



The resilience of the food supply chain to pandemic COVID-19

– a case study on the impacts of the novel Corona in the grain industry of Swedish food supply chain

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Abstract

Today's business climate is subject to a variety of challenges associated with environmental turbulence that demands resilience to achieve sustainable business. The rare external disruption by a natural cause like a pandemic directly affects the organization's ability to continue its operations from getting raw materials from suppliers to provide finished goods to market. The aim of this thesis is to understand the present resilience system in the food supply chain in the grain industry in response to a pandemic through a qualitative case study methodology. It focuses more on the risks which are external to the focal firm where the cooperative Lantmännen's grain supply chain is the case.

The results from empirical data that came from the semi-structured and in-depth interviews suggest that appropriate application and practices of the resilience ideas can make a supply chain robust and withstand any kind of environmental turbulence to attain business continuity. This thesis finds that how has the resilience practices by the leading grain industry of Sweden increased its capability of operating even in an unprecedented event like the Corona pandemic. Lantmännen's existing structure, supply chain design and the combination of global and local supply chain strategies gave them an edge to manage their operation and supply chain in a good way. Moreover, its diversified business portfolio, existing risk management culture and intense collaboration with upstream and downstream supply chain actors supported their business continuation despite the disturbance created by the pandemic. This existing proactive resilience mechanism has backed their managers to be agile to take the reactive measures very quickly to adjust to the new situation of the pandemic. According to the literature, the supply chain resilience increases the ability of an organization to endure, adjust and grow even in the turbulent situation, findings on Lantmännen's supply chain confirms the justification and validation of the effect of resilience practices.

Keywords: Corona pandemic, resilience, Lantmännen grain supply chain, flexibility & adaptability, robustness, collaboration, supply chain risk management, vulnerability, business continuity, risk management culture.

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Abbreviations

B2B	Business to Business
B2C	Business to Consumer
B2F	Business to Food Service
BoD	Board of Directors
BCP	Business Continuity Plan
CoC	Code of Conduct
ERM	Enterprise Risk Management
HGL	Head of the Grain Unit of Lantmännen Lantbruk
R&D	Research and Development
SVP	Senior Vice President
SEK	Swedish Krona

1. Introduction

1.1. Background

Today's business climate is subject to a variety of challenges associated with environmental turbulence that demands resilience (Pettit, 2008) to achieve sustainable business. Particularly it concerns when it comes to managing the supply chain in continuous turbulence. Business managers rely on their own risk management strategies to managing the flows of products, information, and resources to ensure a high level of product availability to the customer and to remain competitive and profitable. Boosting supply chain efficiency through managing supply chain risk has become one of the key considerations for business organizations these days (Ho et al., 2015). In the academia, supply chains have been considered as a complex network of organizations that suffer turmoil incessantly, exposing it to unpredictable disruptions (Pettit et al., 2010). The most common notion of the supply chain comprises the actors such as suppliers, manufacturers, wholesalers, retailers when it also includes transporters, warehouses, retailers, and even the customers (Chopra & Meindl, 2016). With that said, any interruption in any stage of the supply chain can affect the entire supply chain and may halt the flow of goods or services to the ultimate customers. Studies reveal that globalization, higher demand, intense competition, and market saturation (Chadist, 2012) along with other environmental turbulence have been making the supply chain more exposed to the risk in recent decades. An organization may face a major negative impact if it fails to assess supply chain risk that occurs in multi-dimensional ways such as falling product quality, decrease in performance and productivity, delivery delays, loss in reputation along with service level failure and revenue loss (Demirci, 2021; Mitchell, 1995).

Some researchers put supply chain risks in two groups as explained by Ho et al., (2015) as *macro and micro risks* where macro risk refers to adverse and relatively rare external disruption by natural catastrophic events or man-made risk. While micro risks originate within the companies or between the relationship within the partners in its supply chain (Sodhi et al., 2012, Tang, 2006; Ho et al., 2015). In this

thesis, the researcher investigates the macro risks in the supply chain that have a much greater negative impact on companies as described by Ho et al., (2015). Here, the researcher considers macro risk since the thesis particularly focuses on the understanding the impact of novel Corona which is understood as the reason of the external disruption for the companies that puts their supply chain in risk.

The rare external disruption by a natural cause like a pandemic directly affects the organization's ability to continue its operations from getting raw materials from suppliers to provide finished goods to market. Since the entire supply chain is mutually dependent on each other together with suppliers, manufacturers, wholesalers, transporters, the service unobtainability from any link can shake the ultimate product and service availability to the market. As discussed by Demirci (2021), Kumar & Chandra (2010), the disruption magnitude of an outbreak spreads too fast to hit from the local to the global supply chain, and its associated logistical challenges are enormous as it may possibly hit all interconnected supply chain at once like a knock-on effect. The authors suggested that organizations should keep measuring their business continuity plans (as referred by Elliot et al., 1999, p.48) "as the process of creating systems of prevention and recovery to deal with potential threats to a company" to carry on the business even with the pandemic situation. (Demirci, 2021; Kumar & Chandra 2010).

1.2. Problem statement

The world economy has been suffering from the rippling effect of the Corona pandemic since November 2019 when the first confirmed case of this endemic was detected in Wuhan, China (The Guardian, 2020). According to the experts, it may leave its legacy for many years in the future as the core of global value chain hubs including Europe, the USA and China have been disrupted by this novel disease and expected to have long-term implications for the supply chain of international production networks (UNIDO, 2020). Organizational leaders and policy makers have been struggling to find out which strategy will work better for the business continuation that can minimize financial impact while tackling the challenges related to the protection of their employees, supply assurance, and market uncertainty that is pushing down the demand. According to the economists, the novel Corona pandemic has already created severe negative impacts in all sectors of the global economy. Especially it hits hard in the travel and tourism industry, energy and automobile industries, fashion, apparel and retails sectors, and food processing industries (Chowdhury et al., 2020; Statista, 2020). Studies reveal that this damage is mainly driven by a fall in demand when there are no consumers to purchase the goods and services available in the economy (Statista, 2020).

Moreover, with the “social distancing”¹ policy to limit the spread of this virus has primarily prompted the supply chain disruption as it forced the factories to keep shutting down (Chowdhury et al., 2020) for an uncertain period. It reduces the supply of goods and services that ultimately ensues reduced product available in the stores and price hike. It is already evident that the restriction of movement and the isolation policy by the individual countries to tackle the infection have a strong impact on the countries up and down the supply chain (UNIDO, 2020).

The figure below shows an empty highway in Dubai, United Arab Emirates, and the sign above “*Stay Safe, Stay Home*” represents the real phenomenon during lockdown time in Corona pandemic as discussed above.



Figure 1." Above the highway, a sign reads "Stay Safe, Stay Home." © Mo Azizi/Shutterstock (Source: worldbank.org)

The present understanding of the resilience of the supply chain is largely relied on building some proactive redundancies to deal with the significant environmental turmoil but it is argued that it only works effectively at the beginning of the crisis (Ivanov & Dolgui, 2020). With a prolonged continuation of an infectious disease like the Corona, the redundancy capacity for an organization is supposed to be less efficient because of forced isolation policies of individual countries that literally stop the movement of individuals as well as goods and services. As such, this thesis argues for the need of a new insight of supply chain resilience or an adjustment of the existing idea towards creating a more resilient supply chain. The Corona has

¹ ‘Social distancing’ is a non-pharmaceutical measure to prevent the spread of contagious disease by maintaining a certain physical distance between people and reducing the number of times people come into close contact with each other (Wikipedia, 2021).

been an emerging, rapidly evolving situation with its overarching novel characteristics that eventually forced to halt the business growth that world economies have never experienced before. According to Ivanov & Dolgui (2020), there is a significant amount of research that suggests coping with the epidemic outbreak from the humanitarian logistics points of view. It implies to ensuring the supplies of goods and services to the vulnerable people of affected areas during the environmental disturbance. Therefore, this thesis tries to find out the research gap on the supply chain concerning supply chain risk management and operation by analyzing the impact of Corona to make a significant contribution that would make the supply chain networks less sensitive to the long-term environmental agitation by a pandemic.

Thus, this study intends to examine the impact of the Corona pandemic in the Swedish food supply chain in grain industry as it is also vulnerable to disruption. For narrowing down the scale of investigation to stay focused, the researcher takes the stance on examining the Swedish grain industry value chain as a case study given that it is one of the most thriving industries in the agricultural sector. According to Lyddon (2018), Sweden has a concentrated grain-processing sector with a yearly production at 5.7 million tons in the year 2017-18 that is built with a high level of vertical integration between milling and baking and processing (Lyddon, 2028). By the self-observation through living in the entire pandemic situation, the researcher asserts that it could be an interesting study to explore the present supply chain resilience mechanism in the Swedish grain industry to know how the actors in this industry keep continuing their business and digesting the shocks of the Corona crisis. When it is almost certain that in addition to panic buying and rapidly changing consumer behavior, demand, and distribution for both upstream and downstream supply chain (from producers, farm input suppliers, grain merchandisers to processors and grain-based food manufacturers to retailers) have confronted a huge shake by this novel crisis where the scale of adaptations are supposed to be massive. Nevertheless, the pandemic creates uncertainty and volatility in consumer demand that creates shock in the supply chain (Demirci, 2021) and makes the demand and supply equilibrium imbalanced. Therefore, it is critical for the supply chain managers to make food supply chains resilient during a pandemic to keep business continuity as well as to build a sustainable food supply chain that can ensure food security for the consumers during the crisis.

For an empirical example, this thesis examines the value chain of the co-operative Lantmännen, a major player in the Swedish grains sector to understand and validate their supply chain strategies under the lens of resilience theories through a thorough literature review. The researcher wants to identify the factors that the literature

suggests are significant to make a supply chain robust to withstand this kind of environmental turbulence from the pandemic.

Considering the complexity related to the supply chain and the pervasive effect of an endemic towards a society in the long run, this study could be considered as a departure point for future research to attain more resilient food supply chain during pandemic. The socio-economic effect of this ongoing endemic is not yet quantifiable and perceptible as the companies are still reeling with the on-going crisis. But this qualitative study would be an effective initiation for the researchers who might want to research this facet. It will serve the right motivation to research on a broader level for further validation on the result of this study and contribute to generate the new knowledge to develop a more effective resilience system in the fields of supply chain risk management.

1.3. Objective and research questions

The purpose of this thesis is to understand the present resilience system of the Swedish food supply chain in the grain industry in response to a pandemic.

The whole study is guided by the following research questions to achieve the central objective of this study:

1. How is the Swedish food supply chain in the grain industry reacting to the Corona pandemic?
2. What are the impacts of the Coronavirus (COVID-19)² on Lantmännen³ and its aggregate food supply continuity?

To answer the above research questions, the author intends to pull the answers more specifically by formulating following sub-questions that includes:

- I. How has the chosen organization changed their strategies focusing food supply due to this pandemic and what are their risk management strategies and resilience.
- II. Is COVID-19 more threatening for the continuity of individual companies than that of the continuity of food supply at the aggregate level or vice

² The COVID-19 (known as the coronavirus pandemic) is an ongoing global pandemic caused by severe acute respiratory syndrome (Wikipedia, 2021)

³ as a farmer cooperative processing farm outputs to sell to the retail stores, that sell to consumers.

versa? I.e., whether the companies are in need to get support from other stakeholders of the supply chain to deal with this crisis.

1.4. Scope and delimitations

This study is focused on understanding the present resilience in the supply chain to the Corona pandemic in the Swedish grain industry as a case. It takes the empirical data from cooperative Lantmännen as they are a large and dominant actor in their value chain. The researcher has chosen the grain industry as its products are consumed by almost everyone in Sweden thus it is important to consumers. The flours and the processed foods from grains such as cereals, breads, pasta, beans are the most common items in the daily meal mostly in the breakfast for Swedes (Swedish Institute, 2021). By investigating the supply chain phenomena in the important sector of Swedish agriculture, an interesting insight can be produced that may lead to a better crisis management approach to handle the supply chain risks during a pandemic.

This thesis used the country context of Sweden as it has similarities with most prosperous EU countries in managing the food supply chain in terms of its characteristics of short food supply chain⁴ and local food systems (Kneafsey et al., 2013). Remarkably, cereals such as barley, oats, and wheats are cultivated in the 40% of arable land in Sweden (Jordbruksverket, n.d.). Besides, it involves in export and import of agro-food product where 63% of its exports go to the European countries, specially to the Nordic countries (ibid). Furthermore, it is claimed that the productivity of the food sector in Sweden has increased significantly during the last two decades for the reason of its efficient supply chain and distribution networks (Eriksson, 2016).

Thus, exploring the Swedish context can help to recognize the shocks and trials in a food supply chain during the pandemic that can be relevant in other countries in Europe. Besides, investigating the supply chain through Lantmännen gives this thesis a comprehensive understanding of the impact of Corona in the entire supply chain from producers to retailers as this co-operative is positioned in the core of its upstream and downstream value chain and has direct contact with those actors.

The researcher sets to gather empirical data based on online interviews to avoid physical presence because of the ongoing pandemic situation where social distancing is highly encouraged and a matter of top consideration.

⁴ A short supply chain defines as when there are a smaller number of intermediaries between farmer and consumer (Kneafsey et al., 2013).

1.5. Structure of the study

Chapter 1 – describes background information regarding the supply chain, its challenges, and risks in the time of disruption along with problem, aim, research questions and delimitations to provide a glimpse about the research topic.

Chapter 2 – reviews the research conducted on resilient supply chain, supply chain vulnerability, risk management, and business continuity to identify the research gap that is intended to be addressed in this study especially in the context of pandemic situation.

Chapter 3 – introduces methodology and how the data was collected and analyzed along with the explanation of quality criteria at the end of this chapter.

Chapter 4 – presents an overview of the empirical case. It provides an introduction of Lantmännen to investigate how these leading cooperative deals with their grain supply chain in the pandemic situation.

Chapter 5 – presents data analysis and result that are based on the theoretical framework, presented in chapter 2. The data analysis was mainly done by summarizing the interviews of the key people of Lantmännen who are directly and indirectly involved in supply chain management.

Chapter 6 – offers a discussion, where the researcher compares her results with other researchers' results. It confers the answers to the research questions from the lens of existing theories and provides the new insight of resilience in supply chain management.

Chapter 7 – ends with a conclusion, study limitations, and future implications of the study. It proposes strategies for the supply chain managers to drive business performance in the supply chain to be more resilient to long-term environmental agitation like the Corona pandemic.

2. Literature review and conceptual framework

To develop the theoretical base for the study, the researcher reviews the academic literature to know, in the present case, the current understanding of the supply chain and its resilience concerning what it suggests making a supply chain robust and withstand any kind of environmental. The literature is also reviewed with having as a goal to understand supply chain ‘vulnerability’, and ‘risk’ which are terms that can be considered as opposite compared to ‘resilience’. As the coronavirus has been creating an unprecedented event of disruptions in every stage of global and local supply chains, it pushes the companies to think about a new perspective of individual supply chain resilience for the sake of their business continuity.

