

**Enhancing Supply Chain Resilience through Hybrid Strategies:
An Empirical Study of Australian Retail Sector's COVID-19
Disruption Recovery**

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Abstract

The COVID-19 pandemic caused unprecedented disruptions to global supply chains; Australia's grocery and pharmaceutical retail sectors were no exception. These sectors faced significant challenges, including supply shortages, labour constraints, and logistical bottlenecks, highlighting the urgent need for robust supply chain resilience (SCRE) strategies. While prior research has predominantly focused on proactive strategies to prevent disruption, there remains a critical gap in understanding the during- and post-disruption recovery strategies. This study addresses this gap and aims to explore the resilience-enhancing strategies utilized by the Australian retail sector during the pandemic. Grounded in Resilience Theory (RT) and Resource Dependency Theory (RDT), this research further examines how the available resources (e.g., technologies, human resources, and finance) enabled retail businesses to recover and sustain efficiently.

A qualitative methodology was employed, involving semi-structured interviews with 32 supply chain managers from Western Australia and Victoria within the grocery and pharmaceutical sectors. The interviews were analysed using NVivo software to identify key themes, revealing that a combination of proactive and reactive strategies led to the development of a comprehensive hybrid SCRE framework.

The findings revealed that hybrid strategies, including the adoption of digital technologies, enhanced supply chain visibility, adaptability, and collaboration with government and supply chain ecosystem partners, were crucial for faster recovery. This research contributes to the field by providing actionable insights for supply chain managers and policymakers on how to enhance resilience in response to future disruptions. The SCRE framework developed in this study not only applies to pandemic scenarios but also serves as a strategic guide for navigating other unforeseen disruptions.

Keywords: supply chain disruptions, hybrid resilience strategies, supply chain resilience, sustainable recovery, Australia retail sector, COVID-19, Australia.

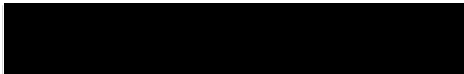
Declaration of Authenticity

I, **Brian Kaunda Chikwava**, declare that the Doctor of Philosophy thesis entitled *Enhancing Supply Chain Resilience through Hybrid Strategies: An Empirical Study of Australian Retail Sector's COVID-19 Disruption Recovery* is no more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references, and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

I have conducted my research in alignment with the Australian Code for the Responsible Conduct of Research 2018, and Victoria University's Higher Degree by Research Policy and Procedures.

Ethics Declaration

All research procedures reported in the thesis were approved by the Victoria University Human Research Ethics Committee (VUHREC) HRE20-227).

A solid black rectangular box used to redact the signature of the author.

Signature

Date: Dec 2024

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Dedication

This thesis is dedicated to my children, Tafadzwa, Tanyaradzwa, and Tvanashe.

Paper Publications and Conference

1. Chikwava, Brian, Shee, HK, Milcock, S. and Chapman, P. (2022). Organic Compost Supply Chain Analysis: A TCE perspective, Operations and Supply Chain Management: An International Journal. 15(4):1-14.
<http://doi.org/10.31387/oscm0510364>
2. Chikwava, KB, Shee, Himanshu and Ewedairo, Kola (2022). Resilience-Enhancing Strategies for Australian Retail Sector Supply Chains. A paper presented in *ANZAM-OM 2022 conference on theme “Building Resilience in Operations & Supply Chains during Major Disruptions”*, 26-27 Sept 2022 at The University of Melbourne
3. Chikwava KB (2012), “Sustaining Contractual Business: An Exploration of the New Revised International Commercial Terms 2010.” *Xlibris publishing Company UK Printed in USA*

List of Abbreviations

ABS	Australian Bureau of Statistics
AHP	Analytical Hierarchy Process
AI	Artificial intelligence
ARA	Australian Retailers Association
BCI	Business Continuity Institute
BCP	Business continuity plans
BOPIS	Buy Online, Pick Up in Store
CILTA	The Chartered Institute of Logistics and Transport
CIPS	Chartered Institute of Procurement and Supply
CRM	Customer relationship management
DIFOT	Delivery in full and on time
DSN	Digital supply networks
DT	Digital technologies
EBIT	Earnings Before Interest and Taxes
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
EOI	Expression of interest
EOQ	Economic Order Quality
ERP	Enterprise Resource Planning
ESG	Environmental, social, and governance
FDI-	Foreign Direct Investment
GDP	Gross Domestic Product
GSC	Global supply chains

GVT	Government
HGV	Heavy Goods Vehicle
HR	Human Resources
IBP	Integrated business planning
IoT	Internet of things
ISM	Institute for Supply Management
IT	Information Technology
JIT	Just-in-time
LCN	Low-Certainty-Need
LFHI	Low Frequency and High Impact
NRA	National Retail Association
OMS	Order management systems
PEST	Political economic, social, and technological
PGA	Pharmacy Guild of Australia
POS	Point-of-sale
PPE	Personal protective equipment
RBV	Resource-based view
RDT	Resources Dependency Theory
RFID	Radio frequency identification
RO	Research objectives
RT	Resilience Theory
S&OE	Sales and operations execution
S&OP	Sales, and operations planning.
SAPICS	South African Production and Inventory Control

	Society
SC	Supply chain
SCA	Supply chain adaptability
SCCA	Shopping Centre Council of Australia
SCD	Supply Chain Disruptions
SCLAA	Supply Chain and Logistics Association of Australia
SCM	Supply chain management
SCRE	Supply Chain Resilience
SCRM	Supply chain risk management
SDA	Shop Distributive and Allied Employees Association
SME	Small Medium Enterprises
SO	Sub-objectives
SRM	Supplier Relationship Management
SWARA	Stepwise weight ratio assessment
TMC	Top Management Commitment
TMS	Transport management system
TOPSIS	Technique for Order of Preference by Similarity to Ideal Solution
TQM	Total quality management
TTR	Time to Recovery
USA-	United States of America
VRIN	Valuable, rare, inimitable, and non-substitutable (VRIN)
VIC	Victoria
VP	Vice President
VUCA	Volatility, Uncertainty Complexity, and Ambiguity

VUHRE	Victoria University Human Research Ethics
WA	Western Australia
WMS	Warehouse management systems

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Chapter 1: Introduction

This introduction chapter begins by introducing the thesis and elucidating the reasoning behind selecting this pertinent and timely research topic. Additionally, it provides an overview of the thesis itself and details the approach taken in conducting the research. To provide context and background for the study, Section 1.2 furnishes relevant information, while Section 1.3 delves into the research objectives and raises pertinent research questions underpinning this study. The subsequent Section 1.4 offers a succinct overview of the research methodology used in this research, while Section 1.5 elaborates on the ethical considerations considered during the research process. Additionally, Section 1.6 serves as a brief introduction to the research contributions, and finally, Section 1.7 outlines the overall structure of the research thesis.

1.1 Introduction

The COVID-19 pandemic exposed significant vulnerabilities in global supply chains, particularly in the Australian retail sector, which faced devastating and unprecedented disruptions in grocery and pharmaceutical supplies. This thesis, titled *"Enhancing Supply Chain Resilience through Hybrid Strategies: An Empirical Study of Australian Retail Sector's COVID-19 Disruption Recovery,"* examines how the COVID-19 pandemic has caused severe disruptions, particularly within Australia's retail sector, and focused on understanding how retailers could build resilience to mitigate such disruptions. Grounded in Resilience Theory (RT) and Resource Dependency Theory (RDT), this study explores the effectiveness of hybrid strategies—combining proactive and reactive measures—in enhancing the resilience of retail supply chains during crises. By examining the lived experiences of supply chain managers in Western Australia and Victoria, this chapter introduces the research context, outlines the study's objectives, and sets the foundation for investigating strategies to recover from and adapt to new normal in a post-pandemic environment.

According to Heaver and Chow (1999), the supply chain (SC) is the group of manufacturers, suppliers, distributors, retailers, and transportation, and other logistics management service providers who are engaged in providing goods and services to consumers. A supply chain comprises both the external and internal associates for a business (Christopher, 2011). Supply chains face more risks than ever before due to increasing disruptions of various types (e.g., natural calamities, wars, pandemics, and epidemics) (Wieland & Wallenburg, 2013; Craighead et al., 2007; Ivanov, 2021). This definition resonates with Simchi-Levi et al. (1999), who view

it as a set of approaches utilized to effectively integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed in the right quantities, to the right locations, and at the right time, to minimize system-wide costs while satisfying service level requirements (Simchi-Levi et al., 1999; Mentzer et al., 2001).

Recent events, such as the COVID-19 pandemic, have highlighted the vulnerabilities within global supply chains, with ripple effects from disruptions in one country impacting operations worldwide (Ivanov & Dolgui, 2020; Sharma et al., 2020). These disruptions have emphasized the need for supply chain resilience (SCRE), agility, and enhanced risk management strategies to maintain service levels and mitigate the impact of crises (Sheffi & Rice, 2005; Tang, 2006; Wieland & Durach, 2021). As disruptions are evident, so are the supply chains because each one has unique characteristics and timing making planning and prediction difficult (Ivanov and Das 2020). A typical example is the recent outbreak of the coronavirus/SARS-CoV-2 (COVID-19) pandemic with a lot of unknowns and uncertainties swinging between extremes that caused severe supply chain disruptions(SCD) across industries (Altay & Pal, 2023; Godrich, Macau, et al., 2022; Moosavi et al., 2022).

The COVID-19 pandemic has had a significant impact across the globe on various SCs (Moosavi et al., 2022; Zhang et al., 2023). Worldwide, the COVID-19 pandemic affected different dimensions of SCs, including but not limited to finance, lead time, demand changes, and production performance. While companies scrambled to adjust their operations to manage the impact of the pandemic, disruptions of all kinds posed challenges for global supply chains, especially in 2021. According to Zimmerman (2021), a series of significant disruptions made 2021 a difficult year for supply chains globally. Besides the surge in COVID-19 cases, other notable events included extreme weather conditions and the blockage of the Suez Canal, which obstructed hundreds of ships and delayed the flow of goods. In the United States of America, a severe winter storm disrupted food supply chains and logistics networks in Texas, forcing grocery retailers to impose limits on certain items and temporarily suspend curb side pickup and home delivery services. In China, the closure of a major terminal at the Shanghai airport led to significant cargo delays, affecting logistics operations. Meanwhile, India experienced a wave of COVID-19 infections that severely impacted manufacturing across various sectors, particularly the pharmaceutical industry, which plays a critical role in global supply chains since approximately 80% of active pharmaceutical ingredients are produced in India and China.

Vietnam, one of the largest exporters of furniture and a key supplier of apparel, electronics, and rubber products to the United States of America, faced extended lockdowns during the pandemic. This resulted in business closures and significant labour shortages, as thousands of migrant workers, many of whom had lost their jobs, left the country once restrictions were lifted. These compounded disruptions highlighted the vulnerabilities in global supply chains and underscored the need for increased resilience and adaptability.

Witnessing the rise of natural disasters, organizations are employing advanced information systems in their supply chains to enhance their capacity for transparency, better prediction, competence, and ability to make quicker decisions (Gupta et al., 2023).

These disruptions leave the Supply chains (SC) with a series of risks, known as SC risks. In uncertain situations, it is hard to make decisions as nothing is known about an event, but in case of risk there is always a probability of occurrence that offers an opportunity to act. SC risk and its management is defined as “the management of SC risks through coordination or collaboration among the SC partners so as to ensure profitability and continuity” (Tang, 2006, p. 453). Most of the studies focus on SC risk management (i.e., assessment and mitigation), and less attention is paid to the SCD and resilience-building. However, studies on resilience-building strategies emerged to a greater extent during the last couple of years to counteract a Low-Frequency High-Impact event like the COVID-19 pandemic (Ivanov & Dolgui, 2019; Moosavi et al., 2022). The pandemic spread very quickly across the globe, turning the SCs into disruption risks (Donthu & Gustafsson, 2020). It is different from the interruption risk which is limited to day-to-day operational issues and temporary in nature. Managing SC risks arising from pandemic typically requires a new approach to research.

