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Achieving supply chain resilience within an opportunity-driven market environment

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Abstract

Purpose – The resilience term can be linked to different types of subjects within the literature that in a way relate to disruptive events. However, when resilience is discussed within the management practises, there can be seen a clear distinction between opinions on how the resilience should be best implemented. This calls for a conceptual clarity that would result in the development of the measurement model within the supply chain management processes. Therefore, the purpose of this study is to apply a LARG(E) Index within a food supply chain industry using a case-company as a unit of analysis, where the results reveal which of the five LARG(E) paradigms can help firms to seize new opportunities while dealing with unexpected disruptions.

Design/Methodology/Approach – LARG(E) Index consists of the supply chain management paradigms and its practises. To apply the index within a food supply chain industry, a Delphi method was used to obtain the new weights for each supply chain paradigm and its sub-indicators. Afterwards, assessment of the case firm's LARG(E) index implementation was conducted while using the survey.

Findings – Based on the results agile, resilient, and entrepreneurial paradigms and their practises with a “green” business focus can be considered as the ones that describe an opportunity-driven resilient supply chain. The examples provided by the case firm can be used as a basis to improve supply chain resilience within the food supply chain industry, and in this way prepare for unexpected disruptions without needing to pause business operations. In the end, the blue print is proposed, that consists of guidelines and strategy examples on how the best to achieve a resilient supply chain within the food industry based on the LARG(E) index.

Practical implications – This study provides firms with a tool that allows to identify the implementation level of different supply chain practises in terms of leanness, agility, resilience, greenness, and entrepreneurial behaviour. The LARG(E) Index allows managers to adjust and improve the firm's behaviour based on the achieved index score that determines how resilient a firm's supply chain is. The tool can be used either to evaluate individual firm's behaviour or to compare different firms within the same industry.

Originality – This study contributes to the literature firstly by adding a fifth paradigm to the LARG(E) Index allowing firms to additionally measure their opportunity-driven behaviour. Secondly, the LARG(E) Index proved to be compatible within another industry as well – the food industry. This shows that the index can be used as a universal measurement model regardless the type of the industry.

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1. Introduction: Utilizing the LARG(E) index in order to achieve a supply chain resilience within an opportunity-driven market environment

Globalization, the outsourcing of production activities, make supply chains more complex due to the increasing number of participants and the considerable number of connections that are created among them. Therefore, these networks become more vulnerable to different kinds of disruptions.¹ The disruptions can be caused by human-related factors or can occur naturally, which can delay the manufacturing of goods or daily operations that result in inability to fulfil the orders on time.² A recent example of environmental risk, which is a disruption that cannot be planned for, is the Covid-19 pandemic. The impact of such disruption could not be predicted therefore companies were left to deal with huge consequences.³ However, the categorisation of possible disruptions and the mitigation strategies to tackle them could help companies to be prepared in advance. On the other hand, the actual impact of a disruption on supply chain differs. For example, the earthquake and tsunami in Japan in 2011 was a one-time event,⁴ that had affected business performance of multinational companies such as Ford or Volkswagen.⁵ However, the affected companies managed to increase their workflow in other production plants that enabled them to react to the disruption flexibly and thus continue with its business operations.⁶ Whereas, the Covid-19 outbreak occurred not in one region but has spread all over the world leaving an unseen level of impact. With closed borders and no possible humanitarian help, countries were left to tackle the battle themselves, and businesses were left with no choice but to stop some of the operations. Industrial sectors such as automotive or electronics struggled with keeping up its business running,⁷ whereas other industries profited such as food sector, specifically within the online business.

In general, during volatile and uncertain times, it is believed that innovative companies with resilient processes in place, will be more likely to survive the disruption and adapt its business operations to uncertain conditions.⁸ Since supply chain resilience can provide knowledge that complements traditional risk management,⁹ companies are focusing on applying resilient practises that allow them to be more flexible and at the same time focus on increasing visibility in order to be able to anticipate the impact on the business.¹⁰ An analysis conducted during the

¹ Tao, Lai & Zhou (2020, p.2)

² Tao, Lai & Zhou (2020, p.2)

³ Trkman & McCormack (2009, p.251)

⁴ Schiele, Calvi & Gibbert (2012, p.1179)

⁵ Park, Hong & Roh (2013, p.76)

⁶ Park, Hong & Roh (2013, p.76)

⁷ Xu et al. (2020, p.154)

⁸ Golgeci & Ponomarov (2013, p.611)

⁹ Pires Ribeiro & Barbosa-Povoa (2018, p.117)

¹⁰ Gholami-Zanjani (2021, p.2)

Covid-19 pandemic by Xu et al. (2021)¹¹ have pointed out that resilience is indeed the main driver to reduce the vulnerability of a firm during uncertain times. However, how exactly a firm recovers from a shock and what strategies are used, still needs to be analysed. A resilience measurement model, could be useful in explaining firm's contingency plans. One of the examples is the developed LARG Index by Azevedo, Carvalho, & Cruz-Machado (2016)¹² where supply chain processes are analysed according to the four paradigms – leanness, agility, resilience and greenness. These four paradigms provide companies with an overview of their supply chain processes and offers an opportunity to increase its supply chain resilience by applying various strategies.

Therefore, the purpose of this study is to investigate how firms can achieve a resilient supply chain within an opportunity-driven market environment under the pandemic related disruptions. The expanded LARG(E) index will be used to examine which of the five paradigms – lean, agile, resilient, green, or entrepreneurial – are the most relevant for firms when seizing new opportunities. The index will be applied within a case firm, that managed to react quickly to constant changes and restrictions, and in this way strive through the pandemic by improving its product offering and introducing new business. Thus, the following research question is developed:

RQ: How to achieve a resilient supply chain within an opportunity-driven market environment under the pandemic related disruptions

The analysis will reveal that three LARG(E) paradigms relate the most to the resilient supply chain and guidelines on how to achieve or improve already existing supply chain processes will be provided.

First of all, to gain the up-to-date information about the supply chain resilience, the literature review, where a clear understanding about what defines resilience, its principles, what kind of strategies are used to achieve it and how it can be implemented and measured, was conducted. The scientific literature review is afterwards used as a basis for developing and validating the questionnaire that serves as the main data collection method. Within the methodology part I, a Delphi method and its application is described. In order to analyse and understand whether the summarised theory and developed questionnaire can be validated, the single case study approach has been chosen and described in the methodology part II. And finally, the results, discussion and conclusion sections cover the detailed answer to the research question by

¹¹ Xu et al. (2020, p.153)

¹² Azevedo, Carvalho, & Cruz-Machado (2016, p.1478)

proposing a blue print on how a resilient supply chain within an opportunity-driven environment can be achieved.

2. Literature review: Understanding resilience – its definition, principles, strategies, and measurement tools

2.1. Defining supply chain resilience

The increasing complexity of supply chain structures is the outcome of constantly increasing interconnectedness between suppliers and manufacturers,¹³ that require firms to focus more on the supply chain management.¹⁴ Complex networks also leave a huge amount of data, that supply chain managers need to process in order to enhance current business practises or to use it in preparation for a disruption.¹⁵ Even if the increasing dependency among the firms allows to create efficient supply chains that are stable, it still leaves them exposed to various risks and disruptions.¹⁶ Different kind of disruptions have affected supply chains over time such as high demand variability, different expectations and requirements of customers, short product lifecycle¹⁷ that increased the vulnerability of supply chains. However, the recent crisis and catastrophes make supply chains even more vulnerable and therefore supply risk management has received lately more attention from the industry¹⁸. Increased exposure to supply risks, can affect companies negatively by influencing its operational and financial performance.¹⁹ Therefore, by having supply risk management processes in place, can help companies to prevent the risks from happening or be prepared to tackle them after the risk has already happened. However, the traditional risk management relies mostly on the predetermined processes that are risk identification, risk assessment, risk monitoring and risk mitigation²⁰, which are based on the statistical information. Since not all risks are known and not all of them can be predicted, the statistical information about it cannot be retrieved.²¹ In order to address this matter, the term “supply chain resiliency” has received more and more attention in the recent years.²² The difference between supply chain risk management and resilience is the way it is defined and formulated. The resilience is viewed as an apparent capability that can be added to the traditional risk management²³ or as the ability to quickly adjust and maintain the functions under

¹³ Kamalahmadi & Parast (2016, p.116)

¹⁴ Pires Ribeiro & Barbosa-Povoa (2018, p.109)

¹⁵ Bhagwat and Sharma (2007, p.47)

¹⁶ Blackhurst, Dunn & Craighead (2011, p.374)

¹⁷ Ghadge, Dani & Kalawsky (2012, p.324)

¹⁸ Hoffmann (2012, p.92)

¹⁹ Hendricks & Singhal (2005, p.42)

²⁰ Berg, Knudsen, & Norrman (2008, p.305); Hallikas et al. (2004, p.48)

²¹ Kamalahmadi & Parast (2016, p.116)

²² Kamalahmadi & Parast (2016, p.116)

²³ Fiksel (2015, p.81)

unfavourable conditions.²⁴ This ability allows companies to prepare for unexpected risk events, recover and respond quickly to disruptions that in the end allows to return to original business operations or move to the new market.²⁵ Since there is no definitive description of the resilient supply chain, it can be used as both a proactive capability - an effort before a disruption, or as a reactive capability to use after the fact.²⁶ Following that, it is important for a firm to understand what the resilience means and how it can be incorporated within the risk management system since it allows the firm to further define its supply chain resilience principles.

2.2. Supply chain resilience principles & framework

Various supply chain resilience principles have been identified by scholars,²⁷ but only a few have managed to combine all principles into one framework.²⁸ By combining the existing literature and the findings by Christopher and Peck (2004),²⁹ Kamalahmadi & Parast (2016)³⁰ have developed a framework where all major components influencing supply chain resiliency are described. The framework provides the ability for researchers and firms to understand and analyse the supply chain resilience in a more systematic way (Figure 1).

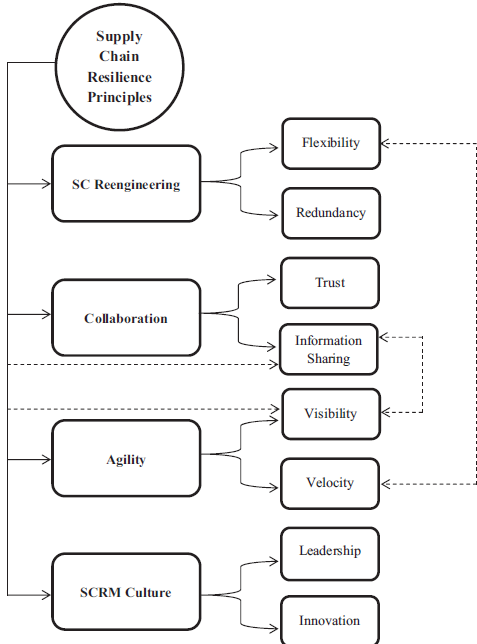


Figure 1: Framework: Supply chain resilience principles

Source: Kamalahmadi & Parast (2016, p.127)

²⁴ Bunderson & Sutcliffe (2002, p.888)
²⁵ Hohenstein et al. (2015, p.96)
²⁶ Kamalahmadi & Parast (2016, p.116)
²⁷ Kamalahmadi & Parast (2016, p.122)
²⁸ Christopher and Peck (2004, p.7)
²⁹ Christopher and Peck (2004, p.7)
³⁰ Kamalahmadi & Parast (2016, p.127)

There are four main principles that need to be considered before designing a resilient supply chain: supply chain reengineering, collaboration, agility and supply chain risk management culture.³¹

2.2.1. Supply chain reengineering

The two main objectives of the supply chains are to achieve customer satisfaction and optimize the cost while doing that.³² But since supply chains are complex structures, it leaves them exposed to various kind of risks. Usually, the supply chain risk management is the one that deals with risks and disruptions but sometimes it is not enough due to its ineffective practises.³³ In order to change that, the focus should be put on designing a resilient supply chain. There are two known practises that stand out in the literature when talking about resiliency: flexibility and redundancy.³⁴ *Flexibility* can be referred to as the ability where a firm is capable to adapt fast to changes within the supply chain, or is able to respond better to unexpected situations.³⁵ An example of such resilient ways can be related to having a flexible transportation system,³⁶ having a flexible supply base³⁷ or simply being able to arrange flexible labour.³⁸ Organizational capabilities as such can help to create a competitive advantage by meeting the changing needs of the customer.³⁹ On the other hand, *redundancy* refers to having multiple supply sources or having supply continuity plans in place that allows firms to reduce the effects once a supply disruption occurs.⁴⁰ The fundamental issue is to understand how to balance between the flexibility and redundancy. A firm must take into account its limited organisational resources and make a decision to what extent which strategy will be used.⁴¹ Winston (2014)⁴² has noted that for a firm to be resilient, their strategies must be transformed in the following ways: (1) vision: re-examining a firm's vision by adopting radical innovation and focusing on the long-term goals; (2) values: re-evaluating a firm's assessment methods that relate to benefits and costs; (3) partners: looking for unusual connections in order to achieve the goals beyond your reach. In the end firms should decide individually to what extent both or one of the strategies should be implemented since flexible and redundant practises provide different benefits.

³¹ Kamalahmadi & Parast (2016, p.122)

³² Kamalahmadi & Parast (2016, p.122)

³³ Sáenz & Revilla (2014)

³⁴ Kamalahmadi & Parast (2016, p.122)

³⁵ Lee (2004, p.107)

³⁶ Tang (2006a, p.483)

³⁷ Tang & Tomlin (2008, p.25)

³⁸ Collichia, Dallari & Melacini (2010, p.686)

³⁹ Zsidisin & Wagner (2010, p.3)

⁴⁰ Zsidisin & Wagner (2010, p.9)

⁴¹ Kamalahmadi & Parast (2016, p.122)

⁴² Winston (2014, p.60)

2.2.2. Supply chain collaboration

Since supply chains are interconnected across the globe, they are left open to risks.⁴³ Therefore, it is crucial that the risk management system is spread across all participating entities. Which means that the risk management system cannot be properly examined without the collaboration and cooperation between the participating parties.⁴⁴ The collaboration and cooperation can be referred to as the working practise where entities operate together for a common purpose to achieve mutual benefits,⁴⁵ that in turn can reduce the uncertainty by distributing risks.⁴⁶ In fact, a study conducted by Wieland & Wallenburg (2013)⁴⁷ confirmed that a communicative and cooperative relationship between entities has a positive effect on building a resilient supply chain. Additionally, Soni, Jain & Kumar (2014)⁴⁸ identified in total fourteen enablers that relate to resiliency and the second ranked was indeed collaboration. In order to be able to create a collaborative relationship, two requirements need to be addressed: (1) Inter-firm trust, and (2) Information sharing.⁴⁹ Trust is seen as a necessity that allows entities to achieve the risk sharing.⁵⁰ Holton (2001)⁵¹ has researched that trust can reduce conflicts, improve the integration, as well as the decision-making once uncertainty occurs. Therefore, by building trust, one is expected not to act in an opportunistic manner. On the other hand, information sharing can be interpreted (1) as the driver for collaboration and (2) as a driver for resiliency. The former relates to prioritising information sharing between supply chain members, where every member acquires the information efficiently⁵² and the trusted network is built.⁵³ The latter, relates to treating information sharing as a separate resilience enabler. Soni, Jain & Kumar (2014)⁵⁴ have outlined multiple resiliency drivers, where information sharing was listed separately from visibility and collaboration. In any case, having the predefined communications tools such as supplier relationship management is highly recommended.

