Master thesis

Disruptions in the supply chain in the context of economic sanctions:
How the companies fulfil the orders of their customers in those situations

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Abstract

Purpose – The purpose of this study is to explore order fulfilment under the pressure of disruption in the supply chain of international private organisations in the context of economic sanctions. A concept’s development was intended with the newest academic studies when the paper was written.

Methodology and approach – It is an empirical research which uses qualitative methods of research. The methods are an integrative literature review and case studies with interviews of companies’ workers on companies facing environmental and economic sanctions.

Findings – The private companies prepare the supply chain disruptions mainly after encountering such problems. The strategies against the disruptions amongst the network improve the resilient. The risk mitigation and the management of this type of crisis are discovered in this study.

Research limitations and implications – The low number of respondents and authors reduces the impact and the possibilities of the research. The methods used limit the results as well as the sampling method.

Practical implications – The theories and strategies built from previous researches are facing the cases of companies. And it shows that the access to various markets by the companies have also effects on the reactivity of the supply chain of the companies.

Originality or value – The context of supply chain disruptions in environmental disruptions and economic sanctions in the case of European sanctions against the Russian federation and coups in Africa are explored.

Keywords - Supply chain, management, order fulfilment, risk management, crisis, disruptions, economic sanctions.

Type of paper – Master thesis with empirical research.
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# Table of contents

Abstract & acknowledgements ................................................................................................................. 3

Table of contents........................................................................................................................................ 5

## 1 Introduction .......................................................................................................................................... 8

1.1 Preamble ............................................................................................................................................. 8

1.2 Theoretical background ....................................................................................................................... 10

1.2.1 Supply chain and supply chain management ............................................................................ 10

1.2.2 The order fulfilment ..................................................................................................................... 12

1.2.3 The customers : requirements, needs and expectations, behaviour .......................................... 13

1.2.4 Supply chain disruptions .............................................................................................................. 14

1.2.5 Risk management ......................................................................................................................... 15

1.2.6 Crisis management and business crisis ....................................................................................... 16

1.2.7 Sustainability and its context ...................................................................................................... 16

1.2.8 Economic sanctions .................................................................................................................... 17

1.2.9 Concepts of the thesis .................................................................................................................. 18

1.3 Problem discussion ............................................................................................................................ 19

1.4 Companies in the study ..................................................................................................................... 21

1.5 Limitations ......................................................................................................................................... 22

## 2 Methodology ....................................................................................................................................... 23

2.1 Research philosophies ....................................................................................................................... 25

2.1.1 Research ontology ....................................................................................................................... 25

2.1.2 Research epistemology ............................................................................................................... 25

2.1.3 Research axiology ....................................................................................................................... 27

2.2 Research approach ............................................................................................................................ 27

2.2.1 Deductive approach .................................................................................................................... 27

2.2.2 Inductive approach ..................................................................................................................... 28

2.2.3 Abductive approach .................................................................................................................... 28

2.3 Choice of research methods ............................................................................................................. 28

2.3.1 Qualitative method ...................................................................................................................... 29

2.3.2 Quantitative method ................................................................................................................... 29

2.4 Research Strategies .......................................................................................................................... 29
2.5 Time horizon ........................................................................................................ 31

2.6 Techniques and procedures of the research ......................................................... 31
   2.6.1 Empirical research ....................................................................................... 31
   2.6.2 Research of the literature .......................................................................... 32
   2.6.3 The conception of the structured interview .................................................. 40

2.7 Sampling method .................................................................................................. 41
   2.7.1 Selection of the literature ........................................................................... 43
   2.7.2 Companies sampling .................................................................................. 44

2.8 Limitations of the methods ................................................................................... 45

2.9 Ethics in research ................................................................................................ 46

2.10 Summary of the methodology ........................................................................... 48

3 Papers’ reviews ...................................................................................................... 49
   3.1 Review of the definitions ................................................................................ 49
      3.1.1 Well-established concepts ....................................................................... 49
      3.1.2 Complex concepts .................................................................................... 50

3.2 Review of the supply chain disruptions ............................................................... 52
   3.2.1 The selected articles .................................................................................. 52
   3.2.2 The important role of the order fulfilment in the supply chain .................... 55
   3.2.3 The supply chain disruption risk mitigation and strategies ......................... 57
   3.2.4 The supply chain disruption management .................................................. 60
   3.2.5 The supply chain recovery ......................................................................... 61
   3.2.6 The supply chain resilience ...................................................................... 62
   3.2.7 The supply chain robustness .................................................................... 63
   3.2.8 The supply chain redundancy .................................................................. 64
   3.2.9 The supply chain flexibility ...................................................................... 64

4 Empirical research .................................................................................................. 65
   4.1 The interviews of the company LYSEO© ..................................................... 66
   4.2 The interviews of the company CMA-CGM© .............................................. 66
   4.3 The interviews of the company MSC© ......................................................... 68
   4.4 The interviews of the company IKEA© ........................................................ 70
   4.5 The interviews of the company Siemens Gamesa© ..................................... 72
   4.6 The interviews of the companies Renault© & Faurecia© ............................... 73

Aubourg, Y.
5 Results and findings ................................................................................................................. 75
  5.1 Analysis of the results ........................................................................................................ 75
    5.1.1 Analysis of the research question 1 ............................................................................ 75
    5.1.2 Analysis of the research question 2 ............................................................................ 77
  5.2 Discussion of the results ..................................................................................................... 79
    5.2.1 Discussion of the research question 1 ........................................................................... 79
    5.2.2 Discussion of the research question 2 ........................................................................... 80

6 Limitations and further researches ......................................................................................... 82

References .................................................................................................................................... 83

Datasets ......................................................................................................................................... 88

Appendix ....................................................................................................................................... 89
1 Introduction

1.1 Preamble

‘Il faut se concentrer sur ce qui nous reste et non ce qu’on a perdu / Focus on what you have left, not what you have lost’ Yann Arthus-Bertrand.

In a world where no uncertainty exists and no loss and disruption happen, the management of the supply chain will be unnecessary. And the customer fulfilment will run smoothly without any kind of human action. But in the real world, the supply chain may have problems such as glitches and it is easily disrupted (Zsidisin, et al, 2016). That’s why the supply chain management exists to intervene and improve the situation. Some parts of the supply chain might be temporarily unavailable and the management needs to be flexible, adaptive and reactive to keep the available parts functioning and seek for new relevant alternatives. It allows the supply chain to continue to reduce the costs in working efficiently and effectively (Zsidisin, et al, 2016). Reacting to the disruptions has many reasons and one of the main reasons is the customer fulfilment.

The aim of this study is to explore how the international private companies address the challenge of the disruptions in their supply chain in order to fulfil the customer requirements. The research will focus on the specific context of international conflicts through economic sanctions and it will explain the concepts linked to these ideas in the introduction part. The applied methodologies will be described in the methodology section. A paper’s review will be performed on the challenge of disruptions of the supply chain linked to the order fulfilment. After this exploration of theories, an empirical research will be performed on this topic with a main interest in the situations of economic sanctions. People have in the top of their mind environmental disruptions such as natural (figure 1) or human-made (figure 2) disasters which speak by themselves the abrupt stops of activities in sectors or regions. These disruptions are linked with climate change and the private firms would more often such disruptions. And the economic sanctions have less explored effects on the private firms directly in the previous research.

Aubourg, Y.
Figure 1: An extreme winter storm named Elliott appears in North America in December 2023 which provokes many shutdowns in Canada and the USA. Several roads and cities were blocked and millions faced deep freeze and coldest Christmas in decades (Global weather, Korosec, 22/12/2022)

Figure 2: A train derailment happened in the city of East Palestine the third of February 2023, Ohio, USA. Toxic chemicals were spilled in the nature, several train cars burnt and the railways was damaged (CNN, Yan, et al, 23/02/2023)
1.2 Theoretical background

First this work is embedded in human science in the business administration. The areas of study are the supply chain and logistics. The main subjects are the supply chain management and the order fulfilment, and the business administration through the supply chain disruptions. These disruptions imply the crisis and risk management. These topics involve the top management which prepares the case of disruption before it happens. Secondary subjects are used in the paper which are sustainable development in the case of unsustainable regional behaviours which could lead to conflict between neighbouring countries and impact groups of people. The environmental disruptions are also linked with sustainable development as effects are indirect effects of climate change. And international affairs are also a secondary field of study through the case of international conflicts which may lead to economic sanctions. The paper’s aim is to explore the disruption of the supply chain of private firms because of the economic sanctions on specific areas or countries as context. And how the private firms fulfil their contractual obligations toward the customers. This topic may be already explored before but research gaps exist in the newest events. There are not enough empirical studies with the companies and their direct participation on those events.

Secondly several concepts need to be defined and clarified such as supply chain and customer fulfilment as the central topic for the theses. The other concepts are the supply chain management and its assessment, the customer requirements, the customer expectations, VUCA, the supply chain disruptions, the risk management and the enterprise risk management, the crisis management and the business crisis, the climate change, the sustainable development, the sustainability, and the economic sanctions. Based on previous research, definitions of terms are made in this paper to make it clearer. It should also attempt to guide firms to meet their definitions and comprehensions with the sense of the terms in this paper. It could be necessary to interpret and change the terms used by companies in the interviews.

Hence the supply chain is often misused and mixed with logistics. The supply chain management follows the same misconception. Then these words need to be clarified and defined.

1.2.1 Supply chain and supply chain management

The supply chain management idea has appeared since 1982 and its conceptualisation was made later. The definition of supply chain is well established and used in the SCOR. It is also used by institutions dedicated to logistics and supply chain such as the Global Supply Chain Forum. A
supply chain is an inter-organisational relation involving at least three entities which can be organisations or individuals. They have a direct action in the upstream and downstream of one or more types of the three different types of flows which are physical, financial and informational flows from a to a customer and the reverse flows are also involved in this chain (Ellram and Cooper, 2014). The most basic three interdependent entities are the supplier, the manufacturer and the customers. A good understanding of the supply chain is the most important element to perform this thesis because the disruptions which happen to the supply chain must be fully understood for a proper comprehension and interpretation of the results.

Despite a common understanding of the supply chain, the supply chain management is not clearly stated and accepted by all the institutions and researchers. Then several researchers are trying to analyse this concept from the institutions and professional articles and spokespersons. A recent research made a paper’s review in order to create a clear definition based on the current meaning used by professionals and academics (LeMay, et al, 2017). The study suggests this definition:

“Supply chain management is the design and coordination of a network through which organizations and individuals get, use, deliver, and dispose of material goods ; acquire and distribute services ; and make their offerings available to markets, customers, and clients” (p.22, LeMay, et al, 2017). This definition reflects more a philosophy and an aggregation of many ideas which is not clearly accepted by academics. However this definition will be used for the current study. Knowing how the supply chain is managed by a company is crucial for the current research and also in every analysis of the company’s supply chain. This management is directly linked with the planning and the reactions in front of unexpected situations as well the daily routine. And in the thesis case, the disruptions of the supply chain are part of the former case, the unexpected situations.

And hence to manage the supply chain, it needs to assess the supply chain. The supply chain assessment has the goal to measure the health of the company’s supply chain and its degree of integration in the activities. The assessment can have other purposes such as measuring the capabilities or the performance of the supply chain (National Supply Chain Assessment (NSCA)). This assessment will be performed for the surveys and interviews of the private companies with the purpose of measuring the role of the supply chain within the sampled companies and its importance. Because the supply chain importance in a company modifies its perception and the answers of the companies may be influenced by this.
Moreover the supply chain is also influenced by the activities of the company itself. For instance the core activities and the outsourced activities have a strong impact on the costs and the management of the company’s supply chain is crucial. Then a product-based company acts in different ways compared to a service-based company (Krause and Scannell, 2002). This context is important to take into consideration and that’s why the interviews gather this information.

1.2.2 The order fulfilment

The order fulfilment or customer fulfilment is a crucial part of the logistics and supply chain of the company. This means that the company has to serve and reach the customer’s expectations. It must prepare to react and manage the uncertainty to fulfil the customer’s needs. The customer pays for a service and/or a product and the company is engaged to deliver it at the right time, at the right place, at the right quantity, at the right quality, and at the right price with the right costs. The top management must be prepared to make the company efficient, flexible, responsive and the customer fulfilment needs to be integrated in the supply chain. Because uncertainty exists inside the supply chain and outside the supply chain of the firm and any problem can reduce the competitiveness of it. And any need of the customer which is not properly fulfilled is considered as the fault of the firm. The firm could lose brand image, a customer or any partner of the supply chain can lose trust and change their partners (Andry, 2020). The order fulfilment process can be described as follows:

“Order fulfilment process starts with receiving a customer's order and ends by sending the final product. This includes activities such as order processing, stock checking, purchasing decision making, supplier selection, a purchase order, planning component manufacturing, and final product assembly and delivery of goods. In different companies, the order fulfilment process is run differently according to their unique business characteristics (for example operating modes: make-to-stock, make-to-buy or order, engineer-to-order by service, and assembly-to-order) [...]” (p.3, Andry, 2020).

The order fulfilment is the second central concept used and investigated in the current study. It is the reason for a private company to plan and react against a disruption in the supply chain. The company’s goal is to answer the customer’s demand and the order fulfilment is a process which addresses all the elements related to the customers within a company.
The order fulfilment is also impacted by the change in the customer needs and expectations. Before the private companies created and led the trends and the customer’s requirements. But in recent years, the market tends to follow the rules of the customers and this change of markets’ paradigm is called by the acronym VUCA (Bennett & Lemoine, 2014). It means that the markets are volatile, uncertain, complex and ambiguous because of the variety of the customers and the high competitiveness of the markets opened at the world scale.

And the internet changed the habits of the customers and they rely more and more on the online services especially after the Covid-19 crisis (Piccoli, et al, 2004 ; Pratap, et al, 2023). And during the last decade, the consumers want to spend less time on purchasing to spare more free-time. They became more demanding and they are expecting to be delivered within one day at home and even during a day-off. Strong companies such as Amazon® made a new business model with a supply chain able to perform such excellent services for their customers (Aćimović, et al, 2020).

To understand the customers and the context of the markets is important for the companies and their top management. A central function of the supply chain is to answer the expectations of the customers and reach new customers and especially in the case of brutal changes as disruptions of the supply chain.

The customer requirements is a concept with different versions and analysis. In this study, the considered requirements are the effects of key customer requirements under the Kano model. It divides the customer requirements into five categories of customer requirements. Those categories are based on the customer’s satisfaction and they are basic requirements, indifferent requirements, reverse requirements, expected requirements, and attractive requirements. The basic requirements have almost no positive effect when they are fulfilled but they have a real negative effect when they are not respected. The customers are dissatisfied and they tend to avoid and reject the product which has not the basic requirements. The indifferent requirements have no real impact on the customer’s satisfaction whether they are met or not. The reverse requirements act as the opposite of the basic requirements where they dissatisfied the users when they are met. The expected requirements and the attractive requirements are the key customer requirements of which the companies should consider to gain a competitive advantage on the competition and increase the market shares in improving the satisfaction of the customers. The expected requirements as their name implies are requirements that the customers expect to have with this service or product and they would be
satisfied with this quality. The attractive requirement is the most competitive part where the company can create its point-of-difference on the product or service and make the customers associate with this unique feature. The customers can be surprised by these unexpected requirements and their satisfaction could be extremely improved by this type of requirements (Nailiang, et al, 2020).

Thus the customer requirements are embedded in the company’s activities as a process in which the customers are translated as technical successive steps. This operationalisation makes the customer requirements clear for the company and the decisions. It is important that the company integrates this concept to be successful and grows, the main goal for the company.

1.2.4 Supply chain disruptions

The supply chain disruptions happen when the normal flow of goods and materials within a supply chain are disrupted by events which are neither planned nor anticipated. Furthermore those events are not only extreme situations which stop the supply chain, but also they are also fluctuations in regular operations. And that might result in a supply disruption (Bier, et al, 2020). Those disruptions have more risks to occur with a more complex supply chain even if the probabilities are very low. The cost of such risks are tremendous for the company and it can stop the production, other activities and the company’s profit for an uncertain length of time. To avoid this, the company needs to prepare for these risks.

The supply chain disruption impacts the region where it occurs as well as private companies directly linked to this region. But it has a major effect which is the propagation of the supply chain disruption. The disruption propagation spreads outside the disruption location and it may impact a large part of the supply chain or even the whole network. This loss of profit is the direct effect and the supply chain destruction might happen as the worst case (Scheibe and Blackhurst, 2018). The risk propagation is linked with that and the risk management should take it into consideration for planning.

For instance the major earthquake which impacted the Eastern part of Japan in 2011 provoked disruptions in most of the supply chains of the Japanese companies as well as foreign companies in some sectors. The country lost 0.35 % of its GDP and some regions and sectors had lost more than 50 % of their profit during the following month after the natural disaster. Even distant regions in Japan were impacted by this event through the propagation. In some regions and industries, several
months were needed to recover from it (Tokui, et al, 2017).
This type of risk is the main studied topic in the current thesis. The research’s purpose is dedicated
to explore how the companies plan the supply chain disruption in a paper’s review. And through interviews and surveys the companies are questioned on how they react to the disruptions in the
specific context of economic sanctions.

