long-term performance as well as improving the company's competitive advantage. The respondents identified several benefits for SRM which are illustrated in Figure 11.

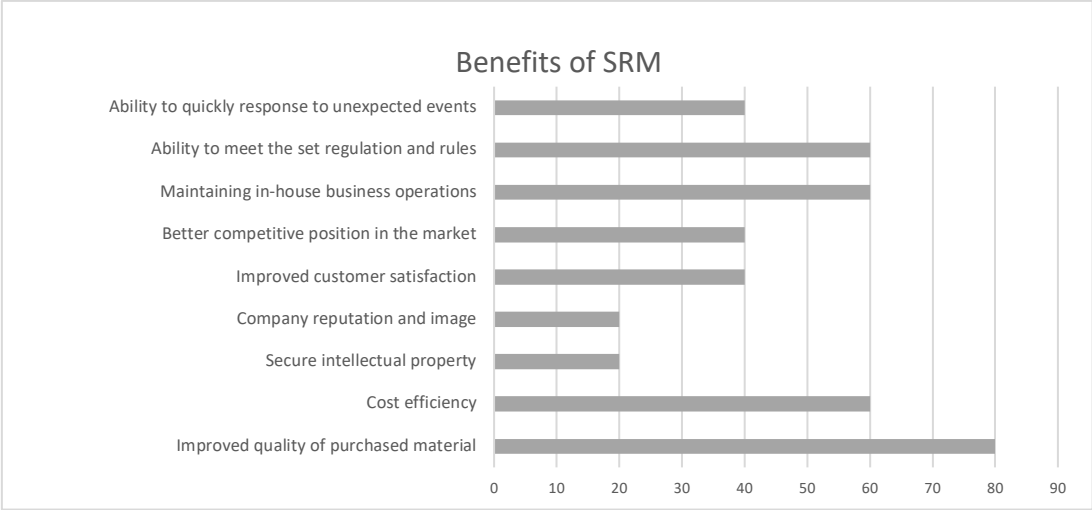

Figure 11. Benefits of SRM

As seen from the Figure 11. the key benefits utilizing SRM include improved quality of purchased material, cost efficiency and continuous in-house operations as well as compliance with set regulations and rules. The case company operates in an industry under strict quality standards and thus meeting the regulations is highly important. In addition, SRM was recognized to foster quicker ability to response to unexpected events due to supplier failures and improve the company's position in the market while creating customer satisfaction. A few respondents also said that SRM benefits the company's reputation and image as well as provides more secured intellectual property. In addition, one of the interviewed professionals suggested that a proactive SRM was also seen to improve efficient resource and order allocation in the case company as the riskiest suppliers and/or parts were identified allowing the company to primarily focus on their risk management.

To achieve the desired outcomes and benefits of SRM, the respondents recognized several drivers and success factors of which some are dependent on the company itself, but some also require the input of suppliers as well. The drivers and success factors which are illustrated against the questionnaire results are shown in Figure 12.

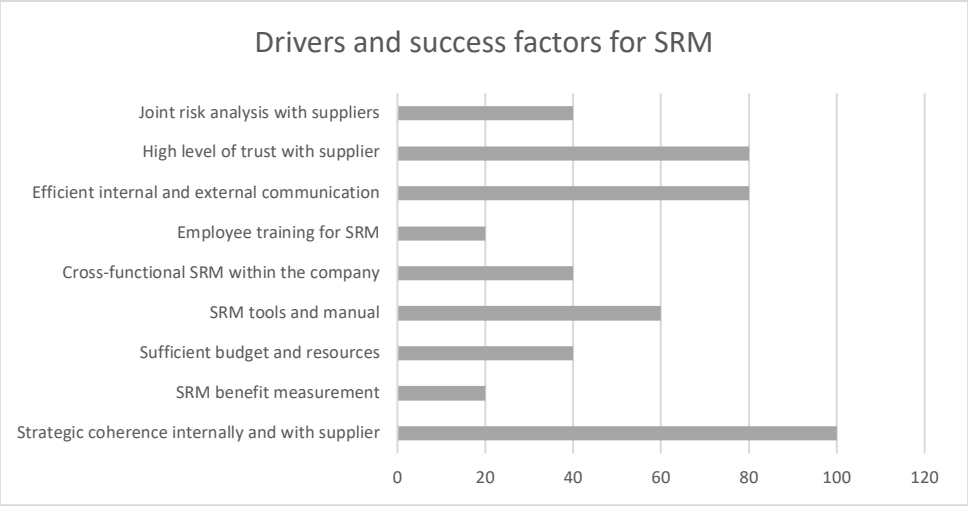

Figure 12. Drivers and success factors for SRM

As the most critical SRM success factor, the respondents recognized the internal and external strategic coherence. The respondents saw that strategic coherence requires a balance among the case company's supply and business strategy but strategic alignment with suppliers. Therefore, it was said to be important to work with suppliers who can commit to same strategic initiatives and objectives. Other critical drivers and success factors illustrated in Figure 12, include high level of trust with supplier, efficient internal and external communication, SRM tools and manual, joint risk analysis with suppliers, cross-functionality within the company, sufficient resources, employee training and SRM benefit measurement. The interviewees said that high level of mutual trust is achieved by holding on to what has been agreed, open and truthful communication, prompt payments, self-imposed disclosure of failures and sharing information, for example, about the demand/ capacity volumes and future outlooks. Therefore, a close supplier relationship and trust were not seen to work without another.