2.2.3. Agility

Agility can be defined as the ability to react quickly and at the same time respond to disruptions by redesigning the supply chain to facilitate a better recovery.⁵⁵ However, agility

⁴³ Kamalahmadi & Parast (2016, p.124)

⁴⁴ Kamalahmadi & Parast (2016, p.124)

⁴⁵ Pettit, Fiksel & Croxton (2010, p.10)

⁴⁶ Reinmoeller & van Baardwijk (2005, p.62)

⁴⁷ Wieland & Wallenburg (2013, p.311)

⁴⁸ Soni, Jain & Kumar (2014, p.14)

⁴⁹ (Kamalahmadi & Parast (2016, p.124)

⁵⁰ Soni, Jain & Kumar (2014, p.15)

⁵¹ Holton (2001, p.37)

⁵² Mandal (2012, p.52)

⁵³ Kamalahmadi & Parast (2016, p.124)

⁵⁴ Soni, Jain & Kumar (2014, p.15)

⁵⁵ Blackhurst, Dunn & Craighead (2011, p.377)

does not necessarily mean flexibility. Hohenstein et al. (2015)⁵⁶ makes a clear distinction between the two elements by noting that agile supply chains generally include flexibility, whereas flexible supply chains not necessarily need to be agile. Therefore, flexibility can be seen as an element of agility.⁵⁷ On the other hand, agility combines multiple elements that include: information sharing (that relates to the visibility element) and communication and velocity (quick response to the disruption).⁵⁸ In this research, the agility will be described using two elements: visibility and velocity.⁵⁹ *Visibility* can be referred to as the clear view of upstream and downstream demand, inventories or supply conditions.⁶⁰ It can be achieved during a close collaboration with firm's customers and suppliers, where information on market trends and perception of risk can be shared. However, the biggest barrier to achieving visibility is a firm's organizational structure.⁶¹ The organizational structure should focus on promoting cross-functional processes within a firm to avoid a lack of communication. To address the visibility element successfully, it is important to classify it into two perspectives where one is: being a driver for agility, and the second for resilience. Wieland & Wallenburg (2013)⁶² have verified that by enhancing the visibility functions of communication, the agility of the firm will be improved as well. Whereas Jüttner & Maklan (2011)⁶³ found out that resilience is achieved through supply network visibility once entities start sharing risks and knowledge. Another element that influences agility is *velocity*, which can be explained as the distance over time.⁶⁴ The idea behind it is that once a disruption occurs, a firm that employs a resilient supply chain, will achieve a faster recovery by redesigning its supply chain and mitigating risks.⁶⁵ The emphasis on velocity is that it helps to achieve efficiency rather than effectiveness of the response time of supply chain.⁶⁶ Multiple authors⁶⁷ have explained resilient practises through velocity by focusing on lead-time reduction strategies. One of the strategies that were used, focused on increasing the downstream velocity of the supply chain by splitting up the market in two different regions⁶⁸. By shortening the lead-times, a firm's revenue targets can be

⁵⁶ Hohenstein et al. (2015, p.102)

⁵⁷ Chopra & Sodhi (2004, p.60)

⁵⁸ Wieland and Wallenburg (2013, p.302)

⁵⁹ Christopher & Peck (2004, p.8)

⁶⁰ Christopher & Peck (2004, p.8)

⁶¹ Christopher & Peck (2004, p.8)

⁶² Wieland & Wallenburg (2013, p.311)

⁶³ Jüttner & Maklan (2011, p.250)

⁶⁴ Christopher & Peck (2004, p.10)

⁶⁵ Barroso, Machado & Machado (2011, p.181)

⁶⁶ Smith (2004, p.28)

⁶⁷ Spiegler, Naim & Wikner (2012, p.6182); Tang (2006a, p.459)

⁶⁸ Jutner & Maklan (2012, p.252)

increased as well. In the end, velocity is all about the speed acceleration and the responsiveness of the supply chain.

2.2.4. Supply chain risk management culture

Moore and Manring (2009)⁶⁹ state that the organisational behaviour of a firm has a huge influence on how resilient and sustainable organisation will be in the future. A firm's leadership style, its visions and overall soft, less tangible practises are the key to building an effective communication within the firm and its partners.⁷⁰ Therefore by focusing on implementing the supply chain risk management culture, can result in a firm becoming more resilient. In order to achieve that, the leaders of the firm are advised to review the practises and policies in order to understand how vulnerable the supply chain is.⁷¹ Afterwards, employees should be provided with training and education possibilities in order to improve their security and resilience capabilities.⁷² As mentioned earlier, cultural changes require in-depth analyses of behavioural patterns and values. To do that fully, a firm could focus on employing an innovative and creative type of thinking.⁷³ Improving leadership style and focusing on adapting innovation can in the end help firms to overcome disturbances easier. However, Kamalahmadi & Parast (2016)⁷⁴ stress the importance that previously mentioned principles should not be viewed as single antecedents to resilience but instead as interdependent factors that influence each other. After defining the appropriate resilience principles within the firm, the focus can be then put on the supply chain management practises and its resilient strategies implementation.

2.3. Supply chain resilience strategies

2.3.1. Proactive and reactive type

Generally, the supply risk management process consists of the following stages: risk identification, risk assessment, risk monitoring and risk mitigation.⁷⁵ While each firm designs the first three stages of risk management process individually, the last one – risk mitigation, can be comprised by looking at the environmental, financial, operational, and strategic supply risk sources⁷⁶. However, the important distinction should be made between the proactive (ex-ante) and reactive (post-disruption) type of risk management strategies, specifically when it relates to developing a resilient supply chain management (Table 1).⁷⁷

⁶⁹ Moore and Manring (2009, p.278)

⁷⁰ Seville et al. (2006, p.13)

⁷¹ Wilding, (2013, p.57)

⁷² Blackhurst, Dunn & Craighead (2011, p.380)

⁷³ Martins & Martins (2002, p.58)

⁷⁴ Kamalahmadi & Parast (2016, p.127)

⁷⁵ Berg, Knudsen, & Norrman (2008, p.305); Hallikas et al. (2004, p.48)

⁷⁶ Hoffmann (2012, p.53); Giannakis & Papadopoulos (2016, p.457)

⁷⁷ Hohenstein et al. (2015, p.102)

<i>Strategy type</i>	<i>Readiness elements</i>	<i>Sub-elements</i>
Proactive strategy	Collaboration	Coordination, cooperation, joint decision making, knowledge sharing, supplier certification, supplier development
	Human resource management	Employee training and education, risk-sensitive culture and mindset, cross-functional teams, experienced employees for crisis management
	Inventory management	Use of inventory and safety stocks to buffer disruptions
	Predefined decision plans	Contingency plans, communication protocols
	Redundancy	Production slack, transportation capacities, multiple sourcing, and production locations
	Visibility	Early warning communication, information sharing, real-time and financial monitoring
Reactive strategy	Response, recovery and growth elements	Sub-elements
	Agility	Communication, information sharing, quick supply chain redesign, velocity
	Collaboration	Coordination, cooperation, joint decision making, knowledge sharing, supplier certification, supplier development
	Flexibility	Backup suppliers, easy supplier switching, distribution channels, flexible production systems, volume flexibility, multi-skilled workforces
	Human resource management	Employee training and education, risk-sensitive culture and mindset, cross-functional teams, experienced employees for crisis management
	Redundancy	Production slack, transportation capacities, multiple sourcing, and supplier locations

Table 1: Supply chain resilience strategy: proactive and reactive

Source: Hohenstein et al. (2015, p.105)

Proactive mitigation strategies are developed in order to predict the supply chain risks and eliminate the risk source.⁷⁸ The risks are identified and their impact is assessed within the supply chain according to the probability and importance.⁷⁹ Several proactive strategies can be used to prepare for unforeseen disruptions such as collaboration – by sharing crucial information and establishing joint efforts⁸⁰, or by focusing on human resource management practises that involve cross-functional team development.⁸¹ Craighead et al. (2007)⁸² also noted that having multiple suppliers can help out in situations where short-term disruptions need to be handled. While implementing the proactive type of strategies might appear to be logical, firms should

⁷⁸ Dani (2009, p.58)

⁷⁹ Deep & Dani (2009, p.5)

⁸⁰ Jüttner & Maklan (2011, p.254)

⁸¹ Blackhurst, Dunn & Craighead (2011, p.380)

⁸² Craighead et al. (2007, p.151)

keep in mind that it requires various resources in terms of people and investment, that in the end could get costly.⁸³ On the other hand, the reactive type of strategies focus on hindering the possible negative effects. Since supply chain operates on a day-to-day basis without worrying about risks, managers only tend to react once the disruption occurs.⁸⁴ Some of the examples of strategies that relate to post-disruption phase are: creating flexibility - through flexible production systems or having multi-skilled employees,⁸⁵ agility - focusing on agile processes that allow a quick supply chain redesign.⁸⁶ However Altay et al. (2018)⁸⁷ highlights the importance that different strategies should be applied to different business units since a disruption can have a dissimilar effect. For example, the flexible strategy will help a firm to focus on reactive capabilities such rapidity and recovery, that as well creates a competitive advantage in the marketplace.⁸⁸ Whereas, by focusing on efficiency a firm could put more systematic focus on their functional products.⁸⁹

2.3.2. Other examples of supply chain resilience strategies

Another way to manage disruptions is by looking at the visibility and response time to it, especially when dealing with the Covid-19 impact on the global supply chains.⁹⁰ First of all, the distinction between short and long-term losses needs to be made. In order to mitigate *short-term losses*, firms are advised to identify their tier 1 and lower tier suppliers to avoid the ripple effect.⁹¹ In order to be able to respond fast to disruptions, firms should be able to acquire some sort of alternative products.⁹² By having an alternative plan about where to source from in case that all inventory is in the risk area, allows firms to choose from more sourcing options.⁹³ Secondly, the firm's products and volatile customer demand should be analysed carefully⁹⁴ by communicating with the relevant stakeholders and planning inventory levels.⁹⁵ When dealing with *long-term losses*, firms should understand the vulnerabilities that could affect the supply chain and therefore develop a system that allows to spot the disruption at an early stage.⁹⁶ Sourcing from multiple suppliers increases firm's chances of not being affected by the

⁸³ Deep & Dani (2009, p.5)

⁸⁴ Deep & Dani (2009, p.5)

⁸⁵ Sheffi & Rice (2005, p.46)

⁸⁶ Blackhurst, Dunn & Craighead (2011, p.382)

⁸⁷ Altay et al. (2018, p.1169)

⁸⁸ Zsidisin & Wagner (2010, p.3)

⁸⁹ Fisher (1997, p.110)

⁹⁰ Xu et al. (2020, p.159)

⁹¹ Dolgui, Ivanov & Sokolov (2018, p.423)

⁹² Worstell (2020, p.4)

⁹³ Paul & Chowdhury (2020, p.4)

⁹⁴ McKenzie & Economics (2020, p.13)

⁹⁵ Xu et al. (2020, p.160)

⁹⁶ Xu et al. (2020, p.160)

disruption and provides a backup capacity for supply production.⁹⁷ In the end, the actual estimation and understanding of the disruption will reveal how effective the overall preparation and planning actually was.

On the other hand, Namdar, Sawhney & Pradhan (2018)⁹⁸ investigated various sourcing strategies that could help achieve the supply chain resilience when taking the buyer's warning capability and the type of disruption into account. In total six different strategies were analysed under various disruptions and buyer's risk aversity: single and multiple sourcing, back up supplier contracts, spot purchasing, collaboration, and visibility. Since disruptions differ by its impact, severity and frequency, Kleindorfer & Saad (2005)⁹⁹ suggested two categories of risk: operational and long-term. The former is also called a Low-Impact-High Frequency (LIHF) risk since they do happen often but have no high impact on the business, such as uncertainties in lead times or machine breakdowns.¹⁰⁰ The latter, such as natural hazards and political instability, have severe consequences and are therefore called High-Impact-Low-Frequency (HILF) risks.¹⁰¹ Therefore, by taking into account the type of disruption and the buyer's attitude towards risk, the appropriate strategy can be selected. For example, under HILF disruptions (natural disaster), when a buyer is low or moderate risk averse type, the single sourcing is more appropriate, where one supplier is selected and a resilient strategy is developed respectively.¹⁰² On the other hand, when risk aversion increases, multiple sourcing becomes a better sourcing option. Under LIHF disruption (machine breakdown), multiple sourcing dominates the single sourcing strategy since focus is made on choosing the cheapest suppliers regardless of risk aversion level of the buyer. The idea is to be able to diversify between suppliers that are not expensive and, in this way, to cope with occurring disruptions. The study by Namdar, Sawhney & Pradhan (2018)¹⁰³ helps to choose the appropriate sourcing strategy based on the risk aversion of the buyer and the type of disruption. In the end, there are multiple strategies that can be used in order to achieve a resilient supply chain; however, each firm will need to decide individually which type of strategy is the most appropriate to use based on the sources of risk, the conditions that drive that risk and its interconnectedness within the supply chain.¹⁰⁴ Once the decision is made, the firm can move to the next part of the resiliency implementation within supply chain: finding an appropriate measurement model to understand the resiliency

⁹⁷ Kraude et al. (2018, p.102)

⁹⁸ Namdar, Sawhney & Pradhan (2018, p.2339)

⁹⁹ Kleindorfer & Saad (2005, p.59)

¹⁰⁰ Namdar, Sawhney & Pradhan. (2018, p.2340)

¹⁰¹ Namdar, Sawhney & Pradhan (2018, p.2340)

¹⁰² Namdar, Sawhney & Pradhan (2018, p.2353)

¹⁰³ Namdar, Sawhney & Pradhan (2018, p.2356)

¹⁰⁴ Chopra & Sodhi (2004, p.53)

performance

level.

Following the description of the supply chain resilience theories and strategies, the following sub-question is proposed:

Sub-question 1: What kind of strategies stand out under pandemic related disruptions?