Building resilient supply chains is one way to respond the SC disruption risk and has become critical for companies to maintain their competitive advantage (Zhang et al., 2023). Moreover designing effective ways to improve resilience in this hyper connected world requires an understanding of the elements that lead to SCDs (Patel, 2023). Traditional risk management strategies have proved to be inadequate to support the flexibility and adaptability required to survive, let alone building a stronger, more resilient supply chain to withstand these severe disruptions (Adobor & McMullen, 2018; Chowdhury & Quaddus, 2016; Gregory, 2020; Melnyk et al., 2014; Ponis & Koronis, 2012; Tang, 2006). A resilient supply chain may be able to withstand one set of disruptions and fall vulnerable to a different ones for which it is not prepared (Adobor & McMullen, 2018). Resilience is multidimensional in nature, and it is not

about getting back to business as usual but it is the capability to adapt to a new situation: that is, the new normal (Iyengar et al., 2021). The outbreak of the COVID-19 virus has prompted organisations to be vigilant and reinvent their architectures amid the pandemic and considering future trade challenges. To a certain extent the COVID-19 pandemic has forced firms to transform their business models and SCs into a new normal. However, research and guidance for managers on how to develop resilient capabilities to address the severe disruptions from the pandemic is limited. Supply Chain Resilience (SCRE) is defined as “the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function”(Ponomarov & Holcomb, 2009, p. 13).

Supply chain disruptions (SCDs) pose salient risks to organisations; hence the majority of firms report SCDs as a top priority in their agenda (Shahzaib Khan & Andrew Perez, 2018; World Economic Forum, 2013b). Firms encourage managers to devise ways to enhance resilience against the disruptions (Chowdhury & Quaddus, 2016; Craven et al., 2020; Gajendran & Oloruntoba, 2017a; Wedawatta & Ingirige, 2012). By definition, SCDs are unplanned events that affect flow of goods and information in a supply chain (Blackhurst et al., 2005). Literature abounds with studies on disaster management and resilience-enhancing strategies. For example, related studies discuss *redundancy* (Mackay et al., 2019; Polyviou, 2019), *sourcing and robustness* (Dahlberg R & Guay F, 2015; Wieland & Wallenburg, 2012), *adaptability* (Ponomarov & Holcomb, 2009), *improved visibility* (Brandon-Jones et al., 2014; Christopher & Lee, 2004; Jüttner & Maklan, 2011; Talluri et al., 2013; Wei, 2010), *redundancy& flexibility* (Dubey et al., 2017; Mackay et al., 2019; Ponis & Koronis, 2012; Soni & Jain, 2011), *collaboration* (Jüttner & Maklan, 2011; Pettit et al., 2013; Scholten & Schilder, 2015; Steckel & Kumar, 2009) and *innovative technologies* (Dubey et al., 2019; Min, 2019; Papadopoulos et al., 2020).

The majority of studies cover mostly the preparation and mitigation phases with activities prior to a disruption, while the literature on post-disruption activities within the response and recovery phases is scarce (Ellis et al., 2011; Natarajarathinam et al., 2009; Xu et al., 2020). According to Pournader et al. (2020) and Sauer et al. (2022), a number of relevant research studies elaborate on the assessment and mitigation of SC risks rather than on SCRE and disruption management. Although a few studies have covered the pandemic (Altay & Pal, 2023; Bastas & Garza-Reyes, 2022; D Ivanov, 2021; Seuring et al., 2022; Zhang et al., 2023;

Zimmerman & Anderson, 2022), by covering the effects of the disruption in different sectors, SCM literature on pandemics and epidemics is widely lacking. Even wide-range overview papers do not mention this as a topic for research (Xu et al., 2020). Therefore, further empirical research is required to analyse how retail companies dealt with the challenges of the COVID-19 pandemic and which mechanisms might help in mitigating the unexpected impacts — specifically, how the retailers in Australia, Western Australia, and Victoria in particular, might have responded during the crisis, and devised new normal strategies for business continuity.

The traditional strategies are simply not suitable for complex and extreme situation such as COVID-19 pandemic disruptions that caused devastating impacts on SC (Dryhurst et al., 2020; Seuring et al., 2022). As the pandemic is not limited to a region or confined to a particular time period (Ivanov & Das, 2020), lockdowns of businesses, social distancing and border closure within Australia and with overseas suppliers were some of the unprecedented situations that affected the supply chain operations. With this kind of low-frequency, high-impact pandemic, it is unclear how many of those existing strategies were relevant or effective in the path to faster recovery, and that remains a critical point of investigation. Islam et al. (2022); Zhao et al. (2019) suggest adaptive strategies that include restructuring the supply chain because of part of the network being affected. While this study will not treat the existing strategies (see more discussion in section 5) as contradictory and non-beneficial, instead they will be regarded as complimentary while leveraging them for recovery. The study proposes an integrated framework for supply chain resilience that leverages existing risk and resilience-building strategies in the literature by incorporating supply chain visibility, flexibility, collaboration, adaptability, data analytics capabilities, redundancy, and many others as the major pillars for resilient supply chains.

Retail supply chains play key role in delivering food and essential goods to communities (Pilawa et al., 2022). Additionally, it has the potential to manage the supply risk, especially during supply chain disruptions. For example, when the supply of food and grocery items was disrupted, as witnessed during the COVID-19 pandemic, communities faced shortages of essential commodities like pasta, toilet paper, and hand sanitizers. In the healthcare sector, pharmacies experienced shortages of critical items such as personal protective equipment, disinfectants, and masks, which were vital for community health and safety. These disruptions highlight the need for retailers to proactively develop risk mitigation strategies. Emphasizing resilience, practical solutions and business continuity planning can help prevent severe supply shortages. Additionally, increasing transparency in the retail supply chain can provide

consumers with essential information, such as the origin of products, transportation timelines, and pricing, thereby enhancing trust and satisfaction. Following a disruptive incident, firms commonly implement supply chain risk management (SCRM) measures (Bode et al., 2011, Ho et al., 2015, Manhart et al., 2020). However, certain supply networks appear to be more effective and faster at recovering from inevitable risk events than others. While some have traditional risk management strategies in place and others have the resilience to quickly adjust to the disruption and continue business as usual. Moreover, the extant literature reveals that traditional supply chain risk and resilience understanding needs further scrutiny for Low-Frequency-High-Impact (LFHI) global pandemic disruptions such as the current COVID-19 pandemic (Gregory, 2020; Queiroz et al., 2020). Most supply chains were designed for cost efficiency and time effectiveness (Fahimnia et al., 2017; Martinelli & Tagliazzucchi, 2019), but how they are affected during unexpected disasters needs further investigation. Although, risk management has stages from pre-disaster to post-disaster (National Research Council, 2006; Ponomarov & Holcomb, 2009), this research focuses on enhancing resilience against these risks and recovery mechanisms. The COVID-19 pandemic is an example that clearly demonstrates that the pandemic outbreak signifies a unique and new setting for businesses (Chowdhury et al., 2020b). Literature concerning recovery comes from the research by Eggers (2020), Sheffi and Rice Jr (2005), Blackhurst et al. (2011) and Hosseini et al. (2019). They have all validated that recovery is one of the major stages in supply chain disaster management, but to the extent to which resilience needed that remains to be investigated.

It is against this backdrop that practical innovative resilient-enhancing approaches are to be explored (Chowdhury et al., 2020b; Ivanov & Das, 2020; Queiroz et al., 2020). This study believes in repackaging those available criteria and finding their appropriate combination will be unique in this regard. The research further seeks to review the existing literature to analyse the impacts of digital technologies (such as IoT, robotics, big data analytics and 3D printing) and resources (such as labour and timely availability of merchandise transport) on SCRE in the context of COVID-19. The study argues that those digital technologies could improve SCRE through interaction, from the perspectives of flexibility in information sharing, redundancy, collaboration, and agility. These technologies are not only for COVID-19 pandemic prevention and control, but also assist the supply chain in reacting rapidly to maintain or recover the operations of the disrupted supply chain. Building resilience further delivers additional social and economic benefits such as jobs, new skills, investment, higher business and community confidence and consumer benefits (Deloitte Report, 2017). Drawing upon Resilience Theory

(RT) and Resource Dependency Theory (RDT) as theoretical lens for this study, this can be explored through categorisation of interrelated and correlated SCRE actions: that is, preparedness, mitigation, detection, response, and recovery as proposed by Ivanov et al. (2019).

1.2 Research Background

Since the early 1990s, many businesses have implemented various supply chain initiatives to increase revenue, reduce costs, improve efficiency, and/or reduce assets. However, in order to achieve these goals, most supply chains have become more complex, and as a result, today's supply chains appear to be more susceptible and vulnerable to unexpected disruptions than they were previously (Craighead et al., 2007). The growing role of global supply chains has been associated with increased interconnectedness among suppliers and manufacturers, which has led to higher dependency among firms in the supply chains as well as a higher level of supply chain complexity (Birkie & Trucco, 2020; Bode et al., 2011; Christopher, 2005b; Kleindorfer & Saad, 2005; Schätter et al., 2019; Stecké & Kumar, 2009). This, in turn, resulted in supply chains that are efficient during stable business environments, but are highly vulnerable to risks and disruptions (Hopp et al., 2012; Ivanov et al., 2017; Kamalahmadi & Parast, 2016; Polyviou, 2019; Tang, 2006).

Globalisation has increased the exposure of SC to higher uncertainties that call for adequate strategies, thus supporting the creation of SCRE (Ribeiro & Barbosa-Povoa, 2018), particularly with the growing outbreak of complex calamities such as pandemics. There is, however, no absolute strategy that decision-makers can follow to guarantee such resilience and the knowledge on how to characterise SCRE is still an open issue that needs more and deeper empirical research. Existing research suggests that building SCRE can help to reduce and overcome exposure (vulnerability) to risks (H. Aslam et al., 2020; Bode et al., 2011; Christopher & Peck, 2004; Kamalahmadi & Parast, 2016; Pettit et al., 2010; Scholten et al., 2014; Tang, 2006) through developing strategies which enable the supply chain to recover to its original (or an improved) functional state following a disruption (Jüttner & Maklan, 2011). However, despite growing requirements for firms to develop proactive and comprehensive risk management processes, such as building resilience, theory offers little help or guidance (Craighead et al., 2007; Gregory, 2020; Hale & Moberg, 2005; Ivanov et al., 2017; Ponomarov & Holcomb, 2009). The literature has also reported that there is only a limited amount of empirical evidence related to because the majority of the research is theoretical (Ribeiro &

Barbosa-Povoa, 2018). Moreover, empirical research in this area has been heavily affected by the lack of a validated measurement model (Chowdhury & Quaddus, 2017).

Researchers in supply chain management (SCM) have called for more empirical and event-based research in these domains and underline the significance of risk and resilience. There is little research on post-disruption activities within the reaction and recovery phases, whereas most studies address the preparation and mitigation phases with actions before a disruption (Ellis et al., 2011; Natarajathinam et al., 2009; Xu et al., 2020). A wider broad overview of publications fail to address this as a topic since more research focuses on the evaluation and mitigation of SC risks than on SC resilience and disruption management (Pournader et al., 2020; Sauer et al., 2022) and SCM literature on pandemics and epidemics is severely scarce (Xu et al., 2020). Consequently, more empirical research is required. This research seeks to fulfil the gap that exists by conducting a further empirical research to analyse how companies (particularly in the retail sector) deal with the challenges of COVID-19 and which mechanisms may help mitigating unwanted impacts (Ivanov, 2020; van Hoek & Dobrzykowski, 2021): specifically, how different regions globally might have diverging insights and demand-differentiated measures. The speed of recovery from supply chain disruption has been identified as the predominant factor in building a resilient supply chain. However, COVID-19 as an example of an evolving crisis may challenge this assumption (Fan et al., 2023). Hence, this study tries to fill this gap by investigating the strategies that firms can adopt to build SCORE, particularly the strategies that are practical to mitigate the disruption of Low-Frequency and High-Impact (LFHI) such as the COVID-19 pandemic.

SCORE is on the agenda of academia and industry like never before. One strong instigator for this phenomenon has been the COVID-19 pandemic, which opened the era of global uncertainties and vulnerabilities (Ivanov, 2024). The fragility of our supply chains has been exposed because the COVID-19 outbreak necessitated a shift to a more agile and resilient approach, allowing firms to quickly switch operations and supply lines to limit disruption. In fact, the pandemic has stretched SCORE to the brink, testing the agility of businesses in the supply chain industry to respond to the quickly evolving global crisis (Ramanathan et al., 2022). There is a significant need for a deeper awareness of our supply networks to adequately disclose possible pinch points and respond fast. Standard risk models fall short in the face of low-probability, high-impact “black swan” events such as the COVID-19 pandemic. As a result, most businesses lack contingency plans, leaving supply chain executives scrambling to

respond (Accenture Report 2020). It is clear that the outbreak has changed the ways supply chains operate and it is impossible to return to pre-emergency conditions: To quote Green Peace (Marie-Christine, 2020): “How can we go back to normal when normal was already in crisis”. In other words, the COVID-19 crisis has created an imperative for companies to reconfigure their operations—and an opportunity to transform them as well.