1.2.5 Risk management

Risk management has a wide range of meanings and the financial side is a core value to it. It must be clarified and the operational part is more important to this research. The market’s uncertainties are not so relevant for this research. Then the risks concerning the normal changes in the market are mainly avoided here. The crisis management is linked with the risk management but it differs by its purpose and it will be analysed in its definition.

Risk management is not defined here in its whole definition. The attention is brought to the part of the enterprise. Then the enterprise risk management (ERM) involves any kind of private company in all the sectors of activity. It is defined as a process in which all types of risks are assessed, controlled, exploited, financed and monitored. The aim of this process is to improve the short and long term value of the organisation’s stakeholders (D’arcy and Brogan, 2001).

The Casualty Actuarial Society enumerates the different types of risk which are hazard, financial, operational and strategic risks. All the enterprise risks described by this society are: “Hazard risks are those risks that have traditionally been addressed by insurers, including fire, theft, windstorm, liability, business interruption, pollution, health and pensions. Financial risks cover potential losses due to changes in financial markets, including interest rates, foreign exchange rates, commodity prices, liquidity risks and credit risk. Operational risks cover a wide variety of situations, including customer satisfaction, product development, product failure, trademark protection, corporate leadership, information technology, management fraud and information risk. Strategic risks include such factors as completion, customer preferences, technological innovation and regulatory or political impediments” (p.3, D’arcy and Brogan, 2001).

The research will focus on one type of risk which is the strategic risks for the economic sanctions. Those risks can easily disrupt the supply chain of every supply chain established in sanctioned regions or countries. But the academic and practitioner literatures show that the definition of risks differs from individuals and groups and biases appear on the risk assessment (Bromiley, et al,
2015). Thus the risk’s exploration won’t be made in depth with the questioned companies in this research.

1.2.6 Crisis management and business crisis

The crisis management is applied to different environments and it depends on the type of crisis. Then the crisis needs to be clarified and put in the private firm context as well as its management. A crisis can be defined as a situation which is uncertain and it has latent risks and opportunities for the firm. This situation must be resolved within a specific timeframe (Canyon, 2020). In the study’s topic, a sudden disruption of the supply chain is typically a crisis. This resolution is made with a dedicated management and team. Crisis management can be defined as follows: “The measures and methodologies used to recognize, control and limit the damage of a crisis, and its ripple effects.” (p.9, Canyon, 2020). These measures are the preparation of the firm in case of such a situation and a team should be created. The person in charge is named in advance and different specialists of the company must meet together in the crisis’s occurrence. These different skills are important to tackle the crisis and the team creates creative ideas and solutions which is a crucial part of the team cognition (Moon, et al, 2020).

The supply chain disruptions are a part of the business crisis and its management is a crisis management which follows the overall same path. Then a good crisis management of a company should lead to an effective reactivity against supply chain disruptions. And the papers reviewed in the topic of supply chain disruptions might apply the crisis management partly for the particular context of external risks.

1.2.7 Sustainability and its context

Climate change and sustainable development should be quickly summarised and defined to make these concepts clearer to the readers. Sustainable development and sustainability are concepts linked with global warming or climate change.

Global warming is a concept which is the effect of human activities since the industrial revolution in the end of the 18th century. It compares the difference of global temperatures before the industrial revolution and the current global temperatures. This warming is directly linked to the emission of greenhouse gases by humans which is increasing the greenhouse effect of the planet Earth (Coleman, 2013). This notion is a bit abstract and many sceptical persons don’t believe this
warming effect. A newer term which is more comprehensive is climate change. It is about all the effects of human activities which are not sustainable and exceed the regenerative capabilities of the nine planetary boundaries (Coleman, 2013; Moberg and Simonsen, 2015). Some of the effects are globally unknown such as the depletion of biodiversity but they are still concerning.

To reduce the bad effects of human activities, sustainable development is a way to address this problem. This concept is a newer approach to the development of activity or region which has the goal to replace the common financial development of any kind of human activity. It appeared in the 70’s and it was introduced as a solution to counteract the emission of greenhouse gases. In more recent days, all the planetary boundaries are considered by this development and social development is also a part of it. Sustainable development is a three-dimensional development in which the financial development, the social development and the environment development are the real results to enhance to make sustainable a development of human activity (Ruggerio, 2021). Consequently this development is linked with sustainability. This is a concept applied to a system with the aim of duration in the long term with lower impact on the environment. The reduction of resources’ loss at least and the better solution is to make the resources reusable with no loss. The latter is the core element of a human society with a strong sustainability (Ruggerio, 2021). In some cases, a country or a group of countries ban products for their unsustainability origins or effects. And then the companies are forced to be more sustainable.

The sustainability is becoming central for the companies where the consumers are more aware than before and it may be contained in the customer requirements. The sustainable origins of products are attractive requirements but it tends to be more central. More and more consumers can see this type of origins as expected requirements or unsustainable origins could be reverse requirements. And the external disruptions of the supply chain are largely caused by environmental risks which are the natural and human-made disasters. Then sustainability is indirectly related to the environmental risks of supply chain disruptions and the private companies should address this risk at least to reduce the impacts on their activities.

1.2.8 Economic sanctions

The range of economic sanctions needs to be explored to understand the possible effects on the supply chain of a private company.

A given definition of the economic sanctions from the book ‘Essential Economics’ : “A way of punishing errant countries, which is currently more acceptable than bombing or invading them. One or more restrictions are imposed on international trade with the targeted country in order to
persuade the target’s government to change a policy. Possible sanctions include limiting export or import trade with the target; constraining investment in the target; and preventing transfers of money involving citizens or the government of the target. Sanctions can be multilateral, with many countries acting together, perhaps under the auspices of the UN, or unilateral, when one country takes action on its own.” (Essential Economics, 2004). A case which is on the top of minds during the writing of this paper is the economic sanctions against Russia for its invasion of Ukraine. Since the Crimean invasion, the Russian federation was under economic sanctions such as restrictions on specific products and administrative restrictions. Now prohibitive taxes from the Western countries are imposed on most of the Russian products and services (Li and Li, 2022). The gas and oil have their prices capped by the European Union. Investments are prohibited to Russia and from Russia in most of the Western countries. Several Russian citizens have their assets seized by the Western countries when they are located in those countries. All these sanctions have the aim to punish and stop the Russian aggression against Ukraine and force this federal state to return to the territorial situation before its invasion of Crimea in 2014.

The economic sanctions are the context of the current research where the companies are interviewed about the effect of this context on their supply chain and the possible disruptions provoked by it.

1.2.9 Concepts of the thesis

The crucial concepts for the current study are the supply chain and its management, and the order fulfilment. The supply chain needs to be effective and efficient in order to fulfil the demand on the market through the order fulfilment. The customers have behaviours and requirements that are translated into the order fulfilment and the supply chain must deal with it to continue to grow and survive. The thesis is testing the supply chain in the context of disruptions in the network. These cases can be translated into business crises and risk management. And the companies are analysed in the context of economic sanctions against Russia or coups in Africa. This context is a type of supply chain disruptions which can be environmental disruptions with the case of climate change and political sanctions. The precise case of economic sanctions is investigated in the current work.
1.3 Problem discussion

Currently the news recounts the facts that several important disruptions and changes in the international market are happening. Those data need to be taken into account for the organisations.

The research questions based on this subject are:

- How could the private companies plan supply chain disruptions?
- How could the private companies react to economic sanctions in order to meet the customer requirements and to continue to deliver products?

Hence the first question has the aim to explore and find a framework or a theory about the decisions of private companies confronted with supply chain disruptions. This will be based on previous research.

The second question is dedicated to the exploration of particular situations and direct contact with companies. The idea is to test the built theory or framework and discover specific instances on the case studies. The targeted companies are international private firms with a well-established supply chain in at least two different countries and these firms are located in Western Europe and Northern Europe. In these countries, the worldwide actors should have an efficient and effective supply chain to reduce the costs and stay competitive in the global market. They have an integrative network where they need to act as an element of a whole system and they make decisions with the closest partners. This state-of-the-art supply chain is more relevant for the aim of the study to test the decisions taken in front of the context of economic sanctions.

Research question 1: How could private companies plan supply chain disruptions?

The top management of this type of organisation needs to be prepared. This preparation is an important part of crisis management and risk management. These activities can be summarised as ‘act and react’ and also to avoid the situation worsening during a crisis. In this study the focus is made on the supply chain, the impact of disruptions on it. The researches on uncertainties in the markets are well established and this topic is too wide for the current type of study. The focus will be made on a specific part of the area of research in which empirical research can be investigated and performed. The considered risks which are unpredictable are the political conflicts and environmental disruptions. The natural disasters occurring more often with climate change and social conflicts with important strikes impacted one of the interviewed companies. The political conflicts lead to economic sanctions such as restrictions and embargoes on countries or regions in
the world. Regulations may occur also against specific products, raw material or components which can harm the environment for instance. So a new question should be asked about this subject.

**Research question 2:** How could private companies react to economic sanctions in order to meet the customer requirements and to continue to deliver products?

Many enterprises have a very large supply chain and any kind of conflict may impact them and their customers might be dissatisfied. How the firms continue to serve the requirements of their customers. This study investigates the reactivity and preparation of the private companies against recent environmental disruptions such as economic sanctions and regulations, and social movements to fulfil their order to keep their consumers satisfied. Whereas the customers tend to be more demanding and want to be served in a shorter time than before (Aćimović, et al, 2020). This threat which complexifies the supply chain needs to be also managed by the companies.

Thus before exploring and answering those questions, the need to define important concepts for the research such as the supply chain, its management, and the order fulfilment. Other terms need to be clarified and explained. The use of papers’ reviews supports the ideas and concepts of this research paper which leads to the descriptions of the theoretical background.

In the first part the review will help to find and understand how the companies deal with disruptions in their supply chain. Or how they prepare themselves to react to these types of crisis and the risks. And it is also important to know how the companies continue to fulfil the customer requirements in order to reach a good satisfaction level from them.

In a second part of the research, the use of interviews with several companies will allow the study to make an empirical research and obtain empirical results to confirm, infirm or complete previous research. With these results new insights could be found in the contemporary context and limitations of the research should appear. The questioned organisations are international private companies located in Western and Northern Europe. The region of Europe is known for its diversity in its activities and the most developed part is located in Western and Northern Europe where the use of e-commerce is important (Sadowski, et al, 2021). And they are more conscious of the sustainable development of which they tend to make more effort to reduce their environmental and social impacts with their activities. The software helps to make the firms’ supply chain more efficient and to have control with real-time systems. This fact should help the companies to perceive unexpected change within the supply chain and those companies are more aware of any kind of disruption in their supply chain network.
1.4 Companies in the study

LYSEO©
LYSEO© is a service-based French company which provides logistics solutions to its customers. This third-party logistics company works with international partners and provides services abroad. It has a major partner and customer in China. This company is a case of a company which has not had supply chain disruption and it has encountered minor problems with no environmental origins. Due to this and its small size (less than 100 people), it has no strategy in order to face environmental disruptions.

CMA-CGM©
This international private company is a French and Lebanese company. It is a major maritime company. And the company is well-established in Africa. The company in this continent faces environmental disruptions due to political conflicts and economic sanctions against specific governments.

MSC©
This private company is an Italian company. Mediterranean Shipping Company© is a leading company in the sector of maritime companies and it has important partners in the Mediterranean sea and in Africa. In those areas, political conflicts and economic sanctions occur and the company should prepare for disruptions in its network and supply chain.

IKEA©
This international private company is a Swedish company. Its sectors of activity are furniture and food. This company had been a major player in the Russian market for the furniture sector with IKEA© stores and Mega®©stores, one of its subsidiaries in the Russian federation. The European economic sanctions provoked disruptions in the supply chain of this company.
Siemens Gamesa©

This private company is a major German and Spanish actor in the energy sector especially with wind energy such as wind turbine production. This company has an important manufacturing place for off-shore wind turbines in Normandy in France and social movements disrupted the production.

Renault© and Faurecia©

This international private company is a French company. It is an international major actor in the automotive maker sector. The Russian market was rising before the European economic sanctions. And some parts of the production were located in the Russian federation. The supply chain disruptions of economic sanctions are impacting Renault©. Faurecia© is an important partner of Renault© and it produces automotive parts.

1.5 Limitations

The papers used in this thesis are restricted because all the articles found with search engines are not available for the author. The databases available and used by the author have selections of articles and restrictions. Several studies should have been insightful for the research and the way of how it was conducted. The questions, research gap, the methods used and the results rely heavily on the available materials. Hence the ideas within the study are influenced by the papers and their results.

The targeted organisations are specific and it limits the study naturally. The locations of the companies are a limitation in the study. A more systematic screening of the companies which can be located in one region such as Northern Europe in one specific sector for instance. The sample of the research is specific and other populations could be used in order to test the hypothesis. The target population could be different such as a wider range or a more narrow range. This could be other types of organisations which could be tested and not only the private firms. Other types such as NGOs or state organisations would be questioned as well as private companies. The aim of the study could be larger. For instance to compare the companies which succeed and the companies which fail. Or a thinner target such as companies in one specific sector or industry. And other contexts could have been explored more specifically and in depth or more general contexts could be used.
2 Methodology

Economic studies are a part of the human sciences which use the same methods of research. Many different types of methods are used and for the purpose of this paper, not all the methods are used. The research onion is used as a framework for the methodology of the research (figure 3). This framework was introduced in the book of Saunders et al where the model has been improved several times for the first edition (Saunders, et al, 2019). The human sciences researchers use mostly this model to conduct a study. It uses the imagery of the onion and its several layers. The method starts from the outside and digs deeper in the layers to end in the core layer. There are six main layers which represent important steps of the method. Those layers are the research philosophy, the research approach, the research strategy, the choices, the time horizon and the techniques and procedures (Saunders, et al, 2019 ; Mitchell and Rich, 2020). The first layer is the choice of philosophy and its description through ontology, epistemology and axiology. It represents how the facts and the knowledge are used in the research. The second layer is the approach of the theory development. It leads to the way the theories of the research are built and how the logical construction is made. The third layer is the methodological choice and explains the number of research methods used and which types are selected to conduct the research. The next layer is the strategies of research and it describes the precise methods used to make the study. The fifth layer is the time horizon of the research and it indicates the time period used in the study and its duration. The last layer is the most specific and precise where each technique or procedure is defined and described and how the data are collected and analysed in this research.
Figure 3: Research onion methodology (Saunders, et al, 2019)

These concepts are described and defined in the following sections.
2.1 Research philosophies

2.1.1 Research ontology

The research ontology is constructionism philosophy or subjectivism. To understand the previous sentence, a description and definition of the terms are required. Ontology is a compound word of two ancient Greek words which are ‘ontos’ and ‘logia/logos’. ‘Ontos’ means ‘being’ or ‘that which is’ and ‘logia/logos’ means ‘logical discourse’ or ‘theory’. So ontology means literally the theory of being. This philosophy deals with the nature of existence and structure of reality (Al-Saadi, 2014). In the case of the business administration research, it explains how the researchers see and understand the objects of the research and how this field of research is interpreted by the research group (Saunders, et al, 2019). As written previously the current paper proceeds through the constructionism philosophy which means that the research is surrounded by subjective reality. The reality is perceived by human minds and social constructions where the reality can be translated into successive individual different mental constructions. The reality exists through individual estimated or approximated views with social interactions and it is in permanent state of revision (Al-Saadi, 2014). The research’s aim is to construct a theory based on human interactions and reactions to other human activities in abrupt change. The results of the qualitative methods are used to make this hypothesis (Goertz and Mahoney, 2012). That’s why the reality of the research is subjective and it depends on the human minds.

The other philosophy for ontology is objectivism. This is the opposite of the subjectivism philosophy. The objects of the research are independent from the social context. And then they can be analysed and repeated in other social contexts and the results should be the same (Saunders, et al, 2019).

2.1.2 Research epistemology

The research epistemology follows the interpretivism philosophy. The word epistemology is compounded by two ancient Greek words ‘episteme’ and ‘logia/logos’ which are ‘knowledge’ and ‘logical discourse’ or ‘theory’. This theory of knowledge is important for the researchers which leads to interpretation of the knowledge and how to use it for the research. Epistemology deals with the nature of knowledge and it provides a philosophical grounding for the acceptable knowledge.
And what makes it legitimate and adequate according to the topic of study (Al-Ababneh, 2020). Several philosophies of epistemology exist and for the current study, the philosophy is interpretivism. According to Al-Ababneh (Al-Ababneh, 2020) and Saunders et al (Saunders, et al, 2019) the interpretivism is described as follows: “This philosophy looks to the social world of business and management science as too complex to be treated as a physical science due to complex management studies in the social world will be lost if its complexity is reduced to law-like generalisations. Interpretivism philosophy considers the situation in each business is unique, and differs from other situations. This methodology is not an appropriate method for generalisation due to the changing state of business organisation and various interpretations by people as well as the complexity and uniqueness of the world.” The current paper is embedded in the business and management field of research. It tries to discover a hypothesis about studying companies facing a particular situation with human behaviour that cannot be transferred into general law.

