



## **DID COVID-19 HELP TO PREPARE SUPPLY CHAINS FOR A NEW CRISIS?**

A case study from an energy sector company

Lappeenranta–Lahti University of Technology LUT

Master's thesis in Supply Management

2024

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Examiners: Professor Jukka Hallikas

Junior researcher Aleksi Harju

## ABSTRACT

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### **Did Covid-19 help to prepare supply chains for a new crisis? A case study from an energy sector company.**

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79 pages, 17 figures, 5 tables and 1 appendix.

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Supply chains have become increasingly complex and global, making them particularly vulnerable to disruptions. Global supply chains have recently faced two significant disruptions, Covid-19 and war in Ukraine, which have disrupted the regular flow of supplies. This thesis aims to compare the impacts of these two crises on supply chains, and to find out, how companies can improve the resiliency of supply chains to better prepare for future disruptions.

The study in this thesis was conducted as a qualitative case study, which focused on comparing different purchasing categories within one company. When comparing the direct impacts of Covid-19 and the war in Ukraine, one fundamental difference can be found: while Covid-19 was a global disruption, the implications of the Ukraine war are relatively limited and local.

The findings reveal that Covid-19 did not prepare supply chains for a new disruption, since each disruptive event has very different consequences. Despite every disruption being different and unpredictable, traditional risk and supply chain management practices remain useful. Collaboration and information sharing with suppliers, proactive planning, and alternative sources of supply help to mitigate the impacts during a disruption.

As a result of this study, it would be important to develop efficient risk management processes and utilize modern technology. Based on the interviews, technology and skilled professionals in procurement function were valuable assets during both crises, but greater emphasis should be placed on these aspects to better prepare for future supply chain disruptions.

## TIIVISTELMÄ

Lappeenrannan–Lahden teknillinen yliopisto LUT

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Kauppätieteet

Pauli Palo

### **Autoiko Covid-19 toimitusketjuja varautumaan uuteen kriisiin? Tapaustutkimus energiasektorin yrityksestä.**

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Toimitusketjuista on tullut entistä monimutkaisempia ja kansainvälisempiä, mikä tekee niistä myös erityisen alttiita häiriöille. Globaalit toimitusketjut ovat viime vuosina kokeneet kaksi merkittävää häiriötä, koronapandemian sekä sodan Ukrainassa, jotka ovat haitanneet normaalia toimitusketjujen toimintaa. Tämä tutkimus pyrkii vertailemaan näiden kahden kriisin vaikutuksia toimitusketjuihin, sekä selvittämään, miten yritykset voisivat parantaa toimitusketjunsä resilienssiä vastatakseen paremmin tuleviin vastaaviin häiriöihin.

Tämä tutkimus toteutettiin laadullisena tapaustutkimuksena, joka keskittyi vertailemaan yksittäisen yrityksen eri ostokategorioita. Vertailtaessa koronapandemian ja Ukrainan sodan suorilla vaikutuksilla, yksi keskeinen eroavaisuus korostuu: koronapandemia oli maailmanlaajuinen kriisi, mutta Ukrainan sodan vaikutukset ovat hyvin paikallisia ja rajattuja.

Tutkimuksen tulokset paljastavat, että koronapandemia ei auttanut uuteen kriisiin varautumisessa, sillä kummallakin häiriöllä oli hyvin erilaisia vaikutuksia. Vaikka jokainen tilanne onkin erilainen ja ennustamaton, perinteiset riskienhallintamenetelmät ja toimitusketjujen johtamisen periaatteet ovat edelleen hyödyllisiä. Yhteistyö ja tiedonjakaminen toimittajien kanssa, ennakoiva suunnittelu ja vaihtoehtoiset tavarantoimittajat auttavat pienentämään kriisitilanteen välittömiä vaikutuksia.

Riskienhallintaprosessien ja modernin teknologian hyödyntäminen ovat tämän tutkimuksen perusteella tärkeitä panostuksen kohteita. Haastattelujen mukaan teknologia ja ammattitaitoinen henkilöstö olivat arvokkaita resursseja kummankin kriisin aikana, mutta näihin tulisi panostaa entistä enemmän, jotta uusiin toimitusketjujen häiriöihin voitaisiin varautua paremmin.

## ACKNOWLEDGEMENTS

I started school in 2005 as a first-grader. Since that, I have used over 60% of my life for studying. That is over 15 years. This thesis is without a doubt the biggest achievement (so far) in my life. In the end, it took way longer than I had planned. There were times when I focused on my career and forgot the thesis for several months. Then there were times, when I did some real effort with writing. But after two years with *Paulin gradu.docx* on my desktop, it is now finally done and dusted.

My time as a student was eventful. I had been a student for only some months, when the Covid-19 pandemic hit, and the entire campus was shut down. This forced all of us to study remotely. Empty streets of Skinnarila and student meals in take away boxes are something that I will never forget.

For almost the entire time of writing this thesis, I have been working full hours. My biggest gratitude goes to my closest colleagues Neele and Lucas, who have been always so kind, supportive and understanding with my balancing between work and studies. Also, a big thanks to those colleagues, who helped me by attending to the interview. Last but not least, thank you Jukka for all the support especially with finalizing this project.

I am proud of this achievement.

But I will not write another thesis anytime soon.

In Helsinki 8.4.2024

Pauli Palo

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# 1 Introduction

Russia and Europe have a long mutual history and traditions for trade, and especially many European countries have relied heavily on Russian energy supply (Liadze, Macchiarelli, Mortimer-Lee and Juanino 2023). The movement of traffic, goods, workforce, and capital between Europe and Russia has been constant for decades, and the importance for both the European countries and Russia great. Despite tension had already started to build up in 2014 after the annexation of Crimea (European Commission 2023a), no one could ever expect the realization of Russia-related risk to become real so severely (Pöysti 2022). Russia started an illegal attack to Ukraine. This caused a lack of for example wheat, aluminium, and crude oil. The military conflict also blocked several crucial shipping routes in and through the Russian territory. (Ngoc, Viet, Tien & Hiep 2022.). Naturally it also caused lots of human suffering and a humanitarian crisis (Liadze et al. 2022). Supply chains had not yet recovered from disruptions caused by Covid-19 when the war began (Hassen & El Bilali 2022). What makes the situation so severe is the fact that these two crises followed each other. The impact of these two consequent crises has been strong to many companies, which makes it interesting to investigate the topic more deeply.

The importance of supply chains has increased during the last few decades, which has also made supply chain risks topical (Sodhi, Son & Tang 2012; Paul, Chowdhury, Moktadir & Lau 2021). Chowdhury and Quaddus (2017) say that due to increased complexity and globality, supply chains face disruptions more often than earlier. Complex supply chains are also more difficult to manage comprehensively. This makes supply chains vulnerable for risks and unexpected events, and the possible consequences can be severe, which is something that the latest events have clearly shown as companies have decided to leave Russia in the fear of reputational damages and operational risks. A study conducted by Dun & Bradstreet revealed that there are only 15.000 first tier suppliers in Russia, but when we look to the second-tier suppliers, the number is already as high as 7.6 million (Kilpatrick, 2022). These figures showcase how difficult it can be to comprehend the country-related risks, and also why the war hit so many companies so badly.

Covid-19 taught the world multiple things regarding supply chain management. Increasing the number of suppliers, building more agile logistics networks, and improving real-time



monitoring of supply chains are just few of the examples that have been recognized as universal points for development post-Covid-19 (Sakthivel, Kandasamy & Davim 2021, 92-94). In a study conducted by Ernst & Young (2021), over 60 per cent of supply chain professionals said that Covid-19 pandemic has promoted the importance of supply chains as a strategic function. Thus, it is interesting and much needed to study, whether the observations after one crisis, combined with the increased strategic importance of the supply chain function, have helped to prepare for a new crisis or not.

This paper is a master's thesis, which aims to address the current world situation and combine it with supply chain management from a risk management perspective.

## 1.1 Research gap

Supply chain disruptions, supply chain risk management, and recovery from disruptions have been studied widely. Paul et al. (2021) conducted a study about challenges in recovery after Covid-19 pandemic, finding that there is a clear need for reforming global supply chains. Tynkkynen (2022) conducted a master's thesis study on risks identified in Finnish companies post-Covid-19. On the other hand, Hallikas and Lintukangas (2016) surveyed Finnish companies and found out that there are several supply risk mitigation methods that are considered to be important. Kähkönen, Evangelista, Hallikas, Immonen and Lintukangas (2023) studied the impact of Covid-19 to the development of firms' capabilities and resilience and concluded their study by saying that "in the future, focusing on lessons that can be learned would be important for better preparing companies for similar catastrophic situations and disruptive events."

The war in Ukraine is, however, a novel crisis with only little existing literature. It is rather self-explanatory that the current world situation has not yet been studied widely. Most of the existing literature and research is focusing on the supply chains of wheat and agricultural products, which is logical, since these are important commodities for both Russia and Ukraine. Almost at the same time of making this paper, another master's thesis was written by Elina Helosvuori (2024). Her focus was also on comparing the differences between Covid-19 and the war in Ukraine, and companies' ability to manage disruption risks. The main findings in this paper was that traditional supply chain management practices helped to mitigate the instant effects of both Covid-19 and Ukraine war.

The situation is also interesting since there has been two consequent crises that both had significant effects to many different domains of societal and economical topics. Anghel and Jones (2023) observed that the “combination of closely connected crises should have a reinforcing effect” and that both the Covid-19 and Ukraine war were caused by some external factors that would have been nearly impossible to control. Shen and Sun (2023) highlight that the world, including supply chains, have evolved and become more integrated than before – thus the previous literature and research may differ quite a lot from current situation, which makes it interesting to investigate these two consequent disruptions more deeply from a supply chain perspective.

Since it is likely that more and more new crises and disruptions will arise, it would be important to understand the learning curve and development of firms’ preparedness for disruptions. It is also important to understand if companies have used known risk mitigation strategies and learned from past, which is the motivation and literature gap for this study. With this knowledge, companies can prepare better for future disruptions and enhance their supply chain and risk management practices.

## 1.2 Research questions and limitations of the study

This thesis aims to study the impacts of two consequent crises on supply chains. The focus is placed on company’s ability to change and adapt to rapid changes in their environment. As Shih (2020) writes, Covid-19 pandemic showed the weaknesses in global supply chains. Paul et al. (2021) add to this that supply chains must be able to recover from disruptions effectively. On the other hand, Hohenstein (2022) found out in his study that many companies modified their risk treatment strategies after Covid-19, in addition to many other actions, such as setting up task forces, utilizing more digitalisation, and improving information flows. Kähkönen et al. (2023) consider Covid-19 to have changed to the way companies manage their supply chains. This means that companies should have learned something from the Covid-19 pandemic, but also that supply chains should be more resilient and able to withstand new disruptions better than before. Thus, the first research question in this thesis is:

RQ1: How did Covid-19 help to prepare for a new crisis?

To support this research problem, it is important to understand the current situation in a more detailed level. This can be done by looking at the situation from a supply strategy perspective, since supply strategy should always direct the way supply chains are managed. Each disruption is a different scenario, and also the environment is constantly changing. Ahtonen & Virolainen (2009) say that because situations are unique, also supply strategies must change and adapt. Scheuing (1989, p. 140) capsulizes the nature of supply strategies well by saying that a supply strategy should always be based on the current operational environment. Thus, it is safe to assume that supply strategies have changed after the war began, which is why the second research question is:

RQ2: How has the war changed the way different elements of supply strategy are seen?

As already concluded earlier, each disruption is slightly different, and the consequences may also vary. The third and final research question aims to explain and combine the forementioned two questions by analysing the differences of Covid-19 and the war in Ukraine in a holistic way. Understanding the differences between the two crises may also help to understand and explain, why Covid-19 did or did not help to prepare for the disrupting effects of the war.

RQ3: What are the major differences of impacts of the Covid-19 pandemic and the Ukraine war on supply chains?

The first limitation of this study is to focus on global supply chains: it makes only sense to focus solely on a company with a global supply chain. Impacts of Covid-19 and war are largest in a global context, and this decision will make the results more relevant. The second limitation for the study is that it focuses on one single company only. This will create an

interesting case study and provide insights on how the effects of Covid-19 and Ukraine war differed between different purchasing categories. The third and last limitation to the thesis is that it will not study purchasing or selling of electricity, which is the focus company's core business, and it is therefore not as interesting as focusing to the actual procurement function and purchasing of other supplies. Energy crisis has been a big discussion point during the war time: the lack of Russian natural gas caused electricity prices to spike, and ever since the entire energy and electricity market has been turbulent. Therefore, it is fair to conclude that the focus is on upstream parts of the supply chain with certain limitations.

### 1.3 Conceptual framework

This thesis is built on existing literature and research on supply strategy and supply chain risk management. Theoretical framework is formed on the interface between these two: the main goal is to study how different elements of supply strategy can affect supply chain's risk level, but also how the different supply strategy elements are visible in the daily way supply chains are managed. After this, findings are adapted to the current world situation and to practice. Figure 1 presents the conceptual framework for the thesis in a visual form.

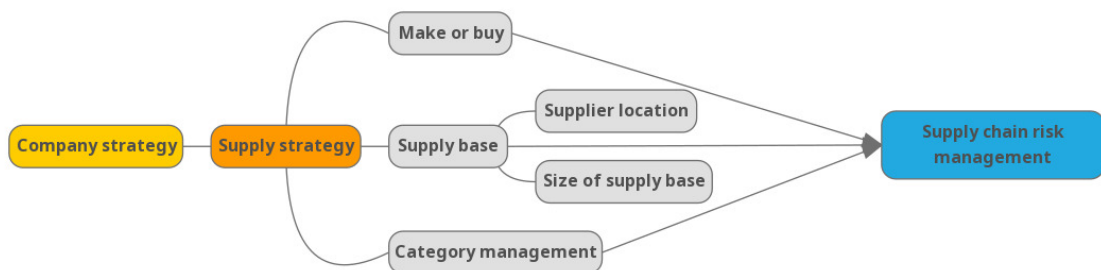


Figure 1: Conceptual framework of the study.

### 1.4 Key concepts explained

**Supply Chain Risk Management (SCRM)** refers to those processes and actions needed to reduce vulnerability, but also to make the impacts as little as possible if something happens. The concept covers all stages from risk identification to assessment, treatment, and

monitoring. (El Baz & Ruel 2021). Wieland and Wallenburg (2012) define SRM as "the implementation of strategies to manage both everyday and exceptional risks along the supply chain".

**Risk** as a concept can be understood in multiple ways. Risk can simply refer to certain threats or hazards, or then to the negative outcomes of a decision. One definition can also be "a probability or a measure of the range of possible outcomes from a single rational decision". (Mangan, Lalwani, Butcher & Javadpour 2012, p. 308.) Hallikas, Karvonen, Pulkkinen, Virolainen & Tuominen (2004) use a dictionary definition and describe risks to be something uncertain yet harmful.

**Supply strategy** can be defined as "the pattern of decisions related to acquiring required materials and services to support operations activities that are consistent with the overall corporate competitive strategy" (Watts 1995). Supply strategy extends the concepts of purchasing and sourcing strategies to a holistic end-to-end strategy, which covers the entire supply chain (Lintukangas et al. 2013).