2.4. Supply chain resilience measurement models

The increasing complexity of supply chain operations is leaving firms with huge amount of information that is left unanalysed.¹⁰⁵ In order to extract that information and use it for example in the management against disruptions, various quantitative metrics can be implemented.¹⁰⁶ Therefore, by processing and measuring the quantitative data correctly, can help a firm to build a more resilient supply chain and tackle occurring disruptions. Since different authors have different objectives about which strategies and metrics to use, the ways to quantify resilience naturally varies. Pires Ribeiro & Barbosa-Povoa (2018)¹⁰⁷ have found that only three publications¹⁰⁸ show how to quantify supply chain resilience by creating a supply chain resilience index. For example, Wang & Ip (2009)¹⁰⁹ have developed a single index that provides the available supply over the demand in case of the risk. It analyses the structure and design of the logistic network where a resilient metric is assigned to each network node and afterwards the weighed sum of resilience node is displayed.¹¹⁰ This index was developed to provide a general guidance to the logistic network design for an aircraft service. Soni, Jain, & Kumar (2014)¹¹¹ on the other hand, have provided firms with a single numerical index that allows to assess how effective various mitigation strategies are. The authors proposed ten supply chain resilience enablers based on its importance ranking: agility, collaboration, information sharing, sustainability, risk and revenue sharing, trust, supply chain visibility, risk management culture, adaptive capability and finally supply chain structure.¹¹² The uniqueness of this index is that multiple indexes from different supply chains can be compared to each other to see how similar or dissimilar they are. And finally, the third group of authors, Azevedo, Carvalho, & Cruz-Machado (2016)¹¹³ have developed an index for measuring leanness, agility, resiliency and greenness of firms and its supply chain. The idea is that four vectors - lean, agile, resilient and

¹⁰⁵ Pires Ribeiro & Barbosa-Povoa (2018, p.109)

¹⁰⁶ Bhagwatand & Sharma (2007, p.56)

¹⁰⁷ Pires Ribeiro & Barbosa-Povoa (2018, p.118)

¹⁰⁸ Azevedo, Carvalho, & Cruz-Machado (2016, p.1477); Soni, Jain, & Kumar (2014, p.16); Wang & Ip (2009, p.167)

¹⁰⁹ Wang & Ip (2009, p.172)

¹¹⁰ Pires Ribeiro & Barbosa-Povoa (2018, p.118)

¹¹¹ Soni, Jain, & Kumar (2014, p.11)

¹¹² Soni, Jain, & Kumar (2014, p.16)

¹¹³ Azevedo, Carvalho, & Cruz-Machado (2016, p.1478)

green - can be used by firms as a benchmarking tool in order to measure its LARG behaviour and have the ability to compare it to their supply chain partners (Figure 2).¹¹⁴

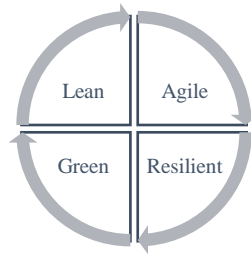


Figure 2: LARG Index constructs

Source: Azevedo, Carvalho & Cruz-Machado (2016, p.1474)

The **lean** principles and practices relate to the supply chain activities that mainly focuses on waste reduction. Lean principles such as quality management or supplier/customer relationship can help firms to achieve sustainable benefits,¹¹⁵ reduce the negative effects of environmental impacts¹¹⁶ and help to acquire new business opportunities.¹¹⁷ In the end, the implementation of lean processes, allow firms to utilise its assets more productively. Being **agile** means having capabilities to respond rapidly and effectively to various disruptions. Since customer demands are constantly changing, it gets difficult for firms to deliver the right product at the right quantity.¹¹⁸ Therefore, by developing responsive and flexible supply chain processes such as speed customer service¹¹⁹ or use IT systems for manufacturing coordination,¹²⁰ firms can react quickly to changing market needs. **Resilient** practises allow firms to respond and recover faster from unexpected disturbances. Therefore, it is important that firms are able to take advantage of occurring opportunities and at the same time focus on new future possibilities.¹²¹ There are multiple resilient practises that firms can apply: flexible sourcing or flexible transportation,¹²² lead time reduction¹²³ or focusing on creating a supply chain visibility.¹²⁴ The **green** management contributes to the efficient use of resources: water, energy and raw materials, while minimising the cost.¹²⁵ In order to achieve complete sustainability, environmental policies should be integrated within the firm as well, such as: collaboration with suppliers while

¹¹⁴ Pires Ribeiro & Barbosa-Povoa (2018, p.1472)

¹¹⁵ Fliedner (2008, p.3324)

¹¹⁶ Carvalho, Azevedo & Cruz-Machado (2010, p.306)

¹¹⁷ Kaebernick, Kara & Sun (2003, p.465)

¹¹⁸ Azevedo, Carvalho & Cruz-Machado (2016, p.1475)

¹¹⁹ Swafford, Ghosh & Murthy (2008, p.295)

¹²⁰ Lin, Chiu & Chu (2006, p.288)

¹²¹ Azevedo, Carvalho & Cruz-Machado (2016, p.1475)

¹²² Tang (2006b, p.39)

¹²³ Christopher and Peck (2004, p.20)

¹²⁴ Iakovou, Vlachos & Xanthopoulos (2007, p.12)

¹²⁵ Walker, Redmond & Giles (2010, p.41)

taking environmental issues into account,¹²⁶ focusing on using the recycling materials for products and for the packaging as well¹²⁷ or acquiring the ISO 14001 environmental certification.¹²⁸

When referring to the actual process of acquiring the index, the individual behaviour of a firm can be analysed by combining the calculated scores from the sub-indicators (Figure 3): lean practises (P_{L1} to P_{LY}), agile practises (P_{A1} to P_{AY}), resilient practises (P_{R1} to P_{RY}), green practises (P_{G1} to P_{GY}).

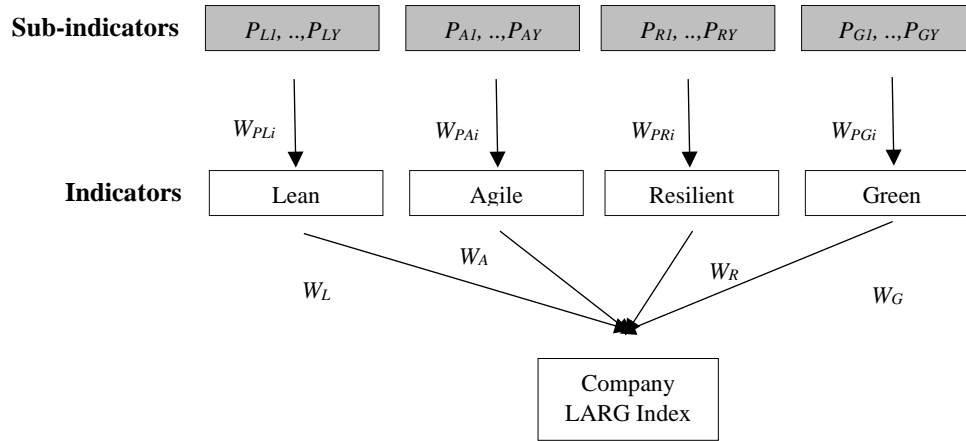


Figure 3: Relationships that represent the LARG behaviour assessment of a firm

Source: Azevedo, Carvalho & Cruz-Machado (2016, p.1478)

Each paradigm and its sub-indicator are assessed using a five-point Likert scale where 1 represents “practise not implemented” and 5 “practise totally implemented”.¹²⁹ The calculation can be used to assess the level of LARG Index at any firm, where the indicators and its sub-indicators will be aggregated accordingly to its importance. For each firm j a generic formula can be used: j represents the behaviour of a firm according to the paradigm x , (P_{xy}) represents the implementation level for a firm j of practise i of paradigm x ; a total of y (see Appendix A) practises are considered for each paradigm. Therefore, the firm’s behaviour is calculated according to the function of each practise implementation level (P_{xy}) and its weight (w_{xy}):

$$(B_x)_j = f [w_{x1} \times (P_{x1})_j, \dots, w_{x,y-1} \times (P_{x,y-1})_j, w_{xy} \times (P_{xy})_j]$$

$$\text{Being } w_{xi} \geq 0 \text{ and } \sum_j w_{xi} = 1$$

Equation (1) Firm’s behaviour according to the implementation of the paradigms

Source: Azevedo, Carvalho & Cruz-Machado (2016, p.1478)

¹²⁶ Holt & Ghobadian (2009, p.643)

¹²⁷ Paulraj (2009, p.458)

¹²⁸ Gonzalez, Sarkis & Adenso-Diaz (2008, p.1029)

¹²⁹ Azevedo, Carvalho & Cruz-Machado (2016, p.1478)

As mentioned before, each practise is assessed using a five-point Likert scale, whereas the weight w_{xy} values are reflected differently. Here the values range between 0 and 1, meaning that the range is between “not important” and “extremely important”. The equation (2) reflects the firm’s behaviour that consists of the implementation level of each paradigm/practise and its weight accordingly. Therefore, the firm’s behaviour B_x when taking each paradigm into account ranges between 1 (none of the paradigm practises are implemented) to 5 (where all of the paradigm practises are implemented) and the equation showing a firm’s j LARG Index is:

$$\text{LARG}_j = f [w_L x (B_L)_j, w_A x (B_A)_j, w_R x (B_R)_j, w_G x (B_G)_j]$$

$$\text{Being } w_L, w_A, w_R, w_G \geq 0 \text{ and } w_L, w_A, w_R, w_G = 1$$

Equation (2) LARG paradigm calculation

Source: Azevedo, Carvalho & Cruz-Machado (2016, p.1479)

The weights are calculated using the equation (3) and can be explained as: w_x represents the weighting of the paradigm x ; M_x represents the mean rating of the particular paradigm x ; and represents the summation of mean rating for each paradigm.

$$w_x = \frac{M_x}{\sum_{g=1}^n M_g}$$

Equation (3) Weight’s calculation

Source: Azevedo, Carvalho & Cruz-Machado (2016, p.1481)

With the help of LARG Index, the firms will be able to adjust their organisational behaviour by responding rapidly to unpredicted changes, coping with disturbances and maximising customer needs, as well as improving its environmental footprint.¹³⁰ The index itself, will reveal what areas within the supply chain should be improved and what kind of strategies could be used in order to make the supply chain more resilient. However, in the end, each firm will be deciding upon the measurement model individually based on how the resilience is defined within the firm.

3. Case background: food industry and the case company

3.1. Traditional vs meal-kit food supply chain and its risks

The traditional food supply chain can be simply explained as getting the final product to the end consumer. The food supply chain consists of different parties that range from farmers,

¹³⁰ Azevedo, Carvalho, & Cruz-Machado (2016, p.1490)

suppliers, transportation, wholesalers, retailers, to consumers.¹³¹ Since it involves different processes and activities at the same time, the complexity of getting the final product to the customer increases. The difficulties can result from intensive labour, the technology to keep the food cold while transporting or external barriers such as legal difficulties when importing the goods.¹³² Whereas, meal-kit supply chains represent a different understanding of how the food is supplied. Meals are delivered in boxes containing all the ingredients that are packed according to the quantity that is needed for preparing a meal.¹³³ Such a shift in food supply represents the changes to the meal itself since it is pre-portioned and packed, as well as it is being delivered to the household rather than consumers needing to travel to the store themselves.¹³⁴ Therefore, the main difference between the two supply chains is that the meal-kit supply chain is shorter (Figure 4).

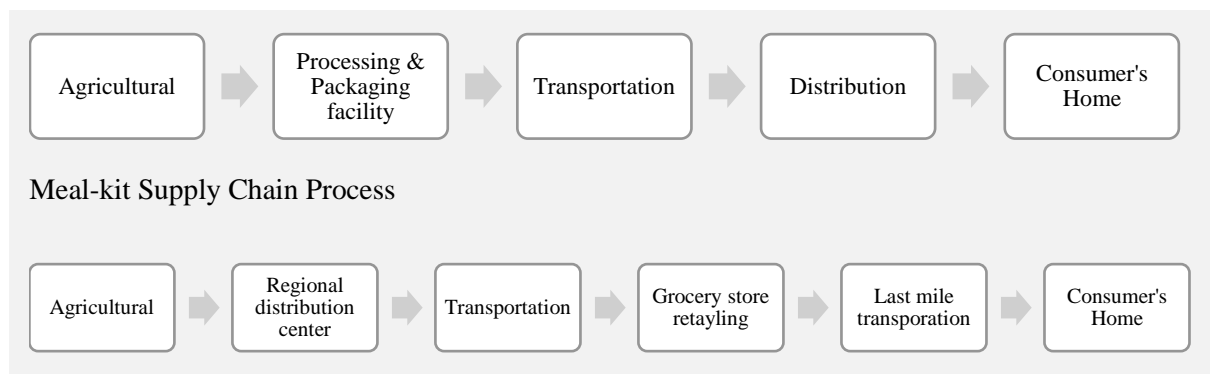


Figure 4: Comparison between traditional and meal-kit supply chain processes

Source: Heard et al. (2019, p.191)

Since food supply chains are complex systems and the dependence on suppliers is constantly growing, the focal firm is becoming more vulnerable to unpredicted events and risks.¹³⁵ The risk is generally linked to an unwanted loss regardless of its area of analysis.¹³⁶ More precisely, the supply risk is associated with the individual supplier failures, that results of the buying firm not being able to meet its customer needs.¹³⁷ Supply risks can be identified in accordance with how the firm is being affected and the way the risks are categorized. The risks that affect companies can either be of direct or indirect nature.¹³⁸ Direct risks can be referred to as risky events affecting the firm directly, and indirect risks are the ones that cannot be traced right away

¹³¹ Folinas et al. (2013, p.419)

¹³² Bloemhof et al. (2015, p.103)

¹³³ Heard et al. (2019, p.190)

¹³⁴ Miller and Keoleian (2015, p.3070)

¹³⁵ Hallikas & Lintukangas (2016, p.488)

¹³⁶ Tummala and Schoenherr (2011, p.474)

¹³⁷ Zsidisin (2003, p.220)

¹³⁸ Pellegrino, Costantino & Tauro (2020, p.4)

- such as stock return or sales.¹³⁹ On the other hand, Tang & Tomlin (2008),¹⁴⁰ classify supply chain risks into two categories, that are of operational or disruption nature. Operational risks can relate to the uncertainties with the demand¹⁴¹ whereas disruption risks relate more to natural disasters and economic crises.¹⁴² Since the parties within the supply chain are connected, if one party is affected by a disruption, the whole network can experience the imbalance.¹⁴³ Sometimes, unexpected disruptions, such as earthquakes, tsunamis or wars, can make it difficult for parties within in the supply chain predict the needed supply and demand.¹⁴⁴ Usually, that kind of disruptions are limited to certain geographic areas, but a disruption such as Covid-19 pandemic, has spread and affected many economic sectors throughout the planet, that led to lockdowns and multiple restrictions.¹⁴⁵ Some businesses were short on labour or raw materials that led to a temporary shutdown, whereas other business received more attention and benefitted from the current pandemic situation. This disruption has changed consumer behaviour as well, where the trend to do online grocery shopping increased, that also created difficulties in resource and raw material planning.¹⁴⁶ The online shopping trend also included the increase in meal-kit delivery services,¹⁴⁷ that allowed customers a contactless meal delivery to their home. However, prior to Covid-19 period, the online grocery shopping was met with resistance and a lack of trust from the customer.¹⁴⁸ Therefore, for the moment it is difficult to predict whether this trend will continue in the future.