The other philosophies existing in epistemology are positivism, realism and pragmatism.

The positivism philosophy is commonly used in natural sciences, physics and mathematics. The events are called phenomena only if they are observable, measurable and repeatable. The phenomena are not dependent on the context such as the social context and those facts are the only acceptable data for the study. The researchers under this philosophy are focused on the causality of the phenomena and they draw knowledge as general laws from the data. Hence the conclusions drawn from the study deemed to be repeatable in any further situations involving the same experimental causes. This should be used to build theories and to make generalisations (Saunders, et al, 2019).

The realism philosophy is close to positivism and it is also used in the scientific approaches. But it differs in the way that the data and the facts are perceived by the human mind. And it claims that the senses of the human beings feel the reality and then the data and facts are acceptable through this position. The results are independent of the human minds and they are real. There are two types of realism which are direct realism and critical realism. The first type says that what the human senses perceive is the reality and it is directly possible to draw conclusions from those data and facts. The second type, critical realism, adds a second step because it deems that the feelings and senses can deceive the researchers and modify the data and facts from direct observations. These sensations need to be analysed through mental processes to obtain the real data and facts in order to draw conclusions and make specific theories or hypotheses (Saunders, et al, 2019). This philosophy can be also used in human sciences.
The pragmatism philosophy is more adaptable than the previous philosophies. It is considered acceptable for the research to use both phenomena and subjective data. The research questions should be adapted to practical situations because the knowledge is grounded to the context of the research. The research is influenced by the context and the research may also influence the data and facts in acting directly within the study. Several origins for the data are possible and the different perspectives must be integrated to the study to interpret the results and to draw conclusions (Saunders, et al, 2019).

2.1.3 Research axiology

In link with the epistemology, the research axiology is value laden because the values and the facts cannot be dissociated in this paper. This philosophical concept is formed by two ancient Greek words which are ‘axios’ and ‘logia/logos’. These words mean worth or value and theory and it leads to the theory of values which has a strong link with epistemology and metaphysics (Hart, 1971). The axiology deals with the knowledge and the values which are attached to it. This concept helps to analyse what are recognized as facts and the interpretations that are drawn from them (Amaratunga, et al, 2015 ; Saunders, et al, 2019). And the facts can have dissociated values or they can be value laden.

2.2 Research approach

The research approach is the way of reasoning and how new knowledge is acquired. In the current study, the abductive approach is used to perform explorative qualitative research. The abductive approach is a mixed approach of deductive and inductive approaches.

2.2.1 Deductive approach

The deductive reasoning or approach is a process of theory testing. This theory is already established or it tends to become a generalisation and the tests are performed on specific situations (Hyde, 2000). Then this approach can be summarised as starting from a general scale based on recognised literature which is associated with a theory to reach specific cases. In this approach, a causal correlation between concepts and variables is tested and verified. Mainly the quantitative data collection is used in order to make the systematisation of the research and the hypothesis test
easier (Saunders, et al, 2019). In the current paper, the theory building is made from the literature’s review but no quantitative method nor quantitative data collection are performed.

2.2.2 Inductive approach

The inductive reasoning or approach is a process of theory building. From analysis of specific case studies, the process tends to make generalisations about the phenomenon that was discovered with the research (Hyde, 2000). So this approach can be summarised as starting from specific cases of study to reach global scale and theory. In this research, the results from the case studies help to find a pattern.

2.2.3 Abductive approach

The abductive reasoning or approach mixes the deductive and inductive approaches. Then it is neither data-driven nor hypothesis-driven but it conducts research with empirical data and theoretical basis in parallel (Thompson, 2022). This approach is not dedicated to discover an objective truth but to discover the most logical solution and interpretation to revealed phenomena. And for instance, when data revealed a surprising and unexpected pattern, the researchers need to be creative in theory building to fit more properly to the context of the empirical results (Thompson, 2022). In the current paper, the work starts from the scratch and a theory is built through a literature review. And then a particular context is tested in case studies and the specific empirical data help to discover a new pattern which needs to be interpreted to fit to the context.

2.3 Choice of research methods

The choice of research methods means that the researchers have been choosing specific types of methods to conduct the study which are qualitative or quantitative. It can be a single method or several methods within a study. Thus the method is called a mono-method when the research uses only one method to collect data. Then it is called mono-method qualitative for one qualitative method used. A mono-method quantitative consists in using one quantitative method to perform the research. When at least two methods are used to conduct the research, the choice can be multimethod or mixed method. The multimethod uses several qualitative methods or several quantitative methods. A mixed method uses both qualitative and quantitative methods in order to
collect data. The last choice can be a simple mixed method which consists in the use of several methods directly connected to each other for the data collection. The use of the data implies a unique phase and it does not require interpretation steps by the researchers in order to express the results. The complex mixed method uses methods not directly related to each other and it requires the researchers to reinterpret the data. And several phases where the researchers mix the data to have different types of results (Saunders, et al, 2019). In this study, the choice of research methods is a qualitative multi-method which consists in two distinct qualitative methods.

2.3.1 Qualitative method

This method is an empirical research method with a specific approach to data collection. It is an open-ended approach to data collection where data cannot always proceed statistically through a software. The answers can be based on personal point of view and a wide range of qualities. The main reasons of the use of a such method are the attempt to discover trends and characteristics of an unknown topic, to discover new elements of a well-known topic, to collect more in-depth information and diversify information, and when the researchers want to collect more information of a complex topic or when the respondents have personal views on the analysed topic (Starr, 2014; Saunders, et al, 2019).

2.3.2 Quantitative method

This method is an empirical research method which proceeds with a high amount of data. It analyses the relationships between variables with a priority for numbers and statistical techniques. The data collection is standardised and there is no room for interpretation during the collection. The generalisation of the results is preferred and that’s why probability sampling methods are used for this type of method. The methods used to perform quantitative research are experimental research and survey research (Saunders, et al, 2019).

2.4 Research Strategies

The qualitative method of data collection has five ways to do so which are in-depth interviews, focus groups, case studies and site visits, fieldwork or ethnography, and life histories.
The in-depth interviews are extended discussion with research subjects which have three possible shapes that can be structured, semi-structured or unstructured interviews (Starr, 2014; Saunders, et al, 2019).

The focus groups consist in semi-structured group-discussion sessions with a facilitator who leads the discussion (Starr, 2014; Saunders, et al, 2019).

The case studies and site visits are in-depth analysis with questions on the topics which lead to very detailed information. The cases are generally a small number because of the high level of information collected and the time passed with each case (Starr, 2014; Saunders, et al, 2019).

The fieldwork or ethnography has some similarities with case studies. But it focuses the observation on a given group of people to discover social rules and norms which govern the behaviour and interactions of the members of the analysed group. It is used in anthropology and sociology (Starr, 2014; Saunders, et al, 2019).

The life histories are a large amount of information collected about subjects through in-depth interviews. The information consists of important events and periods of life of the subjects. They have mostly subjective thoughts and ideas of the individual (Starr, 2014; Saunders, et al, 2019).

In this paper surveys and structured interviews were performed to collect data to build and test the theory.

This study has a strategy of qualitative research with an explorative method. The strategies used are a grounded theory and interviews. The exploratory method is used for the exploration of possible developments and it studies different futures events or scenarios. The grounded theory uses data and then the theory is grounded to the data. This inductive approach collects data and helps to conceptualise a new theory or framework (Saunders, et al, 2019). In the current study, the literature review on disruption of supply chain is used to find a hypothesis. The interviews consist in detailed study of a subject which is, in this study, private international companies. The data collections used are interviews and the main goals are in-depth understanding of the subject and the contexts which cannot be dissociated (Saunders, et al, 2019). In this research, the political and economic context is a core element of the study, and the cultural influence may interfere with the results.
2.5 Time horizon

The time horizons of research are the time period used and considered by the researchers to conduct the study. They can be long-term, middle-term or short-term. After the time terms, the study can be made over the time and during a specific period that is called a longitudinal research. Or the research can be conducted on a specific date which is cross-sectional time horizons. For a study, change in time is contextual and multi-faceted. And the longitudinal qualitative research is interested in the changes over the time, and re-interviews and the returns on-site may be performed to witness the change (Corden and Millar, 2007). In the current research, the time horizon is longitudinal and a short-term analysis because the interviewed companies answer about disruptions in the past five years. The questions ask for disruption in the supply chain from 2013 to nowadays and also how they are preparing for similar situations in the future.

2.6 Techniques and procedures of the research

The techniques and procedures used in this study are the empirical research, qualitative method, literature review and interviews.

2.6.1 Empirical research

The term empirical can be defined as: “The systematic process of deriving and analyzing data from direct or indirect observation” (p.2, Vamsi Krishna Jasti and Kodali, 2014). Then the empirical research is based on research gaps and theories to confirm or infirm. And its goal is to fulfil the identified gaps and to answer the questions about theories. In the supply chain field of study, the empirical researches are used for the theory buildings and theory verifications. The most common empirical researches in the current field are the case study and the interview research. Both of these methods are useful for theory building. But the interview use is also interesting for the theory verification. The interview consists mostly of interview guide and discussion but other forms exist such as panel study, focus study and observations. The observation can be outside observation and participant observation. In this paper the interview method with an interview guide is used to collect data. In the case study the methods of data collection consist mainly in historical archive analysis and
interviews. The case studies can be single case or multi-case with interviews of many members of the organisation considered for the study (Vamsi Krishna Jasti and Kodali, 2014). The empirical research can be qualitative, quantitative methods or a combined method. The current research performs a qualitative method due to the small size of sample and heterogeneous locations of the interviewed firms.

2.6.2 Research of the literature

All academic research activities are based on existing knowledge which are recognised by academics and institutions. The empirical researches are based on the academic papers and the purpose is to bring new answers to fulfil the research gaps identified previously. But the access to relevant previous works could be complex. The literature review is a good way to collect and synthesise previous works to corroborate the theories on which the current paper answers to new questions or discovers new ideas and concepts. This method helps to develop theories with the integration of empirical findings from previous work and it investigates hypotheses which have not been explored yet.

It has also another use which is helping the researchers and the readers to learn interdisciplinary and new knowledge, and to find different insights and ideas.

There are three main different types of literature review in economic research which are the systematic review, the semi-systematic review and the integrative literature review.

The purpose of a systematic review is to identify all empirical evidence and seek for them to answer a precise question. The evidence needs to be included in criteria specified in advance. This method is used mainly for well-known concepts which are globally accepted by the researchers (Snyder, 2019).

The aim of a semi-systematic review is to analyse how a topic or a field of research has evolved during a period of time. This method seeks for all relevant research about the field and synthesises complex areas in meta-narratives. The areas should be understood by a majority of researchers and they need to be already researched by a large amount of study (Snyder, 2019).

The integrative reviews are close to the semi-systematic reviews but the aim is different. The integrative reviews use known topics or new topics and they try to find new concepts or conceptualise through a critical review. The emerging topics obtain their first conceptualisation with this type of review. The research is not systematic and the purpose of the review is not to seek for
all the available articles on the field of research and it is more a creative way of exploring the area in order to develop new concepts (Snyder, 2019).

As a consequence the use of databases and search engines for academic papers are central for this research. Google Scholar® and EBSCO® were used as search engines. The databases were RISE® ‘Research Institute of Sweden’, Business Source® Complete, EBSCO®, CAIRN®, Cambridge University Press® and Emerald Insight®.

Two different arrays of research were made. But both of the researches are integrative reviews. The first one was dedicated to find and use definitions of the following terms: Supply chain, supply chain management, order/customer fulfilment process, customer needs and expectations, VUCA, customer requirements, supply chain disruption, risk management, business crisis, crisis management, climate change, sustainability, sustainable development and economic sanctions.

The second array of research was linked with crisis management, risk management, supply chain, environmental disaster, climate change and economic sanctions. It leads to a paper review on the overall theories about the disruption in the supply chain in the context of climate change and economic sanctions.

After the use of research papers, an empirical research was conducted. This research consisted mainly in the use of interviews which had been made and interview guides had been sent to several companies before the interview. Several questions linked to the management of crisis and risks, the sustainable development and how recent natural or human-made disasters impacted their supply chain and/or new economic sanctions impacted their business. This research is a qualitative method due to the low rate of answers and accessibility by the researcher which make the small size of the sample and the location of the answering private organisations. The areas of origin of the firms are heterogeneous and the research did not target a specific and systematic area (Vasileiou, et al, 2018).

2.6.2.1 Search of the definitions and concepts

The first array of research had been made on the following concepts: Supply chain, supply chain management, order/customer fulfilment process, customer needs and expectations, VUCA, customer requirements, supply chain disruption, risk management, business crisis, crisis management, climate change, sustainability, sustainable development and economic sanctions. Google Scholar® gives access for almost all the available academic studies but not all the texts are not fully accessible and not all the newest articles are available. Then EBSCO® through its search
engine Business Source® Complete is useful to find newer articles. And a search option for only fully accessible articles exists on it. The research of the articles had been based on the relevance of the articles in accordance with the aim of the concept’s definition. The title, the keywords and the abstract had been read to seek the relevance of the article when the former seemed to be interesting. The released date was secondary but a recent date was preferred. An acceptable release date starts when the article has been released after 2013.

2.6.2.1.1 Supply chain and supply chain management searches

The first attempt for a definition of supply chain was made on Google Scholar® with the words ‘Supply’, ‘Chain’, ‘Definition*’. More than 4,000,000 results were found. The word ‘Terms’ was added and the results decreased to below 4,000,000. The ten first articles were analysed but some of them were books and they were not fully available. The change was made with the words ‘Supply’, ‘Chain’, ‘Management’, ‘Definition*’. The results decreased to 3,530,000. The first articles were analysed and the seventh article is fully available and relevant for the definition of supply chain management (LeMay, et al, 2017). In this article, a relevant article was found which is used for the definition of supply chain (Ellram and Cooper, 2014). This article is used to define the supply chain.

2.6.2.1.2 Order fulfilment and order fulfilment process searches

Order fulfilment or customer fulfilment is a concept which needs to be defined. A first search was made on Google Scholar® with the words ‘Order’, ‘Fulfilment’, ‘Definition*’. And another research with ‘Customer’ instead of ‘Order’. But the results were not good and this concept was embedded with other topics and ideas where the latter are defined and not the order fulfilment. A different attempt was made on another search engine which was Business Source® Complete. The use of the same terms was made and the same type of results was found. The last research used the word ‘Order’, ‘Fulfilment’ AND ‘Definition’ OR ‘Define’ OR ‘Meaning’ OR ‘Description’. The results continued to be not relevant and linked to other concepts.

A new search was made with the words ‘Customer’ OR ‘Order’, ‘Fulfilment’, ‘Process’, ‘Description’. 115,000 were found on Google Scholar® and the first articles were analysed to find a proper definition or description of the concept. The fifth article gives an up-to-date description of the order fulfilment process (Andry, et al, 2020).
2.6.2.1.3 Customer’s needs and expectations, VUCA searches

In order to obtain documented sources about the change in the customer’s needs and expectations, a search on Google Scholar® was launched with the following words ‘Customer’, ‘Needs’ AND ‘Expectations’, ‘Evolution’. 683 000 were found and the two first articles were relevant for this purpose. The first article describes the changes in the customer’s mind because of the Covid-19 crisis (Pratap, et al, 2023) whereas the second article is older and deals with the effects of internet on the customer’s expectations in the 90’s and early 2000’s (Piccoli, et al, 2004). A second search in this sector was made to underline the current markets : VUCA. On the same search engine, a search was made with ‘VUCA’. 32800 articles were found and the third article was chosen which explain this concept of VUCA (Bennett and Lemoine, 2014).

A last search to find an example of excellent customer service to underline the new customer expectations. On Google Scholar®, a search was launched with the keywords ‘Amazon’, ‘Delivery’, ‘Model’. More than 300 000 results were found and the second article was selected which explains the business model of the logistics of the firm Amazon® (Aćimović, et al, 2020).

2.6.2.1.4 Customer requirements search

In addition to the customer’s needs and expectations, a search on customer requirements was launched on EBSCO®. The words used are ‘Customer’, ‘Requirements’ and 13 997 results are found. The fourth article was chosen. It explains the key categories of customer requirements and the link with the customer satisfaction (Naijiang, et al, 2020).

2.6.2.1.5 Supply chain disruptions search

The search for a definition of disruption of supply chain was launched on Google Scholar® with the terms ‘Disruption*’, ‘In’, ‘Complex’, ‘Supply’, ‘Chain’. 712 000 academic documents were found and directly the very first article is relevant for the understanding of the concept with a complex supply chain and a clear definition is available (Bier, et al, 2020). And a case study was searched as an example to underline the broad effects. On Google Scholar® the words used were ‘Supply’, ‘Chain’, ‘Disruption’, ‘Effects’. The third article expands the supply chain disruption concept to the propagation from a focal company to the whole supply chain of this company (Scheibe and
Blackhurst, 2018). And the tenth article with nation-wide effects of a natural disaster on Japan is relevant (Tokui, et al, 2017).