2.1. Understanding supply chain & food supply chain

The most common understanding of the *supply chain* characterizes it as a network between a company and its suppliers that includes people, activities, entities, information, and resources to produce and distribute a specific product to the

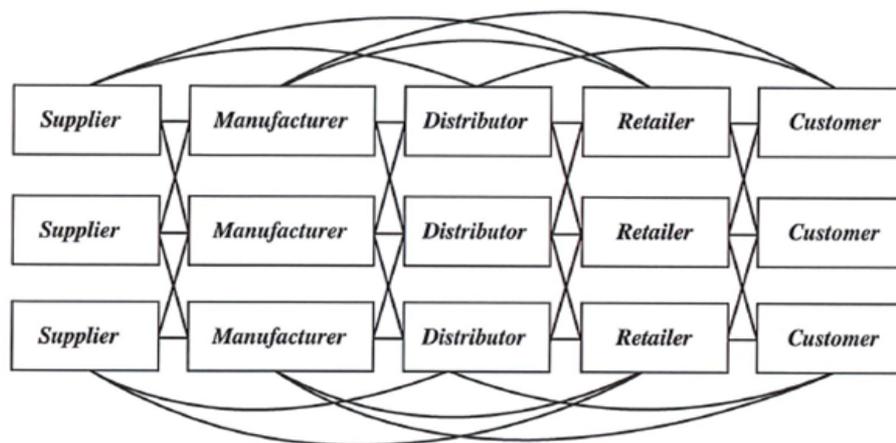


Figure 2. Supply chain (Chopra & Meindl 2016, p. 15)

customer (Kenton, 2020). Comparably, Chopra & Mendi (2016) defined the supply chain as a configuration (as shown in Figure 2) where the different actors such as supplier, manufacturer, distributor, the retailer in different stages are linked with each other and work directly or indirectly to fulfill a customer request.

On the other hand, Garnett et al., (2020) suggest supply chains as networks of multiple and two-way interdependencies between organizations where one organization feeds resources and materials into another. The authors argue that this interdependence between organizations in the supply chain challenges the theoretical understanding of how supply chains should operate in terms of resilience in the event of shocks or disruptions (Garnett et al., 2020).

Thus, the author argues that the impact of disruption between organizations and their supply chains is expected to be strong because of the interdependencies since failure in one part of this network can expose the supply chain to ripple effects. In the case of unavailability of any links such as supplier, processor, wholesaler, and transportation could result in the supply shortage and delivery delays that eventually may lead to a drop in performance, service levels, revenues, and so forth (Tang, 2006). Christopher & Peck (2004, p.5) portray the challenges of this phenomenon of interdependencies between organizations and their supply chain as “it may be business that is at risk from its supply chain or the supply chain that is at risk from a business.”

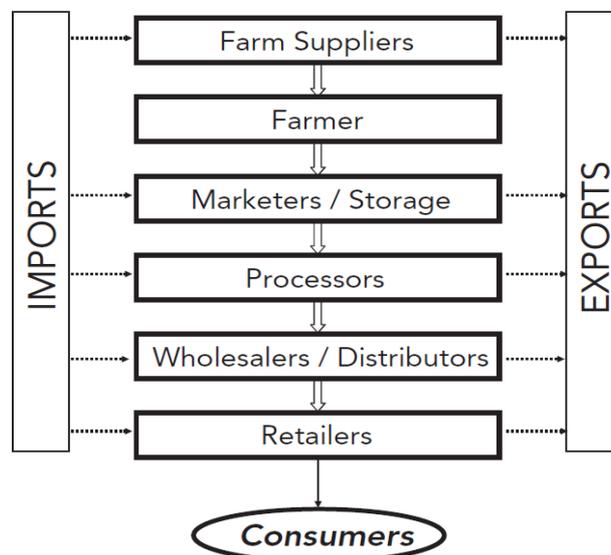


Figure 3. Generic Model of Food Supply Chain (Roth et al., 2008, p. 24)

Roth et al., (2008) explained the typical food supply chain as shown in Figure 3 that starts from farm supplies to farmers such as machinery, seeds, agro-chemicals and

continues along with the supply chain stages from storage to retailers to sell it to ultimate consumers. Folinas et al., (2013); and Demirci, (2021) clarified these steps of the food supply chain further where they described that the involvement of farmers does not prolong to customers or even the distributors and usually limited up to deliver the goods to the food processor and sales via cooperatives or consolidators.

2.2. Current understanding of supply chain resilience

Supply chain resilience is considered as an essential element of supply chain risk management in the research arena (Ponomarov & Holcomb, 2009). Juttner & Maklan (2011) explained the concept by identifying and relating the relationship between supply chain vulnerability and supply chain risk management empirically (Ponis, 2012) with a view to building a resilient supply chain.

According to Christopher & Peck (2004), resilience is the ability that helps firms to return to their original situation or move to a new or more desirable condition after being disturbed. Similarly, supply chain resilience refers to a firm's capability of performing operations during an unprecedented event (Blackhurst et al., 2011; Chowdhury et al., 2020) that helps firms to endure, adjust and grow even in the turbulent situation (Fiksel, 2006). A study by Pettit et al., (2010), explained a more elaborative concept of supply chain resilience that emphasizes the need to balance the managerial capabilities of a firm with its unique vulnerabilities of the supply chain design and the environment in which it operates. The authors stress the point of maintaining a balance between capabilities and vulnerabilities for an enterprise to achieve the highest level of resilience.

Some researchers see supply chain resilience as a reactive ability that works against disruption or shocks when others find it as more proactive efforts on preparing firms to handle the disruption successfully (Melnik et al., 2014). In later studies by Pires Ribeiro & Barbosa-Povoa (2018) described that the scope of supply chain resilience is not only limited by the capability to prepare, act, and recover from the disruptions, but it also should have the grip to keep the operation steady with growth after the turbulence.

In this thesis, the researcher takes the stance that resilience scope should not be limited only to proactive or reactive abilities of an organization, rather it must have a combination of both proactive and reactive approaches. Especially in the case of resilience for a pandemic like Corona, it is impossible for any organization to predict the scale of disruption and duration of the tumultuous situation to devise the mechanism of resilience. As such, organizations must find out the vulnerabilities in

their existing supply chain where the risk factors are considered in the case of environmental turbulence to align the resources as a proactive approach. This proactive supply chain resilience mechanism is expected to aid the reactive supply chain risk management approach through balancing the management capabilities. These capabilities are more focused on the ability to predict the risk, plan, collaborate, and develop long-term relationship with other stakeholders in its supply chain that help firms to endure, adjust and grow even in the turbulent situation (Verdier & Olsson, 2017).

Therefore, this thesis first discusses the considerations that literatures suggest making a supply chain robust and help it to survive in the environmental turbulence. Singh et al., (2019), suggested the most common indicators of supply chain resilience that many researchers explained are vital to achieving a resilient supply chain. In this thesis, the author focuses on 'flexibility', 'adaptability', 'robustness', 'collaboration', and 'risk management culture' as proactive and reactive strategies of supply chain resilience.

2.2.1. Flexibility & adaptability

The *flexibility* to adjust quickly with required resources in the environmental turbulence represents a resilient supply chain (Singh et al., 2019, Stevenson & Spring, 2007) and the flexibility necessitates to both an organization and its entire supply chain (Chopra & Sodhi, 2004). Scholten & Schilder (2015) quoted that flexibility enables organizations to deal with high levels of uncertainty by facilitating coordination processes. The sources of uncertainty that make the supply chain exposed take place in different ways including environmental turbulence and external pressures that need to be counterbalanced with managerial controls (Pettit et al., 2013). The authors refer to these managerial controls through resilience strategies when an organization has flexible planning in order fulfillment, flexible sourcing/supply base, strong supply chain relationship, and flexible contracts along with flexible transportation (Pettit et al., 2013; Scholten and Schilder, 2015).

On the other hand, Ponomarov (2012), described the *adaptability* of a firm's response to disruptions and recover timely by maintaining operation at the desired level as supply chain resilience. In this way, the supply chain's ability to adapt to the situation quickly and return to the original or ideal state after external disruptions (Xiao, 2012) is also a sign of a resilient supply chain. Hence, adjusting to a new condition and continuing the firm's operation and progress even after the disruption refers to the adaptability of supply chain resilience. Thus, the researcher argues that both flexibility and adaptability of supply chain resilience may function as proactive and reactive strategies of managers where flexibility appears more workable in designing supply chain in advance in the case of turbulence while the

adaptive capability of the supply chain is the more reactive approach in adjusting the unpredictable external disruption.

2.2.2. Robustness

Supply chain *robustness* is the ability of the supply chain to keep functioning and remain effective under any plausible future despite the disruption (Kitano, 2004; Klibi et al., 2008). Similarly, other researchers portrayed it as the capacity to oppose change that involves proactive planning to construct a supply chain to keep it operational before and after the unwanted event (Singh et al., 2019; Wieland & Wallenburg 2013; Ehrenhuber et al. 2015; Izadi & Kimiagari 2014). Tang (2006) explained the necessity to establish a robust supply chain strategy that helps a firm to deploy the associated contingency plans effectively and efficiently and sustain its operations during a major disruption.

2.2.3. Collaboration

Collaboration in a supply chain suggests the capability of two or more autonomous firms who work effectively together to plan and execute the supply chain operations toward common goals (Scholten and Schilder, 2015; Cao et al., 2010). The authors further clarified specific collaborative activities such as information sharing, knowledge development, collaborative communications, resource sharing, and incentive alignment among the firms to increase supply chain resilience. Besides, in a turbulence situation, collaboration keep supply chain organizations together and help to manage the risk efficiently (Singh et al. 2019).

Some researchers emphasized that strong buyer and supplier relationships that motivate suppliers to take measures to mitigate risk in the event of a disruption (Dimirci 2021; Simba et al., 2017). Axelsson & Karlsson (2014, p.80), argues that successful collaboration of buyers and suppliers depends on the mutual benefit in terms of “operational performance, mutual dependence, communication, knowledge exchange, innovation, socialization, support activities, trust, fairness and commitment” with each other.

2.2.4. Risk management culture

A review of the literature by Jain et al., (2017, p.6782) suggests that “to understand the concept of resilience in any organization, it is highly desirable to have a risk management culture in the organization.” As supply chain risks lead to serious threats for business continuity in the long run for the organizations as stated by Saglam et al., (2020), it is imperative to create a risk management culture to evaluate risk in the supply chain to implement risk mitigation strategies (Christopher & Peck, 2004; Fan et al., 2017). The authors highlighted that sharing

and promoting values and beliefs among the members in the supply chain to manage risks are very critical to achieve resilience in the supply chain. Saglam et al., (2020) advocated the view of other researchers that the risk management culture should be proactively managed that will help organizations to make effective planning to manage the losses caused by supply chain disruption. Thus, risk management has to be embedded in the corporate culture for every organization as mentioned by Waters (2007) to achieve supply chain resilience.

2.3. Supply chain vulnerability

Many academics explain *supply chain vulnerability* as a state of supply chain characteristics for an individual firm that increases the effects or degree of impact of a supply chain disruption and make supply chain susceptible to the disturbance (Wagner & Bode, 2006; Chadist, 2012). According to their study, the extent of supply chain vulnerability and risk differs due to the individual characteristics of the supply chain of the firm such as the firm's reliance on certain customers and suppliers, dependence on global supply sources, the extent of single sourcing, and so forth (ibid). Christopher & Peck (2004) summarized supply chain vulnerability as an existing internal and external risk within the supply chain that makes it exposed to serious disturbance. They underlined the importance of understanding the unique structure of individual supply chain by the business entities to systematically explore their own network to identify its vulnerabilities (Christopher & Peck, 2004). The authors suggested the ways based on a process control perspective to identify the sources of risks to business continuity in the wider supply chain in terms of their location to the focal firm. That will help managers to take better strategies to fix its vulnerabilities. In this thesis, the author tries to understand the existing vulnerabilities of the Lantmännen supply chain that make it exposed to risks in the case of pandemic disturbance and what proactive or reactive strategies of resilience they have taken so far to counterbalance the risk associated with supply chain vulnerabilities.

2.4. Supply chain risk

Several researchers defined and classified *supply chain risks* differently and from the various perspective (Verdier & Olsson, 2017). On which Ho et al., (2015) argued that all definitions have applicability in specific spheres of the supply chain. Such as demand and supply risk, information and material flow risk, and general macro and micro risks⁵, disruption and operational by Tang (2006) associated with

⁵ Macro and micro risks are also mentioned as catastrophic and operational by Sodhi et al., 2012).

a particular supply chain. Similarly, as cited by Chadist (2012), many authors describe supply chain risk as the probability of incurring a loss that is related to the logistics activities in terms of the flow of materials, goods, and services for the companies by a failure or environmental disturbance (Ritchie & Brindley, 2007, Zsidisin, 2005).

As discussed earlier, the sources of risks make the supply chain vulnerable as explained by Christopher & Peck (2004) and shown in figure 4, they suggested the three types of risks that originally derived from the framework of Mason-Jones and Towill (1998). Those are the risks that are internal to the firm that includes process and control risks, external to the focal firm as demand and supply risk, and external to the network that is mostly related to environmental turbulence. The authors defined process risk that arises from the disruption of managerial and value-adding activities of a firm in managing assets and supporting transport, communication, and infrastructure (Christopher & Peck, 2004). While they describe control risk that relates to uncertainties from the application or misapplication of the systems, procedures, rules, and policies that govern how an organization employs control over the processes. On the other hand, external risk is supply risk that involves uncertainty in the upstream supply chain in terms of material and information flow while the demand risk arises in the downstream supply chain in predicting the product demand and disruption in the flow of finished goods (Christopher & Peck, 2004; Jüttner, 2005; Verdier & Olsson, 2017).

Christopher & Peck (2004), referred to environmental risk that arises externally from natural disasters or other kinds of environmental turbulence that impact the focal firm or its upstream or downstream supply chain which has the ultimate effect on the consumer market. The author of this thesis focuses more on the risks which are external to the focal firm (where the Lantmännen's supply chain is the case) but internal to the supply chain network such as demand and supply risks and the environmental risks that arise out of the pandemic situation.