There is a need to recalibrate and refocus on risk and resilience while keeping one’s eye on the ball of sustainability. Without a doubt, sustainability and risk are inextricably linked, and firms must transition from crisis to resilience. Going forward we must rebuild a stronger model that not only protects organisations’ **profits**, but also one that is better for **people, planet**, (Triple Bottom Line) (Roobeek et al., 2018). There is a need to continue investing in technology by digitalising businesses so that they can be more responsive, have better access to better data and business intelligence, and stay connected with suppliers—all of which are important parts of SCRE. Simultaneously, communication, supply chain visibility, trust building, and transparency will become more important.

1.3 Research Aims, Objectives and Questions

The literature has revealed that there is a lack of research dealing with the possibility that the companies affected by any disruptions can handle the disaster’s consequences by themselves in a context of severe uncertainty and complexity (Mitroff & Alpaslan, 2003; Queiroz et al., 2020; Schätter et al., 2019). Although several strategies have already been identified in the literature, most of them are overly generalised for recovery from disruptions (Dryhurst et al., 2020; Gregory, 2020). However, they are less likely to react adequately at the time of sudden disruptions (Kamalahmadi & Parast, 2016). Hence, a significant gap exists on how select strategies, particularly resources and technologies, are exploited for quicker recovery given the COVID-19 disruption has its own unique characteristics. Based on these considerations, this study seeks to figure out what drove SCRE in times of COVID-19 pandemic. The researcher explored the retailers’ recovery strategies from the COVID-19 pandemic disruptions. The study was based on interviews with supply chain managers in the grocery and pharmaceutical sectors. The thematic analysis revealed recovery strategies such as restored supply chain continuity, improved inventory levels, improved financial capabilities, enhanced supplier relationships, and sustained customer service levels. These indicators were triangulated with the participants’ insights and industry reports on post-pandemic performance.

The research is grounded in both Resource Dependence Theory (RDT) and Resilience Theory (RT), as they offer complementary insights into how retail companies navigated the challenges of the COVID-19 pandemic. RDT sheds light on the critical role of resource dependencies among supply chain partners during the crisis, emphasizing how limited resources and external dependencies can support a company's ability to respond to disruptions. This perspective is crucial for understanding why companies with more resources recovered faster. Meanwhile, RT focuses on the adaptive capabilities and resilience strategies that allowed these companies to overcome adversity. These theories are critical for examining the dynamic interactions between resources, capabilities, and SCORE during crises.

The objective of the study is to explore the factors that contributed to retail companies' resilience for faster recovery and its sustained performance during the pandemic and beyond.

The sub-objectives (SO) are:

SO.1 To identify the proactive resilience strategies that were effective in mitigating supply chain disruptions in the retail sector, and to analyse how these strategies contributed to sustaining recovery during the COVID-19 pandemic.

SO.2 To investigate how hybrid strategies, combining both proactive and reactive approaches, supported by organisational resources (such as technologies, labour, transport), can enhance recovery from supply chain disruptions leading to continued business performance.

The following research questions address the above objectives.

RQ1: What extent the supply chain disruption caused by the COVID-19 pandemic impacted the retail industry?

RQ2: What proactive resilience strategies were employed by the retail sector to enhance supply chain resilience, and how did these strategies contribute to sustainable recovery during the COVID-19 pandemic?

RQ3 What reactive resilience strategies were adopted by retail supply chains to overcome disruptions in COVID-19 pandemic, and how did they contribute to the sustainable recovery of pandemic-affected retailers?

RQ4 To what extent did resources, such as technologies, labour, and materials, contribute to faster recovery from disruptions?

1.4 Research Methodology

The research is described as exploratory because it aims to investigate an under-explored area—specifically, the resilience strategies of the Australian retail sector during the COVID-19 pandemic. This exploratory approach is justified as there is limited prior empirical research in this specific context, necessitating an open-ended, flexible research design. As such, the exploratory nature of this study allows for an in-depth examination of how retailers adapted their supply chains to recover from unprecedented disruptions. Additionally, interviews can provide in-depth knowledge about the study and allow the researcher to explore the research questions in their natural context (Ramanathan et al. 2017). Further, it is appropriate where existing knowledge drawn from literature is limited. Thus, interviews were undertaken on selected firms representing a cross-section of retail industry. Ketokivi and Choi (2014) propose three methodological approaches to interview/case research: theory generation, theory testing and theory elaboration. This study embarks on theory elaboration approach that offers more variables than the existing model under consideration (Ramanathan et al., 2017).

The study undertook interviews with senior supply chain and risk managers, executive directors, and owners of medium and large retail sectors, particularly from the pharmaceutical and grocery sectors, in Victoria and Western Australia. They were contacted via LinkedIn, where snowball techniques were used to get more contacts. The respondents were provided with a copy of the semi-structured questionnaire a week prior to the interview date, offering them the opportunity to prepare answers. A review of relevant literature was used to develop the questionnaire, which ensured its alignment with the research objective(s). A total of 32 interviews were conducted in Western Australia and Victoria States. The lack of availability of participants due to COVID-19 resulted in fewer participants from both retail sectors that operated under multiple lockdowns and restrictions. NVivo software was used for data analysis and for the generation of themes. Table 4. 2 in chapter 4 provides retail firms (coded as C1 to C32) for confidentiality) as either pharmaceutical or grocery where participants were engaged in retail activities.

1.5 Research Significance

This study is timely as most organisations are looking for strategies to deal with the effects of the COVID-19 pandemic and sustainable operations post-COVID-19. This empirical and evidence-based research to develop a framework of hybrid strategies that likely enhance the

supply chain resilience. As Scholten et al. (2020) argue that a considerable part of the literature is conceptual, having a limited empirical base. Adding to that, Van Hoek (2020) pointed out that the gap between industry practices and well-defined literature needs further investigation. The study is critical to understand how the retailers can cope with the strategies while facing the disruptions, particularly in Australia context. Hudecheck M et al. (2020) highlight that over 1,400 epidemics hampered business activities, retail sector in Australia was not different. The recent unprecedented and devastating COVID-19 outbreak pushed the researchers further to investigate the adequate level of SCRE considering epidemic and pandemic outbreaks (Paul et al., 2023). While the retail firms are heavily affected by the current pandemic, there are no clear guidelines for the managers of retail firms to fight the disruption and recover. This research, therefore, extends the literature by exploring the hybrid resilience enhancing strategies, that the business owners/managers can adapt and innovate in times of crisis (Beckers et al., 2021; Donthu & Gustafsson, 2020; Pantano et al., 2020).

While most of the literature on epidemics and pandemics emphasised humanitarian logistics and ignored commercial organisations (Chowdhury et al., 2020b; Rahman et al., 2021), the study aims to provide strategies to ensure the retailers' supply chain is resilient. The study thereby builds on previous research of several scholars who show that SCRES supports organizations to better cope with disruptions and helps them to gain a competitive advantage in turbulent environments (Hendry et al., 2019). By studying the hybrid strategies that other successful companies adopted to recover from such pandemics, this study investigates how best the retainers prepare for and react to future disruptions.

This research, thus, contributes to the literature as follows:

- I. It offers a comprehensive list of proactive and reactive strategies that help recovery process from the impacts of COVID-19 outbreak in the retail industry.
- II. The use of resilience theory (RT) and resource dependency theory (RDT) underpinning the hybrid resilience strategies leading to faster recovery contribute in a way that these theories are extended further to the area of resilience enhancing strategies.
- III. It guides managers and stakeholders to make strategic and premeditated decisions to implement strategies in the context of the retail context successfully.

1.6 Research Ethics

Human participants are exposed to some ethical issues during face-to-face interviews. Therefore, ethics approval from Victoria University's Ethics Research Committee was obtained (HRE20-227)- see attached copy in (Appendix D) to ensure that the interview questions adhered to general ethical codes of conduct for research of this nature. Following the selection of the informants and entities, they were given an overview of the research and the scope, purpose, and objectives of the interview. They were also told how the findings would be used and published. To obtain participants' opinions and views, their role as interviewees was clarified. Prior to each interview, the interviewees were given consent forms as well as a list of questions. Before the interviews were conducted, all the participants were supplied with a participant information sheet and asked to sign the informed consent form. The consent form explained the purpose of the study and emphasised that participation in the study was voluntary. To comply with the condition of anonymity, each retailer and participant was assigned a code as its fictitious name. Consequently, personal details concerning participants (interviewees) are omitted from the study. Furthermore, the confidentiality, privacy, and anonymity of informants and their organisations were guaranteed and maintained throughout the research.

1.7 Thesis Structure

After defining the research objective and justifying the study of resilience-enhancing strategies for the Australian retail sector supply chain in **Chapter 1**, **Chapter 2** provides an overview of the Australian retail industry, with a focus on the pharmaceutical and grocery industries, as well as a snapshot of their major supply chain actors. The chapter further discusses some of the pressing issues and challenges that pharmaceutical and grocery supply chains faced, particularly during the COVID-19 pandemic. After establishing the context, **Chapter 3** provides a detailed literature review as well as a description of the thesis's theoretical foundation and conceptual framework. **Chapter 4** focuses on the research methodology, followed by **Chapter 5**, which presents the findings from the analysis of the interviews. **Chapter 6** presents a discussion of findings supported by existing literature. This chapter also offers a series of propositions based on the discussion as well as a revised conceptual framework. Finally, **Chapter 7** presents a summary of the thesis and highlights the theoretical and practical contributions as well as research limitations and suggestions for future studies.

1.8 Summary of the Chapter

This chapter sets the stage for investigating strategies to enhance SCRE in the Australian retail sector, specifically focusing on the period during and after the COVID-19 pandemic. The study delves into the complexities of retail supply chains, emphasising the increasing consumer demand for transparency in the origin of goods, transportation timelines, and pricing. By examining the triad supply chain model—encompassing producers/distributors, retailers, and customers—the research identifies how proactive and reactive strategies from existing literature were adapted and merged into hybrid strategies within the Australian context. This unique longitudinal approach offers a comprehensive analysis of the dynamic adaptations made to sustain recovery during a global crisis. The study's primary contribution lies in its in-depth exploration of these hybrid strategies, providing a first-of-its-kind longitudinal analysis of SCRE in the context of a pandemic. The research employs the RDT as a theoretical framework, facilitating a deeper understanding of the dependencies and vulnerabilities within supply chains. Methodologically, the study uses qualitative interviews with 32 organisations across pharmaceutical and grocery supply chains in Western Australia and Victoria consisting of two phases. Through NVivo thematic analysis from interviews, the research identifies key determinants of SCRE enhancement. Finally, this thesis significantly contributes to the field by offering practical insights for industry stakeholders on managing supply chain disruptions. It highlights the effectiveness of various strategies in mitigating risks and ensuring a stable supply of essential goods. The findings not only address immediate challenges posed by crises like COVID-19 but also provide a foundation for future strategic planning, making a substantial impact on the development of resilient supply chain practices in the retail sector.

Chapter 2

Understanding Australian Retail Industry and Contextualisation

2.1 Introduction

This chapter focuses on the contextualisation of the retail sector in general and the Australian retail sector. Even though over the past two decades there has been growing pressure on retail companies to transform their operations to become more proactive from both efficiency performance and building SCRE perspectives, improved customer relationships, increased visibility, improved brand image, increased efficiency, and improved customer service are significantly stronger drivers of such initiatives. Presently, the retailing sector stands out as a frontrunner in adopting innovative technologies and exhibits significant diversity in terms of business size, geographic region, retail formats, sector competition and the nature of goods sold. As a result of the COVID-19 pandemic's subsequent lockdown and social distancing measures, retail firms have been forced to innovate and adapt to the COVID-19 pandemic by developing and adopting a variety of both reactive and proactive strategies for survival. This chapter is organised into six sections. Section 2.2, following the introduction in 2.1, presents a discussion on explaining the concept of retailing and the contextualisation of the study in an Australian retail context, including a discussion of the impact of the COVID-19 pandemic. Section 2.3 focuses on retail supply chains, exploring responsive and agile supply, and making reference to literature reviews. Section 2.4 delves into exploring the grocery and pharmaceutical sectors' operations prior to the COVID-19 pandemic, and contextualising and revising the scenarios in both Western (WA) and Victoria prior and after the pandemic. Section 2.5 presents a summary of the key findings drawn from this chapter.