**Supply chain disruption** is an unexpected event that according to El Baz and Ruel (2021) occur with low frequency but have high impacts. During a disruption, the flow of goods from the supplier to buyer is not working as intended, thus it is disrupted (Nikookar and Yanadori 2021). It is however important to notice that there is no consensus on one definition for a supply chain disruption (Graves, Tomlin & Willems 2022), and for example Shen and Sun (2023) define supply chain disruption as "an unintended and unanticipated event" which threatens supply chain's usual functioning.

**Supply chain resilience** refers to the firm's capability to be prepared for disruptions, and to the capability to recover effectively from disruptions (Hohenstein, Feisel, Hartmann & Giunipero 2015; Mangan et al. 2012, p. 309; Shen and Sun 2023). According to Shen and Sun (2023), supply chain resilience consists of six individual elements: flexibility, agility, visibility, collaboration, information sharing, and risk management practices.

## 1.5 Research methodology

The study of this thesis has been conducted using qualitative research methods, which is often considered to be the opposite for quantitative, even though this is not necessarily true

(Puusa, Juuti & Aaltio 2020). Qualitative research aims to describe and understand certain situation or phenomena (Tuomi & Sarajärvi 2018), and one key characteristic of qualitative research is that it is based on subjective opinions and experiences of those being interviewed (Puusa et al. 2020).

One of the most common data collection methods for qualitative research is interviews (Tuomi & Sarajärvi 2018), and therefore also the data for this thesis was collected using interviews. Interview is a flexible form of collecting data since it allows rather informal discussion and asking specifying questions without a pre-defined order (Tuomi & Sarajärvi 2018). According to Eriksson and Kovalainen (2008), these kinds of free-form interviews usually provide comprehensive results, which can help making conclusions.

## 1.6 Structure of the thesis

The thesis started with an introduction to the topic, including the research questions, and methodology. In the second chapter, the Ukraine crisis is presented to give the reader basic information on the situation. The impacts of war are also discussed, as it will explain the importance of the topic. Next the thesis focuses on a literature review, which aims to create a theoretical background: Third chapter provides a theoretic background on supply strategy, as a safe and sound supply strategy is a key capability in ensuring well-functioning supply chains, and the fourth chapter introduces the concepts of supply risks and supply chain risk management. In the fifth chapter, research methodology is explained and motivated. Finally, results are analysed both empirically and reflecting to already existing literature. A flowchart of the structure of this thesis is presented in figure 2.

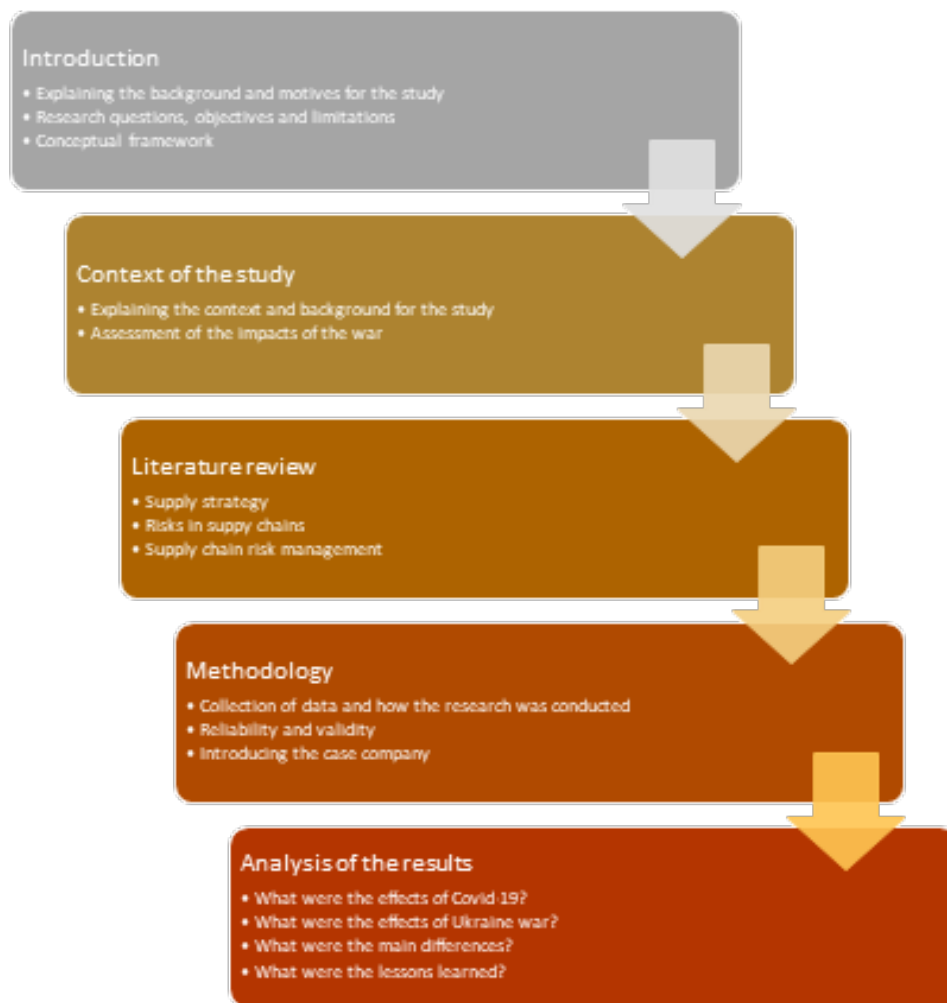


Figure 2: Structure of the thesis.

## 2 War in Ukraine

The relationship between the member countries of the European Union and Russia had been tense already since 2014, when Russia illegally annexed the Crimea. Since that, some trade co-operation had been suspended and restrictions for trade set up. Limiting the access to finance, and banning the trade of arms, dual-use goods, and some high-technology products, were basically the only forms of restrictions set by the EU. Russia responded by banning the imports of some agricultural and food products from EU. (European Commission 2023b.) In practice, these restrictions had only little impact on both sides. On Thursday 24<sup>th</sup> of February in 2022, the crisis escalated after Russia started an armed attack to Ukraine, which has then developed to a full-scale war. The war is not only a large-scale humanitarian crisis, but it will also have massive economic consequences (Orhan 2022). The consequences will be felt especially in Europe due to the long traditions of trade with Russia, geographical proximity, and high dependency of Russian energy (Liadze et al. 2023). According to Orhan (2022), there are three ways that the economic impact of the war is mainly visible: 1) the higher prices of basic commodities will drive inflation up, 2) supply chains especially in the proximity of Ukraine and Russia will be disrupted, and 3) increased uncertainty and tighter conditions will reduce the economic confidence and willingness for investments.

This chapter aims to provide a background for the thesis, explaining the consequences of the war from both economic and supply chain perspectives. The first subchapter studies the volumes and characteristics of trade between EU countries and Russia and explains how this has changed during the war. The second subchapter focuses on the supply chain perspective and explains how supply chains have been disrupted because of the war.

### 2.1 Economic impact of the war

The war in Ukraine will cause remarkable economic costs for the economy globally, but especially Europe will be impacted heavily due to its close connection and long traditions of trade with Russia (Liadze et al. 2023). About half a year after the war had started, OECD (2022) estimated that the war could slow down economic growth globally by more than 1 percentage point, and that the inflation could be 2.5 percentage points higher than expected



– only because of the war. In Europe, especially Germany will be affected heavily due to its strong reliance on Russian gas (Liadze et al. 2023).

Following Russia’s invasion of Ukraine and the war, the European Union has set multiple restrictions and sanctions for trade with Russia. This has also strongly affected the trade between EU countries and Russia, which has also had a major economic impact. When comparing the situation between February 2022 and June 2023, there is a clear drop in both imports and exports: the monetary value of imports from Russia has decreased by 84 % and exports by 61 %. At its peak right before the conflict began, the imports of European Union countries from Russia were approximately 23.5 billion euros. After one year this had dropped to only 5 billion euros. Figure 3 depicts the changes of European Union countries imports and exports with Russia.

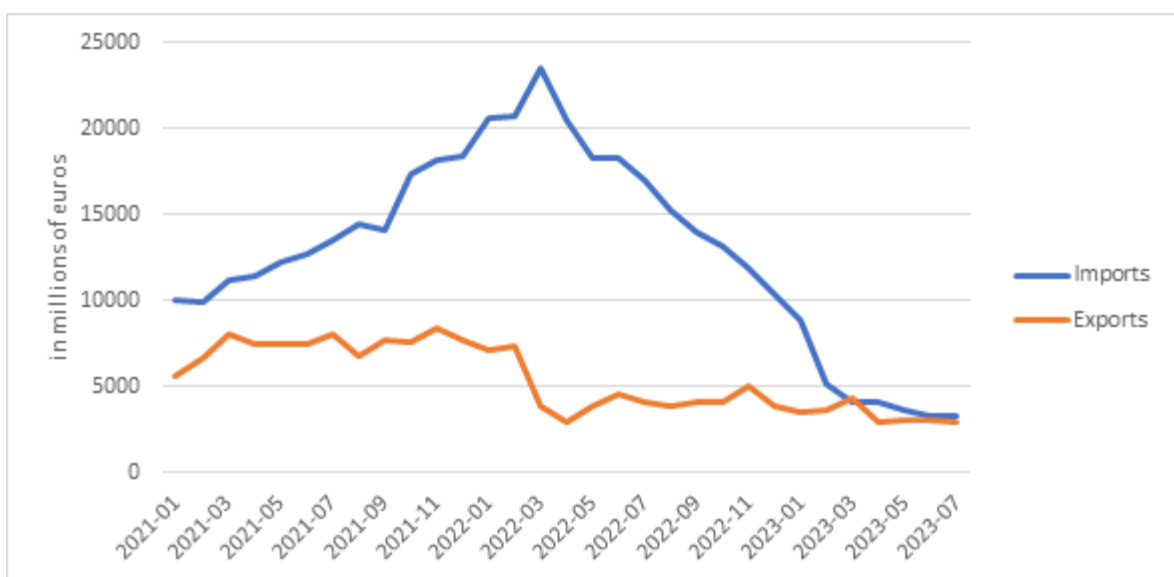


Figure 3: Monetary value of imports and exports of EU countries and Russia. (Eurostat 2023).

The war has been clearly visible in the key product articles that European countries have used to import from Russia. Based on Eurostat (2023) analysis, there are multiple reasons for the drops in trade volumes: for petroleum oil, fertilizers, iron, and steel there are some import restrictions in place, which explains the decrease. However, for nickel there is no such restrictions. Eurostat explains the drop in natural gas mainly with the fact that Nord

Stream gas pipe can no longer be used after it got destroyed in September 2022. Figure 4 shows the changes in some of the key import articles of EU from Russia.

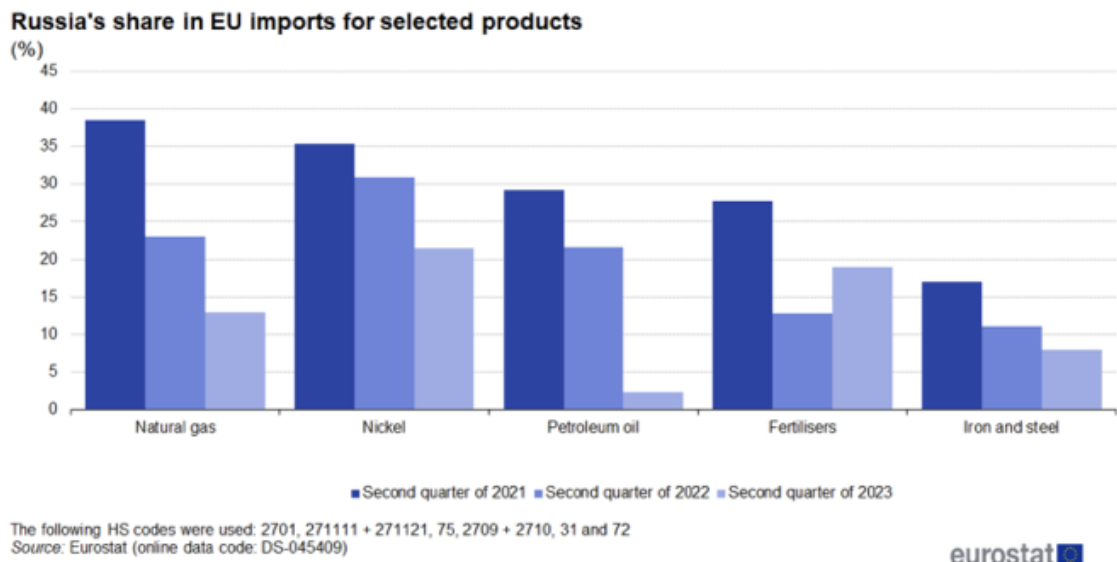


Figure 4: Russia's share of EU imports in some products. (Eurostat 2023).

## 2.2 Impact on supply chains

The impacts of war globally on supply chains are huge. According to a Dun & Bradstreet (2022, p.4-6) report, there are approximately 7,6 million second tier supplier relationships globally with Russian entities, and that over 600 000 businesses globally rely fully on Ukrainian or Russian suppliers. Companies have been relying in Russia due to its big size, and also its nature resources. Crude oil, agricultural commodities, such as wheat and fertilizers, and many minerals are amongst Russia's most important export items (Kilpatrick, 2022). Thus, Russia has been not only an important provider of multiple products, but also a trusted partner, which makes the situation so severe. Interestingly, Steinbach (2023) reminds that trade implications have been very limited for other countries than Russia and Ukraine, and also that the largest impact is visible in only certain products, such as fossil fuels, metals, and agricultural products. Liadze et al. (2023) argue that that the impacts of war to supply chains could be categorized into demand and supply side, where supply side consists mainly of disrupted supply chains and trade restrictions, and demand side from the

tight economy, volatile markets, and lack of confidence. A table of supply and demand effects of the war can be found in table 1.

Table 1: Demand and supply effects of Ukraine war to global economy (adapted from Liadze et al. 2023).

Demand side	Supply side
Trade restrictions	Technological bans
High inflation and smaller real income	Disrupted supply chains
Loss of confidence	High energy costs
Tightened monetary policy	Increased costs of input raw material
Increased financial risks	
Increase in public expenditures, especially defence expenses	

The war causes massive challenges for those operating in Russia: especially the decision to exclude Russia from SWIFT has made it difficult to operate in Russia (Sutton 2022), since the exclusion will for example delay and disrupt payments to and from Russia (Dun & Bradstreet 2022, p.5, 9-10). SWIFT is one of the most used payment remittance systems, and there are only very few real alternatives (Cipriani, Goldberg and La Spada 2023), which is why the impact has been so severe. Even though the aim of this sanction, excluding certain Russian banks from SWIFT, has been targeted against Russia as a country, it will also disrupt the daily operations of normal companies that would like to buy goods from Russian companies, or sell something there. It must also be emphasized that not all items fall under the sanctions, and there might be a real need to buy something from Russian suppliers.