Internal communication was seen to be a success factor too as it was seen an avenue to inhibit discussion of how different risks interact. One interviewee stressed that to succeed in SRM the purchasing professional who is primarily responsible for the supplier selection, should do the selections and evaluations of potential supplier candidates in dialogue with other company departments to find out the best criteria attributes. According to the interviewee the basis for supplier risk management lies in supplier selection and thus the selection of right set of supplier criteria for a certain purchasing situation and part is highly important. Another success factor that was brought up during an interview, was a high level of visibility.

Visibility was seen as a factor to foster the case company's ability to predict and proactively act against potential disruptions from suppliers as well as to have accurate, updated, and relevant information and knowledge of their suppliers' operational and strategic issues.

Most of the key SRM organizational competencies, employee skills, the respondents mentioned related to manufacturing business know-how, such as understanding the common industry processes, characteristics and environment. An in-depth knowledge of their suppliers' supply chains, operational techniques and processes were seen to increase the ability to identify potential risks and their root causes which again was seen as an aim for the risk management. In addition, interpersonal, such as negotiation skills and supplier relationship management skills were seen to be important as SRM was seen to be done in dialogue with both, internal and external stakeholders. Some respondents also highlighted that to be able to success in SRM, different risk management phases and techniques need to be understood as without risk management skills the identification, assessment, mitigation and monitoring of supplier risks is difficult and often left for less attention in daily work. Suppliers' willingness and joint activities towards SRM were seen to be crucial as otherwise important potential risks could be ignored. In addition, purchasing professionals' ability to build a holistic picture in supplier risk return trade-off situation was recognized as a success factor. This was seen to be an important skill in supplier selection and order allocation situations in which purchasing professional must make a decision on whether to accept a higher risk associated with a probability of higher return or decide not to take the risk and accept a smaller return.

When it comes to techniques and approaches, the respondents saw that the best practices for SRM in terms of realizing the benefits included use of dual or multi-sourcing strategy, build of strategic partnerships with suppliers, utilization of detailed contractual policies and arrangements, practice of risk-oriented pre-assessment for new suppliers, regular internal and external follow-up meetings, conduct of supplier side-checks, continuous evaluation of suppliers and market research, as well as use of safety stock. Dual or multi-sourcing was seen as the safest option for the critical purchases to avoid any significant disturbance. Thus, the case company has sought to move towards a more flexible supply base and introduced dual and/or multi supplier strategy in most of its item categories. Single sourcing was in turn rather seen as a driver for higher supplier risk exposure, especially in cases of supplier

bankruptcies and supply shortages. The respondents also saw that supplier site-checks during visits or auditing suppliers were necessities as such checks helped to identify and assess possible risks at the supplier's premises and its culture while giving a basis for designing and implementing responses to the observed risks. In addition, contractual policies, such as code of conduct, were said to be important risk transfer technique and supplier contracts were said to be good for SRM when product quality requirements and sanctions regarding contract violations were included in them.

Even though having safe stock was seen with some downsides, such as higher inventories resulting reduced cost-efficiency, many interviewed professionals stressed its importance regarding to SRM. Safety stock, especially supplier-managed inventories, were seen an efficient technique to execute reduction of uncertainties and avoid supplier risks as they allow the supply continuity and increase the case company's reaction time in risk events. Also, regular follow-up meetings with internal stakeholders as well as with suppliers were seen as best practices for SRM as they enabled efficient communication, evaluation and information sharing and thereby a higher level of visibility on risks. Last, but not least, the case company respondents stressed the importance of continuous analyzation of existing suppliers' capabilities, strengths and weaknesses, as well as conduction of market research for new supplier selections and opportunities.

5 DISCUSSION AND CONCLUSIONS

The following and final chapter will present the key findings of this study by concluding what the thesis has extracted from the literary (literature review) and empirical (case study findings) parts of the study. Thereby, this chapter will discuss the found similarities as well as differences between the literature review framework and study findings, provide answers to the research questions and objectives, and introduce managerial implications for the case company as well as other manufacturing industry companies. This thesis finishes with dimensions, in which the research validity and reliability are discussed and suggestions for further research will be identified.

5.1. Empirical findings and discussion

This thesis discussed supplier risks and their management. The study framework was created by utilizing existing supply chain and supply management literature referring to supplier risks and their management though SRM process and SS. Moreover, the most typical and well-known approaches, best practices, benefits as well as challenges and barriers for SRM were extracted from literature and earlier studies. The objective of the framework was to create a basis for the topic and analysis of the case study that discussed supplier risks and SRM in a context of manufacturing industry. When the case study findings were analyzed and compared to the literary framework, similarities as well as some differences could be found. Therefore, in this chapter the study findings are discussed against the framework to provide a more in-depth understanding of the case company's supplier risks, SRM maturity and supported practices as well as experienced SRM benefits and challenges.