2.2 Contextualisation of Retailing

Over the last two decades, there has been growing pressure on retail firms to transform their operations to becoming more proactive on efficiency and resilient. Key drivers of such initiatives include improved customer relationships, enhanced brand visibility, increased efficiency, and better customer service. The literature varies on the scope and activities of retail operations, but there is a consensus that supply chain management—particularly transport and logistics activities—represents the highest cost areas. These aspects have been inadequately explored in research, with their resilience not well covered (Ekinici et al., 2024; Petljak1 et al., 2014). According to the Australian Retail Sector Report (2022), nearly 140,000 retail businesses operate in Australia, contributing to 4.1% of Gross Domestic Product (GDP) and

employing 10.7% of the workforce. The sector exhibits significant diversity in terms of business size, geographic regions, retail formats, sector competition, and the nature of goods sold. The dominance of large supermarket chains, franchise companies, and shopping centres has resulted in a prevailing trading philosophy of “daytime, everywhere, everything the same.” Retailers have been compelled to adapt to the rise of online shopping, leading to the closure of many brick-and-mortar stores (Pacheco, 2020). The COVID-19 pandemic further accelerated these shifts, with many stores temporarily or permanently closing due to reduced foot traffic and staffing challenges (Grimmer, 2022; Medina, 2021). Consequently, consumer shopping habits have undergone significant transformation (Eger et al., 2021; Sheth, 2020).

The retail industry has demonstrated its ability to adapt to evolving customer preferences and purchasing behaviours. However, the pandemic and subsequent lockdown measures significantly disrupted consumer buying habits. As consumers were forced to improvise, new routines emerged, such as increased reliance on home deliveries when visits to physical stores were restricted (Sheth, 2020). In response, retailers have been re-evaluating their business models to optimize their store portfolios while enhancing their online and digital presence (Macau, 2022) Ngoh & Groening, 2022). Despite these efforts, retailers face the ongoing challenge of achieving profitable growth across multiple channels in the face of unprecedented challenges caused by the COVID-19 pandemic. As non-essential businesses closed and individuals self-isolated under lockdown measures, the retail supply chain shifted from physical stores to online channels. This shift prompted panic buying and stockpiling of essential products like medicine, cleaning supplies, toilet paper, and groceries.

In Australia, retail businesses faced disruptions due to fluctuating demand for certain products. According to a Gartner report, changes in consumer purchasing patterns and temporary store closures forced non-essential retailers, such as those dealing in luxury goods and apparel, to halt operations temporarily. Understanding how the retail sector copes with the disruptive effects of the COVID-19 pandemic is crucial for future preparedness. The prevailing trading philosophy, as described by Fischer (2005), implies that large supermarkets and warehouses centrally drive procurement and supply chain policies. They often prioritize bulk orders from price-competitive producers and farmers, sometimes overlooking unique local characteristics. This approach has contributed to a somewhat monotonous shopping environment. For instance, in Australia, numerous franchise businesses sell inexpensive products, often of lower quality, sourced from China and other countries. Despite various “Buy Australian Made” campaigns,

these initiatives have had limited impact on consumer purchasing decisions, especially during times of economic hardship.

2.2.1 The meaning of retailing

Retailing refers to the comprehensive range of activities involved in the sale of goods or services directly to the end consumer for their personal, non-business use. These activities can take place through various channels, such as physical stores, markets, door-to-door selling, mail order or over the internet. The buyer's intention is to consume the purchased goods or services (Bhattacharyya, 2012). According to the Australian Bureau of Statistics (Australian Bureau of Statistics(ABS), 2020), the retail industry trade encompasses businesses primarily engaged in the resale of new or used goods to final consumers for personal or household consumption. It may also include selected repair activities, such as repairing household equipment or motor vehicles. While there are different definitions of retailing in the literature, for the purpose of this study, the researcher relies on the definition provided by(Alexander & Doherty, 2009) which describes retailing as the process of selling goods and services directly to end consumers or those purchasing on their behalf. This process typically takes place through store outlets, but it can also involve mail order or other specified channels. Retailing involves direct interaction with customers and encompasses the coordination of business activities, starting from the conceptual or design stage of a product or offering all the way to its delivery and post-delivery service to the customer (Bhattacharyya, 2012; Martinelli & Tagliazzucchi, 2019; National Retail Association Report, 2020).

2.2.2 General Retail Trends.

Generally, the retail industry is commonly viewed as a traditional business sector, often associated with securing favourable deals, exerting pressure on suppliers, and engaging in competitive pricing. The marketing aspect of this field is often perceived as having a short-term focus, predominantly centred around price promotions (Krafft & Mantrala, 2006). However, recent years have witnessed a profound transformation in the realm of retailing. Retail operations conducted by companies such as Woolworths and Coles have evolved significantly in terms of complexity and sophistication. Presently, the retailing sector stands out as a frontrunner in adopting innovative technologies like radio frequency identification (RFID) and self-service technologies (Larkin & Nankervis, 2021). Retailing has emerged as a pivotal industry driving advancements in supply chain management and logistics. It takes the lead in capturing customer data, utilising data warehousing, and conducting analyses.

Moreover, retailing serves as a prominent field for the research, development, and application of advanced analytical, econometric and optimisation methods, particularly in areas such as pricing and integrated marketing communications management. Notably, online retailing remains a primary commercial application of the internet, positioning itself at the forefront of the globalisation of business (Sparks, 2010).

With reference to the above definitions, the retail industry is a composition of companies that sell merchandise. Therefore, when studying the supply chain practices of the retail industry, we study the buyer–supplier relationship, which in turn drives the activities between retailers and suppliers. In retail supply chains, the network consists of many suppliers that serve multiple retailers and retailers that are served by multiple suppliers. Between the suppliers and the retailers, wholesalers and other intermediaries often reside and provide the link between retailers and suppliers. There have been changes in the dynamics of the relationship between these three key players in the supply chain due to the fourth major player that drives these changes, the retail customer. Through their spending habits, retail consumers determine the level of customer service that is expected. The strategy behind each retailer is focused on being able to fulfil that demand. Because of recent changes in consumer spending, the focus in the retail supply chain has shifted from handling customer demands through inventory levels to handling customer demands through changes in the trading partner relationship and the use of technology in their supply chain (Grimmer, 2022).

2.2.3 The impact of COVID-19 in Australia’s Retail Sector operations.

According to Ge et al. (2019b), a retailer typically has indirect links with manufacturers and their suppliers in addition to direct links with wholesalers, distribution centres and customers. Due to their proximity to clients, retailers play a significant role in the supply chain (Fleisch & Tellkamp, 2005; Wang & Liu, 2007). It is evident that COVID-19 has an impact on all supply chain participants, including producers, merchants and wholesalers (Sharma et al., 2020). Generally, customers buying vital products in a panic disrupts supply chains and causes demand-side shocks (Hobbs, 2020; Yuen et al., 2020). Retailers as well as other stakeholders of supply chains struggle hard to meet consumers’ needs (de Sousa Jabbour et al., 2020). Transport bottlenecks due to lockdowns and restrictions have disrupted the movement of goods along the food supply chain and on time deliveries and service levels also decreased (Chowdhury et al., 2020b). Figure 2.1 below shows some of the challenges that retailers faced during the pandemic.

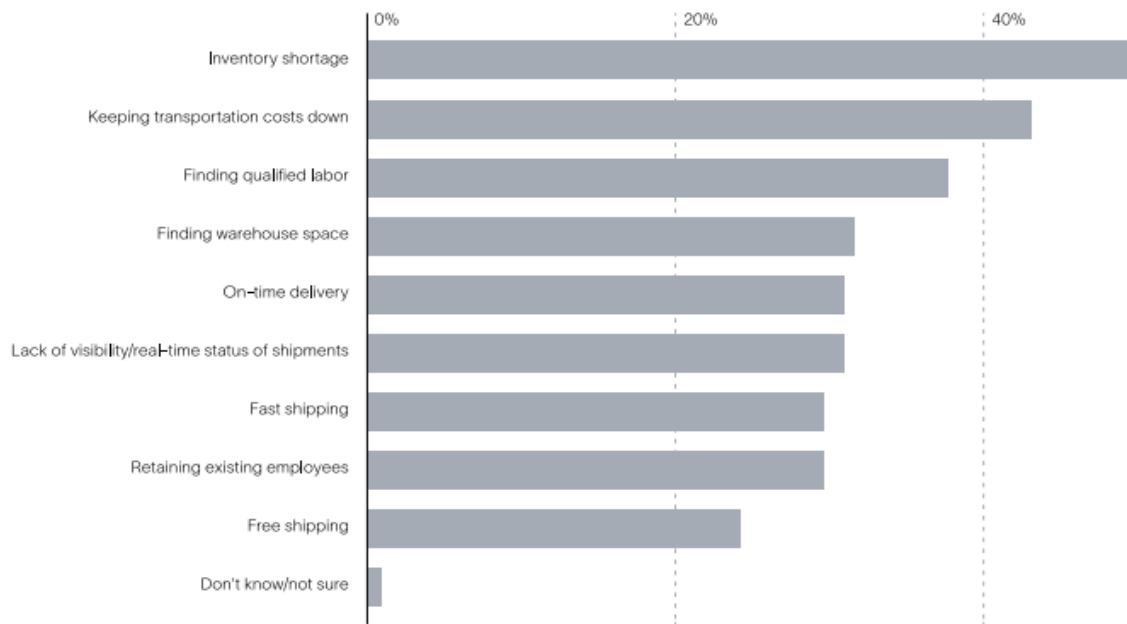


Figure 2-1 Challenges faced by retailers during the COVID-19 pandemic.

Panic buying by consumers has posed significant challenges for merchants, but the current pandemic has also disrupted companies' supply chains, resulting in trillions of dollars in revenue losses and prompting shifts in supply chain strategies (Kumar et al., 2020). Kumar et al. (2020) identified 12 key challenges, including limited access, viability issues, supply-demand imbalances, and communication breakdowns, while providing strategies to address these obstacles effectively. Typically, distributors and wholesalers supply products to retailers. The key factor causing retailer disruption is a high reliance on these suppliers (Gupta et al., 2021). To clarify the understanding of some key terms used in this study, brief definitions are provided below:

Supply Chain: A supply chain refers to the entire network of organizations, individuals, activities, information, and resources involved in delivering products or services to consumers. It includes the coordination of suppliers, manufacturers, warehouses, retailers, and customers (Simchi-Levi et al., 2008).

Retail Supply Chain: A retail supply chain is a customer-centric process focused on distributing goods from manufacturers or suppliers to end consumers through brick and mortar (physical retail stores) or online platforms. It encompasses activities such as inventory management, transportation, and customer service, all tailored to meet the needs of the end customer (Christopher, 2016).

Triadic and Dyadic Supply Chains: A triadic supply chain involves three key participants—manufacturer or supplier, retailer, and end customer—interacting to deliver goods. In contrast, a dyadic supply chain comprises direct interactions between two parties, such as a buyer and a supplier (Carter et al., 2015). A triadic supply chain includes the supplier, retailer, and customer, as illustrated in **Figure 2.2**.



Figure 2-2 shows the triadic supply chain that includes the supplier, retailer, and customer.

The triadic structure demonstrates the interactions among three key players. In comparison, a dyadic structure involves only two participants, such as a supplier and a retailer. In a triadic structure, the supplier provides goods to the retailer, who then sells them to the end customers. Triadic supply chains are often preferred in research due to their manageable structure, which facilitates data collection through surveys or interviews.

According to, Chowdhury et al. (2020b) and Yu and Aviso (2020), it is therefore critical to put emphasis on the importance of finding better approaches to mitigate the effects of a pandemic. Considering the importance of a resilient retail supply chain, this study aims to find out what practical strategies other retailers adopted to recover from the COVID-19 pandemic disruption and build resilience. It offers to elaborate on each strategy for future references in case of such similar disruptions considering that resilience is the ability not only to recover quickly from a crisis but also to bounce back better and even thrive (McKinsey & Company Report 2023).

The retail sector has been selected as focus of study because the retail industry is at the front position of embracing internet of things (IoT) (Balaji & Roy, 2017) to overcome the challenges posed by its current practices and customer expectations (Majeed & Rupasinghe, 2017).