Another major obstacle is on logistics and shipping routes. Due to the war, multiple shipping routes through Russia, including the airspace, are blocked, which will cause delays and difficulties (Sutton 2022). Ships have been trapped to Black Sea, and movement near Russian and Ukrainian harbours restricted (Khanna 2022). It is in the nature of shipping and logistics that they are easily disrupted in for example border crossings (Hohenstein 2022), and when one border is totally blocked, it will affect the entire supply chain. Khanna (2022) also reminds that a major proportion of world's sailors are Russian or Ukrainian: they

estimate that 10 per cent of seafarers come from Russia, and 4 per cent from Ukraine. Given these figures, it may be difficult to recruit enough personnel on ships, which has an impact on the performance of logistics. The European Union has also adopted multiple sanctions, which are impacting the area of transportation and logistics. For example, the entire airspace of EU is closed for all Russian aircrafts, Russian road transport operators are banned from European roads, and EU ports are closed from Russian vessels (European Council 2023a). Altogether, it is fair to say that the war has impacted logistics in many different ways.

As a response to Russia's invasion of Ukraine, the European Union has imposed large sanctions against Russia. Sanctions are a political tool which is often used to affect the unwanted behavior of another party, such as a country, an individual, or an organization (Felbermayr et al. 2020). Sanctions aim to restrict Russia's ability to continue the war by freezing assets, limiting the trade between Russian and western entities, and restricting transport and logistics within the area of EU (European Council 2023b.) After the latest European Union's 10th sanctions package, approximately 49 per cent of EU's 2021 exports to Russia fall under sanctions (European Commission 2023b). Unfortunately, sanctions tend to be disruptive in nature (Cipriani et al. 2023) and therefore cause harm and difficulties to other parties as well. Figure 5 presents some of the main articles that fall under European Union's sanctions against Russia. In addition to the practical implications of the sanctions, there are also some more high-level and operational impacts: since the sanctions originate from EU legislation, all entities operating in EU must comply with them. This means, that for example companies must practice due diligence to ensure that they are not breaching the sanctions regulations (European Commission 2023c).

Sanctioned exports from EU to Russia	Sanctioned imports to EU from Russia	Other types of sanctions, bans, and restrictions
<ul style="list-style-type: none"> <li>• Technology products, such as semiconductors, electric components, software</li> <li>• Oil refinery equipment</li> <li>• Aviation and space industry engines, spare parts, components</li> <li>• Jet fuel</li> <li>• Maritime navigation and radio communication technology</li> <li>• Dual-use goods</li> <li>• Luxury goods</li> <li>• Weapons, firearms, military goods</li> </ul>	<ul style="list-style-type: none"> <li>• Coal</li> <li>• Other solid fossil fuels</li> <li>• Steel, including steel products and iron</li> <li>• Gold and jewellery</li> <li>• Industrial goods, such as cement, asphalt, wood, paper</li> <li>• Seafood and liquor</li> <li>• Crude oil and refined petroleum oils (some exceptions do apply)</li> </ul>	<ul style="list-style-type: none"> <li>• Ban of certain services to Russian entities and persons</li> <li>• Accounting, auditing, bookkeeping, business-related consulting services</li> <li>• IT consulting</li> <li>• Legal advisory</li> <li>• Architectural and engineering services</li> <li>• Oil price cap mechanism</li> <li>• Ban of Russian road transport operators in EU</li> <li>• Ban of Russian aviation operators from flying over EU airspace</li> <li>• Ban of Russian maritime fleet from entering EU ports (some exceptions do apply)</li> <li>• Excluding Russian banks from SWIFT</li> </ul>

Figure 5: Examples of sanctioned items, raw materials and services in EU-Russia trade. (European Council 2023b).

By the side of given supply chain related restrictions and impacts, there are also other implications that must be considered. To avoid reputational damages and mitigate legal risks, many western companies have decided to leave all operations in and with Russia, completely voluntarily (Khanna 2022). But it is not only the pressure from investors and customers that drive companies away from Russia, since also the extensive restrictions can make operations simply impossible (New York Times 2022). In 2021, almost 20 per cent of Nokian Tyres' annual turnover came from Russia and about 80 per cent of passenger car tyres were manufactured in Russia (Nokian Renkaat Oyj 2022). After European Union's sanctions to ban for example importing of tyres from Russia, it was clear that Nokian Tyres' operations in Russia would be impacted the hard way. In late June 2022, Nokian Tyres announced that they would initiate a retreat from Russia. This is just one example on how impactful and harmful the sanctions and reputational pressure can be for a single company.

### 3 Supply strategy

*Strategy* is a difficult and complex concept to define, and Kamensky (2010, p. 18) even says that it is impossible to formulate one single definition for that. However, most of the definitions share a few mutual points:

- 1) Strategy is focusing on the **future**, not current time (Mintzberg 1994, p. 23; Karlöf 1996, p. 13-14).
- 2) Strategy is a well-thought **plan of actions** (Mintzberg 1994, p. 23; Karlöf 1996, p. 13-14; Kamensky 2010, p. 18-19; Booth 2014, p. 61).
- 3) Strategy is **goal-oriented** and it has clear **objectives** (Mintzberg 1994, p. 23; Karlöf 1996, p. 13-14; Kamensky 2010, p. 18-19).

However, there are also some aspects that are not present in every definition. Booth (2014, p. 60-61) describes that strategy aims to differentiate the company from its competitors. On the other hand, Kamensky (2010, p. 18-20) has a strong perspective that strategy must always reflect company's operating environment, and by using the strategy well, a company is able to control these external factors for its benefit. Many authors also mention that strategy is just a high-level concept and it has multiple levels (Kamensky 2010, p. 21-25; Karlöf 1996, p. 19-20). Booth (2014, p. 60-61) compares strategies to an orchestra and concludes that strategy goes step-by-step from corporate level to different functional areas.

In previous literature, supply management has been neglected, whereas other functions such as marketing and financing have been discussed widely (Nollet, Ponce & Campbell 2005) in terms of strategy. But supply chain management should not be any different from the forementioned, it is a business function as well. Nowadays, supply management is widely considered to be a strategic function (Carr & Smeltzer 1997; Lintukangas, Kähkönen & Virolainen 2013; Nollet et al. 2005), which is why it should also have its own functional strategy. A functional strategy is needed, as all individual business functions play a big role in executing the company level strategy (Chopra & Meindl 2007, p. 23). Sehgal (2011, p.105) describes a functional strategy as “a road map for the development of functional capabilities within the scope of a business function and identify its relationships with other

business functions of the firm”. As already earlier discussed, supply strategy – just as all other functional strategies – must be aligned with the company level strategy and other strategies within the company (Lintukangas et al. 2013; Watts, Kim & Hahn 1995; Hofmann 2010; Chopra & Meindl 2007, p. 23-25; Ahtonen & Virolainen 2009). Hugos (2003, p.31-32) even says that supply chain strategy should be supporting the entire business strategy. If your customers prefer for example quality or sustainability over price, it is only logical that this is visible in both of your business and supply strategy: these products must be sourced differently, but also the requirements of end-users understood to serve them efficiently.

The concept and contents of supply strategy have been studied widely. Supply strategies have traditionally focused on cost effectiveness, risk management, and reducing total spend (Kraljic 1983), but usually a supply strategy balances between responsiveness and efficiency (Hugos 2002, p. 17 and 37). Gonzalez-Benito (2010) argues that there are two levels in supply strategy, first one being competitive objects, and the second one supply choices. According to them, most literature focuses on the supply choices only. Ahtonen and Virolainen (2009) on the other hand say that a supply strategy consists of several individual elements, which are presented in figure 6. Gadde, Håkansson and Persson (2010, p. 234-235) argue that a supply strategy consists of three different blocks. Their model is presented in figure 7. These elements of supply strategy depict individual choices, which supply chain professionals and management have to make.

Thus, it is safe to say that there are multiple definitions for a supply strategy, yet all different versions share many mutual aspects. This section will focus on reviewing the nature and elements of a firm’s supply strategy. Elements of supply strategy could be seen as building blocks which help company to formulate a comprehensive supply strategy. Next, some of the most important and studied elements of supply strategy are discussed more in-depth.

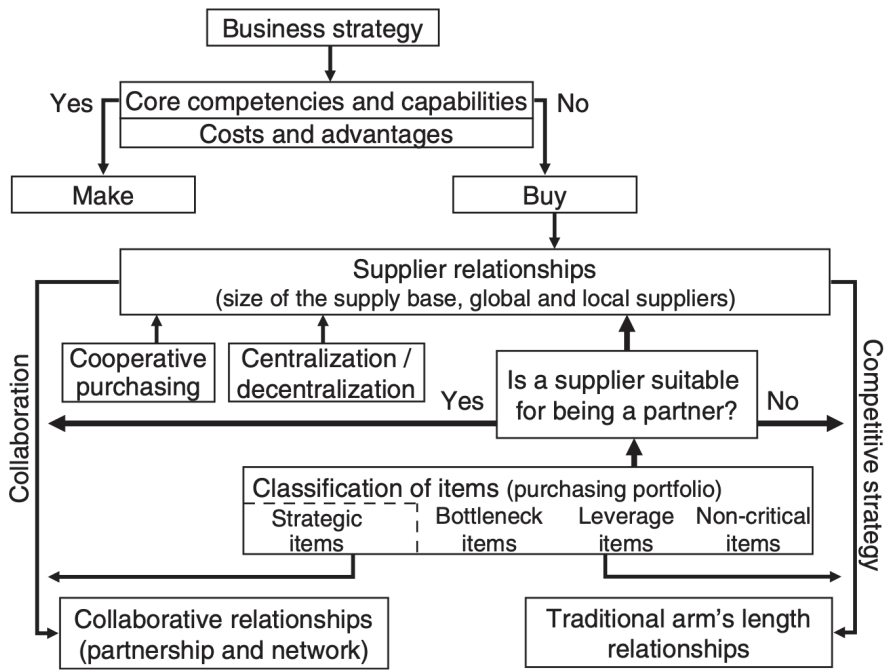


Figure 6: Elements of supply strategy (Ahtonen & Virolainen 2009).

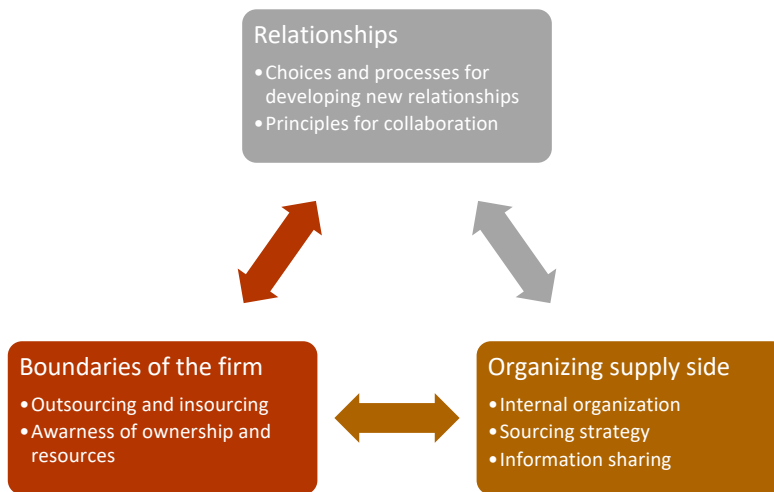


Figure 7: Elements of supply strategy (based on Gadde et al. 2010 p. 234-237).



### 3.1 Make or buy decision

As a concept, the make or buy decision is rather self-explanatory. Make or buy refers to the decision of whether to make something inhouse or to buy it from an external party. Make-or-buy decision should be considered as a strategic decision, which will have an impact on the entire company and its strategy (Humphreys, Lo & McIvor 2000, Quélin & Duhamel 2003, Damanpour, Magelssen & Walker 2020). Therefore, the make-or-buy decision can be seen as an element of firm's supply strategy, which was also concluded by Ahtonen and Virolainen (2009) together with Gadde et al. (2010, p. 234-236). Hallikas, Kähkönen, Lintukangas and Virolainen (2011) even say that "in many cases, supply management strategy originates from the outsourcing decision". Make or buy decision can be seen as such a critical decision that it affects the entire company strategy by setting the boundaries and scope for the buying firm (Gadde et al. 2020, p. 234). In practice this means that make-or-buy decision can for example affect on what kind of facilities and machinery the company owns, or what kind of skills and knowledge is required from staff. After the outsourcing decision, these resources might no longer be achievable with reasonable effort.

Traditionally the alternative of making has been known as outsourcing (Damanpour et al. 2020), though according to some researchers, outsourcing refers to the act of moving an inhouse activity to an external supplier (Quélin & Duhamel 2003). One of the primary reasons for outsourcing and buying something rather than making it is focusing on core capabilities, which can improve efficiency (Wadhwa & Ravindran 2007), though according to Humphreys et al. (2000), also cost reduction is a key motive for outsourcing. Quélin and Duhamel (2003) characterize outsourcing as a capability to build a unique set of capabilities that is distinctive from other companies, thus providing strategic advantage for both the outsourcing company and the supplier. According to Gadde et al. (2020, p. 235-237) outsourcing of certain activities will allow both the buying company and the supplier to focus on their core capabilities, which brings benefits from economies of scale and utilization of advanced technology.

In addition to the benefits of buying or outsourcing previously discussed, also the risks must be recognized and considered when making the make or buy decision. One of the key risks is the increased complexity of the supply base and the number of suppliers (Cousins 1999). With a higher number of suppliers and more complex supply chain network, it becomes also

more challenging to manage, and as Chopra and Meindl (2007, p. 425) mention, the coordination of larger supply network can require a lot of effort and therefore be very expensive to manage. Chopra and Meindl (2007, p. 425) also remind that outsourcing can cause a risk of losing internal skills and capabilities, reduced contact to upstream and downstream parties of the supply chain, and leakage of sensitive information.

Both the war in Ukraine and the Covid-19 pandemic have heavily affected those, who have outsourced some of their activities abroad, and those who are buying supplies from foreign countries. Van Hoek and Dobrzykowski (2021) found out in their paper that many companies were considering reshoring in the after wake of Covid-19 pandemic. This indicates that companies started to reconsider their make-or-buy decisions, which makes it an interesting theme and element of supply strategy for the context of this thesis.

### 3.2 Location of suppliers

Companies are often forced to enter international sourcing due to maintaining competitiveness against other companies (Trent & Monczka 2005). Buying from offshore tends to be cheaper, but nearshore suppliers will make the supply chain more responsive and can shorten lead times (Wu & Zhang 2014). Trent and Monczka (2005) say that in global sourcing, companies must be ready to face some operational challenges that arise for example from longer distances and cultural differences. Some authors (for example Kähkönen and Lintukangas 2022, Bygballe and Persson 2015) highlighted the fact that longer distances, language challenges, and cultural differences tend to make supply chains more challenging to manage compared to supply chains with nearby supplier base. Given all these factors Ahtonen and Virolainen (2009) conclude that the location of suppliers is one key element of company's supply strategy.