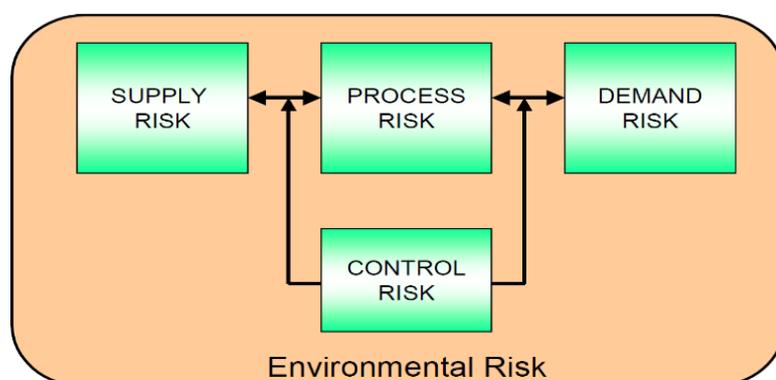


Figure 4. Sources of Risk in the Supply Chain (Christopher & Peck, 2004, p-11)

2.5. Business continuity

The idea of *business continuity* first emerged in response to different kinds of disruptions and shocks that business entities have experienced from the operational, organizational, and environmental factors (Bajgoric, 2014). Similarly, the SSI⁶ (2014) refers to business continuity as the organizational capability to continue supplying its products and service at an acceptable level despite disruption. On the other hand, Zsidisin et al., (2005) explains business continuity management by comparing it with risk management as they describe that risk management is mainly focused on assessing and managing known risks. Whereas the notion of business continuity management stands to minimize the effects of unpredictable disruption that make the firm able to meet customer's requirements (Zsidisin et al., 2005). Verdier & Olsson (2017) see business continuity and business continuity management are two closely linked concepts that complement each other as a proactive supply chain risk management strategy. The authors argued that the business continuity concept differs from other proactive risks management concepts as it begins with detecting the impact of a disrupting event before probing the potential trouble. However, the common consensus among researchers about risk management is about responding to specific identified risks while business continuity management is about responding to unknown risks and events as described in the earlier study of Zsidisin et al., (2005) & Chadist (2012).

Nevertheless, the author of this thesis looks at the business continuity management concept under the lens of Water (2007) as the author defined it as a general way of dealing with emergencies that begins with preparation for business continuity management through monitoring and control.

The magnitude of problems associated with an extremely contagious disease like Corona that has not only stopped the movement of the flow of goods and services but also restricted the movement of employees in every stage of the supply chain for the companies in different ways (Deloitte, 2020). Therefore, it is imperative to assess a continuity plan to keep the business going where effective collaboration among governments, business firms, and other supply chain stakeholders are crucial (Kumar & Chandra, 2010). As described by the authors Gaonkar & Viswanadham (2007), Ponomarov & Holcomb (2009), Barroso et al. (2011), and others, the author of this thesis argues that most of the researchers have explained resilience as the ability of an organization to maintain and restore the operations from disturbance. Therefore, this study tries to find the gap of the existing literature that is lacking to tackle all-encompassing challenges that have emerged by this pandemic in terms of its characteristics. The existing literature for the supply chain resilience largely

⁶ Swedish Standard Institute,

suggest supply chain managers to have a collaborative supplier base strategy and redundancy characterized with availability, efficiency, flexibility for an agile supply chain network that can respond rapidly to changing situation (Christopher & Peck, 2004; Pettitt et al., 2010; Sheffi, 2005).

This thesis argues that the suggested strategy in present literature works well in other kinds of disturbances like fire, terrorism, earthquake, recession, and other kinds of environmental disturbance. But the pandemic like novel Corona forced people to remain quarantined at home for an uncertain period and put the borders, airports shut for most of the countries of Europe, Asia, and America to stop spreading the virus. Thus, it created an unprecedented situation and call for new ideas of resilience mechanism for the sake of business continuity. Thus, this thesis also argues that the scarcity of literature that suggests better strategies for supply chain management to deal with the implications associated with the pandemic outbreak is problematic.

By analyzing the impact of the Coronavirus, this research intends to make a significant contribution to make the supply chain networks less sensitive to the long-term environmental agitation. Besides the theoretical problem that has been discussed above offers new knowledge, a brief study on the supply chain of the Swedish cooperative Lantmännen has carried out to make the base of an empirical problem in terms of the supply chain 'vulnerability', and 'risk' on the supply chain. It provides insights on how the Swedish food supply chain in the grain industry is reacting to the corona pandemic and investigate to what extent this novel corona creates an impact on the system on the food supply chain in Sweden.

2.6. Lantmännen's grain supply chain

The author of this thesis investigates the supply of the cooperative Lantmännen, a major player in the Swedish grains sector to understand and validate their supply chain strategies under the lens of resilience theories through a thorough literature review as discussed above.

Lantmännen, a producer cooperative is one of the largest farming and food industry groups in Europe, and the leading group within the grocery and agriculture industry in Sweden that operates simultaneously in marketing, distribution, sales, processing, and sourcing (Rudberg and Thulin, 2009). As an agricultural cooperative, Lantmännen is owned by 19,000 farmers and has 10,000 employees, stretches its operation in over 20 countries with an annual turnover of

approximately SEK⁷ 45 billion (Lantmännen, n.d.-a). While grain remains in the heart of their operation, their role is not limited only to agriculture and food production, but also in the production of sustainable bioenergy and bioenergy products in Sweden (ibid). The owners (Swedish farmers) of this cooperative have a dual role to the central production and distribution function as they are the suppliers as well as the customers for the cooperative (Rudberg and Thulin, 2009). The author provides a clear elucidation for Lantmännen's grain supply chain under the empirical case in chapter 4 for a clearer insight of their organization and supply chain.

⁷ Swedish Krona-currency of Sweden, 1 EUR=10.13 SEK (June 1, 2021)

3. Methodology

3.1. Research philosophy

Wilson (2014) argues that it is important to understand the research philosophy in order to build the basis of a study to comprehend how to approach a certain study topic. Other authors describe the importance of research philosophy to understand which methodology and method will be appropriate to achieve the researcher's objective through the selection of philosophical paradigm that begins with the understanding of ontology, epistemology, and paradigm choices (Guba & Lincoln, 1994; Denzin & Lincoln, 1998; Rashid et al., 2019). *Ontology* refers to the reality that answers the questions about the nature and reality of the human being when the idea of epistemology concerns how to learn and construct knowledge (ibid). As such, the author intends to carry out the study with the support of these philosophical considerations.

The author takes the stance of relativist ontology to interpret the pandemic phenomenon through contextualizing meanings from people's⁸ beliefs and practices which is explained by Guba & Lincoln (2005) as a socially constructed reality in which we live. The case study method is used to explore how the Swedish food supply in the grain industry is reacting to deal with a pandemic situation like the Coronavirus to observe a real-life scenario where the supply chain actors are involved in managing the turbulence. In this qualitative in-depth case study, this thesis sees the practical application of subjective view of epistemology as explained by Rashid et al., (2019) that assumes that the investigator and subject create understanding and the phenomenon is explored as the investigation process goes on. Hence, the author argues that the impact of Corona in the supply chain can be understood through the interaction between researcher and respondent to refine the social construction process. Besides, the author sees this study from the lens of the *interpretivist paradigm* that describes how people interpret and interact within a specific social environment.

⁸ Supply chain key personnel

3.2. Research design

The author of this thesis has chosen a qualitative approach to understand the phenomenon related to the Corona in the Swedish food supply chain based on case study methodology in obtaining and analyzing the data.

Qualitative research focuses on understanding the nature of the research problem that is based on the researcher's perception that social reality is a man-made creation (Denzin & Lincoln, 2011). This being said, this thesis takes the philosophical standpoint as described by Baškarada (2014) and Denzin & Lincoln, (2011) and interprets the pandemic phenomenon through contextualizing meanings from people's beliefs and practices. Moreover, the case study method which is the most common and popular method in the field of qualitative research (Baškarada, 2014; Rashid et al., 2019) to learn about a convoluted situation where researchers base their study on a comprehensive understanding of that case as a holistic approach by gathering extensive description and analysis of the context (Denzin & Lincoln, 2011).

Thus, the author adopts a case study-based methodology from the lens of the interpretivist paradigm. As the research topic requires an in-depth and exploratory investigation as explained by Yin (2009) to understand the supply chain phenomenon during the pandemic through visiting the context, interviewing actors involved in the supply chain process. Orlikowski & Baroudi (1991) explained that interpretive paradigm accentuates on social context about how people perceive the phenomena, and this view suggests that human being constructs the meanings as the way they interpret the situation. Besides, interpretivism allows the researcher to get the ideas from several dimensions for a research problem as it facilitates the researcher to see the world through the eyes of the participants (Greener, 2008; Rashid et al., 2019). Moreover, as explained by Rashid et al., (2019), interpretivism acknowledges the importance of participant's subjectivity as a part of understanding the social phenomenon.

Since there is a scarcity in the literature to suggest better strategies for supply chain management to deal with the implications associated with the prolonged pandemic outbreak as Corona, a new idea for a resilient supply chain is called for. To answer the research questions of how the food supply chain is reacting to the ongoing pandemic and what are the impacts on the company for food supply continuity, an in-depth case study is needed to achieve the objective of this study.

Designing the case-study methodology, this thesis takes the design model followed by the checklist as suggested by Rashid et al., (2019) to increase the quality and credibility of the analyzable data and research result. The researcher follows their

systematic step-by-step guide that is comprised of four phases, i.e. :1) foundation phase, 2) pre-field phase, 3) field phase, and 4) reporting phase and explained it briefly (see Appendix 3 to understand the process).

3.2.1. Case selection

In the beginning, this research was intended to identify the current understanding of supply chain resilience in the context of the food supply chain in Sweden. The company is chosen based on the standards developed by the authors Scheibe & Blackhurst (2017). First, companies should be a part of a well-recognized food supply chain in the grain industry and then they should have been experienced the turmoil for both or any of its upstream or down-stream stages of the supply chain for the Corona outbreak. And finally, they represent a different variety of foods with a different base of customers. In this thesis, the author looks at the large supply chain and has chosen to investigate the cooperative Lantmännen, a Swedish multinational organization in the grain industry that is a large and dominant actor in its supply chain. To stay focused, the author splits the entire chain of Lantmännen (farmer-Lantmännen-wholesalers-retailers) and investigates only its down-stream supply chain that consists of Lantmännen's grain activities, their processing industries, the wholesalers, and retailers. As the author believes that the link between Lantmännen and their wholesalers and retailers would be the best choice for the research topic to understand the level of impact in the supply chain due to the pandemic.

3.2.2. Data collection method

Since the author chooses a qualitative approach for this study, it is more suitable to carry out semi-structured and in-depth interviews of a reasonable number of individuals from the selected case to collect the empirical data. The semi-structured interview commonly comprises of open-ended questions that facilitate to achieve broad understanding of phenomenon through the participant's perceived reality and allows new thoughts to explore further (Creswell 2012; Bell et al. 2019). Moreover, with the inductive approach, semi-structured interviews fit most to generate primary data at the beginning that leads to a more effective set of questions to the respondents for in-depth exploration of the situation.

Under the case-study methodology, the questions are formulated based on the conceptual framework for this study to answer the research questions. It is designed to seek knowledge from interview participants about their understanding of the problem, current practices for supply chain resilience, actions for the pandemic situation, and the challenges in their supply chain that are associated with the Corona outbreak. This thesis intends to learn from the participants how their present

resilience practices work out in the pandemic and how they are perceiving the supply chain situation out of this prolonged turbulence.

To carry out in-depth interviews, the author invites responsible managers of the supply chain by sending emails that explain the purpose of the research. She got the appointments to interview Carl-Peter Thorwid, the Senior Vice President and Head of Lantmännen Cerealia on April 22, 2021, and Mikael Jeppsson, the Head of the Grain Unit, Lantmännen Lantbruk on April 30, 2021. To get a broad and in-depth understanding of the research topic, 27 questions (see Appendix 1) had been formulated that took a total of 90 minutes for each interview session. It was imperative for this study to interview two key persons of two different stages of the supply chain of Lantmännen to verify their responses through the same questions that increases the reliability of the result. Due to the pandemic situation and the social distancing policy, the researcher relies on the interviews through telephone or/and through online video communication software such as Skype, Zoom, and Microsoft Teams.

However, the author leaves the preference of selecting the means of the interview to the interview respondents for their comfort and convenience. In this stage, the author seeks permission from the interview participants to record their interviews digitally that is needed to analyze the data with coding and memo writing after each session of the interview. The table below reflects the details about interview participants for this thesis, the duration, and the method of the interview.

Table 1. Conducted interviews

Name	Position	Responsible	Date of interview	Interview length	Years in the company	Interview method
Carl-Peter Thorwid	Senior Vice President & Head of Lantmännen Cerealia	In the Food Sector	April 22, 2021	90 minutes	8 years	Microsoft Teams
Mikael Jeppsson	Head of the Grain Unit, Lantmännen Lantbruk	In the Agricultural Sector	April 30, 2021	90 minutes	30 years	Microsoft Teams

She also ensures that she has an ethical permission from all concerned to conduct this study and interviews. She also confirms to provide all necessary information, interview questionnaires to all concerned to seek the approval to conduct the studies as guided by Charmaz (2006).

3.2.3. Data analysis

The researcher carries out data analysis by summarizing the interviews through theme generation and coding as it is the most recognized data analysis method in qualitative empirical information as suggested by Rashid et al., (2019). As cited by Sbaraini et al., (2011) to explain Charmaz's view, "coding is the pivotal link between collecting data and developing an emergent theory to explain these data" (Charmaz, 2006, p.46). On the other hand, Gibbs (2007) explains coding as "how you define what the data you are analyzing are about" in a qualitative research. In this thesis, the author mostly relies on concept-driven themes and coding that look for the concept in the text where the predetermined coding came from the resilience literature and previous studies of supply chain (see table 3 & 4). Here she uses inductive reasoning to generate many ideas from initial data and tries to use the code as similar to the data to make it close to the real phenomenon as much as possible. It is most important for the researcher to find out which initial codes are more relevant to identify resilient practices as well as to understand the pandemic impact that contribute most to the analysis.

For this thesis, the author follows the empirical data interpretation model as designed by Rashid et al., 2019. Here, she interprets the raw data in the form of text derived from interviews, other materials, and observations. The priority is given to the data that are derived from interviews for an in-depth interpretation as it provides more reliable information as compared to other sources. As illustrated in figure 5, the outcome of the empirical data interpretation, that starts with the initial coding of sub concepts, main concept, and the development categories at the end. After that, data triangulation takes place which is according to Patton (1999) a way to develop a comprehensive understanding of phenomena by using multiple methods or data sources to increase research validity of qualitative research. Here she executes the data triangulation through the convergence of information from different sources that have emerged from the interviews, meeting notes, documents for this case study along with her own observation.