The findings of the study are mostly in line with the existing theories in terms of SRM processes, risk means and best practices although some differences were also obtained. However, more similarities were found in SRM benefits, success factors, challenges and barriers even though some were recognized above others. Importance of SRM has been highlighted especially in the recent supply management literature and within practitioners even though a study of PwC (2013b) revealed that most companies are still lacking a sufficient and especially proactive SRM implementation and practices. Findings of this study strengthen the former as the importance of SRM and the proactive management approach were recognized in the case company as SRM was seen to bring many benefits by reducing

the frequency of supplier risks resulting improved organizational performance and competitive advantage. However, consistent with the results of PwC (2013b), the study findings revealed that structured and systematic SRM was still lacking even though progress towards proactive SRM had been recently done through, for instance, value stream mapping. According to the SRM maturity levels introduced by PwC (2013b, 13), the case company of this study is on the second level as its SRM relies still mostly on buffer planning. Thereby, the study findings of SRM maturity level are compatible to the ones of PwC (2013b, 13) which revealed that most companies have an immature SRM and thus are placed on the second level of maturity illustrated in the Figure 9.

The supplier risks in manufacturing industry, according to the study findings, relate primarily to poor or unstable suppliers' financials and performance such as late deliveries, poor product quality and insufficient volume capacity. In addition, the study findings suggest that supplier risks in manufacturing industry concern high dependency on supplier, sustainability, lack of suppliers' competitivity and capability to, for instance, innovation. The framework stresses manufacturing industry supplier risks relating primarily to physical sub-chains which are referred as suppliers' performance risks in this thesis. Therefore, the study findings enrich and reinforce the manufacturing industry set of supplier risks as the ones found by the study refer to the risks illustrated in Table 1 introducing different types of supplier risks concerning multiple fields and industries. Furthermore, the study findings suggest that supplier related financial risk should be treated as a root cause, for example, to supplier performance risks and therefore the supplier financial risk should be treated with high importance. Financial risk in the literature review and Table 1 was rather identified as a type of supplier risk than a root cause for other possible supplier risks arising from suppliers' financial issues.

The study findings support a study of Micheli et al. (2009, 175-176) stressing that supplier selection and evaluation must be viewed under SRM considerations and must be thereby treated as a base and preventative mean for SRM. Selection of reliable, good suppliers and on the contrary avoidance of high-risk suppliers in the case company was recognized to be an important risk mean in which supplier pre-assessment criteria under supplier risk considerations, as well as risk identification and assessment through supplier audits and manufacturing side-checks were seen to play important roles. Furthermore Micheli et al.

(2009, 175-176) highlighted that to be able to derive SRM through SS phase extensively, structured supply processes should be established and recognized as well as pre-assessment criteria must be considered in qualitative measures. The study findings support the former too because deficient maturity of the case company's supply processes was seen as a barrier to proactive extensive risk identification in SS phase. Determining quantitative weights for supplier criteria attributes was seen to foster better SRM performance by the interviewed purchasing professionals as well as literature review because evaluation by quantitative means reduces subjectivity in decision making. The study findings are in line with conclusions of Giunipero & Eltantawy (2004, 710) and De Boer et al. (2001, 78) as it was suggested that selection of supplier requires more risk considerations when the purchase situation is novel and highly critical or complex. The study findings emphasize that in manufacturing industry supplier evaluation requires prototyping of samples obtained from the supplier and pre-production run. Moreover, in accordance with Giunipero and Eltantawy (2004, 703), the findings suggested that the final SS under SRM must be based on TCO perspective.

As the study findings suggest, the case company is to an increasing degree dependent on supplied products that require high level of co-design with suppliers resulted more in-depth and proactive SRM considerations practiced during SS phase. This study finding is aligned with the one of Micheli et al (2009, 862) who pointed out that the need of co-design pushes a company to focus deriving proactive SRM through SS phase due to the difficulty in overcoming the risk related to supplier incapability in co-design.

Approaching SRM by a linear and structured risk management process was highlighted in the literature review. However, the study findings revealed that the case company's SRM maturity isn't yet on the highest level and therefore, risk management process as a whole was not recognized as a formal SRM process in the case company but the process phases were used in isolation. Thereby, the study findings support the case study results of Sarker (2009a, 434), who suggested that SRM derived through a systematic and structured process to identify, assess, reduce and monitor a risk isn't often realized within companies but rather through different supply management practices. Moreover, the study findings supported the fact that most companies are lacking a centralized risk management function including management of supplier risks and therefore, supplier risks are mostly managed by the

purchasing professionals together with other internal business functions and suppliers. The SRM phases in the case company used different risk means depending on the type of supplier risk. The type of supplier risk also defined the amount of resources and time, such as number of actors and departments involved in SRM.