3.2. Seizing an opportunity while managing consequences from the disruption

The unfortunate effects of the Covid-19 pandemic were difficult to predict. Since the normality shifted to the painful disruption, some firms failed and many struggled to survive, whereas some of the businesses managed to continue operating successfully. Therefore, by analysing how a firm reacts to pandemic and use the practical knowledge that is needed to seize unique opportunities, could help businesses in the future.¹⁴⁹ This pandemic has showed firms and researchers that the innovative way of looking at occurring problems is needed. Ketchen & Craighead (2020)¹⁵⁰ have analysed an example that related to closed restaurants and entrepreneurial thinking. Since restaurants were unable to offer in-house dining, many of them

¹³⁹ Dolgui, Ivanov & Sokolov (2018, p.414)

¹⁴⁰ Tang & Tomlin (2008, p.14)

¹⁴¹ Tang (2006a, p.453)

¹⁴² Tang (2006a, p.455)

¹⁴³ Nasution et al. (2020, p.4)

¹⁴⁴ Gholami-Zanjani et al. (2021, p.1)

¹⁴⁵ Xu et al. (2020, p.153)

¹⁴⁶ Kumar & Nigmatullin (2011, p.2155).

¹⁴⁷ Hobbs (2020, p.174)

¹⁴⁸ Gsken, Janssen, & Hees (2019, p.12)

¹⁴⁹ Ketchen & Craighead (2020, p.1331)

¹⁵⁰ Ketchen & Craighead (2020, p.1331)

were pushed to seeking new opportunities and needed to adjust their business models. Restaurants started to offer in-house deliveries, that included the cooking-kits as well, which allowed them to adapt the product offering under pandemic situations.¹⁵¹ According to Shane & Nicolaou (2015),¹⁵² creative personalities will be more likely to contribute to developing and pursuing new business opportunities, therefore this type of view needs to be encouraged within the firm. Boukamcha (2019)¹⁵³ conducted a study that revealed that the combination of entrepreneurship and strategic management capabilities can help firms to maintain efficient business and achieve a competitive advantage. Both capabilities can be also referred to as dynamic capabilities, that influence each other by helping firms to address the rapid changes in the environment, become more innovative and adapt a risk-taking approach.¹⁵⁴ In order to achieve it all, the entrepreneurial type of style and thinking can be developed within the firm. According to Lumpkin & Dess (1996)¹⁵⁵ there are five dimensions that enhance the entrepreneurial orientation: (1) autonomy, (2) innovativeness, (3) risk-taking, (4) proactiveness and (5) competitive aggressiveness. Autonomy (1) refers to the freedom that an individual has, in order to develop an idea and carry it until it is completed.¹⁵⁶ When pursuing autonomy within the firm, the management could focus on developing values such as: open communication channels and interpersonal ties, diffusion of power and accountability.¹⁵⁷ The next dimension innovativeness (2) can be explained by firm's view on developing new ideas, being open to experimentation and the level of creativity.¹⁵⁸ Craighead, Ketchen & Darby (2020)¹⁵⁹ pointed out that during a pandemic such as Covid-19, autonomy and innovativeness dimensions would come in very useful given the uncertain problems that are in the market. The risk-taking dimension (3) within the firm context, can be explained as the tendency to take bold actions.¹⁶⁰ For example, when releasing a new product, firms are advised to promote the internal experimentation in order to be prepared to deal with risky conditions or even failure in unsure environment context.¹⁶¹ Even if risk-taking during the pandemic might not be that wise, it is important to communicate and share the new business ideas with suppliers or even customers to ensure that all parties are on board. Proactiveness dimension (4) can be explained as a forward-looking perspective, where an individual or a firm anticipates and acts on future

¹⁵¹ Ketchen & Craighead (2020, p.1331)

¹⁵² Shane & Nicolaou (2015, p.412)

¹⁵³ Boukamcha (2019, p.299)

¹⁵⁴ Ziyae & Sadeghi (2020, p.2)

¹⁵⁵ Lumpkin & Dess (1996, p.140)

¹⁵⁶ Lumpkin & Dess (1996, p.140)

¹⁵⁷ Akgün & Keskin (2014, p.6930)

¹⁵⁸ Lumpkin & Dess (1996, p.142)

¹⁵⁹ Craighead, Ketchen & Darby (2020, p.852)

¹⁶⁰ Ketchen & Craighead (2020, p.1336)

¹⁶¹ Cowling & Lee (2017, p.186)

opportunities or changes.¹⁶² According to Ziyae & Sadeghi (2020),¹⁶³ having a flexible management within the firm while being able to alter different situations is seen as one of the dimensions of proactiveness. The last dimension is called competitive aggressiveness (5), that explains how firms react to its competition based on market trends and demands.¹⁶⁴ Here firms might not always use traditional tactics of competing but rather more aggressive and unconventional ones. After responding to pandemic in innovative ways and successfully encountering the problems, firms could in the end see that entrepreneurial and strategically focused alternative solutions is the way to survive and stay in the business. This kind of approach once again leads to firms focusing and adopting a more resilient business approach.

Following the literature above, where the food supply chain industry, the measurement tool for resilience and ability to seize new opportunities during disruption time is described, the below proposed sub-questions will allow to research and deepen an understanding of the phenomenon:

Sub-question 2: Which of the LARG paradigms describe a resilient supply chain that also includes the seizing of new opportunities within the market?

Sub-question 3: Which of the LARG paradigms are relevant for the food supply chain industry?

3.3. Situation of the case company

In this study, the international meal-kit company will be used as a case firm to research new insights within the supply chain resilience field. The idea of the meal-kit business is that each subscriber receives a pre-portioned meal with ingredients that includes the cooking instructions, allowing consumers the in-house delivery and still providing the feeling of the dining-out. The company itself is operating within different markets around the world and focuses on a direct-to-consumer business that allows the delivery of fresh perishable products. By doing that, the company is able to save a few steps across the supply chain stages, meaning that consumer products can be directly transported from farmers to the company's warehouses around the world (Figure 5).



Figure 5: Case firm's supply chain

¹⁶² Lumpkin & Dess (1996, p.146)

¹⁶³ Ziyae & Sadeghi (2020, p.5)

¹⁶⁴ Kang et al. (2016, p.633)

During the Covid-19 pandemic, the trend towards eating more meals at home accelerated, needing the case firm to adjust their business processes in order to keep up with the increasing number of subscribers. Since the meal-kit company is basing their order quantities on actual customer demand, the supply chain processes are required to be very efficient when planning demand and supply to be able to avoid food waste. Therefore, it is relevant to analyse how the case firm managed to sustain its business during Covid-19 increased challenges and risks, and whether the efficient management of supply chain processes lies within the resilient supply chain.

4. Methodology

4.1. Part I: Delphi method

4.1.1. The new entrepreneurial addition to LARG(E) Index

As mentioned in the previous section 2.4, there are multiple measurement tools or indexes that can be used to identify the resilience level of a firm. However, firms must consider the increasing pressure from communities to develop sustainable business practises that not only focus on financial matters but also consider environmental regulations and social concerns.¹⁶⁵ Therefore in this study, the LARG Index developed by Azevedo, Carvalho & Cruz-Machado (2016)¹⁶⁶ will be used as a resilience measurement tool that meets before mentioned criteria. In order to understand how new opportunities could be achieved and what practises need to be pursuit within the firm, the new addition to the LARG Index was created – the entrepreneurial orientation. The new paradigm is based on the five dimensions proposed by Lumpkin & Dess (1996), that relate to the firm's or individual's approach to autonomy, innovativeness, risk taking, proactiveness and competitive aggressiveness (chapter 3.2).¹⁶⁷ These behavioural characteristics allow to understand in more detail what factors influence the innovative and opportunity driven behaviour, and to what extent these dimensions need to be implemented within the firm. Therefore, the following sub-indicators are developed in order to explain the new entrepreneurial paradigm addition to the LARG(E) index:

1. Freedom to develop an idea to completion (PE1)
2. The propensity to experiment (PE2)
3. Information sharing between individuals and partners (PE3)
4. The inclination to take bold actions (PE4)
5. The tendency to participate and act on future opportunities (PE5)

¹⁶⁵ Rao & Holt (2005, p.903)

¹⁶⁶ Azevedo, Carvalho & Cruz-Machado (2016, p.1473)

¹⁶⁷ Lumpkin & Dess (1996, p.140)

6. Providing training and education within the firm (PE6)

7. Firm's willingness to dominate rivals in the market (PE7)

By combining all of the LARG(E) paradigms – lean, agile, resilient, green and entrepreneurial - into one index, a firm is able to assess its capabilities within five different categories. Each paradigm has a set of seven explanatory sub-indicators. The LARG sub-indicators are taken from the previous study and for the new entrepreneurial paradigm, the above proposed sub-indicators are used (see Appendix A).¹⁶⁸ After the new addition to the LARG(E) Index, the explained equations in chapter 2.4 are expanded as well by adding the entrepreneurial (BE) paradigm, its sub-indicators and weights accordingly. Thus, the new equation for calculating a LARG(E) Index is proposed, where lean practises (P_{L1} to P_{L7}), agile practises (P_{A1} to P_{A7}), resilient practises (P_{R1} to P_{R7}), green practises (P_{G1} to P_{G7}) and entrepreneurial practises (P_{E1} to P_{E7}) are combined:

$$\text{LARG(E)}_j = f [w_L \times (B_L)_j, w_A \times (B_A)_j, w_R \times (B_R)_j, w_G \times (B_G)_j, w_E \times (B_E)_j]$$

$$\text{Being } w_L, w_A, w_R, w_G, w_E \geq 0 \text{ and } w_L, w_A, w_R, w_G, w_E = 1$$

Equation (4) LARG(E) paradigm calculation

The assessment of the paradigms and its sub-indicators is based on the five-point Likert scale and will be implemented while using a Delphi method, where 1 represents “practise not implemented” and 5 “practise totally implemented”.¹⁶⁹ As mentioned within the theory part (section 2.4), the weight values have a range between 0 and 1, meaning that practises are considered between “not important” and “extremely important”. Since quantitative data produces objective data, the results will be communicated through statistics and numbers in the sections below.

4.1.2. Delphi method in detail

The paradigms and its sub-indicators from previous LARG Index study¹⁷⁰ reflect the supply chain management practises that could be directly applied to the food supply chain industry as well. Whereas, the new assessment of the weights as well as the new entrepreneurial paradigm needed to be developed in order to be able to apply it to the food supply chain industry, since LARG Index was previously applied and tested within the automotive industry.¹⁷¹ Therefore, a Delphi method was chosen in order to assess the new weights. This method is particularly

¹⁶⁸ Azevedo, Carvalho & Cruz-Machado (2016, p.1473)

¹⁶⁹ Azevedo, Carvalho & Cruz-Machado (2016, p.1478)

¹⁷⁰ Azevedo, Carvalho & Cruz-Machado (2016, p.1478)

¹⁷¹ Azevedo, Carvalho & Cruz-Machado (2016, p.1482)

helpful when the unbiased information from professionals and academics is needed.¹⁷² The Delphi method is usually used to determine various supply chain contexts, such as in this study – finding the paradigms that relate to seizing opportunity and food supply chain during a disruption. According to Linstone & Turoff (1975)¹⁷³ there are three steps needed to successfully prepare for a Delphi method: (1) define experts and their selection; (2) select the number of rounds; and (3) decide upon the design of the questionnaire for each round. Rowe & Wright (1999)¹⁷⁴ suggested that there should be between two to seven rounds of questionnaire and the participant number should vary between three and fifteen. In general, a Delphi method is particularly beneficial for this type of research since the assured anonymity reduces the chances of dominant participants influencing the results in any way.¹⁷⁵ Additionally, having the responses weighted equally, allows to form an unbiased overview of the group's opinion.¹⁷⁶

In order to assess the weights for all five paradigms and its sub-indicators, the experts were selected according to their in-depth knowledge, experience, and interest within the food supply chain industry. The panel of so-called experts is made up of academics and professionals, where in total six participants were invited to take a part in the study. In this study, the experts have a general understanding of the topic or have experience within the food supply industry as well as the interest in the results of the research, that encourages thoughtful responses. Based on these criteria, the invited experts for this study can be seen as qualified. The equal division between the experts in terms of their area of operation (being a professor – three participants, or working at the company - three participants) offers a good basis for the analysis and understanding about why specific LARG(E) paradigms were ranked as important or not. The area of expertise varies from broadly described supply management to detailed functions such as entrepreneurship, procurement, or lean management. Three of the experts have conducted studies within the food supply industry, where fields such as strategy, logistics or operations management was researched. In the Table 2, the summary of the participant's profile during a Delphi method can be seen.

¹⁷² Chan et al. (2001, p.709)

¹⁷³ Linstone & Turoff (1975, p.76)

¹⁷⁴ Rowe & Wright (1999, p.355)

¹⁷⁵ Linstone & Turoff (1975, p.22)

¹⁷⁶ Linstone & Turoff (1975, p.9)

<i>Faculty/Department</i>	<i>Areas of expertise</i>	<i>Research within the FSC</i>	<i>What kind of field?</i>
<i>Behavioural, Management and Social sciences (BMS)</i>	Supply management	No	
<i>Technology Management & Supply chain management</i>	Entrepreneurship	No	
<i>Supply chain management</i>	Procurement, planning	Yes	Strategy, logistics and supply chain management
<i>Supply chain management</i>	Production, purchase, and sales	No	
<i>Continuous improvement</i>	Lean management	Yes	Strategy, operations management, logistics and supply chain management
<i>Behavioural, Management and Social sciences (BMS)</i>	Purchasing and supply management	Yes	Strategy, supply chain management

Table 2: Participant's profile during a Delphi method

The data collection was conducted by sending out an online questionnaire (see Appendix B) via E-mail that took place between February and March 2021. The participants were informed right away that there will be a total of three rounds of the Delphi questionnaire. Multiple number of rounds allows participants to re-evaluate their original answers based on the group response, which then provides an opportunity to change or question the answer that was provided before.¹⁷⁷ The first round consisted of academics and professionals giving their perception about the importance of LARG(E) paradigms within the food supply chain industry. In total six responses were collected. In the second round the same participants received the questionnaire once more that additionally included the average results collected from the first round and were asked to consider whether any changes should be made to their original choice. Afterwards, the questionnaire was sent one more time to collect the final data that included the average results from the second round as well. All of the mean ratings were calculated afterwards using the SPSS program, the weights were computed while using the equation (3) and the ranking for each paradigm was assigned accordingly (see Appendix A). In the end, all six participants

¹⁷⁷ Linstone & Turoff (1975, p.4)

completed fully the three rounds of questionnaire, therefore none of the data needed to be removed.