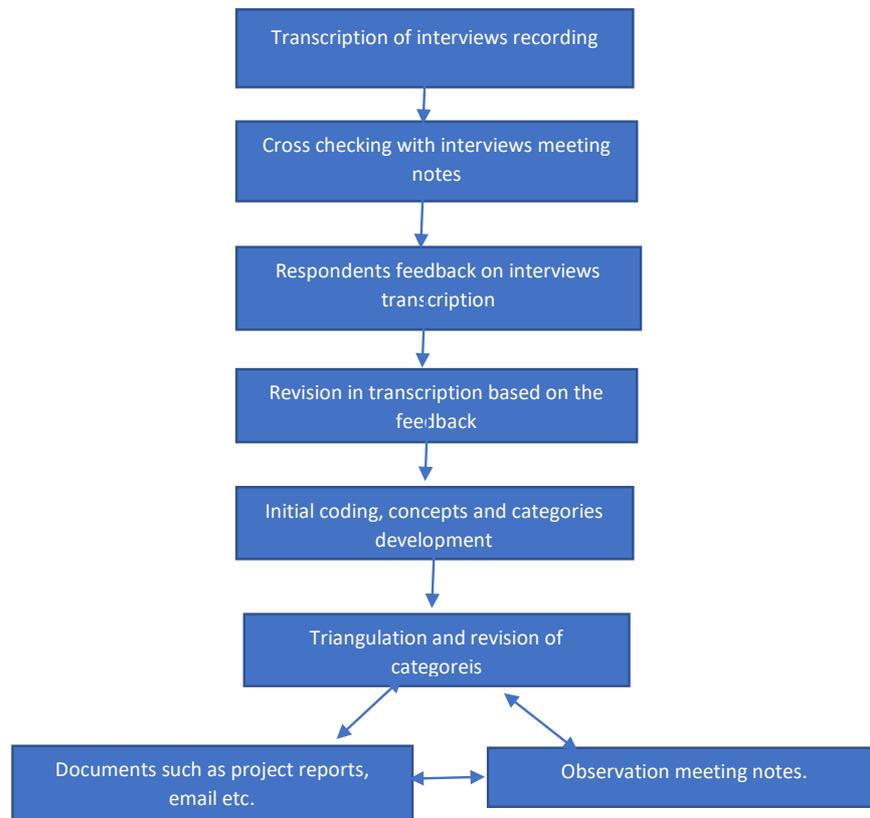


Figure 5. Empirical material interpretation process (Rashid et al., 2019, p-10)

The theoretical coding generates in this process to capture the phenomenon that the Lantmännen supply chain has faced by new challenges that emerged during the Corona pandemic. In the entire period of the study, the researcher writes conceptual memos after each session of the interviews including her impression based on the participant's experience. According to Sbaraini et al., (2011), these memos help researchers to make comparisons between data, cases, and codes to find similarities and differences guide them to the next stage of data collection to get deeper insights into the phenomenon. In the final stage of the study where she needs mapping concepts, theoretical memo writing, and further refining of concepts by analyzing each major focus code with the situations. By examining and re-examining the data and writing the memos, this takes the study to get theoretical saturation towards developing new insight for a resilient supply chain to tackle the major environmental turbulence like a pandemic.

3.3. Literature review

To develop the theoretical base for the study, this thesis reviews the academic literature to know what it suggests making a supply chain robust and withstand any kind of environmental turbulence. It discusses the literature on supply chain resilience in the aspects concerned with ‘vulnerability’, and ‘risk’ to assess the resilience system in Swedish food supply chains especially to the extraordinary disruptions by a pandemic. It also reviews the academic literature, the content of newspaper articles and publications on the pandemic through publicly available databases such as Web of Science, Google Scholar, ResearchGate, Emerald Insight, SAGE Publications, and Google search engine to dig the investigation further from the different perspectives. The secondary data collection included supporting materials like Annual Report of the case company. According to Strauss and Corbin (1998), this supplementary information allows data triangulation that increases the reliability of the study.

3.4. Ethical and quality assurance issues

Bryman & Bell (2007) suggested some prime standards related to ethical considerations in a research study with main consideration associated with respect for the research project participants, respect to group and institutions and obligations to the research community⁹.

Thus, this project aims to follow each of the guidelines of ethical considerations to carry out this thesis. To address these, the researcher makes sure the following points are strictly followed in every stage of the study:

- The voluntary participation in every interview session of target responder and give them the right to withdraw him/herself from the project at any stage.
- The principle of informed consent by giving sufficient information to the participants. Before the interview, every participant is informed about the research aim and objective and makes them understand the implications of participation in this study.
- Design questionnaires in such a way that participants do not feel any discomfort or pressure to answer the questions.
- Ensure the maximum level of fairness and objectivity in every discussion, memo writing, and analysis throughout the research.

⁹Obligations to the research community are referred as scientific integrity, plagiarism, good reference practice, verification, and subsequent use of research material (Bryman & Bell, 2007).

- Follow the Harvard style referencing to acknowledge the contribution of other authors that is used in this thesis.

3.4.1. Quality assurance for this study

This thesis uses a qualitative methodology which is the most popular method to gain a deeper understanding of a phenomenon. Since this thesis is focused on the implications and impact associated with the novel corona pandemic in the Swedish grain supply chain, the researcher finds it appropriate to use this methodology. To understand the present situation of the food supply chain during the pandemic, it is expected that this qualitative study provides an in-depth understanding of present resilience systems and practices in the supply chain in individual settings. This thesis also uses the case-study methodology to attain the explicit and sequential guidelines to carry out this qualitative study. She believes that this methodology is most appropriate to achieve the aim of this thesis as it offers a specific strategy for gathering, analyzing, synthesizing, and conceptualizing the qualitative data for the construction or modification of the theories that previously unexplored or underexplored. However, it is argued that no method and methodology can give complete assurance in academia that stands without limitation or has no quality issue. Thus, it is solely the researcher's obligation and responsibility to maximize the quality of the study by addressing the quality issues in every stage of the research process and meeting the standards for credible data and results.

For maximizing the quality, she ensures the following steps to boost the *reliability and validity* of this research where “reliability and validity are conceptualized as trustworthiness, rigor and quality in qualitative paradigm” as stated by Golafshani (2003). As suggested by Shenton (2004), this study formulates a checklist to maximize scientific rigor throughout the research project.

- For the credibility of the thesis, this study has designed to use appropriate research methodology, ensure peer-reviewing, systematically examine the academic literature to lay the foundation of the study.
- It also ensures the transferability by the detailed description of the phenomenon that allows readers to review and examine the background data.
- A detailed description of the methodology to enhance the dependability that allows the replication of the study for future research.
- Since the qualitative method is often criticized for researcher-induced bias and subjectivity, so the author ensures the clear statement of her views about the problem and outline the limitations of the research work to meet the confirmability standard.

Also, she takes the following initiative in the data collection and data analysis process to ensure the validity and reliability of data and result as suggested by Sbaraini et al., (2011):

- All interviews are digitally recorded, professionally transcribed, and analyzed as early as possible for the theoretical sampling.
- The researcher ensures that in each interview session, memo writing takes place simultaneously in the meeting to capture the initial ideas that enrich the data analysis process and provides insight into the further requirement of data collection.
- The author contacts the participants after interviews, whenever she feels that it needs further clarification within the participants to facilitate the refinement of the theoretical concept and theoretical sampling.
- She analyzes the recorded data through summarizing the interview to produce a narrative to create more abstract concepts that explain the social process.

However, the author acknowledges that despite the above-mentioned safeguards, this study may have some limitations because of the subjective nature of the qualitative study for the reason of contextual implications related to human emotions and perspectives from both subjects and the researcher's point of view.

4. Empirical background and case metaphors

To understand the thesis context, it is important to know the Swedish grain industry and its largest and most influential actor, Lantmännen (see Appendix 3, for a brief overview about Lantmännen) and its supply chain. It is critical to understand how this cooperative works, how it is governed and how its production process and supply chain looks like to achieve the aim of this study.

4.1. The grain industry and its supply chain in Sweden

Sweden is one of the geographically largest countries in Europe in which 2.6 million hectares is the arable land that covers 6.5% of the total land area of Sweden (Jordbruksverket, 2020). The crop production in Sweden is mostly dominated by cereals that include barley, oats, and wheat where in the northern region coarse grains are a common crop and the bread grain is mostly grown in central and southern Sweden. The table below shows Sweden's total crop production in 2019 where the dominance of grain crops is evident. According to Lyddon (2018), Sweden has a strong grain industry with an annual production of 5.7 million tons that has developed under the vertically integrated grain processing sector between milling, baking and processing. The average harvest of wheat during the last five years is 48 percent of the total harvest of grains in Sweden (Lantmännen, n.d.-b).

Table 2. Crop production in Sweden (Jordbruksverket, 2020, p-28)

Crop production 2019		
	Total production, 1 000 tons	Yield, kg/ha
Winter wheat	3 263	7 730
Spring wheat	214	4 520
Winter rye	221	6 760
Winter barley	140	6 830
Spring barley	1 406	5 180
Oats	671	4 760
Winter <i>triticale</i>	175	6 440
Spring <i>triticale</i>	4	4 130
Mixed grain	42	3 440
Grain maize	11	6 960
Peas	69	3 380
Field beans	60	3 310
Potatoes	847	35 811
Sugar beet	2 029	74 000
Rape and turnip rape	382	3 614

According to EFM¹⁰, there are 10 commercial mills in Sweden with an annual capacity of 900,000 tons. These mills are operated by the integrated companies of Sweden. For example, Nordmills and other large mills are owned by the agricultural co-operative Lantmännen, Farina owned by Pågen and Wasabröd owned by Barilla. According to EFM, the major players in the milling industry in Sweden are “Nordmills, Farina, Barilla, Abdon Mills, Skåne-möllan, Leksands, Berte and Frebaco” (Lyddon, 2018).

The grain industry is very much dependent on efficient inventory and distribution management because of its high seasonal fluctuation, large volumes, many suppliers, and customers (Andersson & Rudberg, 2007). As explained by Dietmann & Stålhammar (2020), the grain supply chain in Sweden is complex since it involves many steps and stakeholders. The authors defined the logistical process of the grain value chain from harvest to selling as shown in the following figure 6 (where the \$-signs represent the possible sales points). After harvesting, the grain is transported for drying either at the farm and then storage or sometimes it goes directly to the seller before drying (Dietmann & Stålhammar, 2020).

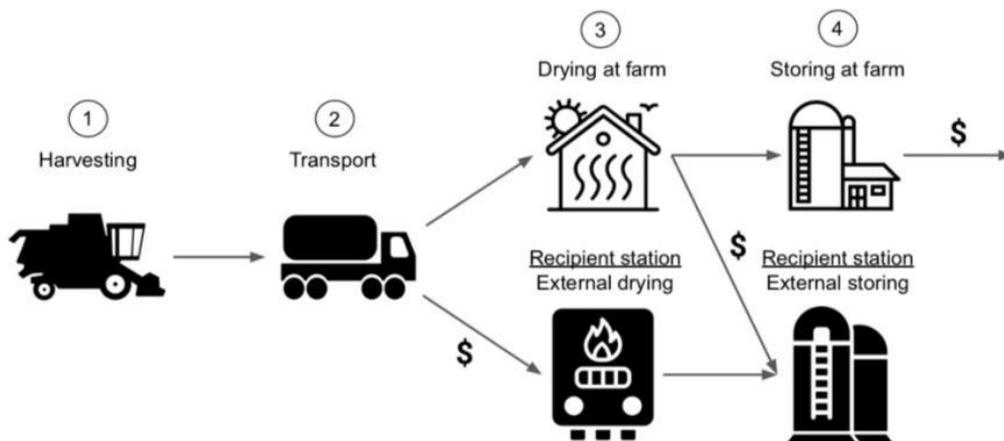


Figure 6. Grain production process, post-harvest (Dietmann & Julia., 2020, p-25)

¹⁰ European Flour Millers

4.2. The case firm Lantmännen and its supply chain

4.2.1. Lantmännen

Lantmännen is one of the largest agri-business firms in Northern Europe, one of the biggest cooperatives in the EU, and the biggest player in the Swedish agricultural market (Hakelius & Nilsson, 2020; Dietmann & Stålhammar, 2020; Nilsson et al., 2012). This cooperative is owned and managed by 19,000 farmers with an aim to optimize the profitability and return of the investment of members' farms, thus it engages in the entire supply chain activities from seed to harvest and through the food in customer's table (Lantmännen, n.d.-a). At present, this company is expanding its operations in foreign markets with production plants with sales and marketing units in more than twenty countries when Sweden remains as the base for its business activities. As shown in figure 7, the total sales by market represent their strong points in Europe, especially in Sweden and the Nordic countries. The business concept "from field to fork", it enables Lantmännen to operate in the complete grain value chain and facilitates the company with the right knowledge and expertise to lead the development in the grain industry (ibid).

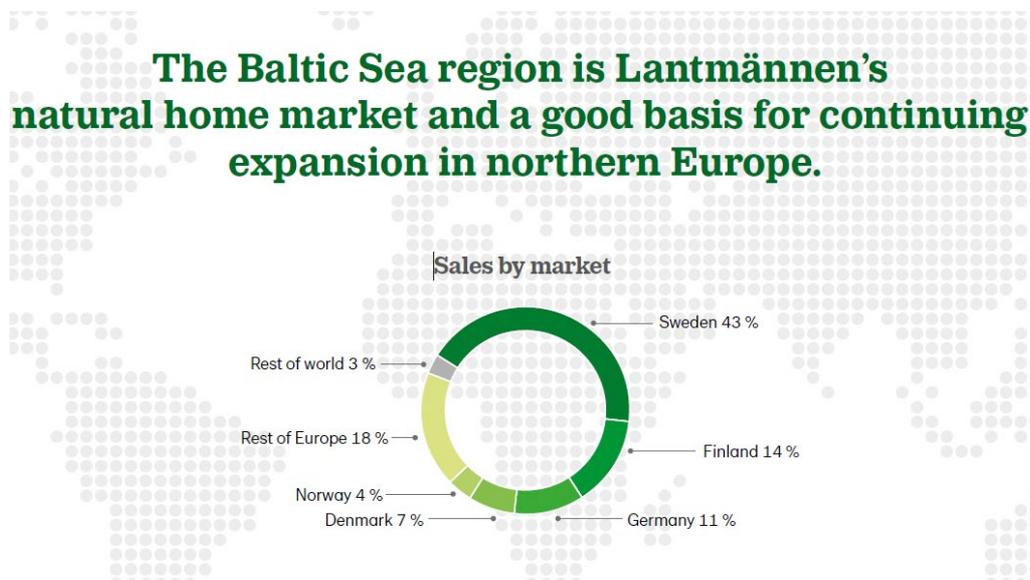


Figure 7. Sales by market (Lantmännen annual report, 2019., p-2)

According to their annual report, this company is divided into five divisions that include the Agricultural, Energy, Food Sector, Swecon¹¹, and Real Estate. The group is arranged in 20 districts in Sweden and supplies seed, fertilizers, feed, and

¹¹ "Swecon is a partner of Volvo Construction Equipment and a dealer in machinery for the construction and civil engineering industry in Sweden, Germany, Estonia, Latvia and Lithuania" (Lantmännen n.d-d).

involved in the processing and selling of the farmer’s produce. Besides being the biggest buyer of grain in the Swedish market, it provides the logistics support to the member farmers to produce high-quality grains. The main grain crops that are produced by their owners/farmers are wheat, malted barley, oats, and rye. The food sector of Lantmännen refines grain and other raw materials from arable land and offers a large variety of products in the consumer market such as flour, bread, breakfast products, pasta, and ready-to-eat meals, and so on (Lantmännen’s annual report, 2019). This activity generates significant added value and creates a market for its members for their grain. Hence, the researcher finds it an interesting company in the grain industry to investigate its supply chain.

4.2.2. Organizational structure

This cooperative enterprise is owned and governed by the Swedish farmers and runs its business operations under five divisions as presented earlier. Lantmännen’s organizational structure can be portrayed as a simple and country-based arrangement with a strong local management team. It helps them to manage and govern their operations effectively through adapting the capability on country-specific conditions (Lantmännen’s annual report 2019).