The globalization of supply chains has increased the country-related risks and dependency on some sources of supplies (van Hoek & Dobrzykowski 2021). Also, for example Gaur, Amini & Rao (2020) say that in global and complex supply chains, the risks of disruptions are higher. Thus, sourcing from foreign countries may increase the riskiness of supply chains. Based on this, it is important to consider the location of your suppliers, and as Paul et al. (2021) found out, during a crisis it is difficult to source goods from offshore suppliers because of longer distances. Covid-19 revealed these vulnerabilities and made companies

consider reshoring to reduce these risks (van Hoek & Dobrzykowski 2021). In a study conducted by van Hoek and Dobrzykowski (2021), country-related supply risk, in other words the location of the suppliers or origin of supplies, was one single triggering event for reshoring consideration. Since this thesis is heavily focusing on two disruptions, where country-related risks realized, also the location of suppliers is one key element to be discussed.

### 3.3 Creating the supplier base and selecting suppliers

Wadwha and Ravindran (2007) argue that vendor selection is a critical step in supply management, especially when outsourcing. They add that due to the recent disruptions seen, risk management should be included as one factor in supplier selection process.

One of the first things to decide in vendor selection is the number of suppliers (Ogden 2006), and supply strategies generally are extremely focused on the number of suppliers (Ahtonen & Virolainen 2009). Some authors (eg. Inderst 2008) think that the number of suppliers for one particular product or category is a part of a firm's supply strategy, some (eg. Ahtonen & Virolainen 2009) say that size of supplier base is a generic decision in the overall supply strategy. Whatsoever, buying firms should always aim in having the exactly right number of suppliers, which can be easily concluded by asking if a new supplier would create any additional value, or if introducing a new supplier would bring something new to the supply chain (Chopra & Meindl 2007, p. 432).

Traditionally companies have aimed for reducing the size of their supplier base, which will primarily reduce costs (Ogden 2006; Ahtonen & Virolainen 2009), make supply management easier, and improve overall efficiency (Cousins 1999). Cut-down supplier bases will, however, increase dependability on those suppliers left in the supply base, which will also increase the overall riskiness of the supply chain. Dependability has been recognized as a top concern and risk within supply professionals (Quélin & Duhamel 2003), and for that same reason, Ogden (2006) highlights the importance of choosing capable enough suppliers if the intention is to cut-down the supplier base to fewer alternatives. According to Gonzalez-Benito (2010), dependability refers to the supplier's ability to fulfil purchasing orders and other requirements. On the contrary, flexibility is the firm's ability to adapt to new circumstances (Gonzales-Benito 2010), and one way to improve flexibility and

reduce dependability is to have a large pool of suppliers for the same product or category. This is something that many companies have once again started to do: they are increasing the number of suppliers in their supplier base to reduce the risks of dependability and to improve flexibility (Cousins 1999).

In addition to the total number of suppliers, also the number of suppliers for one product or category matters. A common approach to sourcing strategies is three-fold: single sourcing, dual sourcing, and multi sourcing. Single sourcing must be differentiated from sole sourcing, as they have slightly different meanings. Sole sourcing refers to a situation where there is only one suitable supplier, while single sourcing refers to a decision to use only one supplier. In multi sourcing, the company has a large pool of suppliers for one product or category, which may bring cost advantage. Dual sourcing is in between of these, the company has two suppliers, of which one may be a preferred one. (Yu, Zeng and Zhao 2009). According to Ahtonen and Virolainen (2009), single sourcing is a suitable option for a situation where the supplier-customer relationship is tight: in the best case, single sourcing can increase information sharing and collaboration and therefore reduce uncertainty. Single-sourcing will however increase the riskiness of the supply chain and dependability of suppliers. One option to reduce this risk is to use multi-sourcing (Gadde et al 2010, p. 21), which Gaur et al. (2020) found to be a better strategy compared to single sourcing in almost 90 per cent of the scenarios they tested. Ahtonen and Virolainen (2009) also mentioned the risk mitigating effect of multi-sourcing. Multi-sourcing can also bring other benefits, such as a feasible degree of competition between individual suppliers (Chopra & Meindl 2007, p. 432; Gadde et al. 2010, p. 21), which can lower prices and promote new innovations. However multi-sourcing often makes supply chain management more complex, and there is a risk of lower quality or supplier performance, since the total spend is divided between the different suppliers, and therefore suppliers may not consider the relationship important.

### 3.4 Supplier relationships

The decision on whether to enter a collaborative or competitive relationship with suppliers should be a top priority in a firm's supply strategy (Ahtonen & Virolainen 2009). As businesses have outsourced more and more of their operations and functions, also the importance of relationship management has increased, also from the strategic point of view

(Gadde et al. 2010, p. 133-135). Collaboration is often started to gain competitive advantages, but it also creates a network of multiple companies. When there is a chance of wins, there are also risks included. It is also worth mentioning that with collaboration and networks, the risks increase as there is a higher dependability on other entities within the network. The risks are also slightly different for the individual companies in the network, and they have different perspectives on those risks. (Hallikas et al. 2004).

According to Gadde et al. (2020, p. 21 and 135), the spending in supplier base is often following so called Pareto principle which basically means that a very large proportion of the suppliers are responsible for a very small share of the total spend. Figure 8 shows a graphical illustration on this Pareto effect on spending across the supplier base. This division of spend for the entire supplier base means that some suppliers must be prioritized (Gadde et al. 2020, p. 21). Some suppliers are simply not important enough to form a tight relationship, as relationship management is highly resource intensive and therefore expensive.

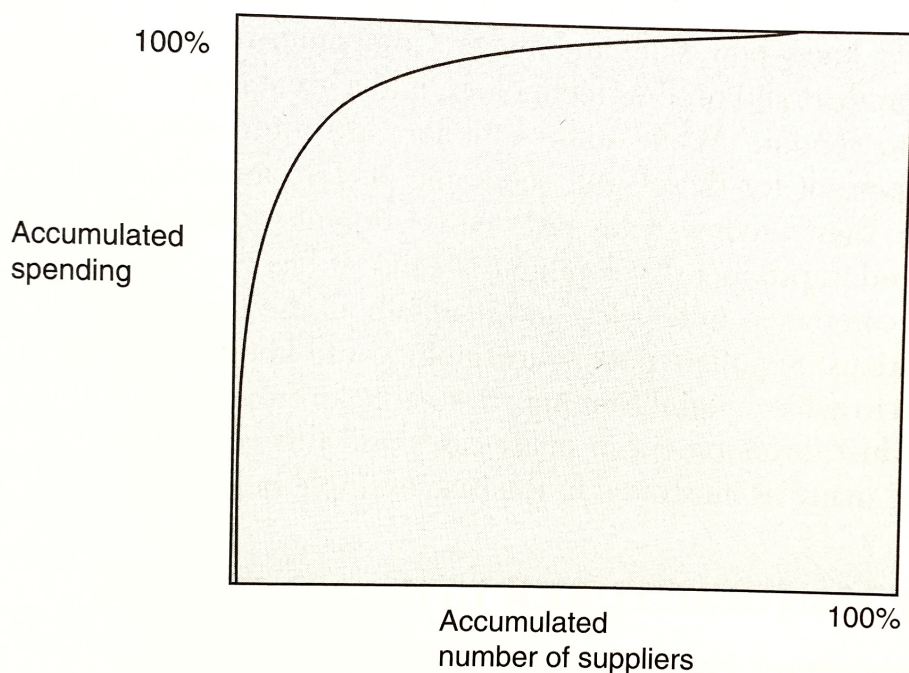


Figure 8: Pareto principle. (Gadde et al. 2010, p.21).

Ahtonen and Virolainen (2009) remind that not all suppliers are suitable for partners, and for some purchasing items, collaboration may not be the best option. They also mention that

it is possible to consider supplier relationship strategies based on the actual items, not only the suppliers. One way to decide between competitive or collaborative relationship strategy is to use Kraljic's purchasing portfolio, which classifies items into four different categories based on the supply risk and profit impact. An illustration of Kraljic's purchasing portfolio can be found in figure 9. According to Kraljic (1983), only strategic items should be treated with long-term and collaborative relationships, for others it usually does not pay off. Collaboration is a suitable way for strategic items, as these are extremely important for the buying company's business, hence also the risks are bigger (Ahtonen & Virolainen 2009). By utilizing collaborative relationships, risks can be mitigated efficiently.

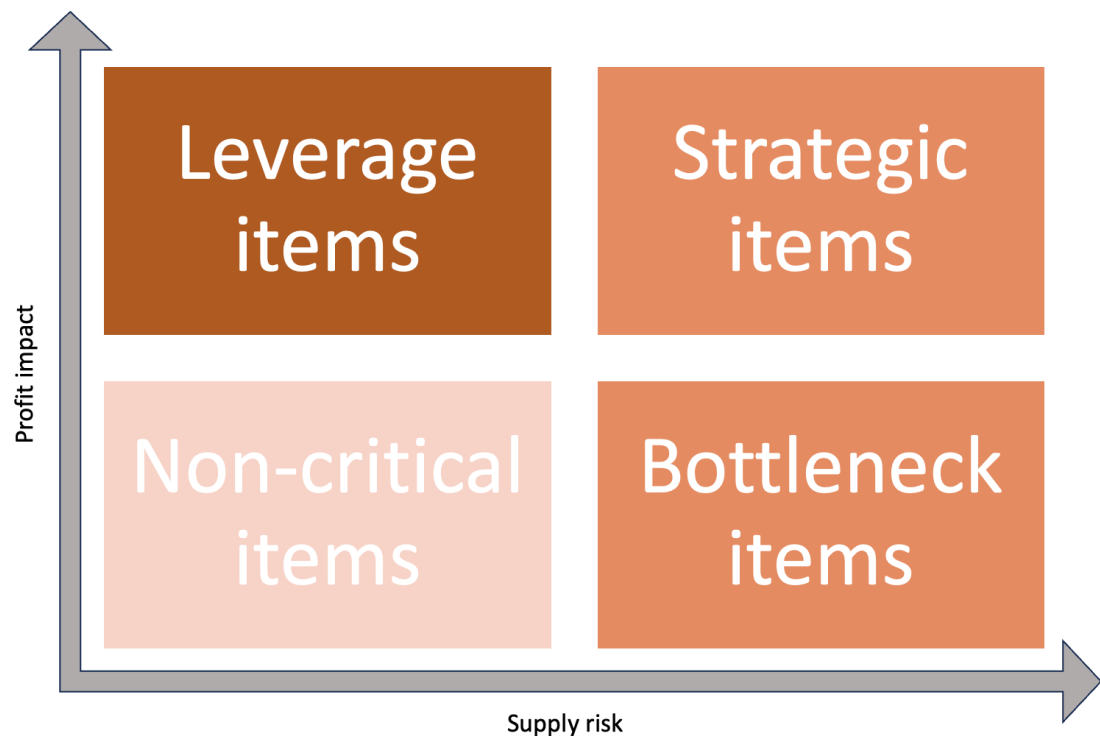


Figure 9: Kraljic's purchasing portfolio (based on Kraljic 1983).

Dependency on suppliers is an important topic in supplier relationship management: when a supplier is chosen for strategic partnership or collaboration, it will also increase dependability on that one supplier. Gadde et al. (2010, p. 138) concludes that there are a few reasons why dependability on a single supplier should be avoided. According to them, one way to avoid dependency is to use arm's-length relationships.

### 3.5 Internal organizing of purchasing function

According to many researchers, one element in a supply strategy is the question of how to organize the actual purchasing or supply chain function (e.g. Ahtonen & Virolainen 2009; Gadde et al. 2010 p. 234-237). This refers to the way the buying firm internally organizes buying, and manages supplier relationships, efficiency, flow of materials, and other similar supply chain related topics (Gadde et al. 2020, p.195). According to Gadde et al. (2010, p. 197-199), there are two main questions for organizing the purchasing function, the first one being the level of centralization (or “location of the purchasing in the firm” as they phrase it) and the second one the actual organization structure (or “how various tasks may be allocated to people” as they phrase it).

One key question in supply strategy and how to organize the purchasing function is the degree of centralization (Glock & Hochrein 2011). Centralization refers to an organizational structure where all the purchasing needs of an entire company are handled by one mutual unit. Treiblmaier (2018) defines centralization as “the distribution of decision-making authority throughout the organizational hierarchy”. By focusing all the supply chain and purchasing needs on one unit can bring several advantages, such as increased subject matter expertise, improved negotiation power, and scale benefits. (Ahtonen & Virolainen 2009; Gadde et al. 2010 p. 198-199.) Centralized supply chain function is often seen beneficial especially for companies with global operations and supply chains (Lintukangas, Kähkönen & Virolainen 2013), and especially if the individual units are buying similar products and services but at the same time those units are geographically widespread (Trautmann, Bals & Hartmann 2009). However, centralization has also its cons. Gadde et al. (2010, p. 199) mention that one of the weaknesses of centralized purchasing is that it is far away from those needing or using the bought commodities. Since both extreme ends have their benefits and weaknesses, companies often seek for the optimal balance between complete centralization and decentralization (Gadde et al. 2010, p. 197-199). According to Munson and Hu (2010) the centralization degree of supply chain function is one of the key strategic decisions a purchasing organization must make.

Englyst, Jørgensen, Johansen and Mikkelsen (2008) argue that one option to find the balance between complete centralization and decentralization is to utilize category management. In an optimal scenario, category management will provide a good balance between the agility of decentralization, and the multiple benefits of centralization. According to Englyst et al. (2008), centrally managed category teams will ensure the advantages of centralized purchasing function. Category management refers to a practice where purchases of a company are looked holistically, and similar products and purchases are consolidated together under a larger contract (Webb 2015). These categories can be basically anything coherent. Classically purchases have been categorized using Kraljic's purchasing portfolio, which classifies purchases to bottleneck, strategic, leverage, and non-critical items (Kraljic 1983, 111). This was presented already earlier in figure 9. However, for the purposes of category management, more practical classifications could be used. Ideally a procurement category consists of similar items or services (Timonen 2000). One way to start this categorization is to split purchases into indirect and direct purchases, where direct purchases are used in the making of company's offerings, and indirect purchases are only supporting the main business (O'Brien 2015, p. 6).

As an option to purchasing categories, Gadde et al. (2010, p. 197-199) present a centralized supply organization, which is based on different functions. In this model, one team consists of experts of the same field, such as planning, forecasting, quality assurance, sustainability or similar. These two alternatives for a centralized supply chain function are presented in figure 10.