2.6.2.1.6 Risk management and enterprise risk management searches

To find a proper definition of risk management, the search on Google Scholar® started. The use of the words ‘Risk’, ‘Management’ and afterward ‘Definition*’ led to a result of more than 5,000,000 documents. And most of the first articles were dedicated to different sectors and activities which did not contain the private enterprise.

The change of the words was made to contain enterprise. The research contained the following words ‘Enterprise’, ‘Risk’, ‘Management’. The two first articles were relevant to explain risk management. The first article explains the traditional enterprise risk management (ERM) (D’arcy and Brogan, 2001). The second article is a review of articles which seeks a modern definition of enterprise risk management with an overall understanding of all the different risks that a company may encounter (Bromiley, et al, 2015).

2.6.2.1.7 Crisis management search

To explore a good definition and meaning of crisis management, the search through the search engine Google Scholar® was made. The used words are ‘Crisis’, ‘Management’ AND ‘Definition*’. More than 4,000,000 results were found and the two first articles were relevant and they were taken (Moon, et al, 2020; Canyon, 2020).

2.6.2.1.8 Climate change, Global warming, sustainable development and sustainability searches

Google Scholar® has been used in a first attempt to find definitions of climate change and sustainable development. Then the words were ‘Climate’, ‘Change’ OR ‘Global’, ‘Warming’ AND ‘Definition*’. The results were above 1,000,000 and the first articles were fairly old and not fully available. The decision to try with EBSCO® was made with the same words. 196 results were found and the first article is relevant for this purpose (Coleman, 2013).

On EBSCO®, the words ‘Sustainability’ AND ‘Sustainable’, ‘Development’, ‘Definition*’ were used. The first article is relevant to underline this concept (Ruggerio, 2021). The report of the Stockholm Resilience centre was also selected in order to explain the concept of planetary...
boundaries. This document is known from previous studies of the researchers (Moberg and Simonsen, 2015).

2.6.2.1.9 Economic sanctions search

A search on EBSCO® was launched to find a definition of economic sanctions. The words used are ‘Economic’, ‘Sanctions’ AND ‘Definition’. 30 documents were found and the first one was chosen which is an extract of the book ‘Essential Economics’ (Essential Economics, 2004). A second article was found to obtain some examples of sanctions. On Google Scholar®, the words used are ‘Economic’, ‘Sanction*’, ‘Russia’ to find a contemporary case of a country under economic sanctions. The release date was important and no article was accepted before a release date of March 2022. The third article was taken for this purpose (Li and Li, 2022).

2.6.2.1.10 Methodology searches

In order to find relevant articles about the methodologies, a search on Google Scholar® was launched with the words ‘Research’, ‘Methods’, ‘In’, ‘Economic’, ‘Study’. More than 8 million articles were found. The first article was chosen for the analysis of qualitative methods and definitions (Starr, 2014).

Then another search was made to have precise explanations and results about empirical methods. On Google Scholar®, the terms used are ‘Empirical’, ‘Methodology’ and more than 6 400 000 results are found. The second article was chosen for the review of empirical methods (Vamsi Krishna Jasti and Kodali, 2014).

The next search about the methodologies was made on the literature review methods. On the same search engine, the words used were ‘Literature’, ‘Review’, ‘Methodology’ and 6 440 000 articles were found. The third article was selected for the purpose of the search (Snyder, 2019).

A second turn of search was performed to find all the concepts around the research onion. A simple research on Google® was launched and a blog describes the different layers of research from the book of Saunders, et al, 2019. Then a search on Google Scholar® with the terms ‘Saunders’, ‘Research’, ‘Method’ was made and the newest edition of the book was directly found (Saunders, et al, 2019). A second search on EBSCO® was made with the words ‘Research’, ‘Methods’, ‘For’, ‘Business’, ‘Students’. 1664 results are available and the first document was chosen (Mitchell and Rich, 2020). And to stick to the research onion, the different terms needed for the different layer were searched on Google Scholar® and the concepts are the ‘ontology’ and the ‘subjective reality’,

Aubourg, Y.
the ‘epistemology’ and the ‘interpretivism’, the ‘axiology’, the approach of the futures in the research with the ‘foresight’ approach, the ‘deductive’, the ‘inductive’ and the ‘abductive’ approaches, the research strategies with the ‘grounded theory’ and the ‘case study, the choice method and the ‘mono-method’ of research, and the time horizons with the longitudinal concept and the term of the time horizon which can be long-term, middle-term or short-term.

2.6.2.2 Literature review

The second array of paper’s research is an integrative literature review. The purpose of this empirical research is to find and elaborate hypotheses and concepts about disruptions in the supply chain of international private companies. And they should be linked with the economic sanctions and natural or human-made disasters. And also to find how these organisations are able to continue to fulfil their customer orders. The newest studies about this field of research when the current paper is written are searched. Google Scholar® is used as a search engine for academic material as well as EBSCO® with its search engine Business Source® Complete. Then the articles used for this review are the new release and the oldest released date accepted is 2017. As the first array of research, the titles and the abstracts were read to check the relevance of the article for the research. But a second search is made and the introduction is also read to verify the complete relevance for the concept building.

A first search is launched on Google Scholar® about supply chain disruption directly with those three words to find a general theory or framework about supply chain disruption in private companies from the year 2017 to now. 32 700 documents are found and 8 articles are retained with this search to gather new insights for the study. A first couple of articles has the aim to analyse and discover the ways of mitigation for the supply chain disruptions. The work of Bier, Lange and Glock (2020) explores the methods employed by the private companies to address the supply chain disruptions in general. The mitigation of such risks is transformed into processes in the study of Bode & Macdonald (2017) where three general methods could be used to reduce the impacts of supply chain disruption on the network. The article of Shekarian and Mellat Parast (2021) is a literature review about supply chain disruption risk and resilience management. It helps to discover and introduce these new concepts for the paper. The fourth article is also a literature review about the supply chain disruption and resilience but it differs from the former with the interest on newer researches and it gives insights for future researches (Katsaliaki, et al, 2021). An in-depth study of the supply chain resilience is made by Tan, et al (2020) which is one the main characteristics of
supply chain disruption mitigation. The work of Dolgui and Ivanov (2021) is an empirical research about the ripple effect linked with the supply chain resilience, and the supply chain disruption management. And the focus is made on the new trends and research environment. An additional research which focuses on supply chain disruption management strategies is used in order to complete the previous work (Moosavi, et al, 2022). This article uses the context of the Covid-19 crisis to explore the potential strategies. An article in the same topic explores a strategy of supply chain recovery from a case study in the same context of Covid-19 supply chain disruption (Chen, et al, 2021).

A second short search was performed on Google Scholar® in order to find the main link between the supply chain and the order fulfilment. The articles published before 2017 were not used for this search and the words used were ‘Supply’, ‘Chain’, ‘AND’, ‘Order’, ‘Fulfilment’. 20 800 articles were found and two articles were retained for the purpose of this review. Research about order fulfilment reliability shows its importance in the supply chain and the link with those two concepts is drawn from it (Lukinskiy, et al, 2023). The article describes a bit the crucial action of the supply chain with the customer fulfilment which is the responsiveness of the supply chain. Another work made by Hum, et al (2017) makes a deep analysis of this concept useful for the purpose of this research.

A third search of academic papers was performed on Google Scholar® with the goal of exploring the main actions used in order to mitigate the supply chain disruptions. These concepts are discovered from the first search of the paper’s review and they are proactive mitigation strategies which are the supply chain robustness and the supply chain redundancy, and the supply chain flexibility. The words ‘Supply’, ‘Chain’, ‘Robustness’ were used to launch the search and 17 400 documents were found. Two articles are taken as they are useful to explain the robustness and the redundancy in the supply chain. The first article is the work of El Baz and Ruel (2021) which described resilience and robustness as intertwined methods in order to counter the effects of supply chain disruptions. The second one is a case study which analyses the role of robustness against uncertainties within the supply chain (Govindan and Fattahi, 2017).

The last search of papers was performed with the words ‘Supply’, ‘Chain’, ‘Redundancy’ and 17 000 results were found. The redundancy is linked with the flexibility of the supply chain and two articles were chosen for the purpose of understanding those concepts. The first document shows the embed roles of flexibility and redundancy in the supply chain robustness and resilience (Mackay, et al, 2020). The work of Kamalahmadi and Shekarian (2022) explore more in detail the concepts of
supply chain flexibility and redundancy and it shows their positive effects on the resilience of the network.

2.6.3 The conception of the structured interview

(Appendix) Before creating an interview guide, the purpose of the interview must be found and what kind of information needs to be gathered. And the targeted entity is very important to receive the proper and relevant information.

The interview is needed to understand and to know how the private organisations address the disruptions in their supply chain in the context of economic sanctions. So the asked entities are the private organisations such as private companies and firms.

The purpose of the interview and its guide is introduced. Then the verification of the interviewee to know if the organisation has a supply chain and it is committed to its supply chain. And in the same question the range of the supply chain is checked. It is useful and it helps to obtain relevant information. The assessment of the supply chain and its importance within the firm may help the researcher to interpret the results.

The questions gather information about the sector of activity of the firm, whether the company has its core activity with production or not. The manufacturing companies and transportation companies are more important in this study. The product-based companies are important but the service-based companies can be insightful for the research.

After that the role of the supply chain and its management for the firm are asked. It is important for the research to know if the company is aware of the supply chain and if the company has an influence on the supply chain.

The size of the supply chain is relevant. So the questions help to know if the private company has a supply chain outside its region, its country, its continent (such as outside Europe) or even if the supply chain touches several continents.

The last but not least part of the interview is dedicated to the purpose of the research. The interview asks for the elements of the supply chain which are located in risky areas regarding political reasons. The parts of the supply chain can be the suppliers, the manufacturers, the customers or even the outsourced activities of the firm. When a problem occurs, the company is really impacted by this change.

So the interview asks for any kinds of economic sanctions such as embargoes that appeared against
a region where the company has a known member of its supply chain. And if it does impact the activity of this member and the company itself. Whether or not it occurs, the interviewee is prepared to react against those kinds of disruption in the supply chain. And how the company reacted when such a problem happened in the past. Does the company sourced to another place or relocated activities or even changed some of its activities to adapt to the new context.

The interviewed companies are mainly located in France. One company is located in Sweden. The interviews were made in French. Except for the company in Sweden where the interview language is in English. The interview guide is made in English and they were translated into French and Russian.

The interview follows the same questions and it adds more explanation to both sides, the interviewer and the interviewee. The interview is 30 minutes long. When some information needed to be clarified, additional questions were used. In each company, the interviewer made appointments with two different persons in two different sessions. The phone-call or face-time through Zoom® were used to make the appointment. The interviewees were targeted as follows when it was possible. One of the interviewees is working on the operations of the company such as shop-floor or production in order to obtain a routine point of view. The other person is working on the strategy or tactics of the firm. This person has a more global point of view on the company’s activity.

2.7 Sampling method

A sampling method is the action to take a sample in a considered population. The sampling process starts with the clear definition of the target within a population which might be inhabitants in a country or organisations within a region (Taherdoost, 2016).

The sample is based on criteria to select cases in a population. The eligibility criteria are important for any kind of research (Nikolopoulou, 2022). In the current thesis, these criteria also known as inclusion criteria and exclusion criteria help to choose the relevant articles for the literature review and also to select the interviewed companies.

- The inclusion criteria contain the characteristics or attributes that an item among a population must have to be selected for the sample of the research. It can be the date of
publication for an article or the size of the private company in order to be included in the study (Nikolopoulou, 2022).

- The exclusion criteria contain the characteristics or attributes that an item among a population should not have to be selected for the sample. If the item has these characteristics, it should be excluded from the research. Even if this item has the inclusion criteria. This could be an irrelevant date of release of a research paper or an uninteresting activity of a company regarding the type of research (Nikolopoulou, 2022).

The fact of taking a subset of a population is sampling. There are several sampling methods that can be divided into two groups which are probability or random sampling and non-probability or non-random sampling. It is based on the way each item of the sample is selected. The first group has five methods which are simple random sampling, stratified random sampling, cluster sampling, systematic sampling and multi-stage sampling. The other group has four methods which are quota sampling, snowball sampling, judgement sampling and convenience sampling (Taherdoost, 2016).

The sample of the probability sampling contains items that have the same odds to be taken in it. The use of software and automated systems is needed to perform this type of sample. The bias of the sample is lower than the non-random method but it is more time consuming and it needs more resources (Taherdoost, 2016).

- The simple random sampling: The odds of every item to be chosen for the samples are equal in the population.

- The stratified random sampling: This method is similar to the previous method with an additional step before the selection of the items for the sampling. This step consists in dividing the population into subgroups (or strata) and then a random sample is taken from each subgroup. This subgroup can be based on the size of the organisations, the gender or other relevant classification within a population.

- The cluster sampling: This method is quite similar to the stratified random sampling method where the whole population is divided into clusters or groups. But the difference consists in the fact that the random sample of each group is merged into one final sample.

- The systematic sampling: Every nth case after a random start is selected as an item for the sample in a population.
- The multi-stage sampling: This method is a process of moving from a broad sample and population to a narrow sample, using a step by step process. This process chose samples which are concentrated in a few geographical regions and its aim is to save time and resources.

The sample of the non-random sampling contains items that have been chosen in some manner and it is mainly used in the qualitative research and the case studies. The bias from the sample is higher but the statistical inferences for a wider population are not the goal of a research which uses such a method (Taherdoost, 2016).

- The quota sampling: The items of the sample have been taken on the basis of predetermined characteristics. The complete sample will have the same distribution of characteristics of the overall population where it comes from.

- The snowball sampling: This sampling method uses a few items for the sample and it should help other participants to take part in the research. The sample size grows bigger afterward with this incentive manner. This is useful for small populations that are commonly difficult to reach.

- The judgement sampling: Also called purposive sampling is a method where the items are chosen deliberately with particular settings. The aim is to provide important information which is unavailable from other choices. The researchers include items that they esteem required for the sample.

- The convenience sampling: This method of sampling consists in selecting cases for the sample because they are often readily and easily available. Commonly, it helps to overcome several limitations associated with the research and the researchers with few resources tend to prefer this method of sampling.

2.7.1 Selection of the literature

In this study, the target population for the literature review is academic articles in the research fields of business, management and supply chain.

The eligibility criteria for the paper’s review are as follows:
• The inclusion criteria are recent publication dates for the article, the link of the topic with the research question which is supply chain disruption.

• The exclusion criteria are the dates of publication older than 2017, other languages than English, too specific topics within the supply chain such as financial impacts of disruption in public transportation, other organisations than private companies.

The selection of the literature follows the judgement sampling method in which the title and abstract of the articles are decisive for the selection of the item in the sample. This method is relevant for exploratory research.

2.7.2 Companies sampling

In the current research, the target population for the interviews is a specific type of organisation in Western and Northern Europe. The targeted organisations are international private companies.

The eligibility criteria for the companies sampling are as follows:

• The inclusion criteria are companies which have supply chain or integrative logistics in their core activities, French companies, English speaking companies in Western and Northern Europe, Russian companies or plants which work with Europe or only recently ceased their ties because of the current context of sanctions.

• The exclusion criteria are companies in which supply chain or integrative logistics is not used or neglected part of their activities, companies which does not speak in English, French or Russian, Organisation which are not private companies such as state agencies, associations and NGOs, companies which have only regional or national activities and no international activity, the unavailability of the company for the researcher.

The method of sampling used for the companies sampling is the convenience sampling. Due to the limitations of direct access to the targeted private companies, the use of related persons working in companies was crucial to establish contact and reach the sampled companies with interviews.
2.8 Limitations of the methods

This study has limitations due to the methods used and the analysed samples. Those limitations impose restrictions in several ways on the research.

The research methods consist in an empirical research using qualitative methods and small samples both for papers and companies which have been interviewed. The ontology and epistemology could have been different, especially the pragmatism philosophy in which the samples would be influenced to draw results and interpretations. The research approach is limited with the mixed approach of abductive approach where a more wholesome analysis can be drawn from a unique approach such as deductive or inductive approach. The methodological choice uses a unique way of conducting methods. Multi-method or a mixed method may bring other insights and ideas. The skills and techniques used lead to results which cannot be generalised as a theory. They can be used for a hypothesis which could be tested with quantitative methods in multimethod for instance in further research. And the researchers could draw theories and general trends with a sufficient sample of at least 300 private companies interviewed. The use of surveys could add more statistical data. The time period could be different and not only based on contemporary situations. A comparison from the last decade or more should have been included in the research. Then the historical archives of the companies could be used for this goal. Other techniques might be used or added to the techniques used in the current thesis.