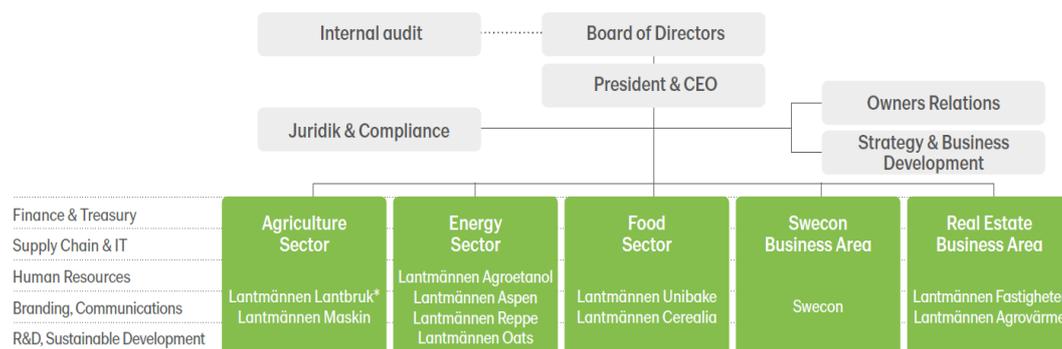


Figure 8. Organizational structure of Lantmännen (Lantmännen annual report, 2019., p-61)

As shown in figure 8, the five divisions of Lantmännen which are supported by several departments and corporate functions to control its business operation and development. The CEO allocates resources, evaluates the result, and takes charge of day-to-day management and governance. Its business segments are divided into three sectors and two business areas which are organized by different types of products and services such as the Agriculture, Energy and Food sectors with two business areas as Swecon and Real Estate that are consistent with group operational structure (Lantmännen’s annual report, 2019).

Since this thesis aims to understand the present resilience system of the Swedish food supply chain in the grain industry in response to a pandemic so the author

limits her discussion only on Lantmännen's Agricultural and Food sectors in the following sections.

4.2.3. Business operations

Lantmännen's agricultural division accounts for 42% of total sales and stays as the core business for the organization (Lantmännen's annual report, 2019). The agricultural sector develops and offers products and services to promote competitive farming which operates in Sweden and many other countries in Europe, Asia, the Middle East, Africa, United Kingdom, Australia, and United States (ibid). The division follows the traditional cooperative principles, and it offers the prices to members based on market consideration (Hakelius & Nilsson, 2020). It reimburses the total profit of this division to the members through patronage refunds, bonus shares, and dividends on common shares in which bonus shares are freely tradable (ibid). Members' due refund and supplementary payments are calculated based on their trade with Lantmännen where the payments are given on their sales of grain, oilseed, and pulses to the cooperative.

Lantmännen Lantbruk involves in buying and selling grain, oilseeds and pulses, pesticides, fertilizers, and machinery where half of the quantity of production is utilized by Lantmännen's own industry. The major export of this cooperative is handled by Lantmännen Lantbruk where its sales mainly go to Europe, North Africa as well as North America (Lantmännen's annual report, 2019).

Lantmännen's food sector accounts for 33% of its total sales, produces food in 50 facilities in 18 countries. This division consists of partly owned companies Viking Malt, Unibake, and Cerealia (Lantmännen's annual report, 2019). It processes and sells members and non-members grain into flour and ready to eat products under well-known brands (ibid).

The Food Sector is divided into two business areas – Lantmännen Cerealia and Lantmännen Unibake. It has 46 production facilities, and the sector is renowned by many well recognized brands such as AXA, Bonjour, FINN CRISP, GoGreen, Hatting, Kungsörnen, Korvbrödsbagarn and Regal. Lantmännen Cerealia is well known in the Swedish consumer market which develops, produces, and markets cereal-based products. This unit has its operation in Sweden, Norway, Finland, Denmark, Russia, and Ukraine and serves the market through food service sector and retailers. The products of the Cerealia brand are flour, hulled grains, granola, muesli, pasta, pancakes as well as a vegetarian range of pulses, food grains, vegetables, and ready meals are popular in the Swedish and Nordic markets. This unit also has a significant amount of export to about 30 countries which are marked mainly by breakfast products and crispbread (ibid). Another important unit is

Lantmännen Unibake which is one of the largest bakery groups in 16 countries of Europe, renowned for the large variety of quality products. This unit also supplies frozen and fresh bakery products to restaurants and retail markets in more than 60 countries across the globe (ibid).

4.2.4. Lantmännen's governance within the production process and supply chain

Lantmännen annually handles large volume of grains that are sourced both locally or internationally in which some quantity is sold internally to Lantmännen's industries, and the rest goes to external customers (Lantmännen's annual report, 2019). The effective operation and customer-oriented agri-business idea that exists throughout the grain value chain are the keys that made this cooperative profitable and the biggest player in the Swedish agricultural market (ibid). Being a business partner of the farmers, they support the agricultural sector by extensive investment in research and development for sustainable food production, bioenergy, and farming (Dietmann & Stålhammar, 2020). In its cooperative model, the farmers as the owners and business partners share the responsibility of the investment, success, and profitability. Alternatively, Lantmännen buys grain, oilseeds, and pulses from the members and processes and refines to sell to the consumer market.

Lantmännen sustainability governance in the supply chain

The cooperative practices and promotes sustainability to reduce climate and environmental impacts in its production process and offers a wide range of healthy and environmentally friendly products to the customers (Lantmännen's annual report, 2019). It sources the raw materials from a sustainable value chain, ensures resource-efficient production, offers sustainable packaging solutions, takes distribution channel and transport with low climate impact, ensures safe working environments, and responsible sourcing and business relationship (ibid). A green logo on the packaging of food products guarantees the responsibly produced and good food from Lantmännen to its customer in retail and other parts of the food industry.

However, the cooperative has become the market leader in the grain value chain through its large investment in research, development, and innovation to meet the demand of the market. With the focus to maintain profitable growth, Lantmännen continuously makes changes in its production infrastructure through efficiency improvement, digitalization, and upgrading. These actions help them to enhance the efficiency throughout the value chain that led to products of consumer preference with clear added values (Lantmännen's annual report, 2019). Moreover, with market research and understanding of customer's expectations in the Nordic region, Lantmännen keeps replacing their product range with low climate impacts

and organic food items (see more details about sustainability practices of Lantmännen in Appendix 4).

5. Analysis & results

To analyze the findings from the conducted interviews, the author relies on the conceptual framework of this study. It summarizes and analyses the interview data from the perspective of resilience as discussed earlier to understand the reaction and impact of the Corona pandemic in the supply chain of the chosen case. The data is analyzed to learn from the participants about how their present resilience practices work out in the pandemic. This chapter starts with an overview of the supply chain of Lantmännen.

5.1. Grain supply chain process of Lantmännen

Lantmännen has total control over the whole value chain from supplying efficient seeds to the farmer and sell the produce to the market as shown in figure 9.



Figure 9. Lantmännen grain supply chain. Own illustration

Its supply chain starts with the grain unit by placing the orders of grain requirement to the farmers and selling all farm inputs to them such as seed, fertilizers, and pesticides for planting efficiently for the high-quality grains. Their grain unit who belongs to the Lantmännen Agricultural Sector acts as a buying entity for other units of Lantmännen that places orders, determines the price of grains, buys from farmers, sells to their own industries and different export markets. According to

Jeppsson (HGL)¹², about 50% of the total grain volume is used inside of their own industry and another 50% of the volume is sold in the market, mostly to export markets such as the Mediterranean area, North Africa, Spain, Germany, and so on. As discussed in the previous chapter, the Food Sector of Lantmännen is divided into two business areas – Lantmännen Cerealia and Lantmännen Unibake. Additionally, their business in Food Sector is divided into three major categories those are Business to Business, Business to Consumer Market and Business to Food Service.

At Lantmännen, B2B¹³ refers to when they sell predominantly bulk volume of unpackaged flour and transport it to the large bakeries which are eventually sold in the baked form of fresh bread and other items to the customers. While B2C¹⁴ market implies when they supply products to the retailers such as ICA, MAX Food, COOP etc. For B2F¹⁵, Lantmännen sells larger packs of flours to Pizza shops, restaurants, cafeterias, and smaller bakeries.

From their mills, either they sell it as the bulk volume of flour or sell it as a consumer's packet in retail markets or it goes to own mills to process, for example, making pasta. Particularly for the oat grain, either they bring it to their oat mills to process and sell in the consumer's market as a porridge mix such as granola, muesli or it is sold as a raw material of the oat drink producer. If it is the B2C market, most of the consumer sales goes through the big retailers of Sweden such as ICA, MAX food, and COOP. Within its food service, their sales very often go through their wholesalers Menigo and Martin & Servera or sometimes by the direct delivery to Pizza bakery. Lantmännen delivers products directly from the mills to the retailers while the wholesalers sometimes collect them from their premises. Its downstream supply chain is straightforward since there are no actors in between except the transport companies.

Lantmännen Cerealia's supply chain starts from placing the orders to the Grain Unit and ends up with its sales to the retailers and wholesalers where it mostly involves both in the B2B and B2C Market. On the other hand, Lantmännen Unibake business involves within the B2F area as it is engaged only in the bakery business, and it sells goes to all the foodservice outlets in more than 60 countries around the world.

At Lantmännen, to predict the demand and to ensure the right quantity harvest are performed by the extensive interaction among four parties i.e., their customers, their

¹² Mikael Jeppsson, Head of the Grain Unit, Lantmännen Lantbruk, also addressed as HGL in this thesis.

¹³ Business to Business

¹⁴ Business to Consumer

¹⁵ Business to Food service

grain unit, the farmers, and their business units such as Cerealia or Unibake. To collect the information about the demand for grain, Lantmännen looks at its market, its product categories, market shares, its competitors' activities, and the underlying trends of the market to make the best possible prediction. They continuously gather this information to fit best in the market with their offers. In case of launching a new product and export potential, they look at the new customers, how much additional sales it will bring, and how much it would impact the total demand of the grains to adjust the demand and supply flow for them.

5.2. Current understanding of supply chain resilience at Lantmännen and its reaction to the Corona Pandemic

At Lantmännen, supply chain resilience means having effective plans and backup systems so that the organization would not need to bounce back but continue as usual in the case of disturbance. According to the Senior Vice President & Head of Lantmännen Cerealia¹⁶, being resilient is meant to him as “to have a stable production, good planning, good alternative sources to make sure that you have a good control over the whole supply chain.” For example, their grain production had been affected by the drought in 2018 in Sweden. But it could not affect the supply to their wholesale and retail customers as they always have a backup plan and alternative sourcing¹⁷.

Lantmännen finds the pandemic situation advantageous for them as more people consume at home instead of dining out that brings their products with soaring sales (Thorwid, 2021). For example, they had experienced a very high demand for pasta that went up to 300% and flour up to 600%. From the period of February to April 2020, their supply chain had been experienced the “hoarding effect”¹⁸ through panic buying at retail stores. It happened when people bought pasta, oat, flour, and so on just as the safeguard in case of running out of supply. It put their supply chain strained which was something that they really could not anticipate. But their existing resilient strategies such as alternate sourcing, having enough assortments, and stability of their processes functioned well to come back very quickly to meet the market demand. Those proactive strategies along with reactive strategies such as mobilizing the good planning function to quickly adjust to the new situation

¹⁶ Also addressed as SVP, and/or Thorwid in this thesis.

¹⁷ In the year 2018, Lantmännen had imported grains from overseas markets, mostly from the Nordic countries to meet the demand of the Swedish market.

¹⁸ Hoarding/panic buying is a common human reaction when normal supply is believed to be disrupted by a catastrophic event. This behaviour disturbs the regular market by emptying store's shelves not only creates inconvenience to other consumers but also conveys a signal of panic to the society (WANG & Na, 2020).

along with their strong customer relationship made it easy to continue their operation even at the time of hoarding effect. Their continuous interactions with downstream supply chain actors like ICA, COOP & the bakeries made them understand where to focus and what products should be prioritized to produce to fulfill the demands of retail markets.

In the initial days of the pandemic break out, they made sure to have enough stock in case of supply interruption from Italy for their packaging materials. According to the SVP, they had to be very prompt in understanding what can affect the normal flow of their supply chain. Their strategy to have a shorter supply chain works out very well in the pandemic situation especially on their reliance on sourcing locally with short lead and transport time. In this regard, he argued, “the European system has been worked out very well to manage the pandemic situation.”

5.2.1. Flexibility and adaptability

All that worked for Lantmännen was the flexibility in their operation and supply chain and the adaptability towards the changing situation during the pandemic. At Lantmännen, the decision-making authority always goes to the local management in the different business units in different countries that facilitate them with the ability to make quick decisions. Moreover, being in the food business, they already have to maintain a high level of health and safety measures which is very similar to the recommendations to resist the infection of the Coronavirus. Besides, their existing culture in the organization of taking care of each other where people are valued has made them quick in adapting to new situations that arise from the pandemic. The SVP pointed out that they have a strong relationship with customers and suppliers that have been built together over the years through continuous and effective communication and collaboration with all actors in the supply chain. For instance, when their supply chain faced the hoarding effect, they had to keep extensive communication with their wholesalers and retailers to know which products they need most as per the surging demand. For doing so, Lantmännen had to reduce their existing assortments and focus on producing the prioritized products like flour, pasta, and oats. The appreciation of the situation, cooperation, and flexibility towards Lantmännen’s techniques to handle the situation were the attitude that they received from their customers. Thus, the key to optimizing their supply chain efficiency is the flexibility within the organization and its entire supply chain.

5.2.2. Robustness

The supply chain of Lantmännen has been remained functional and effective despite the pandemic situation. Lantmännen's grain production in Sweden can meet the local demand even they export the surplus quantity. Though they import pesticides and fertilizers, this did not experience any impact since the supply of these products was not halted at any point during the pandemic. All the supplies from and to Lantmännen in their grain supply chain were not affected since all their inbound and outbound shipment movement run as usual during the pandemic.

Since the initial months of the pandemic, their business has been experiencing a sales boost that eventually brought more efficiency in their production process, management capability, and productivity. This context has been defined by Lantmännen as a situation when volume goes up in a certain plant or production unit, it can utilize and optimize the production system in a better way through utilizing the full capacity of the operation. Lantmännen already had the existing setup that could adjust the additional demand without hiring new people, new set up, or incurring extra costs.

Its collaborative strategy with downstream actors to reduce common assortments to focus on producing what was most efficient to produce keeps them stable and effective despite the disturbance associated with the Corona pandemic. While many other companies failed to adjust to the increased volume because they had to take in more people and additional arrangements to cope with the demand. Even though the customer service level had dropped to some extent in the initial months¹⁹ of the pandemic to meet this abnormal demand (Thorwid, 2021). For instance, they could maintain the exact delivery date in 90% of the cases but their customers were aware of the situation, had a full understanding and were happy about Lantmännen's approach to deal with the crisis.