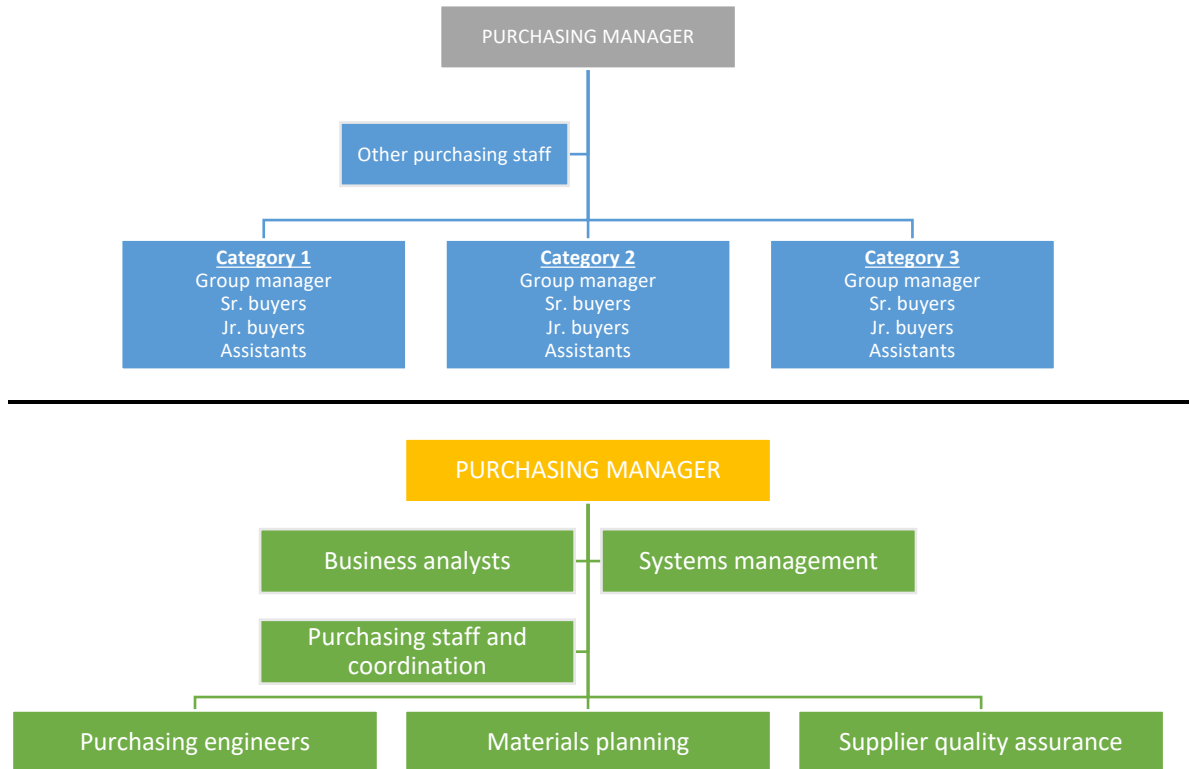


Figure 10: Two alternatives to organize purchasing function (based on Gadde et al. 2010, p. 198).

## 4 Supply chain risk management

Some major disruptions, catastrophes, and crises, such as the Fukushima nuclear accident and hurricane Sandy, have increased the interest towards supply chain risk management (Hohenstein et al. 2015; Hendricks & Singhal 2012, p.1), and supply chain risks together with supply chain risk management are a top area of focus in literature and research around logistics (Wieland & Wallenburg 2012). It is also worth mentioning that supply chains are a strategic function (Carr & Smeltzer 1997; Lintukangas et al. 2013), and its risks should thus be managed. According to Hohenstein et al. (2015), the traditional view on supply chain risk management is the identification and management of supply chain related risks, but they also cite Grötsch et al. (2013), who concluded that supply chain risk management should focus on “building and maintaining resilient supply chains”. At best, supply chain risk management can be considered as an asset that creates competitive advantage to the company (Manuj & Mentzer 2008).

This section aims to provide a comprehensive picture on supply chain risk management and its different aspects. First, supply risks are discussed. Then, some supply chain risk management (SCRM) processes are presented and later more practical SCRM practices are presented. Generic risk calculation methods are out of scope, since those are not relevant to achieve the objectives of this paper.

### 4.1 Risks in supply chains

To better understand the concept of supply chain risk management, we must also understand the risks that could be present in supply chains. This could be called as the scope of supply chain risk management. There is a wide range of definitions for supply chain risks in existing literature. Zsidisin (2003) has defined supply risk as “the probability of an incident associated with inbound supply from individual supplier failures or the supply market occurring”. Ho, Zheng, Yildiz and Talluri (2015) extended the definition based on literature by multiple authors and came up with the following definition: “the likelihood and impact of unexpected macro and/or micro level events or conditions that adversely influence any part of a supply chain leading to operational, tactical, or strategic level failures or

irregularities”. Altogether, a supply chain risk can be considered as an possibly occurring event with a negative or damaging effect to a supply chain. To stay competitive and be able to manage the risks, it is important that companies can identify the risks that are present in their company and supply network. This section aims to study different risks in supply chains and their root causes.

As supply chains are often highly complex and optimized networks of multiple actors, there are also many possible risks that arise from the network set-up (Hallikas et al. 2004). It is not enough to consider only operational or internal risks, as supply chains are complex networks with multiple actors. (Lynch 2011, p.328.) However, the risks are dependent on each supply chain setup and thus individual. The complexity of supply chains and thus also supply chain risks was addressed by Ho et al. (2015), who reviewed over 220 journal articles. They found out that there are a few basic classifications for different types of supply chain risk: internal and external, operational and disruption, and organisational risk, supply chain risk and environmental risk. The classifications can be found in table 2. There are also several other and more detailed ways to classify supply chain risks: for example, Chopra and Sodhi (2004) had a nine-category classification. What is interesting, is that also Chopra and Sodhi’s classification is basically the same: operational and disruption, but the operational risks have been divided into more detailed and specific categories. This classification will help with risk management, as it allows management to focus more on those operational risks that are most likely to realize considering the industry and its special characteristics.

Table 2: Types of supply chain risk based on previous literature (based on Ho et al. 2015).

<b>Risk classification</b>	<b>Authors / original source</b>
<b>Environmental risk (external risk)</b>	Jüttner, Peck & Christopher (2003);
<b>Network-related risk (supply chain risk)</b>	Christopher & Peck (2004); Lin & Zhou
<b>Organizational risk (internal risk)</b>	(2011);
<b>Internal risk</b>	Wu, Blackhurst & Chidambaram (2006);
<b>External risk</b>	Trkman & McCormack (2009); Kumar, Tiwari & Babiceanu (2010); Olson & Wu (2010)
<b>Operational risk</b>	Tang (2006); Ravindran, Bilsel, Wadhwa &
<b>Disruption risk</b>	Yang (2010)

According to Olson (2014, p. 6-8), supply chain risks can be divided into internal and external risks. Some authors have used terms micro-risk and macro-risks, where the first one refers mainly to recurring and internal risks, and the latter one rare but high-impact risks, which can arise from both natural and man-made events (Ho et al. 2015). Lynch (2011, p.328) points out an interesting fact that most companies are highly dependent on other entities, and they control only about 30% of the value-creation. Thus, it would be important to focus on both internal and external risks to have a holistic and complete view of all possible risks within the supply chain. It is also possible to understand internal risks to include the risks in the entire supply chain, from upstream suppliers to downstream customers, leaving pure uncontrollable events to external risks (Olson 2014, p.7). Some examples of external and internal risks can be found in figure 11.

External risks	Internal risks
<ul style="list-style-type: none"> <li>•Nature disasters</li> <li>•Plant fires</li> <li>•Pandemics and diseases</li> <li>•War and terrorism</li> <li>•Regulation and legal</li> <li>•Labor disputes</li> </ul>	<ul style="list-style-type: none"> <li>•Supplier bankruptcy</li> <li>•Capacity issues</li> <li>•Inaccurate forecasting</li> <li>•Bullwhip effect</li> <li>•Agility and flexibility</li> <li>•On-time deliveries</li> <li>•Quality</li> <li>•Information systems</li> <li>•Integrations</li> </ul>

Figure 11: Examples of internal and external risks (Olson 2014, p.7).

Supply chain risks could also be categorized into operational and disruption risks (El Baz & Ruel 2021, Tang 2006, Olson 2014, p. 13). El Baz and Ruel (2021) mention changes in demand and lead times as operational risks, and low frequency but high impact events as disruption risks. Olson (2014, p.13) provides a wider categorization, saying that operational risks arise from the natural elements of supply chain, and disruption risks arise from crises or disasters. Ivanov (2020) describes operational risks to be associated with daily activities. A disruption can also be defined on a more generic level as an unplanned event which disturbs the normal operation of supply chain (Helmold, Yilmaz, Dathe and Flouris 2022). This definition for disruption can probably be the most accurate one since latest disruptions such as Covid-19 caused significant changes and volatility in both supply and demand.

## 4.2 Supply chain risk management as a process

Supply chain risk management could be defined as actions and strategies to control and mitigate both daily and exceptional risks within the entire supply chain. The aim is to ensure continuity and to improve resilience. (Wieland & Wallenburg 2012.) Lynch (2011, p.320) says that the goal of SCRM “is to uncover, prioritize, measure, treat, and monitor” risks within the supply chain. To this he adds also diminishing the impacts using resiliency practices after a risk event has occurred. Thus, in the context of this thesis, supply chain risk

management is considered to include both the proactive planning and preparing as well as reactive actions.

In existing literature, multiple frameworks and processes for generic risk management, as well as supply chain risk management, have been recognized. According to Olson (2014, p.13-15), a typical SCRM process has four steps: risk identification, risk assessment, risk avoidance, and risk mitigation. El Baz and Ruel (2021) name the process slightly differently: risk identification, risk assessment, risk mitigation, and risk control. The process flow could also be risk identification, assessment, management actions, and monitoring (Hallikas et al. 2004). These three workflows of risk management process are presented below in figure 12. All of these three examples have the same two first steps, but the latter two steps have minor differences on the risk management approach: Olson takes a proactive attitude trying to avoid the risks fully, whereas El Baz and Ruel have a more reactive approach. Hallikas et al. are in the middle with their approach of managing risks actively. Next, a generic approach for supply chain risk management process is discussed step-by-step.



Figure 12: Risk management processes (Olson 2014, p. 13-15; El Baz and Ruel 2021; Hallikas et al. 2004).

There is also a standardized process for managing risks. ISO310000 is a generic risk management process, which can be used in SCRM. The actual risk management process in ISO3100 is implemented using the same steps as described before, but the process also

emphasizes the importance of understanding the context given by the environment and provides a clear process flow for the treatment of risk. (Flaus 2013, p. 60-65). The ISO31000 risk management process is presented in figure 13.

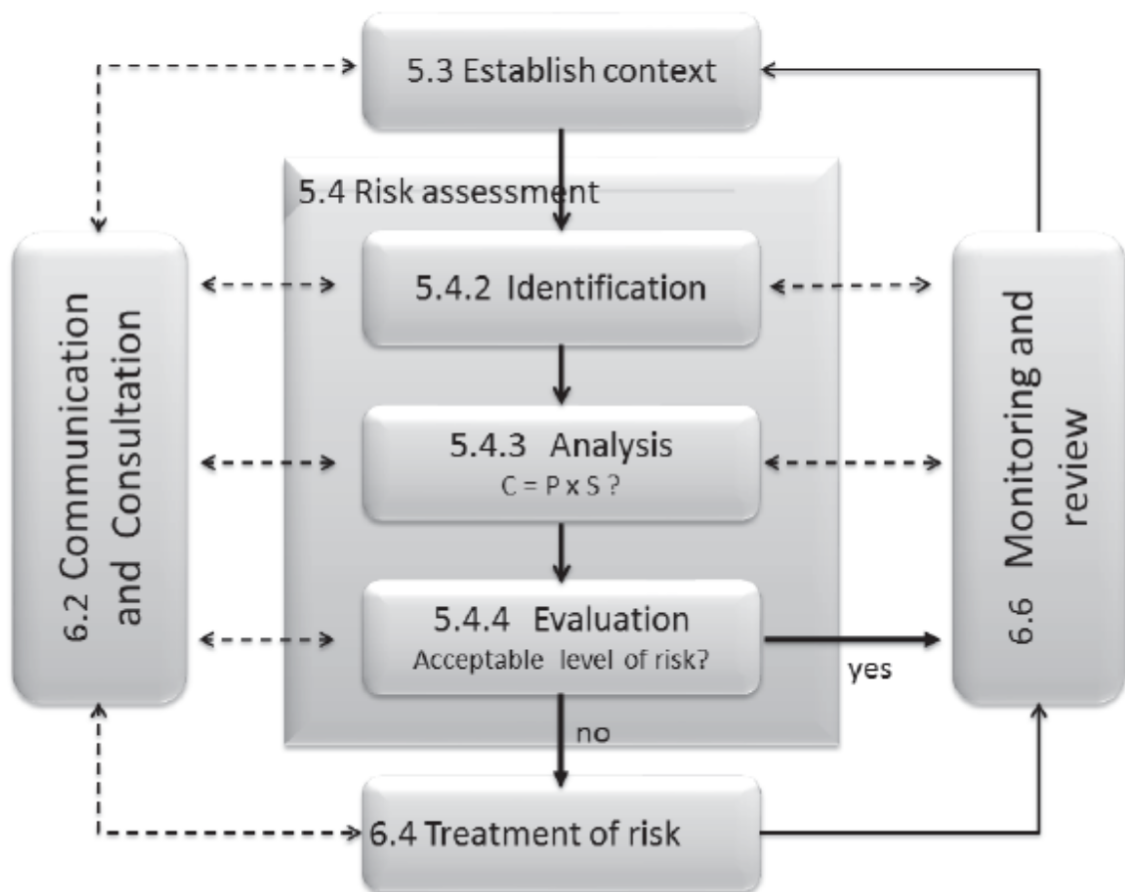


Figure 13: ISO31000 risk management process (Flaus 2013, p. 60-65).

Supply chain risk management process begins with risk identification, which is acknowledged by multiple authors. Risk identification helps on responding to disruptions and other risk events faster, as the sources of risks are already known (El Baz and Ruel 2021). Waters (2007) argues that all other SCRM process steps are based on risk identification and therefore the step is very important. Hallikas et al. (2004) say that risk identification is an essential element in the process, with the emphasis on recognizing risks and helping with proactive management of identified risks. They also remind about identifying those risks that might arise from other parties of the supply network but conclude

that the risks must always be identified from the company's itself point of view. With careful analysis, the root causes for different risks can be identified and effectively managed.

Next, the identified risks are assessed (in some research, analyzed) based on the probability and consequences, which will help in prioritizing of risk mitigation actions, but it will also make all the risks visible and understood (Hallikas et al. 2004; El Baz and Ruel 2021). Flaus (2013, 65) mentions a risk matrix, which can be used to analyze the likelihood and severity. Both axels are given a score, and then the scores are multiplied. The higher the index, the more severe the risk should be considered. An example of risk assessment matrix can be found in figure 14. According to ISO31000 risk management process, this step determines how the risk will be treated next: if there is an acceptable level of risk, the risk can be monitored, but should the risk level be considered too high, then the risk must be treated (Flaus 2013, 63) to make it acceptable or mitigated.

		Consequences/severity				
		1	2	3	4	5
Likelihood	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Figure 14: Risk assessment matrix (based on Peace 2017).