The target populations have their limits. The reviewed papers are related to business and management fields. Further research may explore other fields such as sociology and social implications of disruptions. The research language is only English. The use of other languages should have brought new insights over the researched subject. And other types of document than academic articles could be used additionally to this population.

The population where the sampled companies were taken from has limits. The types of organisation could be wider than private companies in order to make the results more general. Or on the other hand the population might be thinner with specific types of companies. The geographical locations of the firms are in Western and Northern Europe. This could be more specific to a region or a country. Or the results could have been more global with a broader geographical location such as the whole Europe or at the world scale. Or it can be insightful if a comparison between two regions or more was made for different results. The working languages of the sampled companies are mainly English and French with a Russian case. Other languages could be used that help to reach other working cultures and countries.

Aubourg, Y.
The criteria are useful to make a choice and select items or reject elements of a considered population for a sample. But the action of selection means to reject other possible cases for the study and it limits the results to the sample. The inclusion criteria make specific cases preferred to other possible cases in a population. The exclusion criteria reject participants of the population for the sampling (Nikolopoulou, 2022).

The sampling methods used have their weaknesses. The non-random sampling methods can lead to more bias from the samples than probability sampling methods.

In the sampling of papers for the review, the method used is the judgement sampling where the selection is subjective. The authors choose the items for the sample. And the method does not allow to generalise theories. Only a hypothesis can be drawn by the sample (Taherdoost, 2016).

The sampling method used for the private companies is the convenience sampling which has several weaknesses. The selection method has bias and the sample is not representative of the population. The selected cases are available for the authors of the research and it is an important part of the selection in which no quantitative method can be used with this type of sample (Taherdoost, 2016).

The research in itself is limited by its author. The author of the thesis didn’t work with pairs. Thus resources are restricted by this such as time and contacts to obtain different insights and gather information. Moreover the background of each researcher helps to build a wider subject or at least the brainstorming phase before conducting research is poorer than teamwork.

2.9 Ethics in research

According to Saunders et al. (2019) the research methodology implies the need to follow ethical considerations. Ethics in research are moral values which symbolise guidelines and principles that a researcher must follow and adhere in order to ensure credibility and integrity of the findings of a scientific study. An ethical research is conducting responsible and transparent methods of research that protect and respect the rights, the dignity and the welfare of researchers and research participants (Saunders, et al., 2019). The conflicts of interest must be avoided also.

Several ethical considerations must be respected. The participants of the research must freely consent to the study before any action from the researchers. They need to be informed about the nature of the research, its aim and their role in it. The data collection is made with the agreement of the participants and it must respect their privacy and confidential information. To do so, the data is kept secure and anonymous and any information about identity of participants must be made with the concerned participant (Saunders, et al., 2019).

Aubourg, Y.
The researchers have to identify potential risks that can occur with participants and themselves during the research and after it. And the researchers should reduce those risks. It means that the participants are not subjected to physical, verbal nor psychological harm and threat. And the risks are described to participants before taking their consent to participate in the research.

Moreover the researchers have to respect the participants and ensure that the dignity of the participants is not harmed which could be translated into the avoidance of discrimination and disrespect (Saunders, et al., 2019). The same thing must be followed for the researchers where their dignity needs to be respected and any form of threat and harm must be avoided for them.

The organisations which establish the ethics guidelines, principles and standards for the research are institutional review boards (IRBs), ethics committees, ethical academic departments and professional associations (Dicken, 2023). Research ethics standards may vary according to the geography and the country where the study is conducted. Additionally Saunders et al., (2019) advises researchers to seek ethical approval from an appropriate research ethics committee. And that before starting the research.

The current study is conducted within the European Union region and that’s why the author of the research is under the European Union standards for the research ethics. The ethics and data protection follow the EU’s 2016 General Data Protection Regulation (GDPR) (Hayes and Kuyumdzhieva, 2021).

The conflict of interest is an important risk for the research. It can occur whenever a faculty member’s financial interest is in an industrial sponsor and it is affecting his or her impartiality in interpreting the results. It would lead to biassed results of the sponsored project. This might damage the reputation of the investigating faculty member and/or the reputation of the university. And it may compromise public trust in academic research. This could jeopardise public funding afterward (Trune and Sherer, 2001).

The current research follows the ethical considerations of GDPR. The author had no conflict of interest when he wrote the thesis. Thus the researcher would ensure that its research is conducted in a way that is respectful, transparent and safe for all participants involved and himself. And the author did not receive any kind of industrial sponsor when he made the study.
2.10 Summary of the methodology

Consequently the study uses the following elements in each layer (table 1). The research philosophies of the current paper based on the ontology, epistemology and axiology are constructionism and interpretivism. Its research approach is an abductive approach. The research strategies of the paper are the grounded theory and case study research. The choice for the research is a mono-method of qualitative research on the companies and the time horizon is a longitudinal time frame for the last decade of activity against specific disruptions. Finally some methods are purposely selected. The research techniques and procedures are the empirical research and the qualitative method through a literature review and interviews to collect data on existing international private firms. The population used for the sampling in the paper’s review is the academic articles dedicated to business, management and supply chain fields of research. And the population used for the research on the companies is the international private companies located in Western and Northern Europe. The sampling methods used are non-random sampling methods. For the paper’s review, the method is judgement sampling. And for the research on the companies, the method of sampling is the convenience sampling. This thesis encounters several limitations due to the methods used, the target populations and the samples. The current study respects the ethics in the research and no conflict of interest affects the author of the research.

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<th>Onion layers</th>
<th>Theoretical choices</th>
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<tr>
<td>Research philosophies</td>
<td>Ontology : subjective ; epistemology : interpretivism ;</td>
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<td>axiology : value-laden</td>
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<tr>
<td>Research approach</td>
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<td>Choice of research methods</td>
<td>Qualitative multimethod</td>
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<td>Research strategies</td>
<td>Grounded theory and interviews</td>
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<td>Time horizon</td>
<td>Short-term longitudinal time horizon</td>
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<tr>
<td>Techniques and procedures</td>
<td>Empirical research, qualitative method, literature review and interview.</td>
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*Table 1: Summary of the theoretical choices*
3 Papers’ reviews

3.1 Review of the definitions

This integrative literature review has the purpose to find up-to-date definitions and concept clarifications. Then the newest articles are preferred but not compulsory to this research. More precisely two types of concepts are found in this review and the newest released dates are important for one of the categories. A first group of well-established concepts where the definitions and clarifications have not changed for many years and remained the same. So the article which defines the concept does not need to have the most recent release date. A second group of concepts where the meanings of the concepts continue to be discussed and they are associated with different ideas and definitions. The academics and the professionals are continuing to struggle with the clear meanings. So for this type of concept the newest articles are used to obtain updated definitions and clarifications from academic studies in order to use the concept with the lowest possible level of bias in the meaning. The oldest release date used in those searches is 2017. In some cases, no recent and relevant article was available and then several articles on a specific topic were used to highlight the concept and clarify it.

3.1.1 Well-established concepts

The concepts which are globally understood both by academics and professionals are the supply chain, the customer requirements, VUCA, the supply chain disruption, the sustainable development and the economic sanctions. Climate change is a concept which is largely understood with the idea of global warming but its effects and aspects are greatly misunderstood. So this concept can be in the two categories of concepts.

The supply chain has been established by academic researchers for a decade. Before this time, the concept was mixed with logistics and integrated logistics (Ellram and Cooper, 2014). The professionals may be confused by the meaning currently. This article is selected through the reading of the title and abstract and it is already known by the researcher of the current paper. Then this article is relevant for the definition of supply chain.

The customer requirements is a common concept in the marketing studies and the academic researches make classification of the different types of customer requirements (Nailiang, et al, Aubourg, Y.
2020). This recent article defines and clarifies the customer requirements with the five different categories of requirements. That’s why this article was chosen for the research.

The customer’s behaviour and the change of it is vastly researched and analysed in different fields of human sciences. The last decade describes the last evolution of customer’s mind with the acronym VUCA which is well-known and the article of Bennett and Lemoine fits well for the explanation purpose (Bennett and Lemoine, 2014).

The disruptions in the supply chain is a well-known concept by organisations and business logistics. This critical knowledge is even more important with international private companies which have complex supply chain structures. A modern article on this topic is relevant to understand this specific concept (Bier, et al, 2020).

Sustainable development is a quite new topic and concept in academic research but its interest has dramatically risen in the 21st century where its definition is now clearly established (Ruggerio, 2021).

The economic sanctions is a principle known by the majority of the people as almost every country is currently using it or in the past. An official definition of it is sufficient for the purpose of the research (Essential Economics, 2004). A second article is used to give examples of economic sanctions in a contemporary context of the current paper (Li and Li, 2022).

Climate change or global warming is a concept known by most people. But a significant part of the population is confused with the idea of global warming in front of natural effects and disasters. In more recent studies, the term climate change is preferred because of its complexity. A paper in which this topic is defined (Coleman, 2013) needs to be completed with a more recent article to underline this overlapping subject (Ruggerio, 2021).

### 3.1.2 Complex concepts

The supply chain management, in opposition to the supply chain, does not imply the same meaning and boundaries for different academics and professionals. It is even understood differently in several fields of research and in sectors of industry. Then a new article which is performing a papers’ review of the use of this concept in different contexts is needed to obtain a clear statement of this concept (LeMay, et al, 2017).
The order fulfilment or the customer fulfilment is not a concept clearly defined directly. It needs to be captured in its process and each step of it. But the process is described by a large amount of studies and many companies have descriptions of it in their resources. A current article which describes the state-of-the-art order fulfilment process including all the steps is found for the purpose of explaining this concept (Andry, 2020).

The explanatory of what the customers want, expect to have and how they react to unfulfilled service or product from a firm is searched. The subject is summarised through the term of customer’s needs and expectations. This topic is vastly researched in many areas of study and it is an ever changing topic with the customers who follow trends, technologies and contexts. A case of technology emergence is the internet which deeply influenced the customers (Piccoli, et al, 2004). The covid-19 crisis has been impacting a lot of the customers and the use of the internet has risen with this context of lockdown (Pratap, et al, 2023). The companies can also affect the customer’s needs and expectations (Aćimović, et al, 2020). An overall understanding of this subject is made with those articles.

Risk management is used in every private firm and in other types of organisation. This subject has been studied for many years and it is a wide area of research. The concept has been narrowed for the purpose of this study to enterprise risk management with this article which defines the concept (D’arcy and Brogan, 2001). But a second article is needed to explain the different risks and newer risks which were missing in the previous article that is old-fashioned for the study (Bromiley, et al, 2015).

The concept of crisis management is often misused by professionals. In fact the context of the crisis is more important for researchers and for this paper, the proper terms are business crisis management defined in one article (Canyon, 2020). But this concept implies also a specific management and preparation described in a second article (Moon, et al, 2020).

Despite a well-established public awareness, sustainability is not really understood and it is mixed with the sustainable development. This concept is intertwined with climate change and articles which define the first concept need to explain the latter. Then global warming is described in one article (Coleman, 2013) but it needs to have a complementary explanation about the idea of planetary boundaries (Moberg and Simonsen, 2015). Once the concept of climate change is clarified, another article can be used to describe sustainability (Ruggerio, 2021).
3.2 Review of the supply chain disruptions

3.2.1 The selected articles

The selection of the articles and the paper’s review are performed under three following phases. The supply chain disruptions are addressed by the private companies for several reasons. For the purpose of the study and its possibilities, only one reason could be investigated and a selection was made. According to the author, the most important reason is the order fulfilment which plays a key role for the supply chain of the company. That’s why a first exploration in which the link between the supply chain and the order fulfilment is established with two articles (table 3). These articles are the works of Lukinsky, et al (2023) and Hum, et al (2018).

<table>
<thead>
<tr>
<th>Title and authors</th>
<th>Topics</th>
<th>Criteria</th>
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<tbody>
<tr>
<td>‘Measurement and optimization of responsiveness in supply chain networks with queueing structures.’ Hum, Parlar, &amp; Zhou, 2018</td>
<td>Responsiveness in supply chain in particular case of order fulfilment.</td>
<td>➢ &gt; 2017 ➢ SC and order fulfilment</td>
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<tr>
<td>‘A probabilistic approach to information management of order fulfilment reliability with the help of perfect-order analytics.’ Lukinskiy, Lukinskiy, Ivanov, Sokolov &amp; Bazhina, 2023</td>
<td>Information management of order fulfilment reliability concept.</td>
<td>➢ &gt; 2017 ➢ SC and order fulfilment</td>
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</table>

Table 2: The articles about order fulfilment and supply chain

Thus this relation is shown and the second phase can start. This is the main part of the theory building on how the international private companies are tackling the supply chain disruptions and they are planning to take actions. Eight academic articles are sorted in order to find and establish the main methods and strategies used by the private companies against the supply chain disruptions (table 4). The study of Bier, et al (2020) investigates the general methods of mitigation to reduce the supply chain disruption effects. The research of Bode and Macdonald (2017) shows processes with the purpose to act against the disruptions in the supply chain and it is more specific than the previous research. Then important concepts are revealed. The supply chain risk management linked with the disruptions leads to the supply chain disruption management. The strategy of the supply chain recovery is used in the case of disruptions in the supply chain aftermath. And supply chain resilience is the main method used by the companies. Afterward the last phase will seek for the

Aubourg, Y.
other main methods. The research of Moosavi, et al (2022) explores the strategies of the supply chain disruption management with the covid-19 crisis. The supply chain recovery is a type of strategy to face the disruptions (Chen, et al, 2021). The study of Shekarian and Mellat Parast (2021) makes the link between the supply chain disruption risk and the resilience of the supply chain. After this, research through a paper’s review is used to understand the supply chain resilience (Katsaliaki, et al, 2021). The supply chain disruption management underlined by the resilience of the supply chain and its use is made with the study of Dolgui and Ivanov (2021) in the specific case of ripple effect. A last article investigates the resilience with simulations of supply chain disruptions in which the resilience is tested (Tan, et al, 2019).

<table>
<thead>
<tr>
<th>Title and authors</th>
<th>Topics</th>
<th>Criteria</th>
</tr>
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<tbody>
<tr>
<td>‘Methods for mitigating disruptions in complex supply chain structures: a systematic literature review.’ Bier, Lange &amp; Glock, 2020</td>
<td>Strategies against general disruptions in the SC through a systematic literature review.</td>
<td>&gt;= 2017, Solutions to SC disruptions, Paper’s review</td>
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<tr>
<td>‘Ripple effect and supply chain disruption management: new trends and research directions.’ Dolgui &amp; Ivanov, 2021</td>
<td>SC resilience and SC disruption management against ripple effect. Several methods.</td>
<td>&gt; 2017, Several methods against SC disruptions and ripple effect, SC resilience</td>
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<tr>
<td>‘Supply chain disruptions and resilience: A major review and future research agenda.’ Katsaliaki, Galetsi, &amp; Kumar, 2021</td>
<td>SC resilience against SC disruptions through a paper’s review.</td>
<td>&gt;= 2017, Solution against SC disruptions, Paper’s review</td>
</tr>
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</table>
Moosavi, Fathollahi-Fard, & Dulebenets, 2022

‘An Integrative approach to supply chain disruption risk and resilience management: a literature review.’ Shekarian, & Mellat Parast, 2021

SC disruption risks are tackled by resilience management through a paper’s review.

Shekarian, & Mellat Parast, 2021

SC disruption risks are tackled by resilience management through a paper’s review.

‘Structural-aware simulation analysis of supply chain resilience’ Tan, Cai & Zhang, 2019

SC resilience analysis with simulations.

Tan, Cai & Zhang, 2019

SC resilience analysis with simulations.

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<tr>
<th>Table 3: The selected articles for the main methods of disruption risk mitigation</th>
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</thead>
</table>
| Last phase is searching for the other main methods employed by the private companies in order to mitigate the supply chain disruptions. These concepts are the robustness linked with the resilience, the flexibility and the redundancy. And four research papers are used for this goal (table 5). The research of El Baz and Ruel (2021) shows the overall implications of the use of resilience and robustness in the supply chain risk management in the context of the covid-19 crisis. Another article more focused on the robustness through a case study is used afterward (Govindan and Fattahi, 2017).