5.2.3. Collaboration

Lantmännen maintains a high level of communication with their customers. Because of the characteristics of their business, they need to know the market demand one year ahead of harvesting season since cultivating grains requires a long lead time to serve the quantity to their consumer market. Once they have volume predictions from the customers, they place the order to the farmers to harvest according to the demand. It takes quite a long lead time to understand and consolidate the demand of various sorts of grains to transfer that to the agricultural unit who then places the order to the farmers. This is different from other supply chains where one can order anytime and where goods can be produced anytime of

¹⁹ From February to April 2020

the year. Their grain unit actively involves in the interaction with the farmers, transport companies, and their own industries to know the requirement for their own and for the export market to supply accordingly. Therefore, each actor in their supply chain depends on each other greatly and is very much integrated into Lantmännen's processes and systems.

Thus, the information exchange among their upstream and downstream actors is very crucial for Lantmännen. In the early months of the pandemic, when they fell into a capacity problem for meeting the soaring demand of some of their products by the panic buying at the retail market, their level of collaboration with downstream actors like ICA, COOP, MAX had been increased in the manifold. The concerned department of Lantmännen kept communicating with their customers on daily basis to understand what products they needed most in terms of soaring demand at consumer's stores. The intense collaboration with their wholesale and retail customers helps them prioritizing production. According to the SVP, if they took this decision alone without discussing with their customers to reduce their common range of products that they supply to them in the normal situation, it would hurt both businesses and the relationship with them.

5.2.4. Risk management culture

Managing risk is an everyday affair at Lantmännen with unpredictable weather and the risk associated with climate change that affects their harvest quality and quantity. Being in the primary production, they must stay agile and prepared for the unpredictable risks where they do not have any control over happenings, and it is Lantmännen's entire risk management approach (Thorwid, 2021). According to the SVP, knowing different sources, planning well ahead, understanding what to do, and shifting the assortments considering the availability of raw materials is their proactive risk management culture. They have specific risk management practices in place under the name of Enterprise Risk Management (ERM) to deal with all types of risk that their organization can confront with. Their risk management strategies are extended to cover most of the risks that can put their business at risk such as currency fluctuation, political instability, pandemic, fire, IT security breach, strikes, and so on. Their ERM team reviews these various kinds of risk and aligns their strategy and capability based on the assessment and findings to mitigate the impact of those anticipated risks.

Lantmännen's existing risk management culture works well to deal with the pandemic situation. The basic strategies of how they handle their people, how they handle their production, and how they handle customers have worked quite well in the entire pandemic situation (Thorwid, 2021). Though the demand to make some adjustments and take some reactive measures that came up with the new situation

was impossible to predict before it happened. But the key driving strength was a well-developed plan that enables them to absorb the unexpected shocks from the pandemic.

They have existing crisis management exercises and drills where they play out a crisis scenario to manage the crisis. Furthermore, many of their existing practices benefited them in the pandemic situation such as food safety, health and safety measures, high hygiene routines that eventually help them to combat the transmission of the virus. They had formed the ‘Corona Crisis Management Team’ as soon as the first infection of the Coronavirus had been detected in Sweden (Thorwid, 2021). Lantmännen immediately restricted their factories to external visitors as well as some internal visitors to limit the exposure of the infection. Their team immediately swung into action by communicating all required measures to all concerned and arranged to monitor them so that the new measures can be followed strictly. It took all necessary steps to follow the safety recommendations by the government and shifted to a home office arrangement. They had taken feedback daily from the different countries where they operate (at the beginning of the pandemic) and then weekly to understand how to act in various business units in other countries. Since every country has unique policies and recommendations, so their local management team follows and implements the local recommendations and guidelines on top of the standards of Lantmännen. So, the new measures for the Corona pandemic have been different amongst the countries where they operate. So far, their strategy of combining global and local approaches gives them the flexibility to handle the pandemic situation and impact effectively (ibid). Table 3 synthesizes the case analysis according to the theoretical framework of this thesis.

Table 3. Synthesis of Lantmännen’s supply chain resilience to deal with the pandemic.

Supply chain resilience key themes	Identified proactive approaches	Identified reactive approaches
Flexibility and Adaptability	Organizational structure and its governance, local management’s decision-making authority, existing practices to take care of human resources, health and hygiene routine, relationship with upstream suppliers and downstream customers, emphasis on R&D and Innovation	Increased interaction with the suppliers and customers to ensure supply flow, shifting to home office, limiting visitors at factory premises
Robustness	Cooperation with upstream and downstream actors, relying on local production, existing setup to adjust the additional demand, financial strength	Management capability to respond and adjust quickly with changing situation
Collaboration	Internal and external dialogue with stakeholders, information sharing, collaborative communication with suppliers and customers, operational performance, mutual dependence and strong relationship with upstream and downstream supply chain actors, logistical and technical integration with suppliers and customers	Joint plan with suppliers and customers to ensure supply flow for the increased demand

Risk management culture	Sharing and promoting values and beliefs among the members, investment in R&D, innovation for future competitiveness, orientation towards sustainable business development, supplier audit, risk management team, risk assessment procedures, and tools	Agility by the management and entire organization, forming CCMT ²⁰
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5.3. Supply chain vulnerability

The major strength of Lantmännen’s grain supply chain lies in the characteristics of their business and the design of their supply chain that made them even more resilient to keep continuing their operation despite the disturbance from the pandemic. According to Jeppsson, the grain supply has not been affected due to the pandemic. Since it is grown in the field, most of the activities are done outdoors, and the production system is not labor-intensive, hence the infection exposure is less. Furthermore, there was a good harvesting season in the year 2020, therefore the actual sources of grain have not been affected in any way during the pandemic. Moreover, the infection rate of the Coronavirus always remained low in southern Sweden, where their business is based that has also made them less exposed to the vulnerability of pandemic risk. Besides, Lantmännen has production units in every country where they operate²¹. As a result, their local production base business, reliance on sourcing locally with short lead and transport time made their logistic flows uninterrupted. It has been a key factor that made the supply chain of Lantmännen less vulnerable to disturbance.

On the other hand, the length of the supply chain is crucial to deal with this kind of crisis. The longer the length of the supply chain, the higher the risk of managing it during a turbulent time. Remarkably the supply chain of Lantmännen is short where the number of intermediaries between farmer and consumer is less as shown in figure 10. As discussed in the earlier sections, the main upstream actors for Lantmännen are the farmers (the owners of the cooperative) and the downstream



Figure 10. Main actors of Lantmännen grain supply chain. Own illustration

actors are the wholesalers and retailers. This made them have more control over the entire supply chain where they collect the grains from farmers (for storing,

²⁰ Corona Crisis Management team

²¹ For instance, when a product delivers in the Ukrainian market, it produces in Ukraine, and when it is in Russia, the production base is there as well.

processing, refining, and making different products and by-products) and delivers them to the wholesalers and retailers by their nominated transport service provider.

The most important advantage that works for Lantmännen is their business sectors which have experienced an increased demand due to the pandemic. They are local and at the same global that gives them an edge to adapt to local situations and manage their operation and supply chain in a good way (Thorwid, 2021). Although Lantmännen imports raisins, hazelnuts, seeds, papaya fruits for their muesli and other food products and packaging materials, there is no significant impact on that part since they built up higher stocks than usual for those items in the early days of the pandemic. The first thing they did in the pandemic outbreaks is to look at their stocks, the shipments that are coming in, and the contracts with the supplier's whether they can manage an uninterrupted flow of raw materials. Their management team has been highly vigilant about the changes and shift in local laws and policies for the pandemic to understand from which part, the source of supply can be interrupted. Therefore, they kept them abreast with market information and filled in additional stocks as a safeguard where needed if they foresee any disruptions at the sources of their raw materials. According to the SVP, they have prepared their organization in a way that made them resilient to environmental turbulence like the Corona pandemic. He stated that when an organization has a good structure, better planning, process, and resilient practices in place, it increases its capability and flexibility to control the unforeseen when it needs to deal with adverse situations.

5.4. Supply chain risk

For the pandemic situation, the risks Lantmännen have been perceived is the health risk for their employees. It was the supply risk of all the ingredients including packaging materials that they buy from the global market, and the risk was not being able to meet the market's demand (Thorwid, 2021).

The new risk was related a lot to the people's health as with a slight cold, they must stay at home. Even if the schools were closed that would have imposed more risk on the total system and have a greater impact on their operation. Since it would eventually lead the working force to stay at home to attend their children. They eventually could manage to mitigate that risk through fruitful discussions with the political decision-makers at both local and national levels. Since Lantmännen plays an important role in the food sector and involves in a critical function in the food supply chain in Sweden, so undoubtedly, they have the position to influence political decision-making. According to the SVP, it has been a lot of learning experience for Lantmännen that made them take lots of effort to predict. It is all

about the uncertainties what to anticipate from the application or misapplication of the systems, procedures, rules, and policies that govern how an organization employs control over the processes.

5.5. Business continuity

From the overall perspective of Lantmännen, the capability of supplying its products and service has remained at an acceptable level despite the disruption from the Corona Pandemic. During the pandemic, their strategy is more focused on how they keep continuing their business since the demand for grains was not affected where the market for many other companies was disappearing because of declining demand. Lantmännen had tried to secure their operative functions, that was the first reaction for them during the Corona breakout (Jeppsson, 2021).

Though their B2C²², which has been taken care of by Lantmännen Cerealia performed better during the pandemic, their B2F²³ has been affected significantly. Lantmännen's business unit Unibake that involves mostly in B2F business with orientation to the export market affected heavily by the decreasing demand. Since people are not encouraged to eat out in the restaurants and pizza shops that have caused many restaurants to shut. However, that has been compensated by the higher demand of B2C business as people consumed more at home than outside. It was a business channel-shift experience for Lantmännen that divert their business from B2F to B2C (Thorwid, 2021).

Nevertheless, they were not prepared for the magnitude of the effect of the Corona pandemic, such as when their supply chain experienced the hoarding effect. It put their supply chain and production system extremely strained to meet the demand of some specific products. Lantmännen had to supply four to six weeks of an additional quantity of sales in March and April in 2020. Therefore, they had to be very quick in decision-making how to handle the shock of sudden abnormal demand of some products at retails market. For example, when they run out of all of their stocks, they had to work throughout the vacation period to filling inventory and meeting the demand of the market. At the same time, they had to follow the local labor-law that allows personnel to enjoy an entitled vacation after certain hours of work every week. For doing so, they had narrowed down their existing assortments to focus on the production of the high runners that was the most efficient decision to make during the turbulence time.

²² Business to Business

²³ Business to Food Service

They have certain risk management strategies and plans about how to handle unpredictable risks like pandemics, fire, or any risk that can affect their business continuity. The management of Lantmännen takes an active part in preparing BCP²⁴ each year and the extent of involvement by the different departments depends on the intensity of exposure from the business risks and threats from unforeseen disruption. Through continuous business intelligence along with an internal and external dialogue with stakeholders, they identify and evaluate all strategic and operational risks under the ERM²⁵ process. In this process, they try to anticipate all the risks and action plans to secure business continuity. For example, if their IT system collapses or the factory's machine breaks down, what will be the action plans to continue the operations. They prepare BCP in accordance with their anticipated risks that cover all the possible risks including pandemics where its monitoring and control are exercised by the team of ERM. Table 4 summarizes the case analysis for each threat that makes the supply chain susceptible to the disturbance against Lantmännen resilience practices.

Table 4. Observation from opposite terms of resilience

Supply chain threat factors	Identified practices and measures (Proactive)	Identified practices and measures (Reactive approaches for the pandemic situation)
Supply chain vulnerability	Short supply chain model, reliance on local production, operational strategy blended with global and local policies and measures.	Raising stocks of raw materials and packaging in the initial days of the pandemic, more vigilance by the management team about changes in local laws and policies for the pandemic to understand from which part the source of supply can be interrupted to prepare accordingly.
Supply chain Risk	Macro and micro risks related events like a pandemic & others, policy changes that are beyond Lantmännen's control are identified, assessed, and reported annually as part of their strategy and business planning process. Existing health and safety routines, practices, supply, and demand risks have been taken care by the strong relationship and collaboration with the actors of upstream and downstream supply chain	Extensive interaction with upstream suppliers and downstream customers to balance the supply flow following market demand, engaging in dialogue and cooperation with pressure groups, and political decision-makers to know upcoming changes in policies and rules to mitigate the risks that can affect the business.
Business Continuity	Practicing business continuity exercise under the ERM process. Prepare BCP with every unit of Lantmännen to evaluate all strategic and operational risks and make action plans accordingly. Monitoring and control are managed and exercised by the risk management team.	Quick decision making, effective communication, protection of employees, managing from the distance, facilitating the business channel-shift that diverted their business from B2F to B2C, existing portfolio in different sectors made them resilient to keep the business going as usual despite the shocks

²⁴ Business Continuity Plan

²⁵ Enterprise Risk Management

5.6. Synopsis of the analysis

The outcome of the analysis provides an interesting notion of how have resilience practices strengthen the capabilities for an organization to endure, adjust and grow even in a turbulent situation like the Corona pandemic. The results suggest that Lantmännen's risk management strategy lies in the comprehensive understanding of resilience approaches for the organization and the supply chain. Apart from the sector and the diversified business portfolio that made them capable of business channel shifting, its persistent collaboration with the actors of the upstream and downstream supply chain helps them to maintain the unceasing flow of goods and services to the ultimate consumers despite the disruption. Their existing proactive resilience system has supported their managers to be agile to take the reactive measures very quickly to adjust to the new situation of the Corona pandemic. Lantmännen's reactive approach to supply chain resilience for business continuity was more focused on how to keep their operation functioning by protecting their people and producing the key products according to the demand. The result of this study shows that Lantmännen could make a fine balance of managerial capabilities with the unique characteristics of its supply chain through knowing the strength, vulnerabilities, and environments in which it operates.

6. Discussion

The author of this thesis offers a discussion and critical reflection of the results in relation to existing literature. The point of departure for this discussion is the two main research questions: (1) How is the Swedish food supply chain in the grain industry reacting to the Corona pandemic? (2) What are the impacts of the Coronavirus (COVID-19) on Lantmännen and its aggregate food supply continuity?

Supply chain resilience is the ability of a firm to endure, adjust and even move to a more desirable state even in the turbulence situation (Christopher & Peck, 2004; Fiskel, 2006) that demand the organization to have resilience practices in its supply chain. Therefore, this thesis offers new insight into supply chain resilience on how the food company, especially in the grain industry can manage their supply chain during the pandemic and maintain a balance between capabilities and vulnerabilities to achieve the highest level of resilience as explained by Pettit et al., (2010). This thesis fills the gap on the supply chain concerning supply chain risk management and operation by analyzing the impact of the Corona pandemic to make a significant contribution in the literature that would make the supply chain networks less sensitive to the long-term environmental agitation.

6.1. How is the Swedish food supply chain in the grain industry reacting to the Corona pandemic?

To answer this research question, the author explains the phenomenon explicitly through the theoretical understanding of resilient supply chain. The author found that Lantmännen does have strong resilience and sustainable practices in their business and supply chain processes that are the key factors for them to deal with prolong turbulence from the Corona pandemic. The empirical data of Lantmännen implies that they have employed many of the resilience methods as explained in the academia such as ‘flexibility’, ‘adaptability’, ‘robustness’, ‘collaboration’, and ‘risk management culture’ in the combination of proactive and reactive tactics of supply chain resilience.