To calculate the consistency of the six experts' responses, the Kendall's Coefficient of Concordance was applied. The coefficient can be described as a statistical test that measures the agreement or disagreement between the two or more variables, or in other words the consistency of one or more sets of rankings.¹⁷⁸ Kendall's Coefficient of Concordance varies between values 0 and 1. The lower score means that there is no agreement between ranked values and a higher score indicates the complete agreement of the ranking. The SPSS program was used to compute the Kendall's Coefficient of Concordance score for each set of responses collected from the experts that related to the five LARG(E) paradigms. Table 3 summarises the collected data after the three rounds of questionnaire and shows the differences accordingly.

<i>Variables</i>	<i>First round</i>			<i>Second round</i>			<i>Third round</i>		
	Mean Rating	Rank	Weighting	Mean Rating	Rank	Weighting	Mean Rating	Rank	Weighting
<i>Lean</i>	3,8	1	0,21	3,5	4	0,18	4,1	1	0,21
<i>Agile</i>	3,5	2	0,19	3,6	3	0,19	3,6	3	0,19
<i>Resilient</i>	3,8	1	0,21	4,5	1	0,23	3,6	3	0,19
<i>Green</i>	3,3	3	0,18	4	2	0,20	3,8	2	0,20
<i>Entrepreneurial</i>	3,8	1	0,21	3,6	3	0,19	3,6	3	0,19
<i>Number of participants</i>	6			6			6		
<i>Kendall's Coefficient of Concordance (W)</i>	0,090			0,341			0,083		

Table 3: Delphi results of all three rounds for the paradigms importance

Kendall's Coefficient of Concordance shows the highest increase between the ratings after the second round, meaning that the experts achieved a significant amount of agreement between each other. The sudden decrease in the third round could be interpreted in a way that the experts changed their mind about the rating and couldn't provide a mutual agreement between the group members. The reasons for that could relate to multiple influencers such as diverse background of the experts, or simply too little number of interviewees. Therefore, for the final calculation of the LARG(E) Index score, the summarised weights and ranking will be taken from the second round. In general, the data from the second round provides the most information about the consistent group's opinion: the resilience paradigm is rated as the most important supply chain paradigm, following the green, agile and entrepreneurial, and lastly the lean paradigm. The

¹⁷⁸ Israel (2009, p.146)

ranking of the paradigms based on their importance is clear and only two of the paradigms – agile and entrepreneurial, share the same ranking. Whereas the first and the third round cannot provide clear rankings and thus, show more disagreement between the experts.

4.2. Part II: Assessment of the case firm based on the LARG(E) Index

4.2.1. Questionnaire application at the case firm

According to Yin (2002)¹⁷⁹ the case study research should be based on multiple sources of evidence to be able to benefit from prior theoretical propositions that will guide the data collection. Therefore, multiple ways for data collection have been chosen: a previously described Delphi method, a semi-structured questionnaire that is based on the prior research and the new supply chain resilience theory. During the second part of data collection, the questionnaire is shared within an international meal-kit company in order to gain a deeper understanding about how the case firm managed its supply chain processes during the Covid-19 disruptions. First of all, an online meeting was scheduled with the four Heads of Procurement, who represent different markets. Since the research topic relates to the supply chain activities and resilience, the Heads of Procurement were a good point of contact to get more insight about the company and its markets. During the meeting the decision was made to share the questionnaire with the employees that work within purchasing departments at two international markets - Benelux and Germany (Austria, Switzerland), thus allowing to perform a comparison analysis of the supply chain processes. Secondly, the Heads of Procurement filled out the questionnaire themselves and shared it with the colleagues working within the two markets. In total seven responses were collected within the period between May and June 2021, and the summary of the descriptive results can be seen in Table 4.

<i>Operating market</i>		<i>Benelux</i>	<i>Germany</i>	<i>Total</i>
<i>Number of participants</i>	7	5	2	7
<i>Product categories where participants operate</i>	Dairy food	3	1	4
	Dry goods	4	1	5
	Protein	3	2	5
	Spices	4	1	1
	Processed food	4	2	6
	Produced goods	2	1	3
	Baked goods	4	2	6
	Other - packaging material	0	1	1

Table 4: Participant's profile and short comparison between Benelux and German market

¹⁷⁹ Yin (2002, p.96)

The questionnaire itself included the expert identification (job title, job responsibilities, country of operation, product category), five LARG(E) paradigms and its explanatory sub-indicators, and lastly open questions that related to Covid-19 impact on the supply chain activities within the company. The participants were asked to rate the level of implementation of LARG(E) paradigms within the company, where a choice was given between 1 (meaning none of paradigms are implemented within supply chain practices) and 5 (all of the paradigms are implemented within the company).¹⁸⁰

The participants either worked within the Benelux market – five responses, or within the German market – two responses. Their job responsibilities/job title varied from being employed as director of procurement, international procurement manager to team lead procurement operation or supply chain manager. Different hierarchical levels within the firm, allowed to see varying opinions between the importance of supply chain practises or when the implementation level of the LARG(E) paradigm was asked. When analysing the product categories, processed food and baked goods stood out as the ones that relate the most to day-to-day activities. Based on the collected data, the final LARG(E) Index score for the case company can now be calculated using the weights (from the second questionnaire round of the Delphi method) and gathered information from the questionnaire by applying the equation (4). The LARG(E) Index score will be further explained within the results section below.

4.2.2. Reliability and validity

The reliability of the research has been ensured through a precise description of the research method, that enables other researchers to replicate this study method and its results. Furthermore, the research design involves a Delphi method and a case study that allows for subjective statements based on a collective basis, where a peer pressure to conform is reduced. Additionally, the validity of the research is ensured by adapting previously used Delphi method and the interview protocol for the questionnaire from the study by Azevedo, Carvalho & Cruz-Machado (2016).¹⁸¹ This study is based on the systematic literature review, previously mentioned Delphi method and a semi-structured questionnaire that ensures a good quality and accuracy of the research.

¹⁸⁰ Azevedo, Carvalho & Cruz-Machado (2016, p. 1479)

¹⁸¹ Azevedo, Carvalho & Cruz-Machado (2016, p. 1479)

5. Results

5.1. Quantitative results - LARG(E) paradigms and its sub-indicators overview

Within the results section, the quantitative outcome of the second method – questionnaire application within the case firm – will be presented and analysed in order to show the similarities and dissimilarities between the two analysed markets, where LARG(E) paradigms and its sub-indicators are represented in more detail.

The five LARG(E) paradigms were asked to be ranked according to its implementation level within the case firm. The analysis showed that the paradigms with the highest implementation levels – entrepreneurial, green, and agile – did not differ between the two markets and thus it was confirmed that the focus of the firm lies within the same implemented practises (Figure 6).

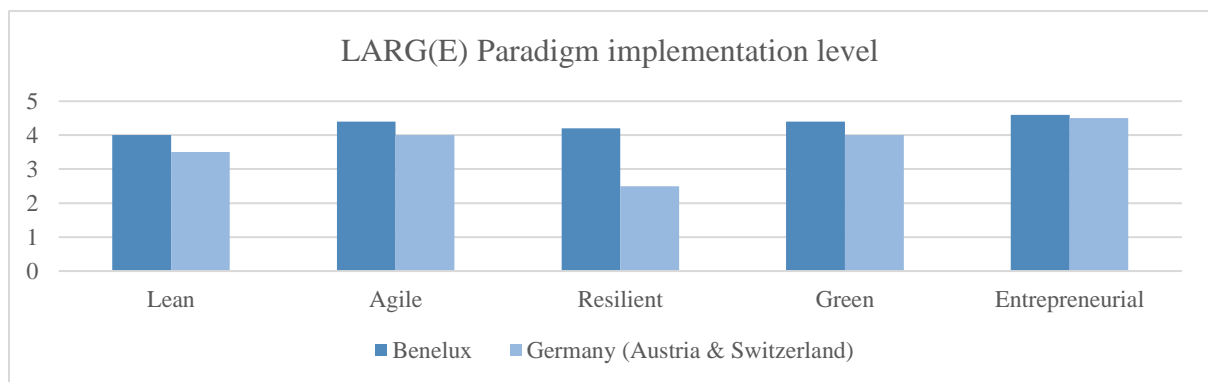


Figure 6: LARG(E) Paradigm implementation level – comparison between the markets

The participants also noted that its flat organisation concept allows them to be open for a change and at the same time focus on promoting green and entrepreneurial mindset inside the organisation. The company also highlights the fact that they are very JIT focused, meaning that quick-decision and risk-taking approach is implemented. Within the Benelux market, the supply chain practises also have a focus on green and sustainable ways of working. However, in order to achieve the highest implementation level, the offer of more CO₂ neutral production and transportation of local products could be increased. On the other hand, the German market is focusing more on increasing the customer value by reducing the delivery time instead of focusing on expanding their market. Both markets also show a high agility implementation level. Meaning that, the company managed to adapt quickly from Covid-19 incurred disturbances and worked very fast in terms of changing and replanning their supply chain processes that allowed to enter new markets and add new acquisitions. From one side, expanding the market is a huge advantage, from the other side – to keep up with increasing volume and at the same time provide the best quality products – is a challenge. Therefore, as a consequence the firm's product quality has decreased. In order to change that, the firm is

focusing is on acquiring the best quality products and keeping their customers satisfied as before Covid-19 pandemic.

5.1.1. Lean – sub-indicators

The lean behaviour represents the firm’s practises implemented in a way that it maximises the customer’s value while at the same time minimising the waste. The Figure 7 summarises the results of the lean paradigm and shows the comparison between the two analysed markets.

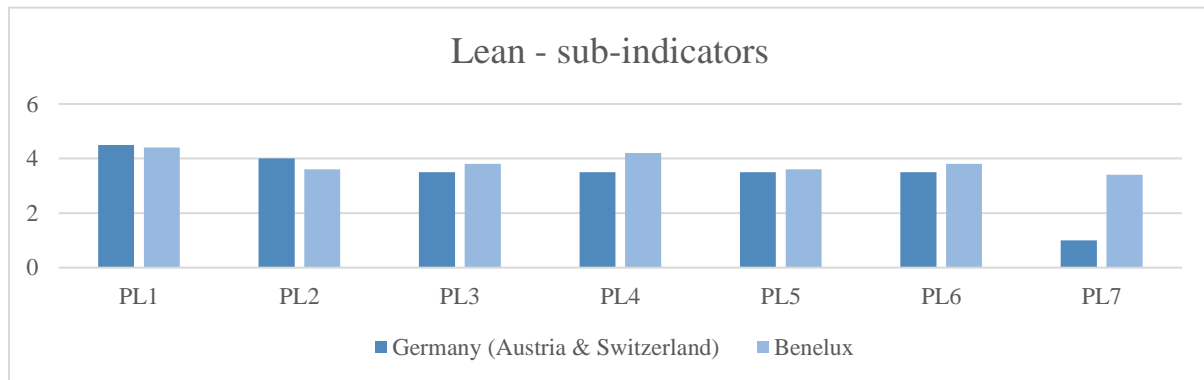


Figure 7: Lean sub-indicators implementation level – comparison between the markets

The first lean sub-indicator PL1 refers to JIT (Just-in-time) production – where the first-tier supplier delivers products as frequently as required to the focal company. Both markets outline this sub-indicator as the one that has the highest implementation level within the firm. Since the specific order volume is dictated by firm’s customer demand, JIT practises allows the firm to have the products delivered daily, especially when working with perishable products that do not have long shelf-life. When analysing the German market, the PL2 lean sub-indicator that focuses on long-term supplier relationship is ranked as the second highest. By focusing on building an actual partnership with a supplier, a case firm can achieve a flexible supply base. Suppliers are involved when any issues arise, or any customer-related decisions are being made, since their know-how product expertise is highly valued within the firm. On the other hand, the Benelux market ranked the PL4 lean sub-indicator (pull flow) as its second highest. To minimize waste and balance customer value, the firm is placing orders on actual customer demand rather than the forecast, that allows daily product deliveries. The last lean sub-indicator, PL7 (focal company – first-tier customer), achieved the lowest implementation level within both markets. The sub-indicator relates to JIT practise but from the customer perspective – meaning that customers receive frequent shipments in JIT delivery set up. Since customers do dictate the actual product demand, the balance between fresh and fast delivery of products is needed. Even if this sub-indicator scores the lowest for both markets, the firm is still placing its focus on short delivery times while at the same time trying to minimize the waste of products.

5.1.2. Agile – sub-indicators

The agile paradigm explains the firm’s ability to react quickly and prepare a response to unplanned disruptions. After the analysis the two sub-indicators PA2 and PA7 were rated as the most implemented practises within both markets, PA5 scored the lowest implementation level within Benelux market and PA6 within the German market (Figure 8).

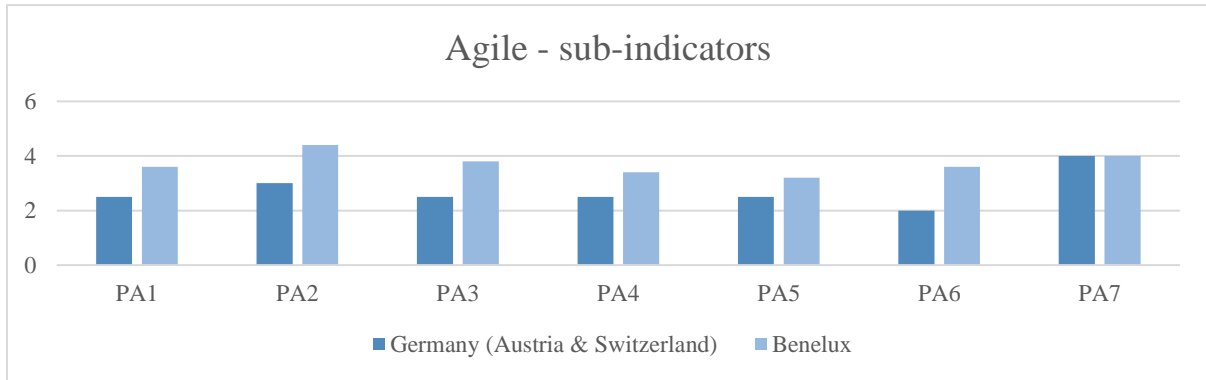


Figure 8: Agile sub-indicators implementation level – comparison between the markets

The first agile sub-indicator PA2, refers to the ability of changing the delivery time of suppliers’ order. During Covid-19, the uncertainty of product capacity and delivery increased immensely, requiring suppliers and the focal firm to be more flexible. Without such flexibility, the firm would not be able to deliver their customers promised products and suppliers might run out of business when not being able to adapt to firm’s changing delivery conditions. Another agile sub-indicator PA7, refers to improving customer service in a way that issues are resolved faster. Here both markets are trying to integrate IT systems in order to speed up and create processes that reduce manual work, however not everything can be automatised. The lowest implementation level at the Benelux market relates to the PA5 agile sub-indicator, where centralised and collaborative planning between the departments is missing. Since each Benelux country has its own local exceptions or considerations, the centralisation of the overall market is very difficult to achieve. The same issue arises within the German market, where PA6 (increase frequencies of new product introductions) agile sub-indicator has the lowest implementation level. For the moment, the firm is not able to achieve frequent new product introductions since no system that would allow it is implemented yet. Without the centralised system, the firm cannot share the possible benefits across markets, making for the moment new product introductions rare.