The third step differs slightly between different authors. El Baz and Ruel (2021) call the step risk mitigation and conclude that this step aims to minimize the risks beforehand, but also to ensure continuity if something happened. Olson et al. (2014, p. 14-15) discuss on avoiding of risks with traditional methods, such as carrying extra inventory, or having multiple suppliers. Interestingly they also mention insurances as one risk avoidance method, although



this one is purely reactive and probably cannot fully cover all impacts should some risks realize. Hallikas et al. (2004) take a wider perspective and consider that risk mitigation is one strategy in risk management. According to Hohenstein (2022), mainly risk mitigation has been addressed in literature, even though some other approaches, such as accepting, avoiding, transferring, or sharing the risk, could also be used to manage supply chain risks. Hallikas et al. (2004) mentioned transferring, taking, elimination, reduction, and further analysis of risks as generic strategies for risk management, but they conclude that in a network set-up, sharing the risk might not always be the optimal solution. This is because in a vertically integrated supply chain, risks are often shared between the different parties. Also, if the supplier is an important partner, it is not reasonable or good relationship management to transfer the risk for them. And in the end, transferring or sharing the risk with a partner supplier would eventually still pose a risk for the entire network. A risk management process based on ISO31000 standard suggests that there are four options to manage risks: treating, terminating, transferring, and tolerating the risk (Flaus 2013, p. 66). The choice between these different strategies should be made based on the likelihood and consequences, as shown in figure 15.

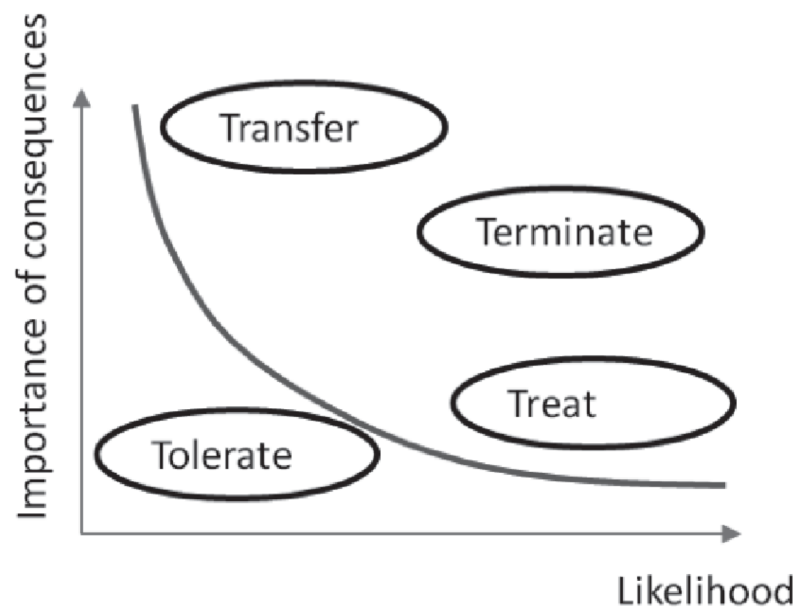


Figure 15: Treatment of risk "Four T's". (Flaus 2013, p. 66).

In the final stage of risk monitoring, identified risks are monitored since the environment and business will always change, which can change the status of each risk or even create new risks (Hallikas et al. 2004). El Baz and Ruel (2021) call the final step as risk controlling, which according to them, can be defined as the overall process of SCRM. With good risk controlling, impacts and frequency of risks are lowered, there are plans made for risks, and all counterparts of the supply chain understand the risks in the supply chain (El Baz and Ruel 2021).

Interestingly, Sodhi et al (2012) took an alternative approach and named the fourth step as responding to risk. Their approach is more reactive, where others have a proactive way for risk management. They also highlighted that this step is often neglected in literature. The idea of responding to risks is to accept that sometimes it is not possible to prevent risk events from happening. For those occasions, efficient ways and tools for mitigating damages must be in place. ISO31000 standard uses the term treatment of risk as the final step of risk management process. This includes for different options: treat, terminate, transfer, or tolerate the risk (Flaus 2013, 66). Different tools and methods for mitigating, monitoring, responding, and treating the risks will be discussed next.

#### 4.3 Different ways and strategies to manage risks in supply chains

After identifying and assessing the risks, risks must also be managed. As already discussed, the variety of different supply chain risks is large, and since different risks must be managed differently, there are also many options for managing the risks. This section aims to discuss and present different approaches to supply chain risk management.

Multiple scholars suggest that supply chain risks can be managed both proactively and reactively (e.g. Chowdhury & Quaddus 2017; Grötsch et al. 2013). Proactive risk management refers to preparing and planning for the worst-case scenarios, and on the contrary, reactive management is mitigating and fixing actions after something already happened. Pujawan and Geraldin (2009) describe proactive risk management as “preventing risk events from happening”. According to Chopra and Sodhi (2004), most companies do prepare for the most likely, often occurring risks, but rare risks are often neglected. However, the main purpose of supply chain risk management is to reduce vulnerability, and if the worst realizes, also to mitigate the impacts of a disruption (El Baz & Ruel 2021). Therefore, it is

only logical that both proactive and reactive approaches to risk management are needed, which was also concluded in a study conducted by Wieland and Wallenburg (2012). They however continue that reactive and proactive approaches are often used for different purposes: reactive actions often focus on the down-stream supply chain, whereas proactive actions are on the up-stream side. Some examples on proactive and reactive risk management practices are presented in table 3.

Table 3: Examples on proactive and reactive ways to manage risks. (Wieland & Wallenburg, 2012).

Strategy	Implementation
Proactive	Multiple-sourcing
	Inventory
	Make-and-buy
	Product design
	Architecture of logistics networks
Reactive	Communicating with suppliers and clients
	Business continuity plans
	Visibility
	Assortment planning
	Make-to-order/postponement

As already discussed, proactive risk management is different actions and strategies to mitigate risks, hedge against risks, and build resilience and robustness to the supply chains. Therefore, proactive risk management will help to withstand the instant impacts in a disruption. One of the traditional proactive risk management actions is to take insurances (Olson et al. 2014, p. 14), which will cover the direct costs in the case something happens, but it will not help in reducing the risks by focusing on the root causes. Naturally, there are also other forms of proactive risk management activities, which will reduce the risk levels from the root causes.

Recently many companies have focused on their supplier base and tried to cut the number of suppliers. The reason for this is primarily to reduce costs, make supplier management

easier, and to build collaborative relationships. However, smaller supplier base increases the dependency and therefore also riskiness of the supply chain. Multi-sourcing is known to be one of the most common strategies to reduce supply chain risks (Tang 2006), and it is especially suitable for non-critical items, where the volumes are high and supplies are not strategically important.

Ensuring quick and efficient exchange of information is important to help manage risks and mitigate the effects of occurrences. Sodhi et al. (2004) mention end-to-end visibility as one important way of mitigating supply chain risks. Due to the complex nature of being a network, supply chains are prone to so called bullwhip effect, which will enhance the effects and costs in a disruption (Hugos 2003, p. 104-105). Graves et al. (2022) highlight especially the importance of supply and demand management, and the ability to manage this in new and untraditional ways to mitigate the bullwhip effect. Jedynak and Bak (2021, 60) capsule that due to the nature and characteristics of supply chains, the risks should be managed jointly with the different parties of supply network, which is why close relationship and discussing with suppliers is so important.

Approaches to risk management in disruptions are different from operational risks. Tackling disruption risks is twofold. Firstly, supply chains must be robust so that they can withstand the impacts of a disruption, but supply chains must also be resilient so that it is possible to recover from the damages quickly. (El Baz & Ruel 2021.) Wieland and Wallenburg 2012 talk about robustness and agility, proactive and reactive strategies, and mention that many risk management strategies can increase both the ability to withstand and recover. Therefore, both proactive and reactive risk management practices are needed in the case of supply chain disruptions. Revilla and Saenz (2017) noticed that most research focuses only on how the consequences of a disruption are managed, but not on how disruptions could be prevented, or at least predicted. Olson (2014, p. 6-7) mentions that disruptive events, such as natural risks, are usually managed by taking an insurance or by having a resilient and diverse supply chain, which are both expensive risk management approaches.

## 5 Methodology

The study of this thesis was conducted using a case study as an approach, which allows the discussion of complex issues in a practical and down-to-earth format (Eriksson & Kovalainen 2008). According to Farquhar (2012), case studies are especially suitable for studying contemporary phenomena, which is why it was also chosen as the approach method of this thesis. Case study is a commonly used approach in business studies. It usually focuses on a contemporary phenomenon in an empirical way, with the aim of achieving a deep and holistic understanding of that particular phenomenon (Farquhar 2012). This chapter aims to justify and explain the methods used in the making of this thesis.

### 5.1 Focusing of the case

One characteristic of case study is that it allows studying a phenomenon in its actual context (Farquhar 2012). In this thesis, the case is built around one company's supply chain function, and therefore the interviewees are all supply chain professionals from the same company. However, to achieve a holistic and comprehensive view, the persons being interviewed were intentionally chosen so that they represent different sourcing categories, business units, or that there is at least some special point of view. Eriksson and Kovalainen (2008) however remind that case studies have been criticized on whether they are scientific or not. Therefore, it is important to remember that this case study will provide insights from only one company's point-of-view, which could be completely different from other companies. The results are also from one single industry only, which can cause a bias in the results.

#### 5.1.1 The company in focus

The study in this thesis is focused on one company only. The company is one of Europe's largest companies in the energy industry and it has operations in six different European countries. Its core business is production and selling of heat and electricity, but the exact offering is slightly different in each country.

The supply chain and procurement function of the focus company is managed by one centralized unit called staff function procurement (later referred as SF Procurement). SF Procurement holds the exclusive power of deciding on all commitments above the value of 10.000 euros, and its aim is to achieve the best total cost of ownership for the case company. Also, maintaining strategically important supplier relationships is within the scope of SF Procurement. The central procurement function is split into seven smaller units, which all focus on providing procurement support to the different business units of the company. SF Procurement is also split into direct and indirect procurement. Therefore, the company has applied some principles of category management to its procurement function. In the context of the focus company, indirect procurement refers to such categories which are not directly affecting the offering of the company, in this case the supply of electricity, heat, or gas.

## 5.2 Data collection methods

Interviews are a good method for collecting new and specific data for the purposes of a study (Farquhar 2012), which is the main reason why the study in this thesis was conducted using interviews to collect data. To be precise, a semi-structured interview was chosen as data collection method. Semi-structured interviews are sometimes known also as theme interviews (Tuomi & Sarajärvi 2018), which describes well the idea of discussing one pre-defined theme. A semi-structured interview is often used as it allows some free discussion and flexibility, but also provides a solid structure which is based on the research questions (Farquhar 2012; Tuomi & Sarajärvi 2018). This was also the reason for choosing semi-structured interviews as data collection method.

The interviews took place in September 2023. Due to the location and long distances between the researcher and the respondents, interviews were carried out using an online meeting tool. Interviews were recorded to provide access to the discussions also afterwards and allow the use of direct citations. Interviews were transcribed using a transcribing tool, after which the transcribing was reviewed and adjusted by the researcher when necessary.

The structure for the interview was designed based on Farquhar's (2012) observation that an interview should have a logical order. In the context of this study, four themes were created. Interview form used in this study can be found in appendix 1.

The first theme was about the background and details of respondents. This was done firstly to ensure the validity of answers, but also to map the basic characteristics of respondents. This can help to find some differences and mutual factors depending on for example the industry or size of companies. The second theme was designed to study the actions the company did after Covid-19 pandemic. The aim was to understand the lessons learned after a major disruption, as this would provide our basis for the main research question of the thesis “How did Covid-19 help to prepare for a new crisis (the Ukraine war)?” Questions in this section were based on previous literature discussed earlier in the thesis. In the third theme, emphasis was put on the current situation and the consequences of war in Ukraine to the respondent companies and their supply chain operations. Lastly, the fourth theme asked some generic question about risk management practises and preparing for crises. The questionnaire form used to conduct this study can be found in appendix 1.

Tuomi and Sarajärvi (2018) write that in qualitative research it is important to choose knowledgeable respondents to ensure the quality of results. For this study, the interviewees were chosen from different purchasing categories and business units to build a comprehensive picture of focus company’s risk management practices and the implications of disruptions to supply chains. One of the interviewees was representing direct procurement and two indirect procurement. All interviewees hold a long experience within procurement, and they had worked within the company already before Covid-19, which provides a great basis for this study. Details of each interview, including the background of each respondent, can be found in table 4.

Table 4: Details if the interviews and interviewees.

	Duration of the interview	Purchasing category	Examples of procured or contracted products and services
1	46:34	Travel, real estate and facility management (indirect)	Travel agencies, airlines, hotels, credit cards, rental and lease cars, trains
2	25:38	IT hardware and software (indirect)	Computers, mobile phones, peripherals, printers and copy machines, servers, data storing, mobile subscriptions, cloud solutions
3	21:22	Wind offshore projects (direct)	Foundations, wind turbines, cables, substations, maintenance vessels, building contractors

All interviewees highlighted that a majority of suppliers are located in Europe, but there are also some exceptions, and that was highlighted especially by the interviews of category IT and power plant projects. In the category IT, some suppliers are originally located in countries such as the USA or China, but the actual contracts are made with European subsidiaries or resellers. This describes the nature of modern supply chains well: the origin of produce can be quite far, and therefore challenging to manage. Also, the category of power plant projects mentioned that especially some sub-suppliers are located outside of Europe, for example in Arabian countries and Asia.



## 6 Analysis of results

This chapter describes and analyses the interviews conducted in this study. First, the effects of Covid-19 are discussed to create a basis for the results and after this the effects of Ukraine war to focus company's supply chain are discussed. Next, the two crises are compared to understand what the main differences were and finally in the last section, the question of 'did these two crises teach us anything' is discussed.

### 6.1 Effects of Covid-19

All three respondents agreed that the Covid-19 pandemic was a major crisis and a huge surprise to the procurement function. Interestingly, interviewee 2 considered that they were well prepared, which was mainly due to proactive planning and having some buffer in stock to mitigate the instant impact. The other two interviewees had a strong opinion that they were not prepared at all for such a disruption. The main reason this was the scale and magnitude of the pandemic, it was never expected that something with so global impact could ever happen.

*“I think we were not prepared at all, to be honest. That was nothing we could foresee or be prepared for”* says interviewee 3.

Because each respondent represented their own purchasing category, they also had different opinions on the effects of Covid-19 to the supply chain. However, each interviewee agreed that the pandemic caused a need to adapt to the new situation. Of course, this meant new ways of working remotely, but also other more critical effects on supply chains were mentioned. Within project procurement, one big challenge was ensuring the daily installation and maintenance of wind turbines. This was a challenge as the installers come from different companies and places, which caused a risk of getting positive test results and spreading the disease in challenging offshore environment. It was both a reputational and corporate social responsibility challenge to avoid any Covid-19 infections. Interestingly, challenges in doing maintenance were also mentioned by the interviewee from category travel: they said that

there was a lack of service due to travel restrictions, which also prevented travelling to power plants for maintenance purposes. It was not a direct challenge or effect of Covid-19 for the travel procurement but set one of the company's key businesses to risk, and therefore it was generally speaking one major consequence of Covid-19 for the focus company's supply chains.