6.1.1. Supply chain resilience

The findings of this thesis reveal that supply chain is an essential element of supply chain risk management as argued by Ponomarov & Holcomb (2009).

In contrast to the definitions of supply chain resilience as explained by some researchers where they see supply chain resilience as either the reactive ability to work against disruption or shocks or proactive efforts on preparing firms to handle the disruption (Melnik et al., 2014). This thesis found that supply chain resilience is a combination of both proactive and reactive approaches especially in the situation of the Corona pandemic where the magnitude and the duration of the effect are impossible to predict. Lantmännen's resilience strategies and practices are in line with the holistic approach as argued by Mojtahedi & Oo (2017). They explained the conceptual model of resilience from the proactive to reactive strategies and actions among the supply chain partners, which is the best suitable solution for effective risk management.

6.1.2. Flexibility & adaptability

As far the Lantmännen's flexibility is concerned, i.e., to adjust quickly with required resources that implies to the organization and its entire supply chain (Singh et al., 2019; Stevenson & Spring 2007; Chopra & Sodhi, 2004; Scholten & Schilder, 2015), the finding supports the above statement. For Lantmännen, their managerial controls through resilience strategies bring flexibility in their supply chain in planning and order fulfillment during the time of hoarding effect in the initial days of the pandemic. Their strong supplier base and relationship with upstream and downstream actors, flexible contract with customers made them tackle the huge demand for their products. It is the reflection of a resilient supply chain as advised by Pettit et al., 2013 & Scholten & Schilder (2015).

On the other hand, the supply chain's ability to adapt to the situation quickly and return to the original or ideal state after external disruptions as explained by Xiao, (2012) & Ponomarov (2012) is also an indication of a resilient supply chain. In the case of Lantmännen, when they reduce their existing range of products to concentrate on the key products that face sudden sales boost was their immediate action to meet the demand of the retailer market. At the same time, they immediately implemented all recommendations and guidelines to prevent the infection through executing home office, managing from the distance, social distancing in the factory premises, heightening health and hygiene measures are the signs of the organization's adaptability to changing situation.

6.1.3. Robustness

As far as the robustness is concerned for the Lantmännen's supply chain, the author finds that their supply chain keeps functioning and remains effective (Kitano, 2004; Klibi et al., 2008) despite the disruption associated with the Corona pandemic. Lantmännen's supply chain strategy also reflects the robustness that is explained by Christopher S. Tang (2006) to establish a robust supply chain strategy that helps a firm to deploy the associated contingency plans effectively and efficiently and sustain its operations during a major disruption. Lantmännen has established a robust supply chain by their active cooperation with upstream and downstream actors, reliance on local sourcing, existing infrastructure to adjust the additional demand, financial strength and diversified portfolio spreading in different sectors made them keep functioning despite the disturbance.

However, some researchers emphasized the robustness more on proactive planning (Singh et al., 2019; Wieland & Wallenburg 2013; Ehrenhuber et al. 2015; Izadi and Kimiagari 2014), although for Lantmännen, it was not only the proactive planning matters but also their management capability to respond and adjust quickly with changing situation. For example, their Food Sector adjusted business continuity through channel shifting focusing more on Lantmännen Cerealia that experienced an increased demand from Lantmännen Unibake which confronted a declining demand during the pandemic.

6.1.4. Collaboration

Collaboration in a supply chain suggests the capability of two or more autonomous firms who work effectively together to plan and execute the supply chain operations toward common goals (Scholten & Schilder, 2015; Cao et al., 2010). In the case of Lantmännen, it has been practiced in its organization to a great extent that gave them an edge to deal with pandemic disruption more effectively. The extent of their collaborative activities has become evident when they could meet the market demand and ensure the normal flow of their goods and services to the consumer market despite the abnormal sales pressure. For Lantmännen, it was the internal collaboration within the organization with their owner farmers and grain units to ensure the flow of the raw materials to meet the increasing demand. The external collaboration with their suppliers was when they were building stocks for packaging materials that come from the suppliers in Italy. Their activities during the pandemic were in line with what Demirci (2021) advocated in the literature of supply chain resilience for the Corona Pandemic.

Moreover, Lantmännen's collaborative approach towards their retail and wholesale customers through increased interaction, information sharing, joint planning to meet consumers' demand made them able to focus on the key products which were

more efficient to produce in the turbulent time. This approach also brought mutual benefit for them as well as for their customers in terms of increased operational performance, trust, fairness, and commitment with each other as suggested by Axelsson & Karlsson (2014).

6.1.5. Risk management culture

Saglam et al., (2020) advocated the view of organizational risk management culture as a proactive mechanism that helps organizations formulating effective planning to manage the supply chain disruption. It appears that Lantmännen's existing risk management culture helped their management to be efficient and quick in decision making to adjust to the situation in the pandemic. The organization's orientation towards sustainable business development, concentration on research and innovation, shared values, and beliefs among the stakeholders are the proactive efforts that made them resilient to deal with the turbulent situation effectively. This proactive supply chain resilience process is expected to aid the reactive supply chain risk management approach through balancing the management capabilities as argued by Verdier & Olsson (2017). The authors explained these capabilities as risk prediction, plan, cooperation, collaboration, and long-term relationship with other stakeholders in the supply chain that help firms endure, adjust, and grow even in the turbulent situation. Both the SVP and HGL shared the same insight that helped them react to the pandemic situation effectively i.e., the key driving strength for them was a well-developed plan and existing crisis management exercises that made them agile to adjust the demand of Corona emergency.

6.2. What are the impacts of the Coronavirus (COVID-19) on Lantmännen and its aggregate food supply continuity?

The thesis offers insights on the impacts of the Corona pandemic in the Lantmännen grain supply chain as a farmer cooperative processing farm outputs to sell to the retail stores that sell to consumers. The author investigates it from the perception of weaknesses as supply chain vulnerability and risks that make a supply chain exposed to environmental turbulence that threatens business continuity. Here the author confirms and justifies Lantmännen's present resilience practices that made them capable of minimizing the impact of disruption in their supply chain, especially to their supply flow to downstream actors for food supply continuity.

6.2.1. Supply chain vulnerability

The findings from the study show that the grain supply chain of Lantmännen has not been affected in any stages of the upstream and downstream supply chain during the Corona pandemic.

Supply chain vulnerability is portrayed as a state of supply chain characteristics for an individual firm that increases the effects or degree of impact of a supply chain disruption and makes its supply chain susceptible to the disturbance (Wagner & Bode, 2006; Chadist, 2012). For Lantmännen, their grain industry is dominated by the local production, supply chain characteristics are supported by the short supply chain (where there are no intermediaries from producers to retailers and wholesalers) gave them full control over their entire value chain. Moreover, the Swedish grain industry is not labor-intensive, therefore, it made them less exposed to the infection from the Coronavirus. Besides, their dependence on global supply sources is not significant since Lantmännen only imports packaging materials, pesticides, fertilizers as well as some ingredients for their Muesli and few other products. However, their very first reactive measures at the beginning of the pandemic were to look into the stocks and contracts with their suppliers. Accordingly, they filled the inventories before the lockdown enforced in their supplying countries that made them resilient from the supply chain vulnerability. Even though Lantmännen's export market in China and the United States had been affected to some extent because of the lock-down, but their food supply continuity to the consumer market did not face any considerable impact. On the other hand, the vulnerability that takes place in the supply chain by the reliance on certain customers as argued by Water (2007), Lantmännen takes care of this risk during the pandemic by their strong relationship with retail and wholesale customers and collaborative plan to supply the demand to the consumer market.

6.2.2. Supply chain risk

The general understanding of supply chain risks is associated with demand and supply risk, information, and material flow risk, catastrophic (macro risk) and operational (micro risk) as described by Ho et al. (2015), Sodhi et al., (2012), and Tang (2006). The findings of the study on Lantmännen supply chain reveal that the major risks for Lantmännen for the pandemic situation were the risks for their employee's health, the supply risk from all the ingredients and packaging material that they buy from the global market, and the risk for not being able to meet the demand of the market. According to Christopher & Peck (2004), these are the risks that are internal to the firm that includes process and control risks, external to the focal firm as demand and supply risk.

Findings suggest that as a pandemic effect when people are not encouraged to eat out, Lantmännen Cerealia that serves the Business to Consumer market has experienced an increased demand for their products. As a result, it brings better efficiency, more collaboration with other actors of the supply chain, and better financial performance. On the other hand, another part of the Food Sector, Latmännen Unibake that serves bakery products to Foodservice (Restaurants, pizza shops, Fast food shops) has been affected significantly due to decreasing demand in local and overseas markets. But as a whole of Lantmännen perspective, they could be able to balance the increasing and decreasing demand of the two segments of food sectors by leveraging business channel shift between them. Where their existing resources became more engaged to serve the consumer market as well as could make the compensation of financial loss of Unibake through rising sales of Lantmännen Cerealia.

Their existing health and hygiene practices along with their risk management culture helped Lantmännen to be very quick on implementing health and safety recommendations in its offices and factory premises. As a result, they confronted a very insignificant case of the Corona infection among their employees. Even though, the organization faced control risk which according to Christopher & Peck (2004) relates to uncertainties from the application or misapplication of the systems, procedures, rules, and policies that govern how an organization employs control over the processes. For example, they could have faced a greater impact in their operation if the schools were closed that would ultimately lead their working force to stay at home to attend to children. That was a kind of new risk that put their business exposed to a threat. But with continuous and intense discussions with local and national level political decision-makers to know what is coming next regarding changes of policy or procedures as well as to get the favorable business environment even in the pandemic situation made them able to mitigate that risk.

6.2.3. Business continuity

The common consensus among researchers about business continuity is about to respond to unknown risks and events by the organization (Zsidisin et al., 2005), that begins with the preparation of business continuity management (Water, 2007) through monitoring and control. The result of this thesis suggests that to deal with the emergency, Lantmännen exercises business continuity management by identifying all the risks that their organization may encounter through continuous business intelligence with internal and external interactions with stakeholders. They have certain risk management strategies and plans about how to handle unpredictable risks like pandemics, fire, or any kind of risks that can affect their business continuity and evaluate their potential impact to prepare the BCP accordingly. This is in line with the expectation of Business Continuity

Management as explained by Water (2007). The monitoring and control of the crisis management for business continuity has been supervised under the process ERM.

Since Lantmännen's capability of supplying their products and services has been remained at an acceptable level despite the disruption from the Corona pandemic, so their reactive strategy after the Corona outbreak was more focused on how to secure the functions of the operation to keep continuing their business. When the first Corona case had been detected in Sweden, they immediately formed a CCM²⁶ team who has been taking care of all safety recommendations for their employees and workers and monitor the implementation of the reactive measures to adjust to the pandemic situation. Since the demand for the grains was not affected rather the flour, pasta and other grain product sales went up manifold, thus their concentration was more about how to meet the demand of the market and at the same time how to protect their working force from infections. When their production system and supply chain faced extreme pressure from the 'hoarding effect' in the initial days of the pandemic, they chose to concentrate on producing key products by lowering the production of other items to meet the market's demand. Their existing infrastructure along with their management capability for swift and efficient decision making enables them to keep supplying products and services and keep continuing their business operation despite the shock created by the Corona pandemic.

²⁶ Corona Crisis Management

7. Conclusions

The purpose of this thesis is to understand the present resilience system in the food supply chain in the grain industry of Swedish food supply chain in response to a pandemic. That seeks to know how the food supply chain in the grain industry is reacting to the Corona pandemic and what is its impact on the food supply chain especially at the downstream supply chain that sells to the retail stores for consumers.

Investigating the supply chain resilience practices of Lantmännen, this thesis concludes that appropriate application and practices of the resilience ideas can make a supply chain robust and withstand any kind of environmental turbulence to attain business continuity. This thesis finds that how has the resilience practices by the leading grain industry of Sweden increased their capability of operating even in an unprecedented event like the Corona pandemic. According to the literature, the supply chain resilience increases the ability of an organization to endure, adjust and grow even in the turbulent situation (Fiksel, 2006; Blackhurst et al., 2011; Chowdhury et al., 2020), findings on Lantmännen's supply chain confirms the justification and validation of the effect of resilience practices.

To provide a synopsis of this qualitative analysis on Lantmännen's supply chain, the author draws the concluding remarks based on the following sub-research questions that have been mentioned in the introduction chapter to push the answers to the main research questions more specifically.

How has the chosen organization Lantmännen changed its strategies focusing on food supply due to the pandemic and what are their risk management strategies and resilience?

This thesis summarizes that, the foundation of Lantmännen's risk management strategy lies in the comprehensive understanding of resilience approaches. The empirical data that comes from two interview participants from two sectors i.e., one from the Agricultural Sector and the other from the Food Sector of Lantmännen's grain value chain confirms this statement.

Lantmännen's existing risk management culture, flexibility in their operation and supply chain, and adaptability towards the changing situation during the pandemic helped to continue their operation without a major hiccup during the pandemic. The basic strategies of how they handle their people, how they handle their production, and how they handle customers worked quite well for the organization. Being in the Food Sector, where they have to maintain a high level of food safety, hygiene routines and other health and safety measures, that benefited them in the pandemic situation to combat the transmission of the virus among their staffs.

Most importantly, the characteristics of their supply chain dominated by local sourcing of grains, short supply chain with no intermediaries (from Lantmännen's processing output to their retail and wholesale customers), the control over the upstream grain producers (who are the owner of the cooperative), the intense exercises of collaboration with upstream and downstream actors have made the balance of the supply and demand situation for Lantmännen. Moreover, their existing structure, the combination of global and local supply chain strategies gives them an edge to adapt to the local situation to manage their operation and supply chain in a good way. Additionally, Lantmännen's diversified business portfolio supports its business continuation despite the disturbance created by the pandemic. This existing proactive resilience mechanism has been supporting their managers to be agile to take the reactive measures very quickly to adjust to the new situation of the pandemic. Christopher & Peck (2004) and Pettit et al., (2010) in their study, emphasized balancing managerial capability with an organization's unique vulnerabilities of the supply chain design and the environment in which it operates to achieve the highest level of resilience. The result of this study suggests that Lantmännen maintains this balance by knowing their unique characteristics of the supply chain, knowing their strength and vulnerabilities, they have adjusted their managerial capabilities and that confirms by the statement of the SVP. He stated, "knowing different sources of threat, planning well ahead, understanding what to do and how to shift to the key products considering the availability of raw materials and following the market demand were the reactive approaches that made them able to deliver the products to their customers despite the hoarding effect." Their reactive strategy after the Corona outbreak was more focused on how to keep continuing their business by securing their people safety and shifting towards producing the key products according to the market demand.

Is COVID-19 more threatening for the continuity of individual companies than that of the continuity of food supply at the aggregate level or vice versa? I.e., whether the companies are in need to get support from other stakeholders of the supply chain to deal with this crisis?