When it comes to SRM best practices, the study findings pointed out that as the supply strategy varies from a purchasing situation to another, so does the SRM strategy. The case company delivers supplier segmentation through Kraljic's matrix and spend analysis and thus the case company's used supply strategies towards supplier risks are comparable to the one's suggested by Kraljic's (Kraljic, 1983, 111). Use of Kraljic's matrix was experienced to be an easy and illustrative way to determine supply strategies as well as approach risk identification and assessment which was also suggested by Govindan & Jepsen (2016, 343). The findings suggest that the safest supply strategy regarding SRM is selecting local or near sources, few-tier suppliers and sourcing at least from dual sources which is in line with findings of Ellegaard (2008, 430-431). Even though dual or multi-sourcing was seen the best supply strategy and thus a best SRM mean in most product categories, single sourcing was seen a better strategy for products that don't have high enough volumes or suppliers' involvement in product development or investments in equipment/new technology is required. This is in line with the conclusion of Blome and Henke (2009, 131) who suggested that neither single nor dual sourcing is safer or better risk mean than another as it depends on the business environment and purchasing situation in concern. However, the findings highlighted that the use of dual or multi-sourcing strategy, build of strategic and close partnerships with suppliers, detailed contractual policies and arrangements, risk-oriented pre-assessment for new suppliers, regular internal and external follow-up meetings, suppliers' side checks and auditing, continuous evaluation of suppliers and market research, as well as use of safety stock were generally seen the best means for SRM and thus practiced in the case company. These findings relate to the SRM techniques introduced in chapter 2.4. However, the literature review suggests that companies these days must focus on proactive SRM methods while a study of Thun et al. (2011, 5511) found out that inventory buffers are still typically used especially among SMEs. The study findings revealed that utilization of inventory buffers especially for the most critical items is crucial in manufacturing industry as even a short-term materialized supply disruption may have detrimental consequences to the purchasing company's in-house manufacturing processes. Therefore, the study findings

highlighted that SRM in requires both, proactive means to prevent and minimize the supplier risk before it materializes and reactive means to take after a materialized supplier risk. A conclusion can be drawn that use of some level of safety stock is preferable and a critical mean for SRM in manufacturing industry.

The study findings suggested that the key challenges and thus barriers for implementing SRM in manufacturing industry relate to lack of SRM competencies and skills as well as lack of sufficient technology and tools. In addition, lack of information sharing both, internally and externally, and high dependency on supplier were seen challenge SRM. SRM competencies in the case company were perceived as deficient largely due to unclear and unsystematic system for SRM, lack of structured supply processes as well as lack of resources and time. Thus, the findings are largely in line with challenges and barriers presented in chapter 2.6 even though the findings didn't recognize risk cost/reward trade-off or interconnection of individual risks being real SRM challenges which in turn the literature review highlighted. The study findings suggested in accordance with the literature review that SRM is resource and time intensive which highlights the importance of organizational willingness, sufficient resources, managerial support and interest towards SRM. Other SRM success factors recognized by the study findings included internal and external strategic coherence, high level of trust with supplier, efficient internal and external communication, SRM tools and manual, joint risk analysis with suppliers, cross-functionality within the company, employee training and SRM benefit measurement. These success factors refer strongly to the six factors identified by PwC (2013a, 31-32). Study findings also emphasized the vitality of selecting the right set of supplier criteria depending on the purchasing situation. Visibility was seen to foster the company's ability to predict and proactively act against potential disruptions from suppliers as well as to receiving accurate, updated, and relevant information and knowledge of issues related to suppliers' operations. Similarly, Tse and Tan (2012, 51) emphasized that high visibility and information sharing are the success factors of SRM. Study findings also proposed that an appropriate SRM requires rooting a risk management culture within the company which was also recognized by Pfohl et al. (2010, 40).

5.2. Answering the research questions

The main study results are introduced in this sub-chapter by answering to the research questions and objectives introduced in the beginning of this thesis. The research sub-questions of this study were formulated to support finding an answer to the main research question; *"what the key supplier related risks in manufacturing companies are and how can they be managed (identified, assessed, mitigated and monitored)?"*. Therefore, an answer to the main research question is provided at the end of this chapter after each sub-question is answered first individually. The research questions are being answered based on the extractions of empirical data which allowed answering the questions in moderate detail.

Research sub-question 1: How can supplier risks be identified and prioritized?

Supplier risks can be identified by risk-oriented pre-assessment of new suppliers by defining selection criteria attributes to ensure that suppliers meet the requirements of purchasing company and suitability for a dyadic relationship. Supplier audits and production factory visits at suppliers' premises enable identification of supplier risks via observation and questioning. Supplier risks can be also identified by utilization of public database information, risk check-lists, value stream mapping, purchasing policies and questionnaires, historical performance reports and references. Continuous analyzation of business environment as well as suppliers' opportunities and threats may reveal some new risks and therefore it is an important proactive risk identification mean. In addition, internal and external follow-up meetings, information sharing with suppliers, certification, knowledge of purchasing professionals and supplier recommendations help the identification of supplier related risks and their level of criticality. Furthermore, prototyping of samples and pre-production run before starting the actual production may reveal possible supplier risks especially in product quality and suitability matters.