With the spread of pandemic, the importance of retail sector has been once more discovered (Ekinici et al., 2024). However, due to a few reasons that increase uncertainty (pandemic spread, inflationary economy, etc.), members of the sector struggle with survival. Moreover, in retail sector, it is where consumers, for example want to know where goods were sourced from, how long is it taking to be transported, how much was paid etc. giving in-depth supply chain analysis of both the dyadic and triadic collaborations (Sandberg, 2005). It is also central to the national economy interconnected to the stakeholders involved that moving goods such as food, fuel and medicines and ensuring the continuation of trade (exports and imports) of minerals, food and fibre is critical to our wealth (ALC). Australia's response to COVID-19 has been one of the most successful in the world. Among the explanatory factors are Australia's early physical distancing steps, relatively high per capita testing rates, political stability, national income and geographic isolation (O'Sullivan et al., 2020). There are currently few specific studies that have focused on SCDs and how Australian Firms in the retail sectors are coping up with the devastating effects of COVID-19 pandemic. The COVID-19 pandemic has introduced a lot of unknowns, with uncertainties that lay ahead swinging between extremes due to its complexity (Moritz, 2020). In this regard, firms, particularly the retail sector, must prepare to dampen the negative effects caused by the pandemic on society and supply chain (Donthu & Gustafsson, 2020; McKinsey Global Institute Report, Aug 2020). It is therefore critical to examine how retail industries in Australia are faring with the negative devastating effect of COVID-19 disruptions. Recovery from a disaster such as the COVID-19 pandemic needs to be approached differently according to place, history and size. It is not about getting where you were, but rather grasping and repositioning opportunity to create a better more resilient place (Chowdhury et al., 2020b; Craven et al., 2020). COVID-19 has dramatically disrupted the sector, with the shock differing massively between brick-and-mortar versus online shops, essential versus non-essential stores, and small versus large retailers. According to Matt Darby Head of Retail and Head of KPMG:

"There can be no doubt that the global retail sector has been impacted by hugely disruptive forces as consumers shift to digital and online as their preferred medium of engaging with their preferred brands. The simple truth is the Australia and New Zealand retailers are not immune to the changes impacting the whole world" (Australian Retail Outlook, 2020).

Recent research conducted by Business Continuity Institute (BCI)(The Sunday Times, 2020) found that 50% of businesses had insufficient plans to cover supply chain issues that arose as a result of the pandemic, While some sectors ,such as groceries and the pharmaceutical industry

were proactive, many were unprepared and therefore unable to react quickly to mitigate the overall impact.

Despite the negative impact of the pandemic, the retail sector will continue to adapt and look for the opportunity to differentiate themselves, reinventing their businesses and leveraging digital and data to engage with their target customer. According to the Australian Retail Outlook (2020), while the fundamentals for successful retailing remain (effective merchandising, supply chain operations and enticing value proposition), technology has become a key area of interest for major retailers across Australia. In fact, one word that can best describe the state of Australian retail and broader economy under COVID-19 pandemic, is perhaps ‘tempestuous’. In the Australia retail sector, the ability for businesses to move to online has implications for the distribution network to make those goods available. In terms of collaboration a concerted effort to fight against the devastation effects of COVID-19, the Shopping Centre Council of Australia (SCCA), National Retail Association (NRA), Shop Distributive and Allied Employees Association (SDA), Pharmacy Guild of Australia (PGA) and Australian Retailers Association (ARA) jointly developed the protocol to provide a consistent, practical and public health led guide for shopping centres and retailers that continued to trade (National Retail Association Report, 2020).

2.2.4 Supply resilience in retail supply chains

A retailer typically has direct connections with three members of the supply chain: wholesalers, distribution centres, and customers. They also have indirect connections with manufacturers and their suppliers (Ge et al., 2019). Retailers play a vital role in the supply chain due to their proximity to customers (Wang & Liu, 2007). The COVID-19 pandemic has impacted all partners in the supply chain, including manufacturers, retailers and wholesalers (Sharma et al., 2020). Panic buying by customers has disrupted supply chains and caused demand-side shocks (Hobbs, 2020; Yuen et al., 2020). Retailers, along with other supply chain members, are facing challenges in meeting consumer needs (de Sousa Jabbour et al., 2020). While retailers have experienced panic buying, they have also encountered disruptions in product supply from companies during the pandemic (Kumar & Kumar Singh, 2021). A total of 12 challenges faced by retailers were identified by M. Kumar et al. (2020). These include challenges such as supply-demand imbalances, lack of access, lack of viability and communication issues just name but a few. Guidelines were provided to overcome these challenges. Retailers typically source products from wholesalers and distributors, and their high

dependence on these suppliers is a key factor contributing to disruptions (Gupta et al., 2021). Consequently, Yu and Aviso (2020) stressed the importance of finding better approaches to mitigate the effects of a pandemic.

Given the significance of a resilient retail supply chain, this study aims to investigate whether retailers face recovery problems during the pandemic and propose strategies to overcome these recovery problems and build resilience in their supply chains. Previous studies have highlighted disruptions in the supply chain caused by the COVID-19 pandemic, primarily focusing on manufacturing firms (Paul & Chowdhury, 2020). However, no study has specifically examined supply disruptions faced by retailers. We argue that managing disruptions in this sector is crucial, as some of these products handled by retailers are essential. The impact of unforeseen disruptions on the supply side of retailers can be mitigated by implementing appropriate supply resilience strategies (Golan et al., 2020). Therefore, the focus of this study, which examines the effects of COVID-19 and provides supply resilience strategies for retailers in the retail sector, is both relevant and timely.

The retail industry has an extremely broad scope. According to (leigh, 2010) retailers were once the passive recipients of products, allocated to stores by manufacturers in anticipation of demand.

The retail industry has a broad scope and has evolved significantly over years. Previously, retailers were passive recipients of products allocated by manufacturers; however, they control and manage the entire supply chain from production to customer delivery (Sparks, 2010). This shift has been particularly crucial during disruptions like the COVID-19 pandemic, which significantly impacted the retail sector. In Australia, strict lockdown regulations, particularly in Victoria and Western Australia, restricted customer access to physical stores, enforced social distancing, and mandated face masks, which directly affected retail operations. As a result, retailers had to swiftly adapt by enhancing online channels to meet changing consumer needs. For example, grocery retailers, who faced unprecedented demand surges, responded by expanding their digital platforms and home delivery services to maintain continuity. This shift towards online retailing and service innovations was essential for ensuring customer safety and maintaining supply chain resilience. The pandemic has underscored the importance of agile strategies, prompting Australian retailers to adopt both proactive and reactive measures to ensure business continuity (Roggeveen & Sethuraman, 2020). However, further exploration is needed to understand how these firms effectively innovated to meet evolving consumer expectations during this period.

As COVID-19 was first identified in China, initial studies investigated how the outbreak of the crisis has reshaped the retail landscape in China with emphasis on the increasing importance of online channels (Gao et al., 2021; Pilawa et al., 2022; Szász et al., 2022). Table 2.1 below summarises the literature on the impact of COVID-19 on the evolution of online retail.

Table 2-1: Literature Summary of the impact of COVID-19 on the evolution of online retail

Author(s)	Country (Retail Branch)	Period	COVID-19 Implications	Short-term Drivers	Long-term Implications
Gao et al. (2020)	China (food retail)	First wave (Feb 2020)	Pandemic (number of COVID-19 cases/day/city)	Pandemic (cases per day/city)	–
Li et al. (2020)	China (food retail)	First wave (Feb 2020)	Consumer behavior (reduce health risks, gain access to food products)	Consumer behavior (reduce health risks)	–
Hao et al. (2020)	China (food retail)	First wave (Feb 2020)	Consumer behavior (food stockpile behavior associated with online channels)	Consumer behavior (stockpile behavior)	–
Guo et al. (2020)	China (food retail)	First wave	Pandemic (securing food supply for the urban population)	Pandemic	–
Jiang and Stylos (2021)	China (food retail)	First wave (Feb–Mar 2020)	Consumer behavior (digital engagement during lockdowns)	Consumer behavior (digital engagement)	–
Tran (2021)	Vietnam (various sectors)	First wave (Jan–Mar 2020)	Consumer behavior (fear of pandemic)	Consumer behavior (fear of pandemic)	Depending on COVID-19 lifespan, consumer behavior might change in the long run
Hall et al. (2021)	New Zealand (various sectors)	First wave (Feb–Mar 2020)	Regulations (travel restrictions and lockdown policies)	Regulations (lockdown policies)	–
Martin-Neuninger and Ruby (2020)	New Zealand (grocery)	First wave (Feb–Apr 2020)	Regulations (lockdown policies)	Regulations	Negative online experience can have a long-term impact
Jílková and Králová (2021)	Czech Republic (various sectors)	First wave (Apr 2020)	Pandemic (spread of COVID-19)	Regulations (government restriction)	–
Mehroliia et al. (2021)	India (food retail)	First wave (Apr 2020)	Consumer behavior (fear for health)	Consumer behavior (fear for health)	–
Hwang et al. (2020)	US (craft and art supplies)	First wave (until Apr 2020)	Regulations (government-issued interventions)	Regulations	–
Chang and Meyerhoefer (2021)	Taiwan (food retail)	First wave (Jan–Apr 2020)	Pandemic (number of new infections)	Consumer behavior (media consumption)	Customers trying the online channel for the first time might continue using this channel
Beckers et al. (2021)	Belgium (various sectors)	First wave (Apr–Jun 2020)	Regulations (travel restrictions, social distancing rules)	Regulations	The ad-hoc setup of local online retail channels threatens their post-COVID sustainability
Guthrie et al. (2021)	France (para-pharmaceutical, healthcare)	First wave (until Jul 2020)	Consumer behavior (panic buying, coping with the pandemic context)	Consumer behavior (panic buying, coping)	–
Hobbs (2020)	Canada (food retail)	First wave	Consumer behavior (panic buying)	Regulations (stay-at-home orders)	Online food retail will receive a sustained upward shift in adoption
Kirk and Rifkin (2020)	US (various sectors)	First wave	Regulations (social distancing rules)	Consumer behavior (health concerns)	–

Pantano et al. (2020)	n.a. (various sectors)	First wave	Regulations (lower accessibility of stores)	Regulations	Further store closures or bankruptcy of major brick-and-mortar retailers
Reardon et al. (2021)	Asia and Latin America (food retail)	First wave	Consumer behavior (fear for health)	Consumer behavior	–
Sheth (2020)	n.a.	First wave	Consumer behavior (impact of a disaster and crisis on shopping behavior)	Consumer behavior	–
Eger et al. (2021)	Czech Republic (various sectors)	Second wave (Sep 2020)	Consumer behavior (fear for health)	Consumer behavior	Customers might change their shopping habits in the long run
Chopdar et al. (2022)	India (mobile shopping)	Second wave	Consumer behavior (fear of COVID-19)	Consumer behavior	Customers might change their shopping habits in the long run
Singh et al. (2022)	India (various sectors)	Second wave	Integration of blockchain and AI for supply chain transparency	Technology adoption	Trust and transparency enhancement in e-commerce
Zhang et al. (2023)	Global (e-commerce)	Post-pandemic (2023)	SCRE with omnichannel logistics	Logistics optimization	Resilient and adaptive supply chain systems
Taylor et al. (2024)	US (e-commerce)	Post-pandemic (2024)	AI-driven decision-making for inventory and personalization	Advanced analytics	Enhanced efficiency and customer loyalty

The above Table 2.1 synthesizes existing published research and incorporates recent studies from 2020 to 2024, providing insights into how the pandemic reshaped online retail globally. It underscores key themes, such as consumer behaviour, technological innovation (e.g., AI, blockchain), and supply chain resilience, while also identifying ongoing challenges and potential areas of future research. This summary is a useful analysis to understand the transformative effects of the pandemic on retail and its lasting impacts on the industry. These studies focused on how the outbreak of the pandemic influenced online shopping (Gao et al., 2021), and how online channels helped the population to cope with the emerging health-crisis (Li et al., 2020; Hao et al., 2020). In this research the scope of the analysis has been reduced to specific segments that mainly focus on pharmaceutical and grocery sectors. Australian retail industry is one of the key contributors to the country's economy and was on a growth trajectory from 2004 to 2019 (Research & Markets Report, 2021). The total retail turnover accounted for approximately AUD 329.6 billion in 2019, which was around AUD 9 billion more than the value it recorded in the previous year. However, the sudden COVID-19 pandemic which hit the country in early 2020 has brought several changes to the retail industry in the country where it recorded a drop in the total number of sales transactions during the first and second quarters

of 2020. Lockdown measures, physical distancing norms, and stay-at-home-to-stay protected protocols have turned one of the largest distribution channels in the country. The physical retailing stores switched to omnichannel distribution to keep the competition alive. Australia is one of the most urbanised societies in the world, with more than 24 million people (90% of the population) living in the urban areas of Sydney, Melbourne, Adelaide, Brisbane, and Perth, as well as in smaller cities and towns within 100 miles of the ocean. Factors such as internet advertising, high brand awareness rate, and the influencer's trend for the product categories including personal care and household products, footwear and apparel and others are helping the market to record more revenue transactions in the country. The trend is anticipated to continue in the forecast period as well owing to the growing demand for them.