Then the study of Mackay, et al (2020) conceptualises the redundancy and the flexibility and shows the imbrication of the former terms in the resilience and the robustness of the supply chain. The last paper describes the effects of the redundancy and the flexibility on the supply chain resilience against disruptions(Kamalahmadi, et al, 2022). |
<table>
<thead>
<tr>
<th>Title and authors</th>
<th>Topics</th>
<th>Criteria</th>
</tr>
</thead>
</table>
➢ Mitigation of disruptions  
➢ SC risk management  
➢ Robustness  
➢ Resilience |
➢ Risk and robustness  
➢ Case study |
| ‘The impact of flexibility and redundancy on improving supply chain resilience to disruptions.’ Kamalahmadi, Shekarian & Mellat Parast, 2022 | Investigation of flexibility and redundancy on SC resilience against disruptions.            | ➢ > 2017  
➢ Flexibility  
➢ Redundancy  
➢ Resilience against SC disruptions |
| ‘Conceptualising redundancy and flexibility towards supply chain robustness and resilience.’ Mackay, Munoz & Pepper, 2020 | Conceptualisations of redundancy and flexibility as key roles for SC resilience and robustness. | ➢ > 2017  
➢ Conceptualisation  
➢ Redundancy and flexibility  
➢ SC robustness and resilience |

*Table 4: Articles about resilience, robustness, flexibility and redundancy in the supply chain*

### 3.2.2 The important role of the order fulfilment in the supply chain

Why is it important for the private companies to struggle against supply chain disruptions? The main reason to keep working the supply chain in the optimal way is the order fulfilment. The order fulfilment also known as customer fulfilment deals with customer requirements and it is better described as a process. To satisfy the customer’s demands is a vital requirement for any company. Then the supply needs to meet the customer’s demand. And the order fulfilment is dedicated to this.

The lead-time is the best representation where each step of the demand within the company and its partners from the reception of the demand to the delivery to the customer is a succession of internal lead-times within the network and the units of the company (Hum, et al, 2018). The lead-time can be a promised lead-time to the customer and the company and its supply chain are obliged by the

Aubourg, Y.
contract to fulfil the production and the delivery to the designated place of the products as wanted by the customer. Thus the international private companies are more challenged by this because of their expanded supply chains and some companies have extreme lead-time such as Amazon® which has same-day delivery services. This type of service imposes a very short lead-time (Hum, et al, 2018).

The work of Hum, et al (2018) theories the succession of internal lead-times as queueing network models. As in a queue, the model represents each step involved in the customer fulfilment of the concerned supply chain as an element to finish before moving to the next one. And this can be symbolised by an internal lead-time that needs to be reached before arriving at the next lead-time. Moreover the customers may ask for different lead-times and the supply chain should respect those orders in their times. And the budget with the implied costs must be acceptable for the company in order to make profits. The supply chain responsiveness is the good adaptability to the customer’s demand and the customer requirements especially in the preferred lead-time with a relevant price for the company and its network (Hum, et al, 2018). As stated in the research of Hum, et al (2018) page 1 : “Faster operations are desired only up to the tipping point at which the marginal benefits from additional time reduction equals the marginal cost of the additional speed.” Hence if the shorter new lead-time costs too much for the company and its network, it should stop this offer or rethink its whole supply chain and improve the responsiveness of it.

Thinking about the capabilities of the network to fulfil the orders leads to questioning the order fulfilment reliability and the supply chain reliability. The supply chain assessment is important as well as assessing the risks touching the supply chain. A good knowledge of it makes it possible to align the supply with the demand (Lukinskiy, et al, 2023). According to the researchers Lukinskiy, et al (2023), the best performing supply chains have three qualities which are the agility and high reactivity to abrupt changes in the supply or in the demand, they are able to adapt and evolve alongside the markets evolution during the time, and they are optimising the interests of all the members of the network in order to maximise the overall profits of the supply chain. This type of fully integrated supply chain is effective against uncertainties of the markets and in particular VUCA target markets. The efficient supply chain is ideal in those cases. But the supply chain disruptions are more erratic and almost impossible to predict in the case of environmental disruptions. And the supply chain should be less efficient and they need to find other strategies.
The supply chain disruptions are a big threat for the order fulfilment reliability and the supply chain responsiveness. They must be mitigated and the next section explores the main strategies with the purpose to handle the risks of disruptions.

3.2.3 The supply chain disruption risk mitigation and strategies

The supply chain disruptions lead to an increase of the costs, a reduction of the profits and the reputation of the company may be negatively impacted especially in the case of unfulfilled orders with promised lead-times. And a majority of companies discover this risk when it is too late with the occurrence of the disruption within the company’s network (Bier, et al, 2020). For instance, most of the new products of the automotive industry have electronic parts and smart systems which need semiconductors. The semiconductors are mostly produced in Taiwan and if this country suddenly stops exporting those products, a large majority of the automotive productors will halt their activities despite the distance and the totally different sectors of activity. This type of environmental disruptions is a very specific risk and a dedicated risk management should be launched in the company and in its supply chain. The sustainable challenges must consider natural disasters and social movements as risks. It cannot be ignored. How do private companies plan and mitigate these risks? What are the main strategies? These questions are associated with the first research question of this thesis.

**RQ 1**: How could private companies plan supply chain disruptions?

First of all, as with every type of risk management, three steps should be included which are identification of the risk, the assessment and its mitigations (Bier, et al, 2020). In the case of environmental disruptions, the private company and its supply chain must identify what kind of disruption can occur and alter the optimal and current movement of physical movement (and also the informative and financial flows can be affected). This could be a war conflict in which one of the countries which is taking part in the war is at least sanctioned by economic sanctions. And a crucial member of the supply chain is localised in the sanctioned country. The assessment by the private company consists in measuring how its activity would be impacted if any member of the current supply chain were unable to participate in the supply chain. The natural disasters and social movements need to be assessed as possible risks by the private companies. The last part consists in
searching solutions and alternatives to bottleneck situations where the activity is severely impacted by disruptions touching those situations.

The works of Bier, et al (2020) and Bode and Macdonald (2017) add elements to the classic risk management method. In Bier, et al (2020) work an academic paper’s review is made in order to find the development and knowledge of solutions and strategies used against supply chain disruptions. The main methods and strategies are explored in this thesis (table 6). But to the risk management, it clearly introduces the additional part of management of risks within the complex network. The supply chain is in essence a complex network and the private companies need to take in account the complexity and the interdependencies of the interconnected members. The disruptions may become systemic risks where several partners can be impacted differently by a disruption and different disruptions might alter the supply chain at the same time. The resolution of the disruption might be different for each impacted member. For example, a new regulation in the European Union about a compulsory new treatment for imported wood will change many things for a supply chain which uses pallets. For a partner, this would increase the costs and it could be difficult to increase the selling prices. Then a solution for a partner would be avoiding the European Union as it is only a transit region. But another partner needs to travel through Europe and sell in the European Union. For a partner the solution would be to switch for plastic pallets but another partner has a priority agreement with a seller of wooden pallets.

For Bode and Macdonald (2017), the solution of disruption in the supply chain consists in the response for a better mitigation. When a disruption in the supply chain appears, the company and its network must react quickly in order to avoid the situation worsens from inaction. As well as the previous part, the identification of the disruption is crucial and obtaining relevant information is required to make decisions. And the complexity of the network makes the task tougher and each partner impacted by the situation tends to act solely. The best thing to do is to take the right decision in which the reduction of the effects of the disruption will reach all the partners effectively or as many as possible. In the research of Bode and Macdonald (2017), the response is divided into four stages which are the recognition of the disruption, its diagnosis, the development of the response and the implementation of this response. For instance an economic sanction is touching one supplier and it needs to be recognised by the company. The effects on the supply chain must be analysed and understood through a diagnosis phase. The development of the answer follows this stage such as sourcing new suppliers for this specific component. And the implementation of the response will consist in applying the new decisions and strategies. Moreover a quicker response would reduce the impacts of the disruption such as a loss of profits, an increase of the costs and promised lead-times.

Aubourg, Y.
not respected in which the company’s reputation will suffer from unsatisfied customers. The top management cannot prevent all the disruptions nor prepare any case. But it can plan such a method and adapt and readjust afterward.

The diagnosis stage is more important than the other stages because it is a constraining factor. It means the diagnosis stage is an operational bottleneck that needs to be completed prior to starting the next stage, the response development (Bode and Macdonald, 2017). But all the four stages should be accomplished in order to make a proper response to the supply chain disruption. The same study describes the supply chain antecedents which are the supply chain readiness, the supply chain dependence and the complexity of the network. These antecedents exist before the disruption and they have a direct link with gravity of the disruption and its effects on the network. They are linked with the supply chain recovery, the resilience and robustness of the supply chain as well as the redundancy and the flexibility of the supply chain. The next sections explore in detail the methods and strategies with the purpose of reducing the impacts of the disruption within the network.

<table>
<thead>
<tr>
<th>Supply chain strategies</th>
<th>Summary of the actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC disruption management</td>
<td>Overall management of the risks with the planification of the possible risks and crisis management. The other strategies come from this management.</td>
</tr>
<tr>
<td>SC recovery</td>
<td>Reaction to the disruption with the will of returning to the optimal function in the previous state of SC network.</td>
</tr>
<tr>
<td>SC resilience</td>
<td>Reduction of the impacts such as loss of profits and costs increase when a disruption occurs.</td>
</tr>
<tr>
<td>SC robustness</td>
<td>Resistance of the SC against a disruption and the capabilities to stay efficient.</td>
</tr>
<tr>
<td>SC redundancy</td>
<td>Reduction of the bottleneck effects with less SC dependence in duplicating the equivalent partners in the network.</td>
</tr>
<tr>
<td>SC flexibility</td>
<td>Capability to adapt and adjust the SC when a disruption happens with a second set of suppliers for instance.</td>
</tr>
</tbody>
</table>

*Table 5*: The different explored strategies against the supply chain disruptions
3.2.4 The supply chain disruption management

As described in the previous section the supply chain disruption management is similar to the supply chain disruption risk mitigation. This management follows the risk management with identification of the risk, its assessment and finally the mitigation of the risk (Bier, et al, 2020) and it adds the antecedent of the supply chain complexity (Bode and Macdonald, 2017). The main risk of the supply chain disruption is the ripple effect. But the wrong reaction of the supply chain may lead to the bullwhip effect or the ripple effect. The ripple effect which, also known as snowball effect and domino effect, is the supply chain propagation of a disruption touching one element of the network. This event is described as a low-frequency high-consequence chain of accidents which has important effects on the financial survival of the companies within a network of supply chains (Katsaliaki, et al, 2021 ; Dolgui and Ivanov, 2021). The bullwhip effect happens when the partners are not reactive enough and the communication is too slow. The supply and the demand become unbalanced and it leads to overstocks or shortages of stocks (Katsaliaki, et al, 2021). The trade-off is difficult for a company to choose between the efficiency and the capability to resist the disruption. For example, lean manufacturing uses a supply chain in tense flow or just-in-time strategy where efficiency is maximised at the expense of flexibility. It needs that all the partners are perfectly synchronised and the uncertainty should be greatly reduced but this strategy is contraindicated to face supply chain disruptions. On the other hand, adding too much flexibility with many alternative suppliers and too much safety stock would lead to higher costs for the company. In the research of Bode and Macdonald (2017) the strategy is only based on the reactivity of the company to a disruption in its network. The response in four stages needs to take into consideration the supply chain antecedents. This response is linked with the supply chain recovery action which is analysed in the next section. The antecedents are also important for the aim of planning further disruptions. The supply chain readiness can be associated with the supply chain resilience and the supply chain robustness explored in the next sections. In the same way, the supply chain dependence is analysed in the next sections through the supply chain redundancy and the supply chain flexibility.

In the research of Moosavi, et al (2022), the main streams and strategies are explored in the context of covid-19 crisis which has been a major supply chain disruption in the global trade. The supply chain resilience and the sustainability are the first appearing strategies effective against the supply chain environmental disruptions. The resilience is explored in the following section but not the sustainability which is an interdisciplinary wide topic not really relevant for this thesis. The next
strategies are the production and the supply chain redesign with several sub-topics underscoring the two strategies. It can be seen as a whole implying different strategies simultaneously. With the paper’s review performed by the thesis, it seems that these two main strategies can be associated with the readiness and the dependence of the supply chain. The same association previously made leads to the four supply chain strategies which are the resilience and the robustness of the supply chain as well as the redundancy and the flexibility of this supply network. Those strategies in the planification may lead to a change in the production and to rethink the supply chain to increase these characteristics.

The last strategy in Moosavi, et al (2022) refers more to the environmental disruption of political decisions through government interventions and it is similar to economic sanctions where the physical flows are directly stopped by the decision of governments.

3.2.5 The supply chain recovery

This strategy is linked with the reactivity of the private company which acts after the occurrence of the disruption in its network (Chen, et al, 2021). In other words, it is the capability to recover from a disruption and return to the state before this event. And so the profit loss should be temporary and return to the optimal level that the company usually had. Thus this strategy is the main answer for the research question number 2.

**RQ 2**: How could private companies react to economic sanctions in order to meet the customer requirements and to continue to deliver products?

According to the study of Chen, et al (2021) there are several methods and strategies which have in common two main actions. They are the emergency procurement and the change in the production by the manufacturer.

The first action has the main purpose to avoid any interruption in the production in having a continuous supply of raw materials and components (Chen, et al, 2021). But it is performing at the expense of higher cost for the procurement of the product. The new supplier might be outside the current supply chain and due to the lack of time its selling price would not be bargained as usual. This new supplier is able to provide the raw materials that are not available by the usual suppliers of the company.

The second action changes the procurement of the manufactured products in order to reduce the
dependences to the uncertain and interrupted partners from the current supply chain disruption (Chen, et al, 2021). This strategy has a price for the company which is researching and developing the new way of production with the attempt to rely less on the weak nodes of the network. Despite all the efforts the disruption reduces the profits of the private companies because of alteration of the order fulfilment and the companies must give backorder price compensation to reduce the loss of reputation. It should make the customers less unsatisfied especially in the case of promised lead-time which is not respected. But it may cost a lot for the companies.

The four last sections deal with the planification of the supply chain disruption by the private companies which are proactive strategies before a disruption happens.

3.2.6 The supply chain resilience

The supply chain resilience is the most cited strategy in the paper’s review where it is a common method used by the private companies to reduce the impacts of the disruptions. The supply chain resilience is the ability of a company to resist a disruption in its network and return to the state before it occurs or to change for a better state in taking the relevant opportunities revealed by this disruption (Shekarian and Mellat Parast, 2020). In the same paper four characteristics are introduced as resilience enhancers improving the responsiveness of the supply chain which are the flexibility, the agility, the collaboration and the redundancy. Some analysed papers in the research explore also the robustness which is deeply linked with resilience. The flexibility and the redundancy are discussed in the next sections. But the agility and the collaboration are linked to broader topics and they are not analysed in the current thesis or indirectly such as the collaboration which is an attribute of integrated logistics or a performing supply chain with deep relationships and ties between the partners.

The work of Shekarian and Mellat Parast (2020) shows the importance of the supply chain risk management in the resilience strategy and it is self-improving from the risk antecedents. And the study of Katsaliaki, et al (2021) shows the embed roles of resilience and recovery strategies. The recovery follows the resilience step when the supply chain starts to recover from the disruption whereas the resilience is translated into the resistance part in which the effects of the disruption are reduced by the active work of the network. The resilience is in its way the opposite of efficiency of lean supply chain management because the resilience increases the costs of the supply chain in putting bigger safety stocks, several backup sources and transport modes. When the supply chain

Aubourg, Y.
disruptions don’t occur, the resilience could be associated with a useless cost. The resilience shows its interest when a disruption happens and its impacts are reduced, in particular the ripple effect (Katsaliaki, et al, 2021).

The research of Tan, et al (2020) describes the supply chain resilience strategies as the reduction of the supply chain vulnerability and the enhancement of the recovery when a disruption occurs. Then redundancy is a key element of the resilient strategies in the research of Tan, et al (2020). This strategy is explored further in this thesis.

3.2.7 The supply chain robustness

The supply chain robustness is a strategy mostly used in parallel with resilience. The robustness is the ability of a supply chain to resist a disruption and to keep its performance as high as possible or as scheduled without the disruption occurrence (El Baz and Ruel, 2021). This planned strategy prepared the supply chain in advance of possible disruption. This passive resistance implies that the private company does not rely on only one supplier, transporter or retailer for instance. A node in the network should not be a bottleneck and a disruption would only alter slightly and as little as possible the supply chain. The solution of Govindan and Fattahi (2017) is the multi-commodity and multi-stage supply chain network which shows the smaller impacts of disruptions with several similar partners in the supply chain.
3.2.8 The supply chain redundancy

The supply chain redundancy is a passive strategy where the failing elements of the supply chain affected by a disruption don’t alter the performance of the supply chain (Mackay, et al, 2020). This means that the private company can be affected by disruptions without suffering reduction of profits or increase of costs until a certain limit. This is possible because the private company has back-up suppliers, different transporters and modes of transport available, and warehouses and plants (Kamalahmadi, et al, 2022). Different sources for the company improve this resistance but it has a cost for the supply chain and especially when no disruptions appear. This proactive solution could be counterbalanced by the supply chain flexibility in the next section of the current study.

3.2.9 The supply chain flexibility

Supply chain flexibility has many applications in business studies. But according to the study of Mackay, et al (2020) on the supply chain, this is the ability to restructure the available capabilities of the network and use a different configuration in order to face the impacts of the disruption. In a broader meaning and in the long-term the flexibility is the capability of the private company to address the changes in the long-term or on a crucial part of the supply chain in managing it to face evolutions of the markets and supply chain network (Shekarian and Mellat Parast, 2021).