5.1.3. Resilient – sub-indicators

Resilient paradigm explains what kind of practises firms are using in order to cope with unplanned disruptions. The results showed that both markets focused on three resilient sub-indicators – PR1, PR2 and PR6 (Figure 9).

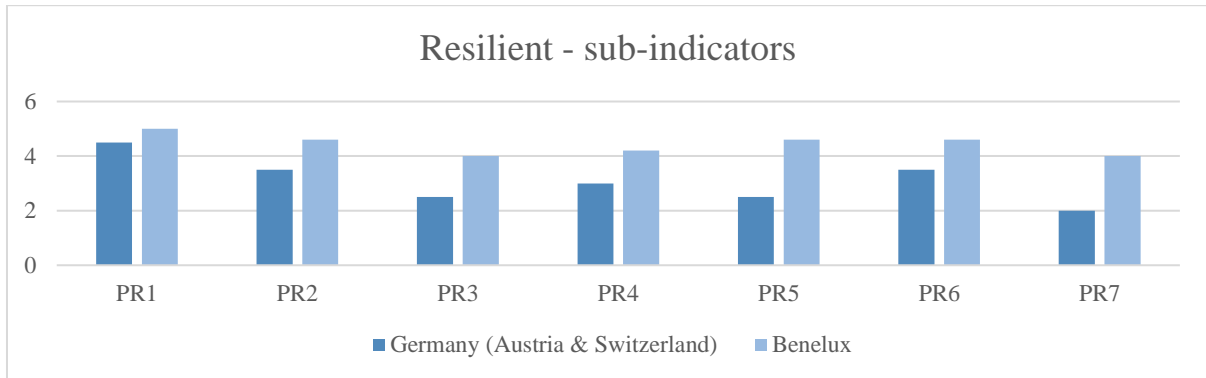


Figure 9: Resilient sub-indicators implementation level – comparison between the markets

The sub-indicators refer to resilient practises such as sourcing strategies (PR1), flexible supply base and sourcing (PR2), as well as flexible transportation (PR6). The firm has worked extensively during Covid-19 period to build robust procurement practises and contingency supply. To reduce the risk of short supply, the inventory as well as the sourcing pool for major product categories (except canned goods and packed dried goods) has been increased, allowing the quick switch between suppliers. However, both markets also experienced a downside of sourcing strategies and flexible supply base, hence the low level of PR7 (visibility of downstream inventories and demand) resilient sub-indicator. Due to the enormous growth during the Covid-19, the downstream processes and demand conditions are not yet optimised. Within the firm, many departments are at different development stages, making it difficult in keeping the focus on the future goal and instead the focus is put on fixing short-term issues. However, the firm is still trying to achieve its goal where a resilient supplier landscape with trustworthy suppliers, safety stock and robust supply chain practises is developed.

5.1.4. Green – sub-indicators

The green behaviour represents how a firm is achieving its profit by reducing the environmental impact. In the Figure 10, it can be seen that the firm places a high focus on green paradigm sub-indicators PG2 and PG5 – where recycling materials and environmental

monitoring upon suppliers stays as top priorities.

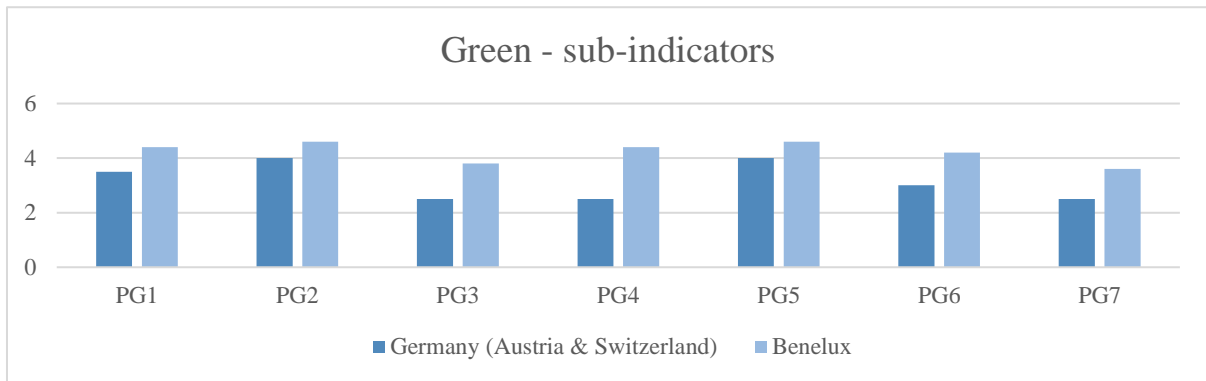


Figure 10: Green sub-indicators implementation level – comparison between the markets

The meal-kit business in general produces high level of packaging material. Therefore, by working together with firm’s suppliers, the focus has been placed on implementing greener practises. Plastic reduction or its replacement is one of the mentioned practises, where the packaging material is changed to more sustainable alternatives such as paper or recycled materials. Suppliers are also requested to show the evidence of how green their practises are – specifically the usage of recycled materials for the production. The reverse logistics sub-indicator, PG7, has received the lowest implementation level from both markets. Since the firm has different product categories, the focus has been firstly placed in assuring the full recyclability of primary ingredients and secondary packaging. Such prioritising is an unfortunate consequence of a hyper growth during the Covid-19 period.

5.1.5. Entrepreneurial – sub-indicators

The entrepreneurial paradigm reflects the firm’s abilities to adapt to unplanned changes and take actions that might lead to innovative business opportunities. The comparison in the Figure 11 revealed that within both markets, the freedom of developing ideas is promoted (PE1).

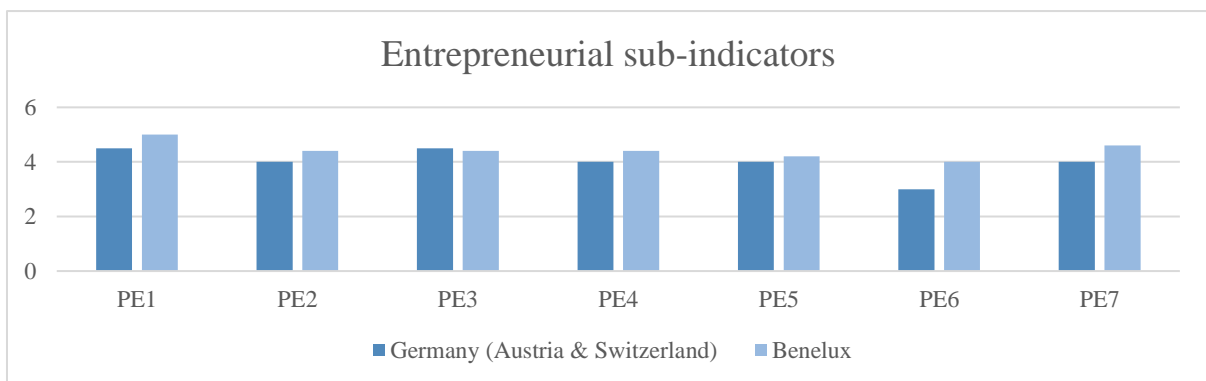


Figure 11: Entrepreneurial sub-indicators implementation level – comparison between the markets

Since the encouragement and support comes directly from the higher management within the firm, bold-actions are implemented frequently. The higher management appreciates and considers new ideas fast, so that in between thinking and implementation, no time could be wasted, which sometimes leads to new ideas being implemented within weeks instead of months. When looking at the Benelux market, the entrepreneurial sub-indicator PE7 – the firm’s willingness to dominate rivals in the market – has reached a high implementation level as well. Since the case firm is known for being a market leader, their position allows them to influence suppliers in a way that products are designed and adapted to their needs. By being an industry disruptor, the case firm is focusing on innovating and challenging their supply base. On the other hand, the German market, is putting its focus on the information sharing between individual and partners (PE3) in order to keep up with market trends. However, the improvement points for both markets relate to the training and education within the firm (PE6). In both markets regular training and development is offered, but due to Covid-19 disruptions it is not within the current focus of the firm. However, the increasing number of standardized processes should show in the future the necessity of such regular trainings.

5.1.6. LARG(E) Index calculation – the index for a case firm and comparison between the markets

After analysing the sub-indicators in the sections above for each LARG(E) paradigm, the behaviour according to each paradigm’s implementation can be calculated while using the Equation (1). The summary of the calculated values can be seen in the Appendix E. After obtaining all the necessary data, the LARG(E) Index for a case firm (combining the two markets) can be calculated while taking the results from Appendix E and applying the Equation (4):

$$\text{LARG}(E)_j = f [w_L \times (B_L)_j, w_A \times (B_A)_j, w_R \times (B_R)_j, w_G \times (B_G)_j, w_E \times (B_E)_j]$$

Equation (4) LARG(E) paradigm calculation

$$\text{LARG}(E)_{SC} = (0,18 \times 3,8) + (0,19 \times 3,4) + (0,23 \times 4) + (0,20 \times 3,9) + (0,19 \times 4,4) = 3,9$$

Since Appendix E also includes the paradigms and its sub-indicators implementation level for both analysed markets, LARG(E) Indexes can be also calculated for German and Benelux markets accordingly:

$$\text{LARG}(E)_{SC \text{ Germany}} = (0,18 \times 3,6) + (0,19 \times 2,8) + (0,23 \times 3,2) + (0,20 \times 3,4) + (0,19 \times 4,2) = 3,4$$

$$\text{LARG}(E)_{SC \text{ Benelux}} = (0,18 \times 4) + (0,19 \times 3,9) + (0,23 \times 4,7) + (0,20 \times 4,5) + (0,19 \times 4,7) = 4,3$$

All the obtained values for Benelux and German market, as well as the combination of values for both markets can be seen in the Figure 12.

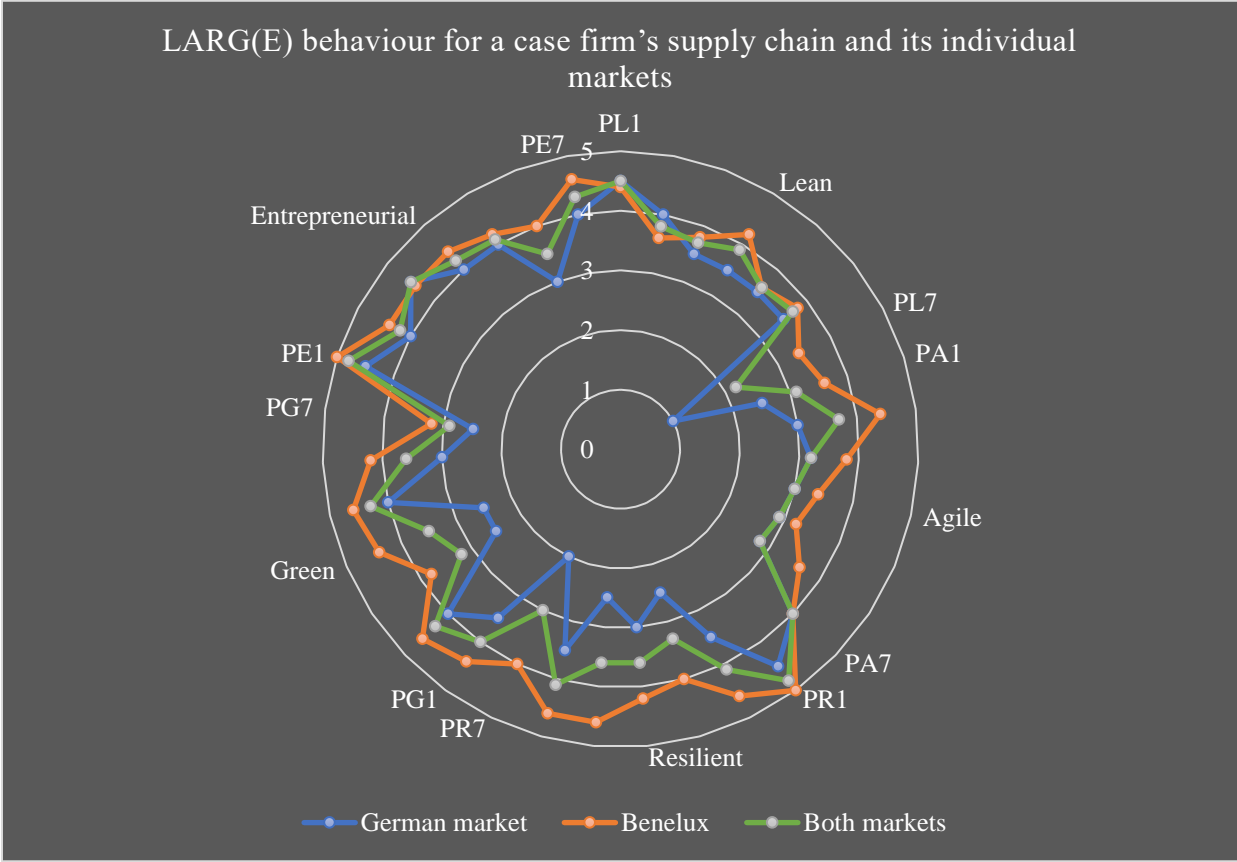


Figure 12: LARG(E) behaviour for a case firm's supply chain and its individual markets

When comparing the paradigms implementation level between the markets, it can be clearly stated that Benelux market has achieved a higher index rate with overall implemented practises achieving 4,3 points (maximum implementation level is 5) rather than the German market with 3,4 points. The implemented practises that achieved the highest rating within the Benelux market, are the resilient and entrepreneurial paradigms with 4,7 overall points each. Such a high score explains what kind of practises are focused on the most. From a resilient point of view, building robust procurement practises and contingency supply allows the firm to reduce the risk of short supply and manage timely deliveries. Whereas open-minded and bold decision-making mindset is allowing to stay the market leader and innovator. Covid-19 pandemic has tested and showed how resilient supply chain within the Benelux market is. Within growing demand and business volumes, the case firm within Benelux market experienced some challenges with sourcing materials (due to restricted immigrant labour within protein production) but in the end managed to keep the promise to their customers and deliver its product.