From the whole Lantmännen perspective, some of their business units could manage the pandemic situation very well as they could be able to do the channel shift, for example when their business to Food Service impacted, they could balance it within the growth in their business to the Consumer market. Apart from their effective strategies and capability of quick decision making, their existing portfolio in different sectors made them resilient to keep the business going as usual despite the shocks. Some organizations could not be able to do so where their businesses were heavily focused on the market of Food Service. Therefore, the degree of impact in business varies as certain markets and certain channels suffered to a great extent due to the falling demand of their product. For example, Restaurant business, Hotel and Tourism industry, Air industry for the reason of falling demand as well as the labor-intensive sectors for the reason of the higher rate of infection that make the organization exposed to operational disturbance.

Lantmännen does not foresee any long-term effect of the Corona pandemic, in terms of productivity, volume, performance, and goodwill where they only see the changes in the way they are working. For example, working remote possesses some psychological effects, and, they are expecting less traveling, more flexibility in terms of using IT (information technology) tools for collaboration. The organization feels the need where they can get back to the situation for a physical meeting for the business development where the physical presence is important to bring the desired outcome. According to the SVP, they foresee the long-term impact of the Corona pandemic is more on the positive side than on the negative side through the greater demand of locally produced products, the bigger demand of the type of goods they produce with the potentiality of a shorter supply chain.

In the concluding remarks based on the insights of the resilience of Lantmännen's supply chain, the author of this thesis argues that resilience scope must not be limited only to proactive or reactive abilities of an organization, rather it should have a combination of both proactive and reactive approaches. Especially in the case of resilience for a pandemic like Corona, no organization can predict the scale of disruption and duration of the tumultuous situation to devise the mechanism of resilience. As such, organizations must find out the vulnerabilities in their existing supply chain where the risk factors are considered in the case of environmental turbulence to align the resources as proactive measures. This proactive supply chain resilience mechanism is expected to aid the reactive supply chain risk management

approach by balancing the management capabilities with vulnerabilities. Where these capabilities are more focused on the ability to predict the risk, plan, cooperation, collaboration, and long-term relationship with other stakeholders in its supply chain that help a firm to endure, adjust and grow even in the turbulent situation. That is what the SVP mentioned in the interview “when an organization has a good structure, better planning, process, and resilient practices in place, it increases its capability and flexibility to control the unforeseen when it happens to deal with adverse situations.”

7.1. Limitation of the study & further studies

At first, the author acknowledges this study may have some limitations because of the subjective nature of the qualitative study for the reason of contextual implications related to human emotions and perspectives from both subjects and the researcher’s point of view.

Besides the general concern of qualitative research, the significant limitation of this research may be the chosen sector, the food supply chain in the grain industry in Sweden. Because of the characteristics of the food supply chain in the European model that is supported by the short supply chain, therefore the magnitude of supply chain disturbance is supposed to be less. Taking another context rather than Europe or another industry would be a better approach to understand the extent of resilience concepts and their applicability. Moreover, the small sample size, which is in this thesis only two key persons of the supply chain that is considered as an insufficient sample size in the research field. Though for the topic of the study for understanding resilience in response to the Corona pandemic, the sample selection gave this study substantial credibility and result. The research topic is focused more on organizational strategies that are mostly taken by the top executives and leaders of the organization. For this thesis, the author got the opportunity to interview the Senior Vice President of Lantmännen who is in charge to oversee the Lantmännen most growing business unit Cerealia. The other interview’s feedback from the key person, the Head of the Grain for Lantmännen Lantbruk also provided this thesis with an in- depth understanding of the pandemic phenomenon of the upstream grain supply chain. Thus, these two interviews had offered a complete picture of the resilience strategies, practices, and impact of the Corona pandemic over the entire grain supply chain of Lantmännen. To achieve this same level of insights, the author would be needed to interview several managers in a different part of the supply chain to get the same or fewer insights and output from those interviews. Besides, two interviews conducted in the different business sectors of Lantmännen, one is from their Food Sector and the other is from Agricultural Sector, have also given the credibility of the study since the author was able to verify their feedback from

two different sectors and two different stages of Lantmännen's value chain. When the Lantmännen Cerealia's activities involve mostly with downstream supply chain from the processing industry to sell the wholesalers and Retailers, the agricultural sector involves more on the upstream supply chain of Lantmännen those are the suppliers and farmers of grains. That provided this thesis a comprehensive insight into the entire supply chain situation of Lantmännen.

This thesis provides motivating insights into the entire food supply chain of the grain industry with a single case study of Lantmännen's value chain. However, if the author could take multiple case studies with other grain actors, then it would offer more diversified insights about the impact of the Corona pandemic and different practices and philosophies of resilience by the different organizations. Moreover, this thesis does not claim that it covers all kinds of risks of the supply chain and brings all-important resilience concepts and practices that are already identified in the literature. Therefore, further research can be done to cover other risk management approaches and resilience practices that would also be significant to achieve supply chain resilience.

Despite the above limitations, the author of this thesis believes that this qualitative study will offer the right motivation to the academic to research on a broader level for further validation on the result of this study. It will contribute to generating new knowledge to develop a more effective resilience system in the fields of supply chain especially for the pandemic and other environmental turbulence. This study will also help supply chain managers of different industries to get a deeper understanding of the vulnerability and risks that presently exist in their supply chain to align their resources and managerial capabilities through the proactive and reactive guidelines of resilience. It will help them to come up with suitable strategies for a more sustainable supply chain through efficient planning and management to endure this kind of shock. The outcome of this study would support boosting the business performance in the food supply chain to become more resilient to long-term environmental agitation.

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Appendix 1: Semi-structured questionnaires

Semi-structured and in-depth questionnaires:

Create a comfort level and explain purpose of the research with introduction of researcher and convey gratitude for the time and effort of interviewees.

- by explaining the purpose of the research
- by clarifying the objective of the interview
- by assuring of confidentiality/GDPR etc.

1. What are you responsible for?
2. Could you please help me to understand the grain supply chain process of Lantmännen? Especially the stages of your down-stream supply chain that consists of Lantmännen's grain activities, your processing industries, and the wholesalers?
3. How do you manage your supply chain? Could you please explain Lantmännen's interdependencies with other actors in the supply chain, especially in the downstream stakeholders of Lantmännen?
4. What does resilience in the food supply chain mean to you?
5. What risk management strategies were in place in Lantmännen to deal with unpredictable risks (macro risk in supply chain that refers to adverse and relatively rare external disruption by a natural cause).
 - Do you have proactive risk management strategies to deal with environmental turbulence? If yes, please explain briefly about Lantmännen's proactive risk management strategies with example?
 - And if no, could you please explain your organization's rationale for not having proactive risk management strategies?

6. What is the initial impact of Corona in your company especially in the grain supply-chain and what is the situation now to deal with prolonged pandemic situation?
7. Were the existing risk management strategies enough to handle the pandemic situation? Did you find some strategies that were effective to deal with the turbulence situation? Did you find some strategies that were ineffective in the pandemic? Which were these strategies?
8. Did you find any new risks that your cooperative never assessed before that led to that your supply chain was exposed in the pandemic situation?
9. Which main types of risks were your cooperative confronted with/by, due to the corona pandemic?
 - Process risks (managerial and value-adding activities of a firm in managing assets and supporting transport, communication, and infrastructure)
 - Control Risk (uncertainties from the application or misapplication of the systems, procedures, rules, and policies that govern how an organization employs control over the processes)
 - External risk (that involves uncertainty in the upstream supply chain in terms of material and information flow while the demand risk arises in the downstream supply chain in predicting the product demand and disruption in the flow of finished goods which has the ultimate effect on the consumer market)
10. How and when did you notice the change (disruption if any) in your supply chain in the ongoing pandemic and what was the immediate effect on your organization (if any)?
11. Could you please give some idea about how quickly your company has adjusted with required resources after being confronted by the effect of the Corona pandemic?
 - this flexibility refers to both the organization and
 - Its entire supply chain
12. Could you please tell me whether the supply chain of your cooperative keep functioning as usual and remaining effective despite the disruption associated with Corona?
13. How much has your grain supply chain been affected due to lockdown policies by other Nordic countries, EU countries and other countries

including USA and Asia in terms of export/import of grain products/raw materials?

14. How do you want to define the customers behavior in-terms of panic buying, rise and fall of demand for certain foods items and rapidly changing customer behavior (with examples)? What were the customers' reaction that you faced in the pandemic situation? And to which extent was your cooperative forced to adjust to the/in response to the with sudden rise and fall of any food items (if your organization has experienced that)?
15. Has your cooperative already calculated the long-term effect of Corona pandemic to your organization in terms of falling productivity, financial performance, and loss in reputation or any other?
16. How do you perceive a sustainable supply chain and to what extent do you want to rate your organization adhering with sustainability benchmarks in its supply chain? Could you please name some of the sustainable practices that your company does follow which help you to deal with Corona disruption effectively in your supply chain?
17. Could you please explain some of the lacking (if any) in your supply chain that has been detected in the pandemic situation and you feel that some mechanisms needed to be there to perform better? What other strategies could be undertaken in this situation in your opinion?
18. To which extent does your cooperative involve itself in collaboration with other actors in the supply chain? Please explain briefly with example.
19. Does your company prepare the business continuity plan and management process to deal with emergencies through monitoring and control? Could you please explain briefly how do you carry out that?
20. For the Corona pandemic, could you please explain briefly how much and to which extent your cooperative changes the strategies in its food supply chain due to the pandemic? Could you please give some examples?
21. What were the changes in operation you had to make in your grain supply chain due to this crisis?
22. How do you find and perceive the entire situation of the Corona pandemic towards your cooperative and your entire supply chain?

23. Do you think the COVID-19 is more threatening for the continuity of your organization than that of the continuity of food supply at the aggregate level or vice versa?
- The effect is more on your cooperative, or it is more on the continuity of food supply chain collectively?
24. Is your cooperative in need to get support from other stakeholders of the supply chain to deal with this crisis?
25. What strategies does your supply chain partners take to prevent long-term risks and what strategies do they take to minimize the impact of Corona? Are you collaborating with each other on formulating plans to deal with these emergencies?
26. Do you think your organization's level of performance has dropped from your original state due to Corona pandemic? If yes, how long would it take to come back in the original situation (with processes, relationships, resources, revenues, and performance) that you predict? If no, how would you define your organizational strength that supports your business to keep going as usual despite pandemic situation?
27. What strategies does your company take to prevent long-term risks? --What strategies have you implemented to improve your supply resilience after the pandemic's impact? What are the results of these new strategies so far?

Closure:

Thank you very much for your interactive participation.

- Do you have any questions/remarks regarding this interview?
 - I will send a summary of the interviews to you, so that you can see what data I got from the interviews to get your confirmation/consent.
-

Appendix 2: Designing the case-study methodology

In this appendix, the step-by-step process (as suggested by Rashid et al., 2019). of designing case-study methodology is outlined to describe the subsection **3.2**.

Foundation phase

At the beginning of the study, the author takes the foundation phase consideration as advised by Rashid et al., (2019) that includes philosophical consideration, inquiry techniques consideration, and research logic consideration. The philosophical consideration guides the researcher with a comprehensive understanding of the research problem and the result researcher wants to achieve through the chosen study topic. Since it is important for the case study methodology to determine what to look for, where to look, and how to look to gather the required information. Since it is a qualitative study, thus the author takes the research inquiry techniques from the lens of interpretivism paradigm and abductive research process/systematic combining as a research logic consideration as explained by Dubois and Gadde (2002). Since this systematic combining process is handy when the researcher wants to develop new insight and provide a platform for future research. Another logic to take the abductive approach as it helps to develop the theoretical framework, empirical data, and case analysis simultaneously in the process (ibid).

Prefield phase

In this phase as recommended by Rashid et al., (2019), the researcher considers constructing research questions, research method, presents ethical consideration, and let the participants aware of their contribution to the research project. Here the researcher decides how to collect data and how to do the empirical material interpretation and analysis. Simply put, it guides the author to maintain a step-by-step research protocol to conduct the case study systematically.

Field phase

Here, the researcher finds the research participants and interactions with participants in the form of interviews take place. As discussed earlier, the author of this thesis has chosen an abductive approach to explore and understand the social

phenomenon through the eyes of social actors, and in this thesis, they are the actors who directly and indirectly involve in managing the supply chain at Lantmännen. In this step in the research protocol, the author also makes sure to protect the rights of participants and the confidentiality of the firm.

Reporting phase

This is the last phase of the case study protocol as suggested by Rashid et al., (2019), where the researcher presents the cases and the participants. Here the discussion and result of analyzed data are presented from empirical evidence. Here the author also documents the details of the interview protocol and draws a conclusion with a summary of the research problem, facts and findings, and suggestions to deal with the case problem.

Appendix 3: Case firm Lantmännen

Glimpse of Lantmännen (brief presentation of the cooperative)

Lantmännen (Cooperative)	Business area	Global coverage	Grain output	Type of grains	Finished product	Customers in Sweden
Multinational organization, owned and managed by 19,000 farmers, 10,000 employees and annual turnover SEK 45 billion.	Agricultural Sector, Energy Sector, Food Sector (consist of Lantmännen Cerealia & Unibake), Swecon Business area, Real Estate Business Area	Strong points in Europe (especially Sweden in 20 districts & the Nordic countries) Asia, the Middle East, and Africa along with the United Kingdom, Australia, and United States	About 3 million tons annually (wheat equivalent)	Wheat, rye, barley, oat & soy	flour, breakfast cereals, pasta, oat flakes, muesli, frozen and fresh bread, crispbread, and ready-to-eat meals	Business to Business (to large bakeries), Business to Consumer Market (ICA, COOP, MAX Food (Restaurants, Bakeries) & Business to Food Service (Pizza shops, Restaurants, cafeterias & small bakeries)

Appendix 4: Sustainability practices of Lantmännen in supply chain

Lantmännen is very much involved in sustainability areas and is ranked as number six by SBI in 2020 (Dehghannejad, 2021). The organization promotes a circular approach that is driven by its brand promise of “taking responsibility from field to fork” through utilizing every part of its resources. For instance, the waste from grain production and old bread converts into energy at their production facilities, processing, and refining industries. Similarly, its by-product from production is used for energy and heating in its production sites in Norway and Sweden (Lantmännen, n.d-c). Under their sustainability program of Climate and Nature, they give premium price to their farmers for the environmentally friendly farming. Under this program, Lantmännen supports farmers to choose green fuels, green electricity for the cultivation, give them training to use the technology to reduce CO2 emissions. Their vision by 2050 to get a complete transformation of their production system to achieve a fossil-free harvest.

Lantmännen’s responsibility in the supply chain is practiced through its control and expertise that is aimed to minimize the negative impact to the other stakeholders in the supply chain including customers and natural resources and the environment. The Board of Directors (BoD) is responsible for the implementation of the Code of Conduct (CoC) at Lantmännen for sustainable business development. While its Code of Conduct guides them to be ethical in the business practices towards the society and environment, at the same time, it represents how the company works to promote sustainable production and consumption system (Lantmännen’s annual report, 2019).

The cooperative enforces the Supplier’s Code of Conduct that its suppliers must need to follow in their premises to ensure a good environment and social conditions for workers, good business ethics, environmental responsibility, and responsively produced products ((Lantmännen’s annual report, 2019).