The research of Kamalahmadi (2022) expresses the idea of improving flexibility rather than redundancy because the cost is lower when no disruptions occur. This strategy prepares alternative and potential sources and partners in case of supply chain disruptions. This is a reactive method and it would lose some profits before the activation of the restructuring of the network.
4 Empirical research

Six companies were analysed and their data were collected through interviews. Structured interviews were used and they followed the appendix model with precision when it was needed. In each company, two interviews were used on two different persons. The interview lasts at least 30 minutes. The data collection is represented in table 6.

<table>
<thead>
<tr>
<th>Companies</th>
<th>Interviewees</th>
<th>Main information</th>
</tr>
</thead>
<tbody>
<tr>
<td>LYSEO©</td>
<td>• Operations manager</td>
<td>4PL, no specific strategy against disruption.</td>
</tr>
<tr>
<td></td>
<td>• Freight forwarding agent</td>
<td></td>
</tr>
<tr>
<td>CMA-CGM©</td>
<td>• Import officer</td>
<td>Shipping company, flexibility and redundancy strategies.</td>
</tr>
<tr>
<td></td>
<td>• Import &amp; export manager</td>
<td>Recovery is prepared.</td>
</tr>
<tr>
<td>MSC©</td>
<td>• Documentation manager</td>
<td>Shipping company, flexibility and redundancy strategies.</td>
</tr>
<tr>
<td></td>
<td>• Ship planner</td>
<td>Recovery is prepared.</td>
</tr>
<tr>
<td>IKEA©</td>
<td>• Purchase manager (furniture)</td>
<td>Furniture and food producer, resilience, robustness, redundancy, flexibility and</td>
</tr>
<tr>
<td></td>
<td>• Purchase manager (food)</td>
<td>recovery strategies.</td>
</tr>
<tr>
<td>Siemens Gamesa©</td>
<td>• Manager of performance and continuous improvement</td>
<td>Renewable energy and wind turbine producer, redundancy and robustness strategies.</td>
</tr>
<tr>
<td></td>
<td>• Logistics manager</td>
<td></td>
</tr>
<tr>
<td>Renault© &amp; Faurecia©</td>
<td>• Process manager (Renault©)</td>
<td>Automotive producer and car part manufacturer, redundancy and recovery strategies.</td>
</tr>
<tr>
<td></td>
<td>• Maintenance &amp; quality manager (Faurecia©)</td>
<td></td>
</tr>
</tbody>
</table>

*Table 6: Introduction of the different interviewed companies*
4.1 The interviews of the company LYSEO©

LYSEO© is a counter example of a company which has not been prepared to face disruption in its supply chain. The appendix was used as a model to conduct the interviews. The interviewees are working in the import and export service in France; they are the operations manager and the freight forwarding agent.

This 4PL company has a main foreign partner which is located in China. The Covid crisis and its lockdowns had made both sides shut down of the companies. Their activities were stopped and no major changes were made for such a tremendous crisis for the activities (Moosavi, et al, 2022). The decision makers rely on the current ability of the company and its network to resist and adapt to the supply chain disruption. Mainly the resilience of the supply chain (Shekarian and Mellat Parast, 2020). The company has flexibility with its carriers and it can adapt to small changes of activity (Mackay, et al, 2020; Shekarian and Mellat Parast, 2021). Except for the Covid crisis, LYSEO© Group has not encountered environmental disruption yet. Such a thing would be treated as any kind of crisis or problem in its network and activity. The reactivity of the supply chain would use the supply chain recovery strategy and the attempt to return to the previous state before the supply chain disruption occurrence (Chen, et al, 2021).

4.2 The interviews of the company CMA-CGM©

The appendix was used as an interview guide to conduct the interviews. The interviewees are working in France in the importation and exportation service. They are the import officer and the chief of the department who is the import and export manager. They work on containerships. These vessels make calls in Africa and other risky areas.

CMA-CGM© is a shipping company which has service-based activities. This company is located in different countries with many partners. Its main activity is transportation. The company calls the main carriage the sea transport and this company owns several vessels. Additional services can be added to the offer such as customs declaration, port activity and container location. The company is making changes in order to reduce the greenhouse gas emissions. The new generation of vessels is using liquified natural gas (LNG) instead of oil.

The employees of CMA-CGM© are aware of supply chain disruption. The company encountered disruptions in its network in the past. Thus the company is prepared in order to face supply chain
disruptions. The top management of the company has business crisis plans and a crisis team is ready
to be formed (Bier, et al, 2020 ; Bode and Macdonald, 2017). The information is shared between
departments, branches and close partners. The company has an agreement with port authorities and
the information is shared on both sides.

CMA-CGM© has faced a major crisis with the covid crisis (Moosavi, et al, 2022). For instance
before 2020, the shipment of a forty equivalent unit (a container of 40 feet of length) from France to
China was sold for a price lower than €2000 by CMA-CGM©. Since the crisis, the number of
shipments and their demands has decreased and the oil price is rising. The price for the same unit
load device is higher than €15000. A ripple effect occurred with the crisis and the company needed
to react (Katsaliaki, et al, 2021 ; Dolgui and Ivanov, 2021).
And in Africa the company faced several environmental supply chain disruption. Several coups
stopped the flow of products in different countries in the last years which are Mali, Guinea, Burkina
Faso, Sudan and Niger. The local authorities could stop the international trade or economic
sanctions could be used against the new government.

CMA-CGM© applies strategies against disruptions. The company has agreement with the other
maritime companies and it improves the redundancy (Kamalahmadi, et al, 2022 ; Mackay, et al,
2020). It can borrow slots for containers on competitor's vessels or it can sell slots on its own vessel
for the competitors. This supply chain resilience is mainly adaptive and flexible strategy (Shekarian
and Mellat Parast, 2021 ; Mackay, et al, 2020). Moreover CMA-CGM© manages its fleet of
vessels. New ships are built and the company sells old and inefficient containerships. The total
freight is estimated per length of time and the total capacity of transportation has the aim to fit the
real needs. During the covid crisis, the company sold the old vessels and stopped the building of
new vessels or postponed it. The unused capacity were reduced in order to reduce the costs of the
fleet and owned containers. The company can borrow vessels for a short period of time when a
sudden increase of the demand appears and the company is able to fulfil the customer demand. In
the risky areas the company has three types of actions and a specific service. The first one consists
in having many contacts and partners. The cargo could be send to the port and local companies take
in charge the products. Or it can make transhipment to a neighbouring country or port. The partners
would make the delivery to the customers by their own and they would be responsible for it.
The second choice consists in waiting and seeing how the situation will evolve. The port authorities
have a mandatory obligation from agreement and they should fulfil it. Then the containers must be
unloaded from the vessels even if political or economic problems occur. But it is not always
fulfilled.

Aubourg, Y.
The last choice is simply the cancellation of the call for the problematic port within the line of the vessel. It can tranship the products to the previous or to the next port. Transhipment ports are usually used within a vessel's line in order to give buffers and adaptability to the sudden changes.

But for all those cases, the company avoids several types of service. The maritime companies work with international commercial terms (Incoterm) and they set the limit of responsibility and costs for both sides. For the areas with risks of disruption in the supply chain, CMA-CGM© would prefer to reduce the service offer and it would offer transportation with the FOB incoterm (Free on Board) where CMA-CGM© would take in charge the load on its vessel and the price of the main carriage is taken into the offer. The port of destination with its customs activities and port handling fees would be the responsibility of the customer.

Hence the supply chain resilience (Shekarian and Mellat Parast, 2020) is mainly improved by the flexibility of its supply chain through the availability of the slots on its vessels, the competitors vessels, and the containers management. The supply chain robustness (El Baz and Ruel, 2021) is low but the redundancy can help with the transhipment in the ports and the use of several ships in the same line (Govindan and Fattahi, 2017 ; Mackay, et al, 2020 ; Kamalahmadi, et al, 2022). And the vessels of the other companies could help to improve the redundancy and it is a part of the strategy of the recovery (Chen, et al, 2021). The price of the offer is adapting to the situation and the gross margin could be leveraged by this and the recovery starts with this reactivity.

4.3 The interviews of the company MSC©

The appendix was used as a base for the interviews. The interviewees are working in France in line and route management of the vessels. They are documentation manager and the ship planner who organise several lines of vessel. These vessels are delivering ports in the Mediterranean Sea and the West of Africa.

MSC© is a shipping company which has service-based activity. It is an important competitor of CMA-CGM© and it is a major player in this sector. Its core activity is transportation and MSC© is located in several countries with partners in those areas and places where it is not physically located in other areas. MSC© possesses its own vessels and it offers the same services as CMA-CGM© such as customs declaration and container location. This company is developing a new activity which is the cruise activity. The interviewed persons do not work on this activity.
The employees of MSC© are aware of disruption in the supply chain. The company encountered disruptions in the past. Especially with its own vessels which had damage problems. The company purchases used vessels from other companies and refurbishes the ships when it is necessary. Thus the company is prepared in order to face supply chain disruptions partly because of that. The top management of the company has crisis plans and crisis teams are ready to be formed and to react (Bier, et al, 2020 ; Bode and Macdonald, 2017 ; Bromiley, et al, 2015).

MSC© faced the same crisis as CMA-CGM©. The Covid crisis stopped its activity (Moosavi, et al, 2022). For example, the average price of a shipment of a TEU dry container (twenty equivalent units of length) has increased by eight times since the end of 2019. The demand dropped and the transportation costs increased a lot.

The environmental disruptions of the supply chain occur in the Mediterranean Sea and in the West of Africa. For instance the coups in Mali, Sudan and Niger are major disruptions for the lines of MSC©. The explosion in Lebanon and the attacks in the area of Israel are also concerning problems for the calls in the ports located in those areas. Those disruptions affected the route of several vessels because of major interruptions (Scheibe and Blackhurst, 2018 ; Bier, et al, 2020).

MSC© applies the same strategies as CMA-CGM©. The company has agreement with its competitors for borrowing and selling slots on its own vessels and competitors' vessels. This strategy enhances the supply chain resilience with the flexibility and adaptability of the supply chain (Shekarian and Mellat Parast, 2021 ; Mackay, et al, 2020). MSC© manages its own fleet of ships and containers. The specificity of this company is the fact that MSC© is building fewer new vessels and it purchases used vessels. It may refurbish the newly acquired vessels and it represents a threat as manufacturing defects could appear later.

The fleet capacity is more flexible (Mackay, et al, 2020) than its competitors with a higher risk in its quality. And MSC© can borrow vessels for a short period of time.

During the Covid crisis, MSC© drastically reduced its fleet because of the reduction of the demand for transportation and the stop of production of most of the production plants in the world (Moosavi, et al, 2022 ).

In the risky areas the company has three different offers of transportation just as its competitors. The first one consists in having several local partners. The products could be sent to the port and local companies take in charge the products. Or it transshipments to a neighbouring port. The partners would make the delivery to the customers on their own and they would be responsible for
The second choice consists in waiting for the evolution of the situation. The port authorities have an official obligation from agreement and they should fulfil it. Then the containers must be unloaded from the vessels even if political or economic problems occur. But it could not be respected by the new government.

The last choice is simply the cancellation of the call for the disrupting port. The ship can transship the products to the previous or to the next port within its line. Transhipment ports are usually used within a vessel's line and sudden changes can be tackled by this way.

MSC© as well as CMA-CGM© and other competitors in risky areas would use the FOB incoterm with the purpose to avoid complications and high uncertainty at the port of delivery and during the post carriage.

Eventually the flexibility of the MSC© ’s supply chain (Mackay, et al, 2020 ; Shekarian and Mellat Parast, 2021) is the main improvement of its resilience to disruptions (Shekarian and Mellat Parast, 2020 ; Tan, et al 2020). The transportation capabilities are adapting to the demand through the changes in the slots availability for containers and the specific fleet management of this company.

The supply chain robustness is almost not built but the redundancy can help against disruption with the use of several ships in the same line and route, and the transhipment in the ports. And the vessels of the other companies help to improve the redundancy of MSC© ’s supply chain (Mackay, et al, 2020 ; Kamalahmadi, et al, 2022). This adaptation enhances the strategy of the recovery (Chen, et al, 2021). The company's profit may recover quickly and the price of the offer is the second part of the recovery of the MSC© ’s gross margin.

4.4 The interviews of the company IKEA©

The appendix was used as an interview guide to conduct the interviews. The interviewees are working in Sweden in two different departments. They are purchase managers: one department is in furniture activity and the other department is in food activity.

IKEA© is a worldwide company located in many countries. This company is a furniture producer and retailer, and it has restaurants. IKEA© has a dense network with many partners and it outsources several products and their production to specific suppliers. IKEA© has stores and partners in Russia and Belarus.
The managers are aware of the disruptions in the supply chain especially with a wide network of partners. And IKEA® is currently facing disruptions in its furniture activity. IKEA® had 14 stores in Russia and 14 shopping centres of its Russian subsidiary Mega®. The direction of the company was prepared and the supply chain disruption management (Bier, et al, 2020 ; Bode and Macdonald, 2017) had made a quick decision to halt all of its operations in Russia and Belarus before any economic sanction was taken. And all the partners who were working with these two countries had their activities stopped with IKEA®. The decision to sell the stores and assets located in Russia was approved by the Russian government in February. The shares of IKEA® in the Mega® group were sold and this company became a Russian company. Then IKEA® registered losses in 2022 because of this market loss and the rise of the transportation and energy costs. This strong supply chain disruption had affected the company. And a supplier located in Belarus saw its ties cut with IKEA® because several workers are political prisoners which may harm the IKEA®’s brand image. The food activity is not facing disruptions but this risk has higher impacts with the break in the cold chain and perishable goods which can not postpone their delivery time.

This company has a resilient supply chain with a strong integrated network (Shekarian and Mellat Parast, 2020 ; Tan, et al 2020). Its robustness shows the ability to continue to perform good results even if several suppliers become unable to deliver the needed parts or products (El Baz and Ruel, 2021 ; Govindan and Fattahi, 2017). The supply chain redundancy of IKEA® is effective because in the case of the cutting of the Russian network, IKEA® is able to continue to produce and to sell the furniture it produced before from Russia and Belarus (Mackay, et al, 2020 ; Kamalahmadi, et al, 2022). The company was able to change and to manage its network in order to fill the blank. Different suppliers changed their productions and new transporters brought this new traffic to the stores. IKEA® recovers from the loss of the Russian and Belarussian markets and partners (Chen, et al, 2021). It returns to the level of gross margins before 2022. The logistics costs especially from the energy is higher than before that reduces the benefits. This is the main difference from the state before 2022.

The food activity is helped by a redundant network of warehouses and transporters (Kamalahmadi, et al, 2022). No loss of time is allowed with this type of goods and the reactivity is a core element of this type of traffic. The food can be easily transported in a different set of vehicles and it can be stocked in different locations.
The interviews of the company Siemens Gamesa©

The appendix was used as a base for the interviews. The interviewees are working in France. They are the manager of performance and continuous improvement and logistics manager.

Siemens Gamesa© is an international German and Spanish company. Its main activities are consultancy in renewable energy and manufacture of wind technology such as wind turbines. This company is the most dedicated to the sustainable development of the interviewed companies in the sample of the master thesis. Climate change is a major topic for this company and one of the company's goals is to contribute to a more sustainable world. This company has an important site of production in Normandy in France for offshore wind turbines. Siemens Gamesa© is acquiring new activities in the sector of renewable energy. The two interviewed persons are working on the production of offshore wind turbines in Normandy. Lately the company encountered disruptions in this production site because of social movements in France. Several days of inactivity which create delays in the scheduled plan of production.

The managers are aware of the supply chain disruption. Most of the production and partners are located in the European Union and Siemens Gamesa© have not encountered important disruptions in its network until the social movements of France. The production site located in Normandy is the very first big production site with many partners. The activity on this site was stopped several times because of strikes by workers.

The strategies of Siemens Gamesa© against supply chain disruptions are mainly the redundancy (Mackay, et al, 2020) and the recovery (Chen, et al, 2021) from its suppliers. For instance, the wind turbine blades come from different sites and suppliers in Europe. On the assembling site in Normandy, the wind turbine blades do not come from only one supplier and transporter. The resilience of the supply chain is improved by that (Kamalahmadi, et al, 2022 ; Shekarian, et al, 2021).

But there is no solution against the sudden stop of activity in the production plant of wind turbines in France. No flexibility exists on this stage of production and the activity is lacking resilience and flexibility at this level and the effects of the disruption were strong (Bier, et al, 2020 ; Scheibe and Blackhurst, 2018). No other assembling sites are available because of the size of the offshore wind turbines which can not fit in a warehouse or factory. In the future the idea of creating several assembling sites is considered in order to avoid the same situation.
4.6 The interviews of the companies Renault© and Faurecia©

The appendix was used as a model to conduct the interviews. The interviewees are working in France. The process manager works in Renault© and the maintenance and quality manager works in Faurecia©.