Supplier risks can be prioritized by calculating the total spend on supplier and creating a spend analysis to as well as use Kraljic's purchasing portfolio model (Kraljic, 1983), which help to recognize the most risk-prone purchases and suppliers by segmenting them into categories and providing thereby a rank of suppliers or supplies based on their risk level. When it comes to supplier segments, the strategic (high importance/high spend) suppliers should be prioritized. Furthermore, cases in which purchasing situation is complex, novel,

single-sourced or highly critical due to purchasing company's operational continuity should be given more SRM efforts.

Research sub-question 2: What are the best means for SRM?

Supplier risks can be either transferred, accepted, eliminated, reduced or further analyzed. The best means in SRM include integration of risk considerations in the supplier selection and evaluation process which means defining company's acceptable risk level, determination of risk-oriented pre-assessment supplier criteria and evaluation of supplier candidates on the set criteria and accepted risk level to mitigate supplier risk proactively. In general, supplier risks can be mitigated by cooperating with good market players, suppliers with long history and reputation, as well as high quality and reliability.

The best means for managing supplier risks include both, proactive and reactive approaches. Even if SRM process isn't linearly followed, the process phases of SRM are important to recognize to be able to manage risks systematically and proactively. Best means for SRM include use of multi-sourcing (or dual-sourcing), inspection or technical testing such as prototyping and preproduction, inventory buffers, ensured supplier capacity based on time-phased volume forecasts, market research for new suppliers and practice of local or near sourcing. Inventory buffers include agreements of VMI in suppliers' location, in-house safety stock and use of strategic stock closer to high demand markets. Also, building long-term and strategic relationships with suppliers, regular internal and external follow-up meetings, supplier audits and visits are important. Successful SRM require a high level of visibility and transparency which can be achieved via an efficient communication, collaboration, mutual trust and information-sharing. Finally, analyzation of suppliers' capabilities, strengths and weaknesses, supplier review checking, and risk-oriented contractual policies are important.

Research sub-question 3: What are the desired outcomes and challenges for SRM?

The desired SRM outcomes relate primarily on competitive and strategic advance impacting both, company's short and long-term performance positively. SRM enables a company an improved ability to act quickly on events that include uncertainty or in materialized supplier risk events while minimizing the potential losses. Therefore, SRM reduces the frequency of supplier risks and the main desired outcomes relate more precisely to improved material

quality, meeting the set regulations and rules, ensuring capacity, increased customer satisfaction and value creation, cost efficiency and keeping the company's reputation and image good as well as its manufacturing processes lean and continuous. SRM was also required to provide more secured intellectual property.

The main challenges and thus potential barriers concerning implementation of SRM relate primarily to lack of resources and time, lack of SRM competencies and skills, insufficient tools and systems as well as lack of internal/external communication and high level of dependency on suppliers. Without a proper SRM system and tools decision-making is highly subjective and thereby heavily reliant on employee competencies, willing and decision-making skills. Successful SRM requires proper level of strategic supply management, leveraging of technology, risk-oriented purchasing culture, managerial attitude and interest towards risk and ability to calculate the trade-off between the reward and risk mitigation cost.

When summarizing and concluding the answers of the three sub-questions and analyzing the empirical findings further, the main research question could be answered. The main research question aims to investigate what the key supplier related risks in manufacturing industry companies are, and how they can be effectively managed.

The key supplier related risks in manufacturing industry companies relate mostly to physical sub-chains but also to financial- and relational sub-chains. These risks are supplier performance risks, such as suppliers' poor product quality, late deliveries and lack of production capacity; dependency risk on suppliers; supplier financial risk; and supplier sustainability risk. Supplier performance risks were seen to have direct and detrimental consequences in the company's operational performance if materialized. Also, dependency risk on suppliers was seen to be critical especially in cases where the power relations are imbalanced leading to supplier lock-in situations and high switching cost hampering proactive SRM manner. Supplier financial risk is a key supplier risk as well, because suppliers' poor financials act as a direct supplier risk but also as a root cause for other supplier related risks. Sustainability risks were seen to be in an increasing importance due to regulation and stakeholders' requirement towards it as well as such risks' impact on the company's reputation if materialized. Therefore, sustainability was also recognized as a key supplier related risk.

SRM is time and resource intensive business function in which cross-functionality within a company as well as cooperation with suppliers is important. SRM can be conducted through supply management practices in which the risk management process phases are used in isolation. Supplier risk identification, assessment, mitigation and monitoring use different techniques depending on the type of supplier risk, risk owner and purchasing situation. Supplier risks should be primarily considered, identified, assessed and mitigated in the SS phase (in the beginning of sourcing process) by defining risk-oriented pre-assessment criteria for new suppliers and then evaluated based on the company's risk appetite. Beside the supplier selection criteria attributes, the best means for identification and assessment of supplier risks in manufacturing industry include, supplier audits and site-checks, prototyping of samples and pre-production run before starting the actual production, continuous business environment analyzation, internal and external meetings, as well as use of purchasing policies and supplier historical performance reports. Methods, such as use of check-lists and supplier database information, share of time-phased and regular information with supplier, certification, check of supplier recommendations and utilization of organizational knowledge and experience towards suppliers help the identification as well as assessment of supplier risks. Identified supplier risks can be assessed by segmenting purchases and suppliers to find out the most critical nodes and organizational needs or by considering the suppliers' risk levels by qualitative or quantitative scorings. As a rule of thumb, it can be considered that strategic and key suppliers, single sourced items, complex and novel purchasing situations should be given more SRM efforts as well as more focus paid on the high probability risks of losses and future recurs. Furthermore, SRM should focus more on SS phase when supplier involvement in product development is needed and SRM process phases when dealing with existent supply base portfolio suppliers.