Australian online shopping experienced a relatively stable growth year on year before COVID-19 pandemic allowing local retailers to leisurely transform their supply chain into omnichannel capable. However, this growth rate has spiked due to the lockdowns whereby online shopping was the only way that consumers could obtain their products. This led to a new generation of online savvy consumers that are not limited to certain demographics, thereby forcing retailers to rethink /reshape their supply chain strategies to be sustainable and relevant. With the COVID-19 pandemic's significant fatality (Lipsitch, 2020) and its high transmissibility (Cai et al., 2020) the pandemic has brought together "a once-in-a-century pandemic", majorly impacting our society and dramatically changing our lives (Gates, 2020). All industries, including manufacturing and retail, continue to face an extraordinary crisis as the COVID-19 pandemic has severely impacted all involved parties, such as suppliers, customers, employees, governments, and financial markets (Anderson et al., 2020). Australia's response and measures to contain COVID-19 have been some of the most successful in the world so far. Among the explanatory factors are Australia's early physical distancing steps, relatively high per capita testing rates, political stability, national income, and geographic isolation.

However, retailers, particularly the grocery and pharmaceutical retailers have faced problems ranging from lack of balance between supply and demand, lack of access and lack of viable communication. In general retailer's source products from wholesalers and distributors. It is this high dependence on the suppliers which causes a severe disruption in retailers (Gupta et al., 2021). According to the Australian Retail Sector Report (2022), the Australian retail sector suffered a number of challenges as summarised in Figure 2.2 below.

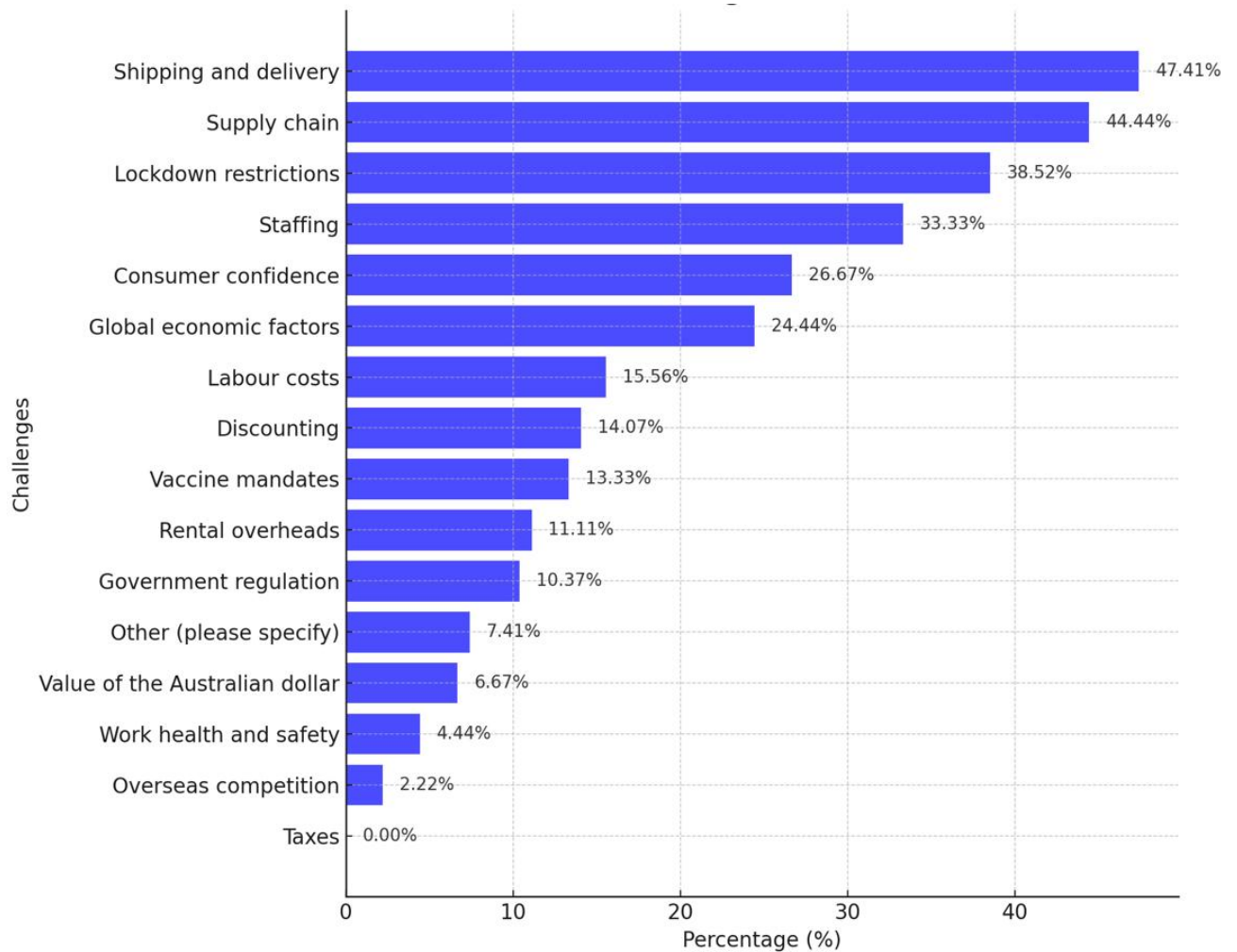


Figure 2-3 Challenges in Australian retail sector (Source Australia Retail Sector Report 2022)

Due to the global supply chain crisis caused by the pandemic, the retail industry in 2021 indicated that shipping and delivery (47.41 per cent) followed by supply chain (44.44 per cent) were two of the biggest problems in 2021. This was closely followed by lockdown restrictions (38.52 per cent) and staffing (33 per cent), all of which impacted each other (Australian Retail Sector Report, 2022). Australia has experienced plenty of supermarket shortages since the COVID-19 pandemic began. Empty shelves were due to spikes in demand as shoppers responded to lockdowns by buying more toilet paper, pasta, and other consumables. Although the shortage of toilet paper was significant during COVID-19, it is interesting to note there has been a shortage of toilet paper before, for example in 1973 in the United States and Venezuela in 2013 (Moore L, 2020) (Figure 2.3).

Toilet paper shortages

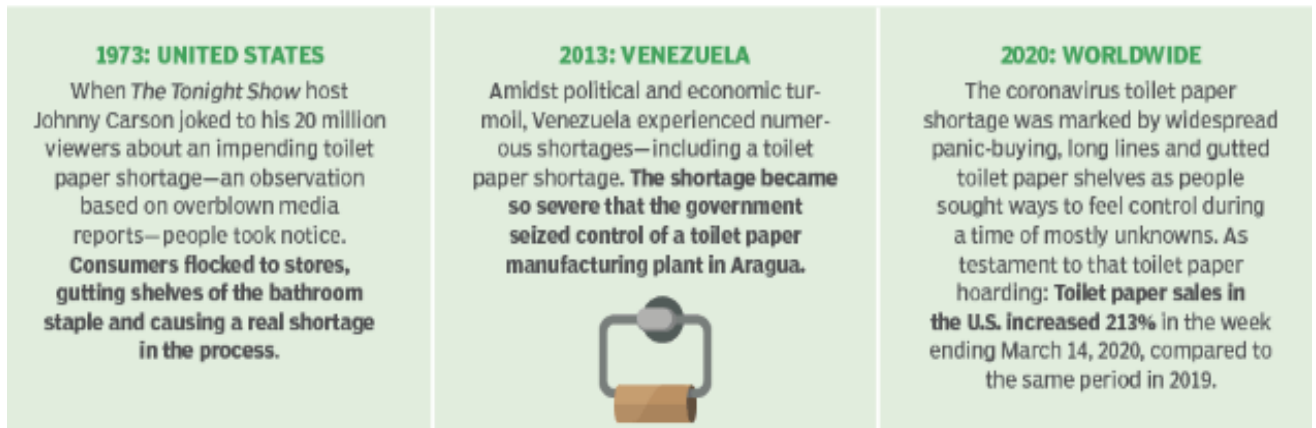


Figure 2-4 showing the toilet paper shortages in history. *Source* (Moore L, 2020)

This disrupted the usual rhythms of predictable supply chains (Macau, 2022). Apart from the first wave of COVID-19 spread in March 2020; shortages were localised. As Omicron infections surged in every state apart from Western Australia, supply chains were crippled by the sheer number of transport, distribution, and shop workers due to sickness or isolation. Another problem was in production, particularly in meat processing—an industry that was highly prone to the effects of the COVID-19 pandemic (Macau, 2022).

2.3 The Retail Supply Chain and Its Complexity

The retail supply chain encompasses a network of suppliers, distributors, and retailers working together to meet consumer demand. This study specifically focuses on the supply chains of the grocery and pharmaceutical sectors in the Australian retail industry, as these sectors played a pivotal role in maintaining the supply of essential goods during the COVID-19 pandemic. The grocery and pharmaceutical supply chains were critical in addressing heightened consumer demand and ensuring public health and safety. The complexities of these supply chains, such as high dependency on upstream suppliers and the need for rapid response to fluctuating demand, underscore their vulnerability to disruptions. This research narrows its scope to examine the resilience strategies adopted by these sectors, addressing supply-demand imbalances, inventory shortages, and distribution challenges that emerged during the pandemic. The study offers actionable insights for building robust and adaptive supply chains in similar crisis scenarios by focusing on these specific sectors.

In the retail industry, the distribution of fast-moving consumer goods takes place through regional distribution centres using large heavy goods vehicles. This method has implications for road congestion, infrastructure damage, and road accidents, resulting in an increase in what is referred to as the “transport intensity” of the supply chain (Christopher, 2011). Improving transport intensity can benefit stakeholders in the retail sector’s supply chain, not only in terms of economic gains but also by enhancing operational efficiency and building SCRE against disruptions. Retailers are responding to the challenges they face in terms of both environmental and economic aspects by exploring various solutions. These include the adoption of intermodal transport and new technologies, as highlighted by the European Retail Forum (2009). While there may be variations in the literature regarding the scope and number of retail operations and activities, studies, such as those conducted by (Petljak et al., 2014), consistently acknowledge that transport and logistics activities incur substantial costs and require further investigation. To effectively manage the supply chain, it is crucial to focus on all relationships and dependencies within the system. The chain’s ultimate culmination occurs with the final customer, underscoring the importance of understanding and meeting their needs.

2.3.1 Retailers and the responsive supply chain strategy

The COVID-19 crisis caused significant disruptions to supply chains, with noticeable fluctuations in both demand and supply. These disruptions triggered widespread chaos and ripple effects that reverberated across global networks (Sarkis, 2020) (Guan et al., 2020). The question still remains: How many traditional supply chain strategies and policies will survive the COVID-19 outbreak once life returns to normal? Retailers can significantly benefit from adopting a strategic supply chain plan that prioritizes responsiveness to predictable demand. This approach aims to achieve objectives such as maintaining stock of popular items, minimizing obsolete inventory, and reducing markdowns. By implementing a responsive supply chain strategy, retailers can effectively handle uncertain sales patterns without holding excessive safety stock. Figure 2.4 illustrates a typical generic supply chain structure, consisting of five stakeholders within retail organisations. Ideally, each stage of this supply chain would focus on cost reduction, with constant efforts from each stakeholder area to identify cost-saving measures. Trade-off decisions are made with a focus on time rather than cost. However, the COVID-19 pandemic had a widespread impact on the entire supply chain, leading to ripple effects across the industry. In response, supply chain managers have increasingly employed responsive strategies to meet unpredictable demand, ensure customer satisfaction, and

minimise waste. Faced with ongoing uncertainty, many retail leaders are now placing a stronger emphasis on building supply chain resilience to better withstand future disruptions.