Renault© is an international and major automotive producer in the world. This French company has a very large and dense supply chain with many partners. The company is at a turning point and it shows the will to increase the production of electric cars and reduce the thermal motor production which represents an important challenge for the company and its network. This change is embedded in a greener strategy where the company and its supply chain will become more sustainable.

Faurecia© is a French car parts producer and it is an important supplier for Renault©. This company produces car seats, car interior equipment and it is developing car emissions control systems.

Renault© is aware of the disruptions in its supply chain and it manages it even in its contracts with partners (Bier, et al, 2020). The partner responsible for a production line shutdown would pay fees for each minute as Renault© is working with the just-in-time model without stocks. It adds these costs to the stock problems (Katsaliaki, et al, 2021).

Faurecia© is aware of it as it is an important supplier for Renault© and it is fully integrated into the network of Renault© (Ellram and Cooper, 2014).

Renault© faced a major disruption with its subsidiary Renault Russie©. The conflict with Ukraine is a threat for Renault because of the economic sanctions. As a European company, the sanctions are disrupting the supply chain of Renault© and it is extremely impacting. Because the Russian market represents the second biggest market after the European Union. Renault© accepted to sell all of its assets to the Russian federation and its Russian companies in May 2022. Several spare parts and car elements were produced in Russia. Thus the company registered a net loss in its global activity. But the benefits continue to increase in the first months of 2023.

For the Russian branch, Renault© did not develop redundancy and robustness (Mackay, et al, 2020; El Baz and Ruel, 2021). The strong impact damaged the benefits of the company. The company is developing better redundancy and robustness. For instance, in the North of France Renault© has built 2 new production plants and it has made new partnerships with French factories since the
beginning of 2023. Those new ties had been made with public offers and not all the production of a specific part or car element was made on only one site (Kamalahmadi, et al, 2022). The carriers are renewed and not a unique transporter provides all the raw materials or car parts to the production site (Govindan and Fattahi, 2017).

In the continuity of greener cars, two old production plants will be closed in the North of France within this year and two factories of new generation started their building. The end of their construction will be finished within a year. Faurecia© is adapting its activity along with the development of Renault©. A part of the production is discussed with Renault© to be localized in the new factories. The supplies are also remade in order to be more accurate with the new lead-times and transports. Thus the redundancy and the robustness of Faurecia© follow the same progression as Renault© (Kamalahmadi, et al, 2022; Govindan and Fattahi, 2017).
5 Results and findings

5.1 Analysis of the results

The private companies are not always aware of the risk of disruption in their supply chain. And they understand it when a disruption occurs and the supply chain is altered by it. This event interrupts the physical flows between the very first supplier with raw materials and the end customers. The supply chain disruption may affect performance through lost sales, stockouts, production shutdowns, premium freight charges, product substitutions, and compensations for the customers. 85% of the private firms face a major disruption in their supply chain. And the aim of the top management is to return to the state of physical flows within the supply chain before the disruption (Bode and Macdonald, 2017).

The case of the company LYSEO® is a good example of companies which do not encounter important supply chain disruption and they do not plan this type of event or it is associated with the more common group uncertainties named VUCA in the markets (Bennett and Lemoine, 2014).

The five other companies learnt mainly the hard way with a disruption in their supply chain which had a strong and negative impact on their activity. This lesson of the past is used as an opportunity to improve the resilience of the supply chain (Shekarian and Mellat Parast, 2020).

5.1.1 Analysis for the research question 1

RQ 1: How could private companies plan supply chain disruptions?

When the risk such as environmental supply chain disruption is integrated into the business model, it is called supply chain risk management (Bier, et al., 2020). Supply chain risk management is a technique of the firm to identify, assess and manage risks which come from the disruption of the supply chain. The supply chain disruption may impact only one element of the chain, several partners in a localised part of the network or it can impact the supply chain at a global scale (Katsaliaki, et al., 2021). This fair new concept is linked with the supply chain resilience and it becomes more and more central to the private companies in an increasing globalised network of partners (Shekarian and Mellat Parast, 2021). This implies mainly the collaboration of the higher number of partners within the supply chain. The supply chain resilience is often cited with supply chain robustness which shares several elements. The mitigation of the risks can be found in the...
supply chain resilience enhancers which are the flexibility and redundancy. In this review, the environmental disasters and economic sanctions are classified as environmental risks. (Shekarian and Mellat Parast, 2021). According to Shekarian and Mellat Parast (2021) ‘the redundancy involves the strategic and selective use of spare capacity and inventory that can be invoked to cope with a crisis, such as demand surges or supply shortages’.

The environmental risks are tackled by flexibility which is the main strategy used by the companies (Shekarian and Mellat Parast, 2021). But the other elements are also used to reduce the risk of environmental disruptions.

This supply chain amplification might result in a shortage of products for the customers in a first step and subsequent overstocks of products in a second step.

The resilience of the supply chain is important to counter the biggest effects. And the supply chain recovery is a way to react against the ripple effect (Dolgui and Ivanov, 2021).

Hence the recovery capability is monitored by the top management in which it proceeds in three steps. They are the identification and the assessment of the disruption, the selection of the relevant recovery method to address this problem, and the use of the method (Katsaliaki, et al, 2021). And from the same research the recovery is the reactive approach in the supply chain resilience. The second approach is the resistance which is a proactive approach. As previously pointed out as a solution the supply chain resilience is translated into supply chain redundancy and flexibility. The recovery step is focused on the backup suppliers for sourcing, the use of the buffer stock for the order fulfilment and redundant capacity for continuing the production (Katsaliaki, et al, 2021). On the ground, the companies’ answers are quite different where they tend to increase the safety-stock and/or duplicate the sourced partners. And instead of collaborating with all the partners within the network, the firms act individually and their supply chain visibility is restricted to the first supply tier above and below (Katsaliaki, et al, 2021).
5.1.2 Analysis for the research question 2

**RQ 2**: How could private companies react to economic sanctions in order to meet the customer requirements and to continue to deliver products?

The crisis management (Canyon, 2020) is used to react against business crises and to perform risk mitigation (D’arcy and Brogan, 2001). And in the particular situation of the study which is supply chain disruption (Bier, et al, 2020). The supply chain recovery (Chen, et al, 2021) and the resilience (Shekarian and Mellat Parast, 2020) are helpful in order to react against a direct cut of the network in the case of economic sanctions.

Mostly the international private companies work on the supply chain resilience after an important supply chain disruption (Bier, et al, 2020). The case of LYSEO© is a good example of this reality. It has not encountered disruptions in its network and then it did not prepare the resilience of the supply chain against environmental disruptions (Scheibe and Blackhurst, 2018). These types of disruptions can harm the private company and its network as it is shown in the case study in Japan (Tokui, et al, 2017). And the private companies which use the just-in-time supply chain strategy are weak against the supply chain disruption. Because this type of supply chain strategy reduce the supply chain resilience in order to optimise the network and reduce the overall costs of this network. The order fulfilment is not respected such as the restrictive lead-times and a ripple effect may occur (Hum, et al, 2018). And in the worst case, the brand image can be harmed by unsatisfied customers. Renault© is one of those companies and the economic sanctions against an important market and partner of this company in Russia (Essential Economics, 2004 ; Li and Li, 2022). The Russian market represents the second biggest market after the European Union. In 2022, Renault© registered net losses instead of benefits as the previous years. This supply chain is not resilient and the majority of the revenues fell in the year of 2022 because of dysfunctions in its network. The recovery is very slow and new partners are not sufficient to return to the level of profit prior to the sanctions (Chen, et al, 2021). Renault© relocates a part of its production in France with the construction of new factories. And new partners are chosen in France and in the European Union with the purpose to avoid a such sudden disruption of its network in 2022.

Most of the interviewed private companies prefer to use supply chain redundancy and flexibility in order to tackle disruptions. Not all parts of the supply chain are taken in charge by one partner. Several partners make the activity and they should be able to follow the changes of the flows (Shekarian and Mellat Parast, 2020 ; Katsaliaki, et al, 2021 ; Govindan and Fattahi, 2017).
For the companies, too much resilience and robustness increase the costs of logistics. They tend to use a lean manufacturing strategy with multiple partners.

It seems easier for service-based companies such as CMA-CGM© and MSC© which can change the partners and the offers according to the sender or the destination. But these companies are world leaders in the shipping sector and their brand image helps them to find new contacts and partners in different areas in the world. A smaller private company can find it difficult to establish contact in a new area. The strategy consists in redundancy and flexibility of their network and transportation capability with multiple partners who are actively acting in the network and possible partners for sudden changes (Kamalahmadi, et al, 2022; Shekarian and Mellat Parast, 2021).

IKEA© is a good example of both sides of economic sanctions. This international private company is a major actor in the furniture market worldwide and it was supported by the public in Russia. This company has a very large network with many different suppliers and markets which are making a robust and resilient supply chain (Govindan and Fattahi, 2017; Katsaliaki, et al, 2021; Shekarian and Mellat Parast, 2020). Some losses of revenues occurred because of the withdrawal from the Russian federation with fewer customers and the cut of ties with local suppliers such as Belarussian raw material suppliers and manufacturers. The separation from its Russian subsidiary Mega led to losses as well. But IKEA© recovered quickly with an effective recovery strategy (Chen, et al, 2021).

Siemens Gamesa© is a different example. Its production activity is growing and it has acquired its first big production site where the offshore wind turbines are assembled. Its network is well established but the site where the finished products are made is the only one for many wind turbines and stocking areas. The social movements in France disrupted this site and the planned schedule was delayed. The company was not prepared to face this type of disruption and it learnt the hard way (Bier, et al, 2020).

Finally the plurality of the markets that a company can reach is as important as the development of the supply chain resilience for the company. Relying on one big market is a big threat for a private company. The problems encountered by the private companies teach them the risk and threats (Bier, et al, 2020). And the private companies prepare themselves in accordance with previous experiences. They have to make a choice of strategy. And too much resilience increases the costs of the supply chain with multiple partners for the same activity in the network for instance.
5.2 Discussion of the results

The recent papers found during this study helped to formulate the answer of the first research question. A hypothesis is built from the papers. And the empirical material was used to confront this hypothesis in order to confirm a theory which is the answer to the second research question. The private companies helped as empirical data.

A trend is discovered from empirical research which is the increasing role of sustainable development in the strategy of private companies. Four of the seven interviewed companies express the sustainable question in their strategies or new projects.

5.2.1 Discussion for the research question 1

RQ 1: How could private companies plan supply chain disruptions?

First of all, a private company needs to be aware of the supply chain disruption. In this case, the company prepares a supply chain risk management. It assesses the risks and it plans these risks. It makes a choice which can be ignoring it for a just-in-time strategy or it develops the supply chain disruption mitigation. The latter implies costs but the benefits could be much higher when a disruption occurs as loss of profits would be extremely reduced by the taken strategy.

The company localises the potential bottlenecks of its network and it identifies the possible disruptions which can impact the bottlenecks. Thus the private company improves the resilience of the supply chain in working on those bottlenecks. The bottleneck effect can be reduced or neutralised with the supply chain robustness, redundancy and flexibility.

The supply chain robustness can be translated into several paths in the network of the company with the purpose to move the flows from a blocked area of the network to another one which is functioning properly. The bottleneck is avoided.

The supply chain redundancy could be expressed as multiple partners in the network with the same role in the supply chain. The disruption effects are reduced because the private company can switch its flows from the blocked partner to another partner which is working effectively.

The supply chain flexibility is the capability to adapt to the situation and to reorder the network when a problem occurs in the supply chain. It is possible for the private company to have partners with unused ability which can be used when a disruption is appearing and latent partners can be enrolled to reinforce an effective flow movement.

The supply chain resilience is a proactive result of those three strategies in which the supply chain is more able to face effectively supply chain disruptions.

Aubourg, Y.
The supply chain recovery strategy is more explored in the second research question where the reactivity of the private companies is analysed through interviews. The recovery strategy has the purpose to react to a supply chain disruption with the aim to recover from this problem and to return to the state before the occurrence of the disruption.

Hence the private companies plan supply chain disruptions with mitigation strategies which improve the supply chain resilience. The robustness, the redundancy and the flexibility in the supply chain are the planned strategies against the disruptions.

5.2.2 Discussion for the research question 2

**RQ 2**: How could private companies react to economic sanctions in order to meet the customer requirements and to continue to deliver products?

Some companies are not aware of this type of risk and they are not prepared. The private companies interviewed are localised in Western and Northern Europe. And they have an important dedication to logistics and supply chain activities. In this region of the world, the private companies plan the supply chain disruptions as a risk and they try to mitigate it through the supply chain risk mitigation management. This strategy improves the supply chain resilience with multiple partners in the network. The diversification of the suppliers and customers is also happening in different areas of the world. This is one type of robustness and redundancy of the supply chain. And prospects could be partners in the future and especially in the case of disruption which is an enhancement of the flexibility and the resilience of the supply chain. The company can start the partnership with the prospects in this specific case.

When an economic sanction is touching an area where partners are localised, the main action for the private company is to continue to deliver products and services and to meet the customer requirements. This is a difficult task and it becomes even more difficult with a wide and developed supply chain. Some bottlenecks are not identified and the disruption which is touching this specific node in the network can strongly negatively impact the activities of the company. And changing partners can modify the quality of the products and services and the order fulfilment is altered by this change.

An efficient reactivity and fast and proper choices are the good solution to sudden economic sanction and disruption in the supply chain. The supply chain recovery depends heavily on this first step. The supply chain recovers effectively when the private company returns quickly to the gross margins earned before the economic sanctions touching partners of the network. The private
A company may find new paths or new partners in order to have a functioning supply chain. Some companies might use this situation as an opportunity to rethink the network and make effective changes. And sustainability is more and more included in the customer requirements because the customers are more sensitive and concerned by this topic. The unsustainable elements become in some cases reverse requirements and sustainability could be an expected requirement. Thus the change in the supply chain may tend to more sustainability such as local partners and no more lowest costs worldwide. Most of the interviewed companies are aware of this evolution and they know about the customer awareness of the sustainable choices made by companies. For instance the change of engine fuel such as the liquified natural gas for vessels, the electricity for car's engines or the production of renewable energy sources.

Eventually the private companies need to be reactive and to adapt to the new situation. And they have to work with their partners to handle the situation with a larger range of possibilities.
6 Limitations and further researches

This study is limited in its empirical results. Because the respondents were very few for the interviews. And a bigger team of researchers should have worked on this type of research. A wider range of ideas should have been made and more insights could be found. The methodology of research used has limitations and the sampling method is also limiting the results. In the previous section, the limitations are explained in depth.

For further research the results found in this study could help to build new hypotheses and to build theories. The practical cases and the particular context of Russian aggression and African coups may lead to wider research on economic sanctions and other environmental disruptions especially in the context of climate change and sustainable development. Several articles mentioned the sustainability and circular economy in order to enhance the supply chain resilience. These topics of closed-loop manufacturing need to be explored in new studies. The degree of integration of the partners in the supply chain could be explored in future research with the differences in front of disruptions.
References


Aubourg, Y.


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Datasets

Images and information about disasters:

National Supply Chain Assessment (NSCA) Toolkit. *USAID Global Health Supply Chain Program.*
Appendix

The interview guide is questioning the international private companies facing disruptions in their supply chain in the context of economic sanctions.

1- Identification introducing part

1.1- What is your position in the organisation ?

1.2- Does your company have several installations or only one ?

1.3- What is the sector of activity of your company ?

1.4- Is your company product-based or service-based ?

1.5- (If product-based company) Does your company own its products ?

1.6- Does your company produce its products or is this activity outsourced ?

1.7- Is your company established outside your country ?

2- Supply chain assessment

2.1- Does your company forecast its activity with the direct suppliers ?

2.2- Does your company forecast its activity with direct customers ?

2.3- Does your company have a hub for stocking the products such as a warehouse outside the production plant ?

2.4- Does your company have distributors or retailers ?

2.5- Does your company have a logistics or supply chain department ? And does it work with counterparts from the closest partner of your network ?
2-6- Does your company organise the logistics for its activities such as transportation and warehousing? Or does it use 3, 4 or 5 party-logistics such as freight forwarder and integrator?

3- Preparation and actions towards supply chain disruption

3-1- Is your company aware of the supply chain disruption?

3-2- Does your company assess the risks of disruption in your logistics and supply chain?

3-3- Does your company have a business crisis plan and form a team when a crisis appears with staff members with designated roles to tackle this event?

3-4- Does your company assess the risks and prepare for the business crisis directly with the closest partners? And even with less close partners?

3-5- Have you encountered any kind of disruption in your company’s supply chain which modified your activity temporarily in the last decade?

3-6- Did those events were totally unpredictable and outside your company? And outside your supply chain and network of partners?

3-7- Do supply chain disruptions linked with political and economic sanctions (war, embargo, restrictions, etc.) touch your company and its partners? How did it impact your activity? Which partners were involved? How did your company act and react against these disruptions?

3-8- Afterward does your company change the way it runs its business in the long-term?

3-9- Does your company have a partner located in a risky area regarding the political system or political conflict?