Before selecting a strategy for risk mitigation, supplier risk cost-reward trade-off, available mitigation strategies and supply strategy in question must be considered. Therefore, SRM methods should be considered simultaneously when making strategic decisions concerning supply. The best ways to manage supplier risks in manufacturing industry companies include use of multi-sourcing (or dual-sourcing), inspection or technical testing of material, inventory buffers for critical items, regular evaluation of existing suppliers, sharing on time-phased volume forecasts, market research for new suppliers and practice of local or near sourcing. Inventories include agreements of VMI in suppliers' location, in-house safety

stock and use of strategic stock closer to high demand markets. Also, build of long-term and strategic relationships with suppliers, regular internal and external follow-up meetings, supplier audits and visits are important means for SRM. Monitoring of supplier risks should be done regularly and in dialogue with internal business units as well as with suppliers. Analyzation of business environment, such as changes in industry and trends, regular supplier performance reviews based on KPIs, as well as future outlook of suppliers are important channels for supplier risk monitoring.

As companies are increasingly dependent on their suppliers, it is necessary to manage supplier related risks to secure continuum of the in-house operations and understand the dynamic environments and their trends through suppliers acting as respected advisors and industry professionals. Successful SRM requires a high level of visibility and transparency with suppliers as well as strategic coherence internally and externally. Furthermore, managerial interest and overall willingness towards SRM and its implementation are important. Main SRM challenges to tackle relate to lack of sufficient technology and tools, lack of competencies and skills, high dependency on suppliers as well as lack of internal and external information sharing.

5.3. Managerial implications

As mentioned in the introduction chapter, SRM is still an evolving topic in supply chain and purchasing literature and thereby more empirical research of it especially in real business environment is needed. Even though this study has some limitations, it contributes to the set framework in the field of supplier risks and SRM and thus also explodes some important managerial implications along with the author's own view on the topic. As a result, the managerial implications of this sub-chapter are extracted from the main findings from both the literature review and the empirical part. The main contribution of the study is the investigation of supplier risks, supplier selection and SRM process in manufacturing industry company, which describes the cross-functional process phases of SRM in isolation and through supply management practices. SRM is clearly important in today's dynamic and highly networked business environment in which companies' dependency on suppliers has increased and as initiatives for global sourcing and cost-efficiency continue to increase, the supplier risk exposures continue increasing too. Because of the threatening supplier risks may entail, companies must realize the importance of managing such risks in a proactive

manner. Utilization and relying completely on reactive strategies aren't neither cost-efficient nor an enabler to decrease the chance of detrimental events from materializing in the supplier network.

Existing research or literature don't seem to provide SRM strategy that would work for all companies or purchases. Even though SRM process system wouldn't be linearly followed, it is important for managers to understand and recognize the process phases, include them into supply management practices and review the phases and process as a whole on a regular basis. If companies want to succeed in their SRM efforts, the author suggests that one of the first requirements is a well-developed SRM process, reflecting as high maturity as possible and practiced cross- functionally within the company. Without precisely defined processes, there is an opportunity of spontaneous, objective and non-systematic action. Identifying of potential supplier risks should be treated the most important as ignored risks cannot be proactively managed.

For the risk assessment, the author stresses the importance of determination of company's acceptable risk level which is often referred as risk appetite. Risks should be assessed by utilization of risk assessment scales by considering the probability and impact dimensions and later visually illustrate the assessment results. By that, prioritization of supplier risks and recognition of critical nodes in the upstream supply chain can be found and further prioritized. When selecting and implementing the risk management technique, managers should be aware of the available means for the company while take account the supply strategy and cost of management compared to the potential reward. Managerial as well as employee competencies are highly important in SRM of which risk management, decision-making, interpersonal and supply management skills including knowledge of processes and manufacturing business characteristics are the most critical and therefore training for the previous is suggested if needed. Managers shouldn't either underestimate regular risk monitoring especially in residual or repetitive supplier risk cases.

To avoid supplier risks arising from inaccurate assessment of supplier competencies, managers shouldn't forget to take into account the possible supplier related risks, uncertainties and risk mitigation techniques when selecting and evaluating suppliers. Therefore, the author suggests that SS should be seen as an important preventative SRM mean and supplier criteria attributes should be carefully defined under supplier risk

considerations in cooperation with different business unit departments. Most important criteria should be later determined and assigned with a specific weight in accordance with the company's risk appetite and supply requirements. Therefore, it is suggested that when selecting new suppliers, supplier risk assessment need to be integrated in SS process as the supplier candidates should be quantitatively scored based on their performance on the criteria attributes. Quantitative scores drive more objective supplier evaluation as a better consensus between the people working with purchasing and SRM. In addition to the supplier evaluation, qualitative supplier scores enable purchasing companies to monitor high risk suppliers and different supplier risks while providing the overall supplier risk level of the company's supplier portfolio. The supplier criteria should be defined according to the purchasing situation and include both, operational and strategic compliance considerations. This is because, the study findings pointed out that one of the main success factors in SRM is strategic coherence with supplier.