The German market achieved the total of 3,4 points that presents a moderate behaviour of all LARG(E) practises. Since the German market has been affected the most due the enormous

growth in terms of revenue and customer acquisition, the firm was not able to adjust quickly enough their processes. Even if the entrepreneurial practises have achieved high 4,2 points implementation level, the German market still experienced a rapid change of processes, meaning that no training could be provided for the employees that led to limited information sharing within the firm and suppliers, that caused quality issues. However, the implemented lean practises, especially the ones that focused on JIT deliveries between the supplier and focal company, still allowed frequent deliveries based on actual customer demand.

The overall LARG(E) Index score of 3,9 points for both markets can be described as the moderate implementation level of the five paradigms within the firm. This score shows which of the practises are already very-well integrated within the case firm and which ones could be chosen for improvement, such as agile practises. The resilient and entrepreneurial paradigms can be described as the dominant ones, which explains why the focus of the two paradigms and its sub-indicators can be seen within different markets as well. Therefore, it can be stated that the core values of the firm are not only theoretically spread out but also reflected in praxis within different markets and regions.

5.2. Qualitative results – insights of the case firm’s supply chain management processes

In order to gain a better understanding of how the case firm’s supply chain is operating, participants were asked to rate the importance of the purchasing and supply chain management practises. Here, two out of six of the practises stood out the most – the delivery of products and its quality (Table 5).

<i>Operating market</i>		<i>Benelux</i>	<i>Germany</i>
<i>Purchasing and supply chain management practises – ranking by its importance*</i>	Improving your organisation's competitive position	3,6	3
	Delivery - uninterrupted flow of products that are required to operate	4,8	5
	Maintaining and improving quality of the product	4,8	4,5
	Finding and developing best-in-class suppliers	4	4
	Cost - purchasing required items and services at the lowest cost possible	3,8	3
	Promoting cooperation between supply and business partners	4	4

* Average scores calculated per market

Table 5: Purchasing and supply chain management practises comparison between the markets

The two practises received the highest ranking for both analysed markets, meaning that the focus of the company's priorities is centralised and does not differ between the markets. According to one of the participants' statements the consistent top quality is imperative to their customer retention. Even if the company's KPI's are driven by the lowest cost, the top-quality products are far more important meaning that the success of business lies within the positive customer experience.

On the other hand, the participants note that finding best-in-class suppliers is not a top priority for the firm. The firm puts more effort on finding the suppliers that are able to fit their needs, are flexible, can deliver on time and provide a high level of service with top quality products and price. Since suppliers are also treated as experts within their field, their involvement within new development activities is crucial. Here the case firm focuses on building partnerships where problem solving and process improvement is seen as a joint effort rather than a one-sided responsibility. In the end, only with such flexible and committed suppliers, the company can sustain a stable market growth and keep its status as a market leader.

6. Discussion

6.1. Revealing the strategies that stand out under pandemic related disruptions

Since supply chain resilience has received a lot of attention in the past years,¹⁸² due to increasing customer demand¹⁸³ and unexpected disruptions affecting the supply chain processes,¹⁸⁴ there was a need to identify a tool that would help firms to assess their resilience performance, its vulnerabilities and possible process improvements. During the Covid-19 pandemic, many restrictions were applied that reduced face-to face activities such as dining in a restaurant, which on the other hand led to increasing demand of online shopping. Especially, the meal-kit boxes providers needed to quickly adjust their supply chain processes since customer interest was increasing rapidly. According to the theory, resilience refers to flexibility and redundancy, where a firm is capable of adapting their processes fast and manages to arrange multiple supply sources once disruption occurs.¹⁸⁵ Both of the concepts cannot be achieved without a close collaboration between the parties where information sharing and trust are prioritised.¹⁸⁶ However, an effective communication can only be built if the leadership style and less tangibles practises are implemented, such as creative type of thinking¹⁸⁷ or where

¹⁸² Kamalahmadi & Parast (2016, p.116)

¹⁸³ Ghadge, Dani & Kalawsky (2012, p.324)

¹⁸⁴ Hoffmann (2012, p.92)

¹⁸⁵ Kamalahmadi & Parast (2016, p.122)

¹⁸⁶ Chopra & Sodhi (2004, p.60), (Kamalahmadi & Parast (2016, p.124)

¹⁸⁷ Martins & Martins (2002, p.58)

training and education possibilities are offered.¹⁸⁸ When taking an example from the case firm, the beforehand described processes did stand out in praxis as well. Entrepreneurial processes such as extensive employee training and education, as well as an open-minded culture where everyone's ideas are welcomed, is promoted within the case firm. Additionally, the close collaboration with the suppliers is implemented in order to receive the best quality products that can also be customised according to the case firm's needs, as well as flexible product delivery where the quantity is based on the actual customer demand. The case firm involves their suppliers not only in product decision making but also in reviewing their supply chain processes once any problems occur. The supplier-specific feedback is highly valued which is the main reason why most of the suppliers have stayed within the case firm since the beginning. Both practises that relate to close collaboration and human resource management, can be interpreted as proactive type of strategies.¹⁸⁹ As mentioned before, the online shopping market has increased dramatically during the pandemic. To cope with increasing customer demand, the case firm has put their focus on improving flexibility and redundancy capabilities. Back-up suppliers were arranged, as well as multiple sourcing strategies were implemented that allowed the quick switch between suppliers and helped to arrange safety stocks at several locations. Flexibility and redundancy, the proactive and reactive type of strategies,¹⁹⁰ allowed the case firm to continue its supply chain operations and keep their focus on receiving products on time and in full quantity. Thus, the comparison between the supply chain resilience theories and an example from the case firm, provided the basis of understanding what kind of strategies are beneficial and could be implemented when disruptions occur.

6.2. LARG(E) paradigms that explain an opportunity-driven resilient supply chain

Based on the results from the questionnaire (see Appendix E), the resilient supply chain that focuses on achieving new opportunities can be explained as the combination of three LARG(E) paradigms – resilience, entrepreneurial and green behaviour. The resilience paradigm focuses on improving flexibility that helps to create the supply chain visibility. Whereas the entrepreneurial paradigm promotes an open-minded flat hierarchy where risk-taking approach is part of the dynamic culture. However, even if the two paradigms – resilient and entrepreneurial - received the highest scores from the questionnaire, the resilient supply chain cannot function without agility factor. Especially under pandemic conditions, when taking an example from the case firm, where they were required to make decisions quickly since business

¹⁸⁸ Blackhurst, Dunn & Craighead (2011, p.380)

¹⁸⁹ Hohenstein et al. (2015, p.105)

¹⁹⁰ Hohenstein et al. (2015, p.105)

environment was changing fast. Being agile allowed the case firm to continuously grow and enter new markets with ease. On the other hand, the high rating of the green LARG(E) paradigm can be naturally understood since communities put a lot of pressure on the firms to do its business in a sustainable way using for example recycled materials for packaging.¹⁹¹ In summary, agile, resilient, and entrepreneurial paradigms and their practises with a “green” business focus can be considered as the ones that describe an opportunity-driven resilient supply chain.

6.3. A blue print on how to achieve a resilient supply chain within the food industry based on the developed LARG(E) Index

The LARG(E) Index allows companies to assess their supply chain practises within five different areas: leanness, agility, resilience, greenness and entrepreneurial behaviour. After the analysis, the companies are able to select LARG(E) practises in a way, that improvements can be made, where new ideas and methods can be implemented.¹⁹² In order to be able achieve a resilient supply chain within the food industry, the following guidelines can be followed:

1. Lean practises – firms should focus on building long-term relationships with suppliers by implementing JIT practises that allows products to be delivered on a frequent basis with a focus of producing more with less input. An example is to implement a centralised system where cross-functional processes such as order quantities are shared between the firm and its suppliers. By standardising order processes for products that are frequently used within different markets at the same time, allows the firm to increase its process excellence while sharing information and at the same time reduces waste. If the standardisation of product orders cannot be implemented due to growing product volume, the firm is advised to move away from the JIT practises since suppliers will not be able to keep up with the demand and instead focus on acquiring distribution centres that are closer to the end market.
2. Agile practises – the main focus is on building a complete supply chain visibility between the focal firm and their suppliers. A centralised IT management system could improve the collaboration between the parties by providing an extended supply chain network overview. The system could provide both parties with the following benefits: early warnings about disruptions and possible risks, sharing the information about changing market trends or having an up-to-date information of the inventory level. Such data visibility allows companies and their partners to see the information simultaneously

¹⁹¹ Rao & Holt (2005, p.903)

¹⁹² Björklund (2010, p.350)

that at the same time moves the decision-making into the network by bringing clarity and alignment between the parties.

3. Resilient practises – are a key factor in achieving efficiency that enables a quick supply chain redesign once unexpected disruptions occur. By putting the focus on the contingency plans once any disturbance occurs – such as arranging flexible transportation or flexible sourcing once supply chain flow is interrupted, allows firms to sustain its business operations as usual.¹⁹³ Firms should put focus implementing back-supplier strategies, that enables a firm to source products from different suppliers and locations. For example, a move towards more regional suppliers could be arranged in case a disruption prohibits firms from crossing borders. Another example is to increase the capabilities and the capacity of existing supplier factories by optimising the inventory. Implemented strategies that reduces the risk of short product supply in the end provide firms with a huge advantage when operating within the food supply chain industry.
4. Green practises – can be seen as value added benefits to the firm from the customer point of view. Companies that put focus on using recycled materials for packaging, especially within the food industry since it necessitates a lot of packaging, are generally seen as more likeable. Therefore, customers as well as suppliers can and should be involved by using predefined communication tools in order to create a green supply chain. Here, the suppliers could be selected based on factors that relate to its environmental footprint, and customers could be involved in product design campaigns, where new packaging ideas are being proposed.
5. Entrepreneurial practises – in order to stay up to date within changing customer trends and demands, the firm should be able to provide the working environment to its employees where new ideas are encouraged, bold decisions are taken and confidence from the higher management is provided. Specialized employee training and education provided by external parties is one of the examples to improve the entrepreneurial thinking. Such a dynamic working environment will increase intrinsic motivation to succeed not only between the employees but also between suppliers. The innovative and experimental thinking allows firms to explore new market possibilities faster when decisions are made within hours instead of months. Therefore, firms are advised to review its practises and policies that relate to supply chain risk management culture, to

¹⁹³ Tang (2006b, p.39)

see what kind of leadership style is practised at the moment since all factors are interdependent.

As mentioned before, the firm should firstly perform an analysis of their supply chain processes based on the five LARG(E) paradigms in order to see the practise implementation level. Secondly, it is important to understand which practises are relevant to the firm's supply chain and define possible areas of improvement. Only then, the above proposed guidelines could be applied by implementing different proactive and reactive type of strategies that in the end improve the overall supply chain resilience.

7. Conclusion

7.1. Resilient, agile, and entrepreneurial paradigms with a “green” focus represent a resilient supply chain

In conclusion, the findings of this study reveal which paradigms from the LARG(E) Index are relevant to achieve resilient supply chain when unexpected disruptions occur. The three paradigms – resilient, agile, and entrepreneurial – have received the highest ranking based on the collected data from the case firm. The case firm provided this study with various business process examples that were successfully implemented during the Covid-19 pandemic. Therefore, a flexible response plan, real-time collaboration with key suppliers and promoted open mind set within the supply chain processes allows to reduce the recovery efforts and helps to avoid disappointed customers. Additionally, the high ranking of the green paradigm should be taken into consideration as well. Even if the discussed green practises do not exactly discuss the way business process should be done, it offers instead a way how the firm's image could be increased while at the same time focus on reducing its environmental footprint.

7.2. Contributions

The main contribution of this research is the new addition of the entrepreneurial paradigm to the LARG(E) Index. The expansion of the index, allows a more explicit analysis of supply chain processes within the firm where the opportunity-driven behaviour is analysed as well. The new paradigm proves to be a relevant factor when analysing how resilient the supply chain is. Additionally, the LARG Index originally proposed by Azevedo, Carvalho & Cruz-Machado¹⁹⁴ has been adapted and tested within another industry – the food supply chain industry, meaning that new weights for each paradigm and its practises were calculated. Its application within another industry, confirms the index being a universal tool for measuring leanness, agility, resilience, greenness, and entrepreneurial behaviour of the firm.

¹⁹⁴ Azevedo, Carvalho & Cruz-Machado (2016, p. 1482)

7.3. Limitations and future directions

The data for this research was collected online and no face-to-face presentations were possible, that made it difficult to collect more responses for the second round of data collection, where different markets – Benelux and German – were intentionally selected for comparative analysis. Therefore, the low response rate might be the consequence of the German market having a moderate value of LARG(E) index. The future research could focus more on presenting the study at the firm's location to acquire more participants and in this way allow a more thorough analysis.

Since the entrepreneurial paradigm has proved to be an important factor when achieving a resilient supply chain within the food supply chain industry, a study, that would examine different industries, could be performed to confirm or deny its significance. Additionally, it was found that lean paradigm and its practises were not that relevant to the case firm. Therefore, the future research could include multiple companies that operate within the food supply chain industry to see whether the collected results were only applicable to the case firm or whether it can be applied to food industry in general. And lastly, the results did not reveal any paradigm importance differences in regards to the product category (seven categories in total). Therefore, research could be conducted to see if LARG(E) paradigms are rated differently under certain product categories and whether there is a need to apply multiple resilience strategies to different product categories.

Another aspect that should be considered is that the Covid-19 caused disruptions might have been temporary. The current attractiveness of online businesses might be the result of a bullwhip effect since consumer demands shifted dramatically from restaurant dining to home consumption causing supply chain inefficiencies. Therefore, it is relevant for the future research to conduct a study that analyses the aspects of a resilient supply chain before and after the pandemic.