*"We could not travel as we were used to. Some of our blue-collar workers, they needed to go somewhere to make maintenance"* interviewee 1 said.

In addition, interviewee 1 mentioned several other effects of Covid-19 to the travel category: some suppliers, such as travel agencies, shut their services almost immediately. This was a challenge, since despite wide travel restrictions, travelling was still required to conduct mandatory operational checks and maintenance for the critical infrastructure of the company. Also, the prices of hotels, rental cars, and flights increased rapidly, which had a direct impact to the prices of travelling.. Some suppliers of travel category were hit hard by the pandemic, which caused financial challenges to them and therefore it was unclear whether the suppliers could make it through the uncertain times or not. Losing the long-term suppliers and partners was a real fear, since that could be harmful to the company:

*"The financial situation on suppliers was extreme. It was definitely a risk during the whole pandemic of losing suppliers. This is something I found critical because we would lose competence on the supplier side"* described interviewee 1.

Generally, longer delivery times and challenges in logistics were rather common consequences of Covid-19. However, the respondents of this interview did not consider these as big challenges for the company. This was due to long-term planning and sharing the plans with the suppliers, which also helps them to prepare for the demand. In category IT, there was also a practice of keeping certain buffer in stock based on the plans and estimated demand. Interviewee 2 considered that longer delivery times were not a problem and there was no real harm to the company, it only meant using some equipment a little longer than usually. Interviewee 3 mentioned that the wind farms they are building require mostly components with long lead times, and therefore the impact was not that big.

*“We do lifecycle management. So normally you use a router for five years and now we had to wait one year for the delivery. That meant that we just had to use it for six years and it is not that big deal in the end”* says interviewee 2 from category IT.

## 6.2 What were the lessons learned from Covid-19 and did it help to prepare for a new crisis?

When discussing the lessons learned and what helped to get through Covid-19, interviewees mention several topics. One topic, however, is present in all three interviews: maintaining close relationship to the suppliers, discussing frequently, and information sharing were extremely helpful to survive through the crisis. On the contrary, it also helped the suppliers to plan their daily operations and make it through the acute disruption. This was clearly visible also in practice: the way of contracting suppliers changed to even more collaborative, and there was more frequent discussion with the suppliers on how to manage during the disruption. These were important, as information sharing helps all parties within the supply chain to plan proactively and therefore the impact of a crisis is not that sudden, but also recovery is much faster.

*“As an example, keeping suppliers constantly informed on what’s going on”* mentioned interviewee 1.

*“We had meetings with suppliers. We did not stop this, we just continued it online”* told interviewee 2.

*“That relationship which we have developed before helped a lot to also get through these times of uncertainty”* said interviewee 3.

Even though interviewees mentioned several effects and lessons learned from Covid-19, two out of three considered that Covid-19 did not help to prepare for the Ukraine war. They mentioned that each disruption is always slightly different and therefore it is impossible to be fully prepared for something, even though they admit that good preparation always pays

off. Some other topics that the interviewees mentioned as beneficial to help navigate thorough Covid-19 were the skills and capabilities within the organization. It was not only having skilled supply chain professionals working, but all three respondents mentioned also for example the ability to adapt quickly as one of the key skills that made the company, including procurement and supply chain function, do so well even during two consequent crises.

*“[These skills] is what I see as a strength which makes us able to adapt quickly, or maybe even quicker than others”* says interviewee 3.

### 6.3 Effects of Ukraine war

The effects of Ukraine war were especially big in the category of projects procurement, which is highly dependent on for example steel, cables, and components. These are commodities, where both Russia and Ukraine are major providers. The war blocked several crucial shipping routes, which caused a need to find alternative routes to acquire and transport these commodities. Since category of projects procurement was the one suffering most challenges during the Ukraine war, some of these key effects for this category have been collected to figure 16.



Figure 16: Effects of Ukraine war on the purchasing category offshore projects procurement.

One major consequence of war was heavily increased market volatility: this made it difficult to estimate and define prices for both the buying and selling organizations. Interviewee 3 describes that increased volatility meant changes in the way suppliers were being contracted: suppliers demanded all prices to be indexed due to rapidly increasing costs, but also the binding validity of quotes was much shorter than what it used to be. Naturally, this required the organisation to learn new ways and practices to work with the suppliers.

*“Before we had a good and stable outlook. We were able to anticipate prices, and that completely crashed”* describes interviewee 3.

Simultaneously with the war in Ukraine, inflation rapidly increased which was quickly visible in prices as well. Within the category travel the impact of energy crisis could be clearly seen in the form of higher prices, especially in hotel rates. Inflation was also strongly present within the category IT, as well as projects procurement.

One consequence of the Ukraine war has been an interest towards where the suppliers are located. As the war has been widely considered to be an unjustified attack by Russia, many companies have been trying to protect their reputation by terminating co-operation with and quitting buying from Russian suppliers. This theme rose also in all three interviews, but from slightly differing perspectives. All interviewees told that they had rather good view already earlier to the suppliers and that the risk of Russia connections was quite low, but also some special attention was paid to find possible risks from the supplier base. However, due to some EU requirements, and also to protect the reputation of the company, a clausula was added to all new contracts to prevent any unwanted Russia connections.

*“We created a declaration form where suppliers needed to sign that they are not active in Russia”* says interviewee 2.

*“We needed to make an assessment of our supplier base to check if they were based in Russia or had business with Russia”* says interviewee 1.

#### 6.4 What were the main differences between Covid-19 and the war in Ukraine?

It was agreed by all three respondents that both the Covid-19 pandemic and war in Ukraine were major crises that challenged the daily operations and supply chain management. However, there were different opinions on which one was the more impactful to the supply chains. Covid-19 was considered to be much more challenging and impactful crisis than the war in Ukraine within categories IT and travel, whereas in projects procurement, the respondent considered Ukraine war to have much larger effects.

*“I see this purely from travel point-of-view, but in comparison to Covid-19, the war in Ukraine is just a normal incidence”* says interviewee 1.

*“Covid-19 really caused a delay in all supplies, the war had not so much impact”* says interviewee 2.

*“Covid-19 did not destroy the international routes because all countries adapted quickly, but the war completely destroyed the balance in the world”* says interviewee 3.

Interestingly, the instant effects of Covid-19 and Ukraine war were partially quite same, but also on some points, very different from each other between the three purchasing categories. Generic effects which touched the entire society, such as inflation and delays in delivery times, were usually present amongst all categories. However, for example category of wind farm projects saw multiple challenges that probably had their root cause in the origin of some materials being in Russia or Ukraine. Table 5 concatenates the effects of Covid-19 and the Ukraine war per each purchasing category.

Table 5: Effects of Covid-19 and Ukraine war per purchasing category.

	Effects of Covid-19	Effects of Ukraine war
<b>Category: Travel and real estate</b>	<ul style="list-style-type: none"> <li>• Severe impacts</li> <li>• Lack of service due to wide travel restrictions globally</li> <li>• Lack of available travelling options to take care of mandatory travelling</li> <li>• Rapid increase in prices of hotels, rental cars, and flights (due to little availability)</li> <li>• Financial challenges on suppliers → fear of losing strategic key partnerships</li> </ul>	<ul style="list-style-type: none"> <li>• ”Just a normal incident”, little to no impact</li> <li>• Awareness on the location of suppliers and screening of suppliers</li> </ul>
<b>Category: IT hardware and software</b>	<ul style="list-style-type: none"> <li>• Only minor impacts</li> <li>• Longer delivery times and delays in supplies</li> </ul>	<ul style="list-style-type: none"> <li>• Only minor impacts</li> <li>• Increased prices and strong inflation</li> <li>• Screening of suppliers</li> </ul>
<b>Category: Offshore wind projects</b>	<ul style="list-style-type: none"> <li>• Severe impacts</li> <li>• Fear of infections amongst maintenance and installation staff in remote offshore locations → availability of skilled personnel</li> </ul>	<ul style="list-style-type: none"> <li>• Severe impacts</li> <li>• Increased market volatility</li> <li>• Increased prices</li> <li>• Changes in quoting and contracting practices: indexations and shorter binding times</li> <li>• Blocked shipping routes</li> </ul>

## 6.5 Did the two crises teach anything?

Supplier management was considered to be very important to survive through challenging times. The ability to adapt quickly was also mentioned as one key skill to survive through the crisis. All respondents agreed that seeing both the pandemic and a war within five years made everyone more aware that something could happen. This is important, as awareness helps to plan and prepare for new possible scenarios.

*“I think we are more aware of supply chain risks. So, we are thinking ‘hey, what happens if’”* mentions interviewee 2.

*“If you have a long time without real crisis or issues, you tend to live in your own comfortable procurement world”* says interviewee 1.

Based on the interviews, it seems that the two crises also affected the supply strategies of some categories. Within the category IT, it was considered to utilize more multi-sourcing to reduce the risk of one supplier failing to deliver. Also, the location of supplier base was now more interesting, and interviewee mentioned that there is a trend of insourcing and especially nearshoring.

*“Before Covid-19 we were still looking ‘more global’. And now we see the danger of it and think hey, perhaps we should keep things closer here”* says interviewee 2.

Digitalization was mentioned as one key tool to survive Covid-19 so well. With modern and digital tools, it was possible to stay in touch with the suppliers, negotiate contracts, share information, and keep business up and running. Digital tools also helped to lead with data and to understand the situation better. But it came also clear that there could still be room for improvement, which was seen as challenges of finding those suppliers with Russia connections.

*“With less digitalization, the situation would have been completely different and much more challenging”* says interviewee 1, and continues later:



*“It was really difficult finding suppliers with Russia connections the manual way”.*

Internal skills and cooperation were strengthened by the two crises, which was mentioned by the lead of category travel. Having two crises which heavily impacted the entire company showed that there are many experts within the company, and it really pays off to discuss internally and share information between different functional departments. This meant for example including procurement function in business continuity planning, as it is important for the business to know, if there will be a lack of important supplies or services.

*“Before we were never really involved in business continuity planning, but now we will give our input and special knowledge as procurement”* describes interviewee 1.

To conclude, the two crises taught multiple things for the interviewed category managers and the organization. Some of the key lessons learned have been collected to figure 17. Interestingly, many of these topics were not directly mentioned by the interviewees, but the themes were clearly present in the discussions with them.

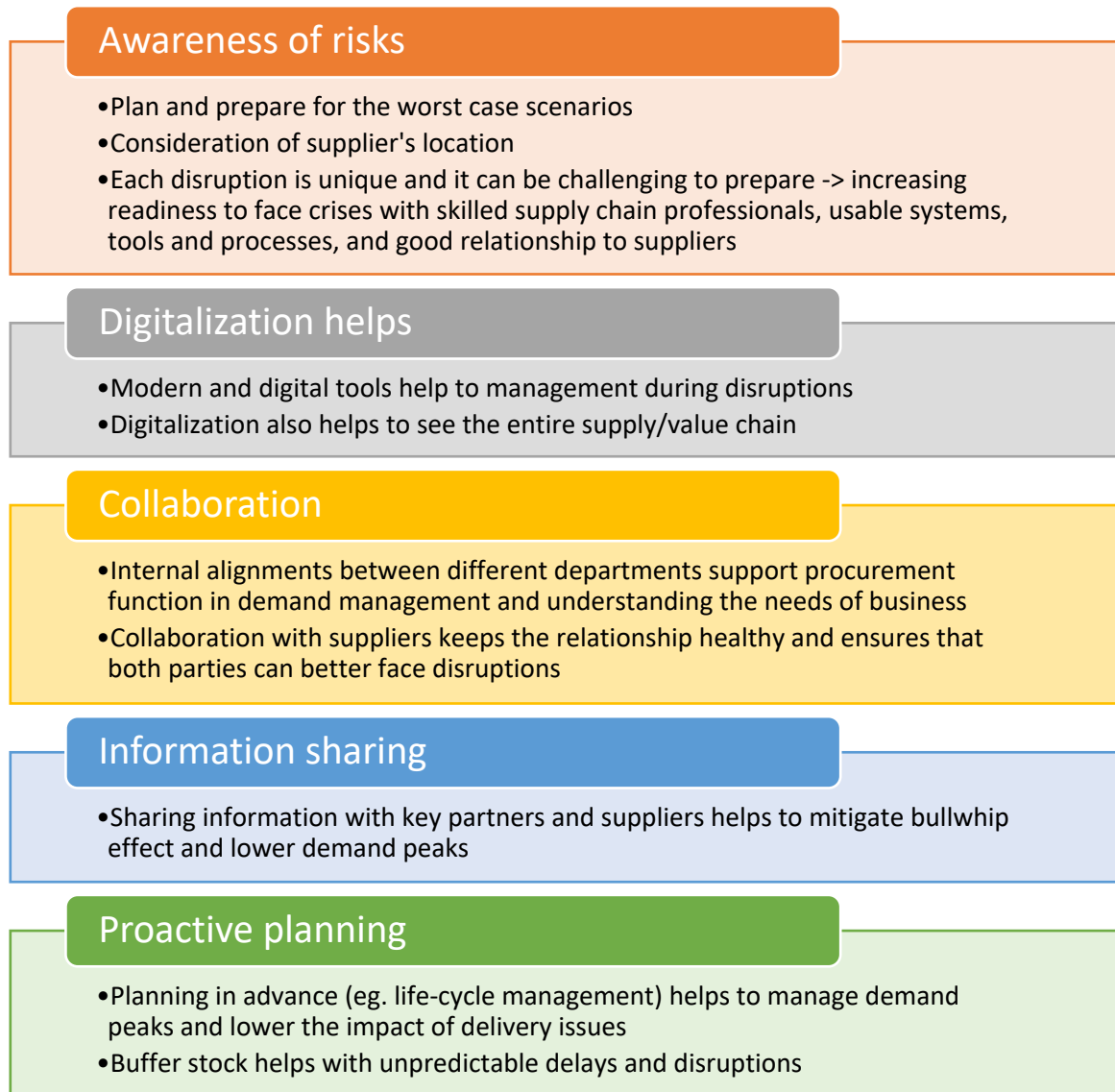


Figure 17: Key lessons learned after Covid-19 and Ukraine war.

## 7 Discussion

This chapter aims to discuss the empirical findings of the study in relation to previous literature. The chapter begins by describing the findings based on some of the elements of supply strategy, which explains well the pros and cons of different strategic choices. Later, research questions are answered to provide a holistic overview of the study.

The results of this study seem to align well with previous research. After the acute situation of Covid-19 pandemic, companies initiated several actions to make their supply chains less risky and more resilient. For example, avoiding single sourcing, contracting several suppliers, and nearshoring, were some of the identified and implemented actions (Tynkkynen 2022, p.68). Collaboration through the entire supply network, resiliency and agility were also mentioned as important actions to improve supply chains (Ernst & Young 2021). However, even if Covid-19 taught us something on preparing for the unexpected, the war came too quickly after the previous crisis, and the society hadn't yet had enough time to recover (Anghel & Jones 2023).