As a managerial implication, the author also proposes overall supply management process improvements and integration of SRM within it so that a clear governance structure and organizational responsibilities as well as process phases and their key content toward supplier related risks could be drawn. Furthermore, developing a comprehensive system to perform both, SS and SRM process based on the same risk criteria and their consecutive coordination could lead to higher SRM performance and enable more efficient resource and time allocation towards SRM. As suggested earlier, SRM should be practiced cross-functionally and thus employees from different departments should be aware of possible supplier risk sources and the right ways to react on them. Therefore, also employee training towards SRM practices and phases is important. To help and guide the work toward SRM, the author suggests an establishment of SRM tool and manual. Moreover, SRM requires available resources as well as willingness to allocate resources on it, and therefore, the importance of SRM need to be recognized and rooted in the company's purchasing culture in which managerial interest and support are important. In addition to the mentioned success factors, information sharing, organizational wide consensus on SRM, and internal strategic coherence should be paid focus.

The managers should also recognize the advantages of IT system utilization in SRM and compatibility with the ones of suppliers to increase visibility on risks. To cite Bakshi and

Kleindorfer (2009, 584), the supply chain is as strong as its weakest node, and therefore a disruption at supplier can cause a disruption not only to the purchasing company but also to its whole downstream supply chain. Due to that, SRM should go beyond the boundaries of the company by introducing supplier collaboration towards risks. SRM participation of suppliers is important as it often increases the level of visibility on supplier risks in its entirety such as supplier network risks that could arise from second- or third-tier suppliers. By an extended upstream supply chain SRM a company achieves a more comprehensive picture of potential supplier risk exposures and is thus able to mitigate the overall supply chain risk. As a managerial implication in can be concluded that companies' abilities in supplier relationship management and management of key suppliers, level of strategic supply as well as both, internal and external resources, are connected to the performance level and thereby maturity of SRM. Managers should view SRM with a long-term perspective and focus primarily on SRM considerations in SS in case of new suppliers, and more on SRM process phases when considering risks of existing suppliers. Therefore, the author sees that a level of strategic supply management influences the SRM maturity.

5.4. Validity and reliability

The quality of a research can be viewed through the concepts of validity and reliability. The level of validity and reliability of this research was partly referred to in limitations sub-chapter 1.3. Research reliability advert to the absence of random errors so if the research was repeated, the outcomes of the research would be the same whereas validity, in turn, refers to the extent the research investigates what is claims to investigate (Farquhar, 2012, 101-102). Thus, the better the set research questions and objects are being answered, the better the research validity.

Stuart et al. (2002, 425) suggest that use of various data collection sources and documenting the research phases improves the research validity. For this reason, it is important to describe the data collection methods and the research steps, which were already introduced in this research. Observation, use of company documents and questionnaire provided satisfying data for the research with was deepened and enrichened with the semi-structured interviews. The questionnaires and interviews were carefully designed in order to be relevant and to have a clear insight into the purpose of the study and the pertinent information required for

analysis. Moreover, all the case company participants in the research were introduced to the subject and they were also sent the research questions in advance which allowed them to get familiar with the research and prepare themselves for the interviews. The documents used for this research are available for recollection and reanalysis which benefits the outcome reliability. In addition, the questionnaire results were documented the same way they were received, and the interviews were audio-recorded and partly transcribed, which improve the research reliability as well. However, the interviews were conducted in Finnish and later translated into English which may have an influence on the reliability of the interpretation and discussion, as during the translation the original meanings and perspective could have been adopted.

5.5. Further research suggestions

Suggestions for further research are also partly related to the limitations of this study. The empirical focus of this study was limited to a manufacturing company and the empirical part was conducted by using a single case company, so the research sample size was fairly small. Thereby, several opportunities and extensions for future research, especially in other risk-prone contexts can be provided. The research could be conducted as a multiple case study to find factors of SRM that this study didn't reveal or allow more generalized results to other manufacturing companies. When it comes to manufacturing industry, the scale of companies varies a lot and therefore, it would be interesting to include different sized, industries and cultured manufacturing companies to see whether or not their supplier risks or SRM practices differ from each other. Also, SRM research could cover companies with different supply strategies such as ones leaning heavily on single sourcing solutions or sole sourcing situation. This research could also be replicated as it is in the case company in future timeframe to see in what extent the findings would be different as by business development and progress in SRM.

Further SRM research could focus on buyer-supplier collaboration and joint risk practices to evaluate their impact on one's SRM performance and to draw a clearer picture of implementation of such SRM process in real business environment. In addition, there seems to be plenty of splintered information available on supplier risks and the best means to manage them, but research still lacks on qualitative SRM strategy frameworks, processes

and systems to implement these topics to companies in an efficient way. Therefore, more practical SRM case studies are needed and clearer distinction of supply chain, supply and supplier risks and their management techniques should be drawn so that both, the researches and practitioners would have a common understanding of each of the areas and units of analysist.