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Appendices

Appendix A: LARG(E) Index: its constructs, sub indicators and weights

Constructs/Paradigm	Sub-indicators (practises)	Weights
BL – lean behaviour 0,18	PL1: just-in time (first tier supplier -> focal company)	0,13
	PL2: supplier relationships/long-term business relationships	0,16
	PL3: just-in-time /focal company	0,14
	PL4: pull flow	0,16
	PL5: total quality management	0,14
	PL6: customer relationships	0,14
	PL7: just-in-time (focal company -> first tier customer)	0,13
BA – agile behaviour 0,19	PA1: to use IT to coordinate/integrate activities in design and development	0,16
	PA2: ability to change delivery times of supplier's order	0,16
	PA3: to use IT to coordinate/integrate activities in manufacturing	0,15
	PA4: to reduce development cycle times	0,14
	PA5: centralised and collaborative planning	0,17
	PA6: to increase frequencies of new product in introductions	0,11
	PA7: to speed in improving customer service	0,12
BR – resilient behaviour 0,23	PR1: sourcing strategies to allows switching of suppliers	0,16
	PR2: flexible supply base/flexible sourcing	0,14
	PR3: strategic stock	0,13
	PR4: lead time reduction	0,16
	PR5: creating total supply chain visibility	0,15
	PR6: flexible transportation	0,12
	PR7: developing visibility to a clear view of downstream inventories and demand conditions	0,15
BG – green behaviour 0,20	PG1: environmental collaboration with suppliers	0,15
	PG2: environmental monitoring upon suppliers	0,14
	PG3: ISO 14001 certification	0,13
	PG4: to reduce energy consumption	0,17
	PG5: to reuse/recycling materials and packaging	0,16
	PG6: environmental collaboration with the customer	0,13
	PG7: reverse logistics	0,11
BE – entrepreneurial orientation (new addition) 0,19	PE1: freedom to develop an idea to completion	0,14
	PE2: the propensity to experiment	0,14
	PE3: information sharing between individual and partners	0,16
	PE4: the inclination to take bold actions	0,14

PE5: the tendency to participate and act on future opportunities	0,15
PE6: providing training and education within the firm	0,15
PE7: firm's willingness to dominate rivals in the market	0,12

Appendix B: Questionnaire for experts

Structured interview protocol	
<p>You are being invited to participate in a research study titled “Achieving resilient supply chain within an opportunity-driven market environment”. This study is being done by Jomante Volk from the Faculty of Behavioural, Management and Social Sciences at the University of Twente.</p> <p>The purpose of this research study is to analyse how companies can achieve resilient supply chain during a disruption and manage at the same time occurring opportunities in the market. The survey will take you approximately 10 minutes to complete. The data will be used for the analysis of the LARG(E) Index that will show what type of paradigms are required to have resilient and opportunity-driven supply chain.</p> <p>Your participation in this study is entirely voluntary and you can withdraw at any time.</p> <p>We believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by storing your data safely, where only I, the researcher will have access to. The data will not be shared with any other parties and none of the answers will be possible to trace back to you as the survey is designed in an anonymous way.</p> <p><i>Study contact details for further information: Jomante Volk, j.klisonyte@student.utwente.nl</i></p>	
Constructs/Paradigm	Sub-indicators (practises)
Academic/expert identification	Faculty department Areas of expertise Do you have any research on food supply chain industry? Yes/No. If yes, in what kind of fields: strategy, operations management, logistics, supply chain management, equipment/maintenance, other
LARG(E) Index Paradigms	For the following supply chain management paradigms , please describe your perception about their importance to the sustainability of the food supply chain industry (considering the following scale: 1 not at all important, 2, 3, 4, 5 extremely important) Lean Agile Resilient Green Entrepreneurial
BL – lean behaviour	For the following Lean practices , please describe your perception of their importance to the leanness of the food supply chain (considering the following scale: 1 not at all important, 2, 3, 4, 5 extremely important): PL1: just-in time (first tier supplier -> focal company) PL2: supplier relationships/long-term business relationships PL3: just-in-time /focal company PL4: pull flow PL5: total quality management PL6: customer relationships PL7: just-in-time (focal company -> first tier customer)

BA – agile behaviour	<p>For the following Agile practices, please describe your perception of their importance to the leanness of the food supply chain (considering the following scale: 1 not at all important, 2, 3, 4, 5 extremely important):</p> <p>PA1: to use IT to coordinate/integrate activities in design and development</p> <p>PA2: ability to change delivery times of supplier’s order</p> <p>PA3: to use IT to coordinate/integrate activities in manufacturing</p> <p>PA4: to reduce development cycle times</p> <p>PA5: centralised and collaborative planning</p> <p>PA6: to increase frequencies of new product in introductions</p> <p>PA7: to speed in improving customer service</p>
BR – resilient behaviour	<p>For the following Resilient practices, please describe your perception of their importance to the leanness of the food supply chain (considering the following scale: 1 not at all important, 2, 3, 4, 5 extremely important):</p> <p>PR1: sourcing strategies to allows switching of suppliers</p> <p>PR2: flexible supply base/flexible sourcing</p> <p>PR3: strategic stock</p> <p>PR4: lead time reduction</p> <p>PR5: creating total supply chain visibility</p> <p>PR6: flexible transportation</p> <p>PR7: developing visibility to a clear view of downstream inventories and demand conditions</p>
BG – green behaviour	<p>For the following Green practices, please describe your perception of their importance to the leanness of the food supply chain (considering the following scale: 1 not at all important, 2, 3, 4, 5 extremely important):</p> <p>PG1: environmental collaboration with suppliers</p> <p>PG2: environmental monitoring upon suppliers</p> <p>PG3: ISO 14001 certification</p> <p>PG4: to reduce energy consumption</p> <p>PG5: to reuse/recycling materials and packaging</p> <p>PG6: environmental collaboration with the customer</p> <p>PG7: reverse logistics</p>
BE – entrepreneurial orientation (new addition)	<p>For the following Entrepreneurial practices, please describe your perception of their importance to the leanness of the food supply chain (considering the following scale: 1 not at all important, 2, 3, 4, 5 extremely important):</p> <p>PE1: freedom to develop an idea to completion</p> <p>PE2: the propensity to experiment</p> <p>PE3: information sharing between individual and partners</p> <p>PE4: the inclination to take bold actions</p> <p>PE5: the tendency to participate and act on future opportunities</p> <p>PE6: providing training and education within the firm</p> <p>PE7: firm’s willingness to dominate rivals in the market</p>

Appendix C: Questionnaire for a case study firm

You are being invited to participate in a research study titled “**Achieving resilient supply chain within an opportunity-driven market environment**”. This study is being done by Jomante Volk from the Faculty of Behavioural, Management and Social Sciences at the University of Twente.

The purpose of this research study is to analyse **how companies can achieve resilient supply chain during a disruption and manage at the same time occurring opportunities in the market**. The survey will take you approximately 25 **minutes** to complete. The data will be used for the analysis of the LARG(E) Index that will show what type of paradigms are required to have resilient and opportunity-driven supply chain.

Your participation in this study is entirely **voluntary** and you can withdraw at any time.

We believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by storing your data safely, where only I, the researcher will have access to. The data will not be shared with any other parties and none of the answers will be possible to trace back to you as the survey is designed in an **anonymous** way.

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Constructs/Paradigm	Sub-indicators (practises)
Your characterization	<p>Your job title</p> <p>Your job responsibilities</p> <p>Country of operation (Belgium, The Netherlands, Luxembourg, France, Germany, Austria & Switzerland).</p> <p>Which of the following food categories relate to your day-to-day activities? Dairy food, dry goods, protein, spices, processed food, produced goods, baked goods, other</p>
Purchasing and supply management practises	<p>Please rank the following purchasing and supply management practises according to its importance within your organisation: (considering the following scale: 1 not at all important , 2, 3, 4, 5 extremely important)</p> <p>Improving your organisation’s competitive position</p> <p>Delivery – uninterrupted flow of products that are required to operate</p> <p>Maintaining and improving quality of the product</p> <p>Finding and developing best-in class suppliers</p> <p>Cost – purchasing required items and services at the lowest cost possible</p> <p>Promoting cooperation between supply and business partner</p>
Open question	<p>After ranking the purchasing and supply management practises, could you please explain why the focus is/is not on rated practises?</p>
LARG(E) Index Paradigms	<p>For the following supply chain management paradigms, please give information on their implementation level in your company (considering the following scale: 1 not implemented, 2, 3, 4, 5 totally implemented)</p> <p>Lean</p> <p>Agile</p> <p>Resilient</p> <p>Green</p> <p>Entrepreneurial</p>
Open question	<p>After rating the implementation level of SC paradigms, could you please explain why the focus is/is not on these specific paradigms? (examples)</p>

BL – lean behaviour	<p>For the following Lean practices, please give information on their implementation level in your company (considering the following scale: 1 not implemented, 2, 3, 4, 5 totally implemented)</p> <p>PL1: just-in time (first tier supplier -> focal company)</p> <p>PL2: supplier relationships/long-term business relationships</p> <p>PL3: just-in-time /focal company</p> <p>PL4: pull flow</p> <p>PL5: total quality management</p> <p>PL6: customer relationships</p> <p>PL7: just-in-time (focal company -> first tier customer)</p>
Open question	<p>After rating the implementation level of Lean practises, could you please explain why the focus is/is not on these specific paradigms? (examples)</p>
BA – agile behaviour	<p>For the following Agile practices, please give information on their implementation level in your company (considering the following scale: 1 not implemented, 2, 3, 4, 5 totally implemented)</p> <p>PA1: to use IT to coordinate/integrate activities in design and development</p> <p>PA2: ability to change delivery times of supplier's order</p> <p>PA3: to use IT to coordinate/integrate activities in manufacturing</p> <p>PA4: to reduce development cycle times</p> <p>PA5: centralised and collaborative planning</p> <p>PA6: to increase frequencies of new product in introductions</p> <p>PA7: to speed in improving customer service</p>
Open question	<p>After rating the implementation level of Agile practises, could you please explain why the focus is/is not on these specific paradigms? (examples)</p>
BR – resilient behaviour	<p>For the following Resilient practices, please give information on their implementation level in your company (considering the following scale: 1 not implemented, 2, 3, 4, 5 totally implemented)</p> <p>PR1: sourcing strategies to allows switching of suppliers</p> <p>PR2: flexible supply base/flexible sourcing</p> <p>PR3: strategic stock</p> <p>PR4: lead time reduction</p> <p>PR5: creating total supply chain visibility</p> <p>PR6: flexible transportation</p> <p>PR7: developing visibility to a clear view of downstream inventories and demand conditions</p>
Open question	<p>After rating the implementation level of Resilient practises, could you please explain why the focus is/is not on these specific paradigms? (examples)</p>

Test Statistics		Test Statistics		Test Statistics	
N	6	N	6	N	6
Kendall's W ^a	,090	Kendall's W ^a	,341	Kendall's W ^a	,083
Chi-Square	2,157	Chi-Square	8,180	Chi-Square	2,000
df	4	df	4	df	4
Asymp. Sig.	,707	Asymp. Sig.	,085	Asymp. Sig.	,736

a. Kendall's Coefficient of Concordance

a. Kendall's Coefficient of Concordance

a. Kendall's Coefficient of Concordance

Appendix E: LARG(E) Index results from the questionnaire

Paradigms	Sub-indicators	Weights (w _{xy})	Practise implementation level		
			German market	Benelux	Both markets
BL – lean behaviour	Lean	0,18**	3,5	4	3,8
	PL1 = just-in-time (first tier supplier→focal company)	0,13	4,5	4,4	4,5
	PL2 = supplier relationships/long-term business relationship	0,16	4	3,6	3,8
	PL3 = just-in-time (focal company)	0,14	3,5	3,8	3,7
	PL4 = pull flow	0,16	3,5	4,2	3,9
	PL5 = total quality management	0,19	3,5	3,6	3,6
	PL6 = customer relationships	0,14	3,5	3,8	3,7
	PL7 = just-in-time (focal company→first tier customer)	0,13	1	3,4	2,2
	*Equation 1	0,18**	3,6	4	3,8
BA – agile behaviour	Agile	0,19**	4	4,4	4,2
	PA1 = to use IT to coordinate/integrate activities in design and development	0,16	2,5	3,6	3,1
	PA2 = ability to change delivery times of supplier's order	0,16	3	4,4	3,7
	PA3 = to use IT to coordinate/integrate activities in manufacturing	0,15	3,2	3,8	3,2
	PA4 = to reduce development cycle times	0,14	3	3,4	3
	PA5 = centralized and collaborative planning	0,22	2,9	3,2	2,9
	PA6 = to increase frequencies of new product introductions	0,11	2,8	3,6	2,8
	PA7 = to speed in improving customer service	0,12	4	4	4

	*Equation 1	0,19**	2,8	3,9	3,4
BR – resilient behaviour	Resilient	0,23**	2,5	4,2	3,4
	PR1 = sourcing strategies to allow switching of suppliers	0,16	4,5	5	4,8
	PR2 = flexible supply base/flexible sourcing	0,14	3,5	4,6	4,1
	PR3 = strategic stock (holding inventories at specific locations - warehouses, distribution centers)	0,13	2,5	4	3,3
	PR4 = lead time reduction to avoid SC disruptions	0,16	3	4,2	3,6
	PR5 = creating a total supply chain visibility	0,21	2,5	4,6	3,6
	PR6 = flexible transportation	0,12	3,5	4,6	4,1
	PR7 = developing visibility to a clear view of downstream inventories and demand conditions	0,15	2	4	3
	*Equation 1	0,23**	3,2	4,7	4
BG – green behaviour	Green	0,20**	4	4,4	4,2
	PG1 = environmental collaboration with suppliers	0,15	3,5	4,4	4
	PG2 = environmental monitoring upon suppliers	0,14	4	4,6	4,3
	PG3 = ISO 14001 certification - environmental management system	0,13	2,5	3,8	3,2
	PG4 = to reduce energy consumption	0,17	2,5	4,4	3,5
	PG5 = to reuse/recycling materials and packaging	0,22	4	4,6	4,3
	PG6 = environmental collaboration with the customer	0,13	3	4,2	3,6
	PG7 = reverse logistics - collection, recovery or disposal of used products	0,11	2,5	3,2	2,9
	*Equation 1	0,20**	3,4	4,5	3,9
BE – entrepreneurial behaviour	Entrepreneurial	0,19**	4,5	4,6	4,6
	PE1 = freedom to develop an idea to completion	0,14	4,5	5	4,8
	PE2 = the propensity to experiment	0,14	4	4,4	4,2
	PE3 = information sharing between individuals and partners	0,16	4,5	4,4	4,5
	PE4 = the inclination to take bold actions	0,14	4	4,4	4,2
	PE5 = the tendency to participate and act on future opportunities	0,21	4	4,2	4,1

	PE6 = providing training and education within the firm	0,15	3	4	3,5
	PE7 = firms' willingness to dominate rivals in the market	0,12	4	4,6	4,3
		0,19**	4,2	4,7	4,4
LARG(E) Index for a case firm's SC	***Equation 2		3,4	4,3	3,9

*Equation (1) firm's behaviour according to the implementation of the paradigms

** weights for each LARG(E) paradigm taken from Table 3

*** Equation (4) LARG(E) Paradigm calculation