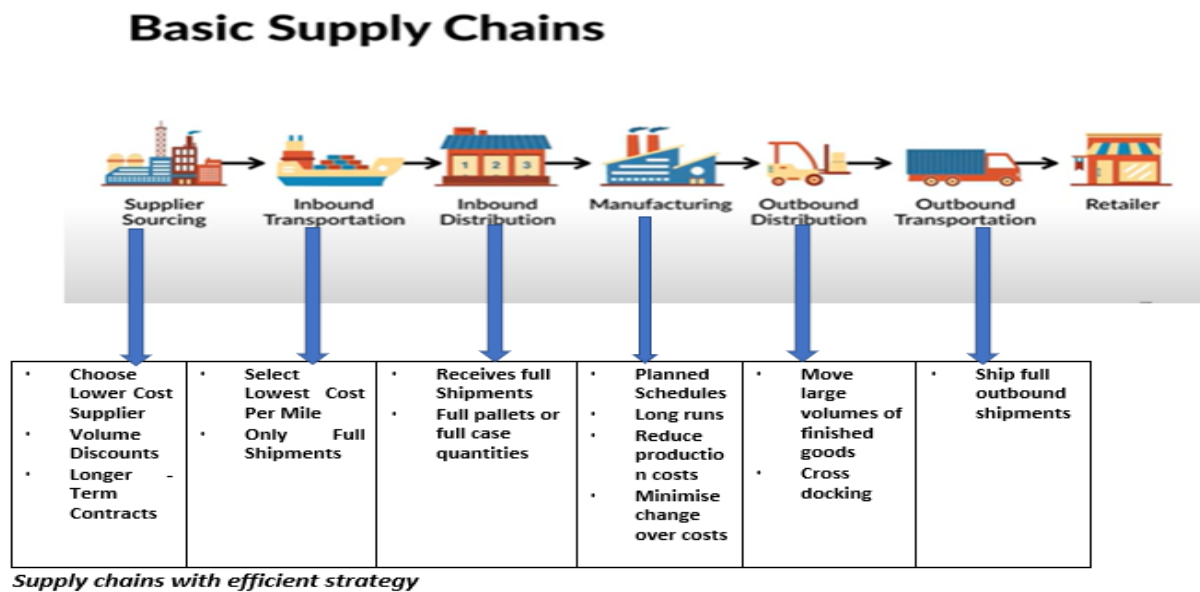


Figure 2-5 Supply chain with efficient strategy. (Source SCMT 4653 Supply Chain Strategy and Change Management)

2.4 The Retail Sector Prior to the COVID-19 Pandemic Lockdowns

According to Sopha et al. (2022) traditional retailers are of particular importance due to their contribution to the economic development of the regions and their social functions, such as by serving low-income consumers. Prior to the COVID-19 pandemic, the Australian grocery sector was characterised by fierce competition and a strong emphasis on convenience and quality. The market was highly consolidated, with a few major players dominating the industry. Coles and Woolworths, the two largest supermarket chains, held substantial market share and maintained an extensive network of stores nationwide (Australian Retail Sector Report, 2022). These supermarket giants offered a wide array of products, encompassing fresh produce, packaged goods, household essentials, and a diverse selection of international and local brands. These supermarkets aimed to cater to the diverse needs of consumers by providing a comprehensive shopping experience with conveniently located stores, competitive pricing, and loyalty programs.

Alongside the major supermarket chains, there were smaller grocery retailers like Aldi and IGA, which competed by offering competitive prices and a more focused product assortment. These retailers often targeted specific customer segments, emphasising affordability, or

establishing a local community presence. Before the pandemic, it was less popular than traditional brick-and-mortar shopping. Customers had the option to order groceries online for home delivery or use click-and-collect services, where they could pick up their orders at designated locations (Australian Retail Outlook, 2020). The Australian grocery sector had already witnessed a shift towards healthier and more sustainable products, driven by evolving consumer preferences and an increased focus on health and wellness. Consumer awareness and demand for organic, natural, and environmentally friendly options were on the rise. However, the arrival of the COVID-19 pandemic introduced significant disruptions and transformations to the industry. This led to shifts in consumer behaviour, supply chain challenges, and a surge in demand for online shopping and home delivery services.

2.4.1 COVID-19 Impacts on the grocery sector.

The Australian grocery sector and pharmaceutical industry are undergoing a transition driven by a complex mix of technological advancements and market forces. Rising consumer mobility and sluggish demand have intensified competition, further heightened by a high level of domestic and international market concentration. Supermarkets and grocery stores remain some of the most successful and diverse businesses within the grocery sector, while the pharmaceutical industry stands as one of the largest and most significant sectors in Australia. This evolution would not have been possible without effective supply chain management (Kourouthanassis et al., 2002). The impact has a ripple effect, particularly during the times when there has been a disruption in the supply chain. Grocery retailers have accepted over the last decade that their supply chains are not sensitive enough particularly to supply chain disruptions (Prater et al., 2005). As such, the grocery industry has been chosen as the focus of study to explore those inefficiencies and propose strategies that enhance building a resilient supply chain. Furthermore, the industry is an excellent candidate for implementing radio frequency identification (RFID). For example, Wal-Mart is beginning to drive the adoption of RFID, which will mean significant changes in the way supply chains are managed. With the increasing availability of information systems and enterprise resource planning software, supply chain management in the grocery industry is becoming an even more effective tool to help businesses grow. In the future, the most successful businesses in the grocery industry will be those who manage their supply chains most effectively (Adobor & McMullen, 2018).

In Australia, prior to the lockdown due the COVID-19 pandemic, food suppliers assured shoppers that food supply chains to supermarkets were fully functioning (New World, 2020).

Australia recently lived through a series of environmental events including fires, floods, and drought, with repercussion for the grocery sector across the country. This, coupled with global supply chain issues, has impacted the continuity and consistency of grocery supply (Supply Chain Management Insider, 2022). However, in the weeks before the lockdown was announced, many individuals began to panic buy and stockpile products such as water, gloves, carbohydrate-rich staples (e.g., bread, pasta), canned food, hand sanitiser, and even toilet paper (Mao, 2020). During the pandemic of COVID-19 lockdowns and social distancing guidelines were implemented throughout most countries and health care workers faced a crisis of staggering proportions. While most businesses and restaurants closed in the spring, supermarkets remained open to keep the country fed and supplied, and quickly focused on safety, adding measures to protect workers and customers, despite supply chain issues, panic buying by the public, and a labour shortage caused by the increased demand for workers to clean stores. The grocery industry hit a tipping point with e-commerce in 2020 and there is no turning back. The pandemic has not only disrupted the upstream part of Australian businesses supply chains, but downstream as well. The concept of interconnectedness in an end-to-end supply chain requires deep knowledge of your suppliers and customer channels. An ability to manage risks in the supply chain also requires an understanding of your costing arrangements and ability to maintain pricing and meet demand-grocery fulfilment will continue to challenge grocery supply chains, making automation technology even more important. Amid all this chaos and tragedy, the grocery business found itself in a challenging position. Many businesses around the world are still in the *Respond* stage.



Figure 2-6 Strategies to combat the COVID-19 impacts on Grocery Sector: Source: Modern Material Handling Magazine Brent Moritz, May 19, (2020)

Those who have been able to survive the storm may need to reconsider their strategies to *Thrive* (Figure 2.5). Some crucial practical steps to take as they progress through *Recovery* and into the post-COVID-19 period are to:

- Sustain the workforce to ensure swift and impactful decisions, sustain the enterprise to build value for all stakeholders, and sustain society as it faces multiple existential threats.
- Align people activities with the most important company and workforce goals.
- Take advantage of COVID-19 responses to learn from them and seize opportunities for future development.

Practical questions that managers, executives, and networks should now focus on include:

- What channels should we be focusing on? Is it important to increase our e-commerce spending or seek out collaborations with CPG companies?
- Which products have proven to be effective in the face of the pandemic? Will we keep investing in them? Do we work mainly with local vendors, or do we look for high demand branded products?
- Should we put more money into remodelling stores to accommodate kerbside deliveries, or should we put more money into opening new compact stores?
- Is the payment system we have now safe and stable for customers? Which is better for us: a) integrating with a wallet provider or b) adding QR code payments?

Having reviewed the complexity of the COVID-19 pandemic, ironically, due to natural disaster's inevitable and frequent occurrences, there have not been significant mitigation strategies to account for the new and changing environment, except for a few traditional measures (Gregory, 2020; Ivanov & Das, 2020; Kamalahmadi & Parast, 2016; Singh & Singh, 2019). At the same time, there has been a real shortcoming in understanding the full scope of vulnerabilities with the value chain (McKinsey Global Institute Report, Aug 2020). The proposed traditional ones do not support the flexibility and adaptability required to survive, let alone grow stronger. It is quite unclear why some organisations react to disruption far better than others. These firms cope with unknowns and unknowable risks/disruption due to characteristics such as **resilience**. Unfortunately, disruptions cannot be avoided. Instead, companies must prepare to overcome the challenges, which may mean rolling back to some supply chain restrictions and innovations of recent years, for example, adopting technology and adopting lean manufacturing to develop long-term resilience.

2.4.2 Australian Pharmaceutical Sector and COVID-19 challenges

The pharmaceutical industry has developed into a significant manufacturing sector over the last 20 years. The sector has been identified as a major contributor to innovation and health improvements. Prior to the pandemic, supply chain experts may have accepted that when supply chains are disrupted there can be shortages or delays, but probably not that it could make the difference between life and death. However, COVID-19 has taught us that when premeditations and ventilators are needed fast, and when vaccines are needed to reach the global population, lives are on the line which makes the COVID-19 situation complex. This might be the reason why resilience is so crucial. COVID-19 may be a century's opportunity for the pharmaceutical industry as it increases the demand for prescription medicines, vaccines, and medical devices. Despite the difficulties of the sudden change in operations demanded by COVID-19, the pharma business model has largely proven resilient in the face of the initial pandemic wave. Nevertheless, the global response has affected the industry's operations from R&D through to its interaction with its customer base, providing an opportunity for the industry to assess how it operates. Most recently, the Australian Government has been developing an Action Agenda to promote the sustainable development of the industry. Pharma companies have not escaped the massive disruption caused by the COVID-19 pandemic. Many of them have been able to successfully negotiate the early stages of the pandemic, and those that had a head start on digitised operations and automation have been at an advantage in a world where

offices are closed, and employees must work remotely. The speed of adoption of digital technologies and novel working practices into the “new normal” business model, therefore, will be key to weathering the logistic and practical disruption arising from continuing COVID-19 outbreaks. At the same time recovery from a disaster such as COVID-19 pandemic needs to be approached differently according to sector place, history, and size.

The pharmaceutical industry plays a major role in high-tech markets. It is heavily reliant on a highly educated and research-oriented workforce (Messinis, 2002). The consensus is that, in terms of development, investment, innovation, foreign trade and employment, the industry has developed into a significant manufacturing sector over the last 20 years. Aside from being a crucial sector and a major contributor to the economy, it has attracted considerable research energy in recent times. For such an important and indispensable industry, it seems high priority to obtain an integrated, comprehensive, global view of the industry. In addition, the pharmaceutical industry sector has been identified as a major contributor to innovation and health improvements. Most recently, the Australian Government has been developing an Action Agenda to promote the sustainable development of the industry (DISR 2000, 2002). Due to globalisation and technology new data have appeared. It is therefore critical to examine how the pharmaceutical sector in Australia is faring with the negative devastating effects of COVID-19 disruptions. At the height of the pandemic, Australian businesses, particularly the pharmaceutical sectors were “shocked” to be subjected to price gouging and had difficulty obtaining essential supplies needed to manufacture drugs and personal protective equipment (The Guardian, June 2020). In Australia, the pandemic followed the summer bushfire disaster, causing a “perfect storm for demand” At the same time the pandemic led to significant disruptions to global supply chains, including in medicines and personal protective equipment causing shortages and panic buying. It has sparked new calls for Australia to improve its ability to produce vital drugs “without relying on opaque and vulnerable offshore supply chains”. The pharmaceutical sector together with grocery sectors were given priority status to ensure the basic crucial goods are available to the communities during the COVID-19 lockdown. Recovery from a disaster such as COVID-19 pandemic needs to be approached differently according to sector place, history, and size.