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APPENDICES

Appendix 1. Online questionnaire questions

1. Background information
   Department:
   Role:
   Experience in the company (in years):

2. Please describe the followings based on your point of view and experience;
   A) Supplier risk
   B) Supplier risk management? (Open question)

3. How important supplier risk management (SRM) is in the company? (Scale from 1 to 10)

4. How often do you work on for supply risk management activities? (Multiple choice question)
   A) Daily
   B) Weekly
   C) Monthly
   D) A few times a year
   E) Yearly

5. Are the suppliers you are working with, involved in the supplier risk management? If yes, how? (Open question)

6. How satisfied are you with the level of suppliers' involvement in SRM? (Scale from 1 to 10)

7. What are the most frequent supplier risks in the company? Please name one to five supplier risks. (Open question)

8. What is the most severe supplier risk occurred? (based on your experience) (Open question)

9. Why is SRM important in your organization? What is the aim of company's SRM practices? (Open question)

10. What are your and the organization's SRM initiatives primarily related to? (Multiple choice question)
    A) Cost efficiency

B) Customer satisfaction
C) Product quality
D) Lean manufacturing process (just-in-time deliveries and lower inventories) E) Maintenance of business operations
F) Value creation
G) Meeting the regulations and rules
H) Competitive advantage
I) Reputation and company image
J) Protection of intellectual property
-Other? Please describe in few words.

11. How do you manage supplier risks? What do you see as the best practices for SRM in terms of realizing the benefits? (Open question)

12. What are the benefits of SRM based on your experiences? (Multiple choice question)
    A) Improved quality of purchased material
    B) Cost efficiency
    C) Leaner manufacturing process (JIT deliveries and lower inventory levels)
    D) Secure intellectual property
    E) Company reputation and image
    F) Improved customer satisfaction
    G) Better competitive position in the market
    H) Maintaining business operations
    I) Ability to meet the set regulation and rules
    J) Ability to quickly response to unexpected events
    -Other? Please describe in few words.

13. What are the drivers and success factors for SRM? (Multiple choice question)
    A) Support and interest from top management
    B) Strategic coherence internally and with supplier
    C) SRM benefit measurement
    D) Sufficient budget and resources
    E) SRM tools and manual
    F) Cross-functional SRM within the company
    G) Employee training for SRM
    H) Efficient internal and external communication
    I) High level of trust with supplier
    J) Joint risk analysis with suppliers
    -Other? Please describe in few words.

14. What are the challenges and barriers you face in SRM? (Multiple choice question)
    A) High focus on SRM costs rather than benefits
    B) Lack of SRM competencies and skills
    C) Lack of interest and support from top management
    D) Lack of sufficient technology and tools
    E) Supplier's unwillingness to involve in SRM
    F) Lack of information sharing (internally & externally)
    G) High level of dependence on supplier
    H) Lack of strategic coherence (business and supply strategies not aligned)
    I) Supply focus is on competitive approach rather than collaborative approach
    J) Lack of trust with supplier
    -Other? Please describe in few words

15. How would you rate the current SRM maturity in company? (Scale from 1 to 10)

16. What would you name as the key organizational competencies (employee skills) required in SRM? (Open question)

17. How would you rate the internal competence level and performance (realized efforts and benefits from the available competencies/resources) related to SRM? (Open question)

18. How could the competencies be improved? In which areas would you like to receive more training? (Open question)

19. How would you rate your company's current SRM tools/manuals? (Are they sufficient for your informative and practical needs) (Scale from 1 to 10)

20. How would you develop the SRM tool/manual? (Open question)

Appendix 2. Interview questions

1. What kinds of supplier risks have you faced in the company? What supplier risks would you name the main supplier risks in the company? Why?

2. What are the consequences of such supplier risks for the company?

3. What means have been taken to manage (identify, prioritize, mitigate and monitor) the supplier related risks?

4. What kind of purchasing power does the company have? Is the company a desired customer for a supplier?

5. When is SRM particularly important?

6. How does top management's support and interest toward SRM appears in the company?

7. How are supplier selection and evaluation (under SRM considerations) conducted?

8. How supplier risks are taken into account in the contract concluded with the supplier?

9. How are supplier collaboration and willingness to SRM taken into account in SS?

10. How does the supplier participate in risk management?

11. How is internal and external communication on SRM carried out?

12. How do you build trust in your supplier?

13. How does the demand and capacity information flow go between the company and the supplier?

14. Have efforts been made to develop, for example, supplier quality collectively or on your own initiative? (Why, Why not?)

15. By what means and how often the suppliers receive feedback on their activities? Are there any incentive or sanction systems (contracts)? (Why / Why not?)

16. Are any purchases held in excess of safety stocks? Where are the safety stocks located? Are suppliers required to stock finished components?

17. Are components sourced from one or more suppliers? Why this is the strategy adopted?

18. How often and how are suppliers evaluated after starting a collaboration?

19. What are the most common KPIs for supplier performance evaluation?