Similarly to Mäkimattila (2022), having a reasonable buffer stock, careful planning, information sharing, utilization of technological solutions, and collaborative attitude with suppliers, were amongst the most mentioned ways to mitigate impacts during and after a disruption. The respondents for this study mentioned that they have done some extensive life-cycle management and long-term planning, and then shared this information openly with the suppliers, which really helped to minimize the effects of disruptions during both Covid-19 and the war in Ukraine. The responses highlighted the importance of collaborative relationship management for strategically important categories, such as wind farm projects. On the other hand, indirect categories such as IT equipment were managed by sharing information openly to ensure the availability as well as adjusting the way of working internally.

Lack of resources, recession, changes in demand, inflation, and fewer sourcing options were amongst the top challenges in recovering from disruptions caused by Covid-19 (Paul et al. 2021). These themes were also present in the interviews as some major consequences and challenges for both Covid-19 pandemic and the Ukraine war. Interviewees across all categories mentioned the volatile economic situation and higher prices, and some were also

worried of losing strategic partnerships due to challenging financial situation on the supplier's side. Inflation and tight economy were also visible in a way that suppliers became more protective and changed contracting terms to tighter than previously. These kinds of changes will cause multiple challenges, when different tools for price hedging must be considered, and also ways to keep the profit margins good enough for the owners of the company. For example, Mäkimattila's (2022) thesis found out that acquiring new suppliers and changing contract terms for buying company's favour were not popular activities to mitigate the impacts of a disruption. As the respondent from category IT mentioned, it would technically be possible to protect against price fluctuations by making long-term contracts with fixed prices. However, this would not be a fair and equal deal for the supplier who on the other hand is an important partner. Therefore, the traditional methods of hedging against risks may not be suitable for all situations, which makes sense since collaborative supplier relationships should be managed differently from competitive ones (Ahtonen & Virolainen 2009).

Hohenstein (2022) found out in his study that digitalisation, employee training, having lessons-learned sessions, and information sharing through the entire network of all actors within the supply chain, would be beneficial and help to prepare for future disruptions. These methods were already used in the focus company, and based on the interviews, these also helped very much to mitigate the instant impacts of Covid-19 and the war in Ukraine. Firstly, information sharing helped suppliers to plan and prepare in the volatile market to ensure the availability of needed supplies. On the other hand, sharing information internally within the company was also important to ensure that all needs, restrictions and requirements are known, as this would help to plan daily operations and mitigate risks. However, some interviewees mentioned that there should be even heavier focus on implementing efficient processes and digital tools, since that would help in risk and disruption management massively.

The war was a great example on the current environment: changes are extremely fast, sometimes even unexpected. Even companies with the best risk management practices were surprised after Covid-19 and the war in Ukraine. But the differences come from how well companies had prepared beforehand with proactive actions, such as multiple-sourcing and efficient information systems, and how well were they able to react after the worst-case scenario happened.

## 7.1 Answers to research questions

The study conducted in this thesis answered the research question which were formatted in the first chapter. Overall, it became clear that the nature of a disruption is always an unpleasant crisis with unpredictable consequences. However, with some certain tools and ways of working, it is possible to improve resiliency and thus also to be better prepared for the unknown.

One of the research questions in this thesis was:

### **“How did Covid-19 help to prepare for a new crisis?”**

Based on the interviews, it can be concluded that Covid-19 helped only little in preparing for a new crisis. Crises and disruptions differ from each other and come with their individual characteristics and consequences (Anghel & Jones 2023), which was also visible in the interviews. Therefore, it is almost impossible to prepare for a new crisis. However, based on the research conducted in this thesis, it is fair to say that people and organizations do learn. Interviewees mentioned that Covid-19 broke the bubble and emphasized that Covid-19 increased awareness that something could happen. This is important, as risks can be managed only if those are first recognized. One respondent highlighted that Covid-19 also taught the art of playing with different scenarios and then building business continuity plans, which could be seen as one concrete way how Covid-19 helped to prepare for a new crisis. Another respondent mentioned that they understood the importance of supplier relationship management, which then helped to lower the highest waves of a new disruption. Also collaborative attitude was mentioned as one key learning of Covid-19.

The second research question of this thesis was:

### **“How has the war changed the way different elements of supply strategy are seen?”**

As already concluded earlier, both Covid-19 and the war in Ukraine, were wake up calls that it is not always a smooth ride. Some respondents mentioned that they have started to realize the risk of global sourcing, and instead of buying from far-away countries, nearby suppliers are preferred to decrease the risk of long-distance shipping. This aligns well with previous literature, where it has been concluded that nearshoring usually makes supply chains shorter

and thus easier to manage (eg. Kähkönen and Lintukangas 2022). Supplier location was also an important topic due to a country risk of Russia. Ever since the war began, multiple companies have decided to eliminate all connections to Russia to avoid any legal, financial or reputational risk. One respondent mentioned that they had to make conscious choice regarding the cooperation with some suppliers, since those still had business in Russia. It was also mentioned by all interviewees, that EU sanctions made them aware that they must know the entire supply chain very well, to avoid any breaches of these sanctions. Also, the risk of buying from only one supplier was recognized as a risk, and therefore a better utilization of multi-sourcing was considered to be a solid option to ensure availability in the future.

Despite supplier relationship management and collaboration were already used before the two crises took place, these were still mentioned in the interviews as crucial points of further development. No other single element of supply strategy received similar attention amongst the interviewees than the relationship to suppliers and collaboration. Supplier relationships were considered important because of multiple reasons. Firstly, a good relationship helps to understand the market better, which is very helpful in new and volatile situations – such as disruptions. Secondly, good relationships are needed to ensure frequent information sharing which helps to manage supply and demand peaks, but also to make some long-term planning together with the supplier.

However, the interviews did not answer if these observations and thoughts of supply management professionals were actually implemented in the supply strategies for each category. Some mentioned operational things, or changing the way of working, such as creating more collaborative agreements or terminated some contracts.

Also, the benefits of category management and centralized purchasing rose in the interviews, especially within the category travel. In the central locations where the most important offices of the company are located, certain hotels have been able to provide competitive and rather cheap prices due to concentrated buying and high volumes. This shows the importance of recognizing who are strategically important suppliers and where the company's spend is going. With the help of staying loyal and providing large volumes, suppliers were able to maintain reasonable prices despite the rising costs and inflation, which are widely known consequences of the war. Also proactive planning and life-cycle management speaks on

behalf of the importance of category management. Without centrally led purchasing, it would not be possible to plan the buying of rather cheap peripherals.

The third and final research question was:

**“What are the major differences of impacts of the Covid-19 pandemic and the Ukraine war on supply chains?”**

It was difficult to find a clear answer to this question, since all interviewees had slightly different opinions depending on the category they were representing. However, one common thing was that Covid-19 was a global disruption, whereas the impact of Ukraine war was rather local and limited to Eastern Europe. This was visible in a way that Covid-19 caused challenges for everyone, despite the industry, location, or purchasing category. Because of this, everyone also had to adapt to the situation quickly, which made it easier to face the disruption. Ukraine war, on the other hand, has its impacts in some specific industries, products, and areas, which makes the disruption more challenging to take.

On a more practical level, Covid-19 caused delays and changes in logistical routes. This was however something that was easy to manage because of proactive planning, co-operation, and information sharing with the suppliers. The war in Ukraine, however, caused some volatility and insecurity in world economy, and this was more challenging to predict and manage. Also, increased volatility makes planning really challenging, because you can no longer rely on the traditional methods.

What is interesting, is that both of these two crises affected also the way of working. During Covid-19 social distancing and remote working challenged the ever so important co-operation with suppliers. On the contrary, Ukraine war made it clear that certain countries can be riskier than others, and it is important to understand where the suppliers are located – also beyond first and second tier. This was clearly visible also amongst the interviewees, who mentioned that they are nowadays required to screen suppliers for any connections to Russia. This is mainly due to European regulation, but also to protect reputation and follow social responsibility initiatives. What remains as a questions still, is how well these new ways of working were implemented to the daily operations of supply chain function.

One potential reason explaining the differences between the responses of individual interviewees is that they all represented different purchasing categories. When you consider the nature and importance of these categories for the company, they are very different. If

you would place these into Kraljic's matrix, they would probably all fall into different groups. For example, the representative of IT category can utilize the buying power and enjoy luxury of multiple vendors. The products are rather cheap and not special, and it is possible to predict the demand well in advance. Travelling is important, but there are only very few potential alternatives – especially during Covid-19, when all travelling was restricted. However, the interviewee of projects procurement represented such a category, which has a huge importance for the company. They are buying components and services to build new wind farms, and generating and selling electricity is the focus company's core business. Also, the items in this category are way more specialized than regular IT equipment, which means that procurement cannot be done the same way. Therefore, it is also logical that the responses and view on challenges during a disruption are different.

## 7.2 Validity and reliability

The sample in this study is quite small, only three respondents were interviewed. However, given the fact that all respondents were representing different purchasing categories, the interviews provide a wide enough perspective. The study could have been more reliable by interviewing more people, also from other categories, to build a more holistic view. However, considering that this paper is a master's thesis, three respondents was considered to be sufficient.

All the respondents were within one company, which may cause a bias to the results. If the research was replicated within another company or industry, or for a larger population of different companies, the results could be completely different. Therefore, the results should not be generalized, but according to Tuomi and Sarajärvi (2018), qualitative research does not even aim to generalize, but rather to explain and describe one certain phenomenon. On the positive side, focusing on one company provides an interesting point of view and allows comparisons between different purchasing categories. This demonstrates how specific and different the impacts of a disruption can be depending on the category.

One of the main weaknesses of this study was that the scope, aim, and research questions were changed slightly during the writing process. Therefore the interview questions were not as well planned and thought as they could have been. If different elements of supply strategy would have been better integrated to the interview form, the research questions



could have been answered more thoroughly, making also comparisons between different categories easier. One interviewee also mentioned that they would have liked to see the interview questions or structure in advance, so that they could have prepared better. It came also clear that the terms and concepts used were understood slightly differently by each interviewee. However, again, considering that that this is a master's thesis, the results are sufficient and reliable enough.

### 7.3 Managerial implications

Creating and implementing efficient risk management processes was mentioned in one of the interviews as one important way to reduce vulnerability and damages caused by a disruption. This is easy to understand when reflecting to the interviews, where topics like stock planning, life cycle management, visibility to upstream parties of the supply chain, and co-operation internally were widely discussed. All of these topics are complex and cross-functional themes, where structured ways of working are important. Managers must also provide professionals with sufficient tools and resources, together with frequent training and educating. One interviewee explicitly mentioned that they consider that the current toolkit and processes in use are not enough for them to successfully develop their category management. Digitalization was also mentioned as one fundamentally important resource to survive through the two disruptions, and therefore availability of modern technologies should be ensured.

As Kähkönen et al. (2023) wrote, it would be important to focus on lessons learned to improve internal skills and supply chains resiliency for disruptions. Each interviewee had very good remarks and observations, and it was also possible to find points for improvement from the discussions. By implementing frequent and formal lessons learned sessions, it would be possible to get valuable insights for developing the supply chain function.

It was also mentioned that cross-functional teams and discussing with other departments helped to survive especially through Covid-19 pandemic. This should be recognized, and all professionals encouraged to 'break the silos', since in the end, each department is working for the same company and same goals. Open internal discussion will help to understand the needs of line-organization, which will in the end support also the procurement function and its planning and preparations.

#### 7.4 Suggestions for future research

Since this study was only a case study from one company, a more thorough review on a larger sample or scope would be interesting. Comparing different industries could provide insights on who were the winners and losers of these two crises. It was also challenging to find literature and existing studies on managing disruption situations, and a detailed review on the actions, processes, and tools used in one such a crisis, could be beneficiary for this field of research.

## 8 Conclusions

The world has recently seen several big events, which also disrupted the normal flows of supply chains. Covid-19 pandemic caused massive blockages to world harbors, when the movement of people was restricted globally to prevent the disease from spreading. In 2021, a large cargo ship Ever Given got stuck to the Suez Canal and blocked all traffic there for one week's time. This caused delays in deliveries, since other ships had to either wait for the canal to re-open, or then start a long journey around Africa. Lately, after Russian attack to Ukraine in February 2022, realized all Russia-related risks. These three are only some examples of supply chain disruptions, and looking into the entire 2000's, there would be many more examples.

This master's thesis aimed to discuss supply chain risks and risk management in the context of Covid-19 and the war in Ukraine. To be more specific, the aim was to find out differences between these two disruptions, and to focus on the lessons learned and how those could be used in preparation for future. Also, one of the objectives of this thesis was to provide some grounds to improve supply chains' resiliency towards a new disruptions. All objectives were achieved, and research questions answered. Based on this study, traditional supply chain management tools and practices are valuable in a crisis and disruption. This includes for example collaborative attitude, information sharing, and ensuring the availability of supply, but also utilizing modern tools and digitalization to support the work. The importance of clear processes and efficient tools is huge to mitigate the instant impacts, to ensure resiliency, and quick and efficient recovery.

No one knows, what the next big global crisis or supply chain disruption will be. World in 21<sup>st</sup> century is changing quickly and there are many political insecurities, geopolitical tensions, climate change, and unstable economy. Probably it is not possible to fully prepare for a new crisis since those will always different than the previous ones.

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## Appendix 1: Interview form

1. Who are you? What Business Unit/Supply category do you represent? How long have you been working in the supply management/procurement industry?
2. What are the main types of products that you procure/contract?
3. Where are the suppliers mainly located at?
4. In general, what are the main types of (supply) risks for the BU/supply category that you represent?
5. Is there an agreed supply strategy for the BU/supply category that you represent? What are the key three points in it?
6. What about risk management practices generally: how are supply risks managed?
7. How big of a surprise the covid-19 was? How well were you prepared?
8. What were the main reasons/skills/capabilities that made you well prepared?
9. How severely did Covid-19 affect the supply chains?
10. What were the biggest challenges that Covid-19 caused? How were these challenges tackled?
11. What were the most challenging products/raw materials/categories to buy? Why?
12. What kind of actions did you take as a direct consequence of Covid-19?
13. How did SCM practices change due to Covid-19?
14. Do you consider Covid-19 as “a lesson learned”? Why?
15. Was there a systematic “lessons learned” discussion post-Covid to develop the capabilities and risk preparedness of the organization?

16. Did Covid-19 help you to prepare for a new crisis, such as the war in Ukraine? Why, how? How well were you prepared for a new crisis/disruption?
17. How big of a surprise the war was? How well were you prepared?
18. What were the main reasons that made you well/poorly prepared?
19. How severely has the war in Ukraine affected the supply chains?
20. What are the biggest challenges that the Ukraine war so far has caused? How have you been tackling these challenges?
21. What were the most challenging products/raw materials/categories to buy? Why?
22. Have you taken actions as a direct consequence of the war? What kind of?
23. Have you made any changes to supply strategies due to the Ukraine war? What, why?
24. What do you see as the main differences between Ukraine war and Covid-19?
25. What about the things in common?
26. If there would be another disruption/crisis in the following few years, how well would you survive? Would you be prepared? Why? What are the main drivers and capabilities for an organization to withstand crises and be resilient?
27. Did Covid and/or Ukraine war affect the way SCRM or supply strategy is seen?
28. Any other observations or remarks on the theme?