2.4.3 WA scenario

The study conducted by Godrich, Lo, et al. (2022) sheds light on the unique status of the retail food sector in WA during the COVID-19 pandemic. WA's distinct geographical challenges, including the considerable distance between food outlets, have historically posed greater difficulties for people in regional areas to access affordable and healthy food compared to their urban counterparts. Prior to the pandemic, research indicated that many supermarkets effectively met consumer food demands, driven by a strong sense of "local loyalty" (Godrich et al., 2017). However, the emergence of the COVID-19 pandemic exacerbated existing food supply issues. Studies from Australia highlighted problems such as delays between food orders and supply, particularly evident due to inflexible supply chains struggling to respond to unprecedented demand. This reliance on "just-in-time fulfilment" led to vulnerabilities in the supply chain, resulting in empty supermarket shelves (Clancy & Ruhf, 2010; Godrich, Lo, et al., 2022). The repercussions were significant, with businesses seeking alternative suppliers, food prices witnessing an increase, numerous hospitality establishments closing, and misinformation circulating through the media. Moreover, government-imposed restrictions on the movement of goods, services and people added further complexity to the challenges faced (O'Sullivan et al., 2020). These obstacles were particularly concerning for vulnerable individuals, defined as those who may lack the means to protect themselves from harm or exploitation.

In contrast, some food supply stakeholders maintained a business-as-usual approach, introducing new products to alleviate certain supply issues. On the consumer side, many individuals shifted their food purchasing habits towards local outlets and online platforms, opting to support local businesses instead of venturing into different regions for shopping (Burgos & Ivanov, 2021; Leone et al., 2020; Whelan et al., 2021). The concept of purchasing region-specific or locally sourced food emerged as a potential solution to address food supply challenges, particularly during a crisis like the COVID-19 pandemic. Recent evidence points to surges in local food sales at farm gates or farmers' markets driven by heightened consumer demand (Kolodinsky et al., 2020). In regional WA, a notable proportion of consumers chose to shop at smaller outlets and roadside stalls, favouring these options over larger supermarkets. This shift was largely driven by altruistic motivations, with consumers expressing a desire to contribute to and support local farmers. The presence of strong social capital within regions and communities, characterised by trust, reciprocity, and interconnected social networks, has proven to be more resilient against shocks to the food supply during the pandemic. This

resilience also serves as a protective factor against food insecurity (O'Meara et al., 2022; Thilmany et al., 2021). Nevertheless, a deeper understanding of the specific impacts of the COVID-19 pandemic on food supply in regional WA remains crucial. This knowledge is essential for adequately preparing regional businesses and community members for inevitable future crises in the food system. Overall, the economic headwinds that have emerged in the wake of the COVID-19 pandemic have hit the retail industry particularly hard, with retailers in Australia battling some key foes: rising costs, tightened consumer spending and shifting consumer behaviours (The AustralianRetail Report, 2023) Fortunately, Australia is rightly known as an early adopter when it comes to new solutions to combat emerging challenges, and many local retailers have wasted no time taking on new technology and strategies to adapt. However, this is not uniform, with some big gaps between short-term and long-term approaches.

2.4.4 Victoria scenario

In response to the prolonged and stringent lockdown measures imposed due to escalating COVID-19 cases, retailers across the state of Victoria were compelled to navigate unprecedented challenges. The closure of non-essential retail establishments during extended lockdown periods inflicted substantial financial strain, plunging many small and medium-sized retailers into dire circumstances, with some facing permanent closure. Faced with such adversity, retailers in Victoria swiftly pivoted their strategies to adapt to the demanding circumstances. Numerous brick-and-mortar stores transitioned their operations to prioritise online sales channels, while implementing contactless delivery or pickup alternatives to cater to shifting consumer preferences.

A brick-and-mortar store refers to a traditional physical retail establishment where goods are sold directly to customers in person. Unlike online stores, brick-and-mortar stores rely on customer foot traffic, physical locations, and face-to-face interactions. According to Bhattacharyya (2012), brick-and-mortar stores have historically been the primary retail format, but the rise of digital commerce has pushed these stores to adopt new strategies to remain competitive. The COVID-19 pandemic further accelerated the need for brick-and-mortar stores to integrate digital solutions, such as hybrid models combining physical presence with online offerings, to adapt to shifting consumer preferences and ensure resilience in the face of future disruptions. Collaborations with local marketplaces and delivery services emerged as pivotal strategies for retailers seeking efficient means of reaching their customer base.

Moreover, retailers proactively leveraged social media platforms and other digital avenues to engage with customers, ensuring continued brand visibility and offering timely updates on operational adjustments throughout the challenging period of lockdown restrictions. As lockdown measures gradually eased, Victoria's retailers turned their attention towards rebuilding consumer confidence and reigniting demand within the market. Initiatives such as discounts, promotions and loyalty programs were widely deployed to incentivise consumer spending and foster a sense of community support. Additionally, the state government of Victoria played a vital role in supporting the recovery efforts of the retail sector by rolling out financial assistance programs, grants and tax relief measures tailored to alleviate the economic burdens faced by retailers. Crucially, collaborative efforts between retailers and local communities emerged as linchpins in encouraging local spending and revitalising the retail landscape, underscoring the importance of solidarity and collective action in navigating the unprecedented challenges posed by the COVID-19 pandemic- Refer to Table 4.1 Chapter 4.

The COVID-19 pandemic had varying impacts on the retail sectors of Victoria and Western Australia. In comparison to the recovery trajectory for retailers in Western Australia, in Victoria the outcome was relatively smoother due to less severe impacts. As travel restrictions eased, tourism-dependent retailers experienced a gradual rebound in customer activity. Some retailers invested in store renovations, expansions, or new product lines to attract customers and capitalise on the increasing consumer confidence. Government initiatives focused on stimulating domestic tourism and supporting local businesses played a significant role in the recovery process. With milder restrictions, retailers in Western Australia had more flexibility to continue their operations, albeit with caution. Many adopted enhanced safety measures, such as mandatory mask-wearing and regular sanitisation, to reassure customers and maintain a safe shopping environment. Some retailers also leveraged e-commerce platforms and introduced online ordering systems to diversify their revenue streams and reach a broader customer base. The retail experience has changed drastically for the near future, following the emergence of the global pandemic of COVID-19. In several countries, supermarkets are the only retail stores available, and the shopping environment has changed drastically. Supermarkets in New Zealand, Europe, Australia, the United States, and the United Kingdom have implemented reforms to curb panic buying and COVID-19 spread while shopping, though the changes differ widely from store to store. The following are some of the more common takes that have an impact of the grocery sector: To counteract the effects of panic buying, retailers have set a

temporary limit of two or three similar items per shopping visit, shortened their opening hours, and asked customers to “shop normal” (Coles, 2020).

2.5 Summary of the Chapter

This chapter explores the contextualisation of the retail sector, focusing specifically on the Australian retail industry. Retail companies are under increasing pressure to transform their operations, prioritising efficiency, performance, and supply chain resilience. Key drivers of these transformation initiatives include improved customer relationships, visibility, brand image, and customer service. The Australian retail sector is notable for its adoption of innovative technologies and diversity in business size, geographic region, retail formats, sector competition, and the variety of goods sold. The COVID-19 pandemic has compelled retail firms to innovate and adapt through both reactive and proactive strategies. This chapter is divided into six sections. It begins with an introduction discussing the concept of retailing within the Australian context, including the pandemic’s impact. The chapter further examines retail supply chains, and the operations of the grocery and pharmaceutical sectors before and after the pandemic, culminating in key findings.

The Australian retail industry, comprising nearly 140,000 businesses, significantly contributes to the country’s GDP and employment. The dominance of large supermarket chains, franchise companies, and shopping centres has accelerated the shift towards online shopping, especially during the pandemic. COVID-19 has disrupted consumer buying habits, leading to stockpiling of essential products, and necessitating changes in supply chains. Retailers have had to innovate to ensure customer safety and attract business during the pandemic. The chapter also addresses the impact of COVID-19 on the evolution of online retail and the challenges faced by the grocery and pharmaceutical sectors. Overall, the industry has faced unprecedented challenges, requiring innovative strategies to adapt and recover.

The impacts of COVID-19 on the grocery and pharmaceutical sectors in Western Australia and Victoria are highlighted, emphasising the need for resilience and adaptive strategies. Retailers in Victoria have shown resilience by shifting to online sales channels, implementing safety measures, and engaging with customers through digital platforms. Government initiatives have also been crucial in supporting the retail sector’s recover.

Chapter 3

Literature Review

3.1 Introduction

This chapter offers a comprehensive evaluation of the existing literature and contextualises the research. It provides a detailed overview of the conceptual framework utilised in this study. Section 3.2 explores the literature review approaches, the importance of SCRE amidst disruptions, including the theoretical underpinnings like resilience theory (RT) and resource dependence theories (RDT), particularly pertinent in scenarios like the COVID-19 pandemic. Additionally, Section 3.3 presents a literature review on various topics relevant to SCRE, introducing SCRE contexts. It investigates SCRE and its facilitators to identify pertinent and applicable strategies. The application of SCRE within the retail sector is exemplified in Section 3.4, which introduces both proactive and reactive strategies as discussed in the literature. Finally, Section 3.5 introduces the theoretical framework and elucidates how the two theories integrate within the context of the research. Section 3.6 summarises the literature review.

3.2 Literature Review approach and Theoretical Underpinnings of Resilience Strategies

The literature review for this study was conducted making use a systematic approach to ensure comprehensive and reliable coverage of the topic. A structured search strategy was employed across several academic databases, including Scopus, Web of Science, and Google Scholar, to identify relevant scholarly articles, consulting reports, and practitioner publications. Keywords such as “supply chain resilience,” “COVID-19 disruptions,” “retail sector resilience,” and “proactive and reactive strategies” were combined using Boolean operators (AND, OR) to refine the search results. Specific search phrases included “supply chain recovery strategies post-pandemic” and “resilience in retail supply chains.” The review focused on publications from the most recent years to capture recent developments and trends, with a particular emphasis on studies conducted after the onset of the COVID-19 pandemic.

Additionally, to academic literature, this study incorporates insights from consulting reports (e.g., McKinsey, Deloitte) and practitioner publications (e.g., Lloyds List) to provide a more holistic view of SCRE strategies. These sources were selected based on a systematic approach to ensure their relevance trustworthiness and credibility. Reports were chosen if they were

published by reputable consulting firms with recognized expertise in supply chain management and contained empirical data or case studies relevant to the Australian retail sector. Inclusion criteria were based on the relevance of articles to SCRE in the retail sector, empirical studies, and high-impact industry reports, while excluding articles that lacked empirical data or focused on unrelated industries. The selected literature was further filtered by journal quality, prioritizing publications in top-tier supply chain and management journals. This systematic approach ensured that the literature reviewed was both current and directly aligned with the study's research objectives, enhancing the rigor and replicability of the research process.

In terms of the theories, -two key theories will serve as the cornerstone of this investigation. First and foremost, Resilience Theory (RT), as elucidated by (McCubbin et al., 1982), defines resilience in the context of supply chains as the capacity to transform adversity into a growth opportunity and progress forward, a notion further supported by Kiers et al. (2022). Given the growing prominence of resilience theory as a theoretical framework in the realm of social work, it becomes imperative to critically engage with it, especially in the context of the COVID-19 pandemic. The second theory of significance is resource dependency theory (RDT), which posits that the performance of an organisation hinges on its degree of reliance on various resources, as articulated by Bryant and Davis (2012) and Hillman et al. (2009). These theories form the bedrock of this research, and I will subsequently elucidate how the resilience of supply chains has undergone transformation.

3.2.1 The Resilience Theory

Resilience can be explored from different viewpoints (Sopha et al., 2022). The resilience concept emerged from the ecological sciences and is a measure of the ability of a system to recover from and adapt to perturbations without fundamentally changing structure and function (Folke, 2006; Holling, 1973). Resilience theory, rooted in the examination of adversity and its impact on individuals, is characterised by a ‘pathogenic’ perspective, as described by Antonovsky (1979). This perspective delves into the origins of illness or social dysfunction, which has traditionally dominated the fields of social and medical sciences. Notable researchers who initially explored vulnerability as a precursor to resilience, include Emmy Werner, who conducted extensive longitudinal research on children born into challenging social circumstances in Kauai, Hawaii (Werner, 1982), and Michael Rutter, who investigated the intergenerational transmission of poverty and disadvantage (Rutter & Madge, 1976). In this study context, resilience is defined as a process encompassing notions such as “the capacity to

rebound from adversity to strengthened and more resourceful” (Walsh, 2006), “the potential or manifested capacity of a dynamic system to adapt successfully to disturbances that threaten the function, survival, or development of the system” (Masten, 2015) and “the process of adjusting well to significant adversity” (Theron, 2016). Here, resilience focuses on the mediating factors or processes that facilitate positive outcomes following adversity. According to Gallopín (2006), resilience theory recognises the inherent uncertainty in predicting the complex and dynamic ways in which individuals, organisations and society may respond to disturbances and change. Closely related are the overlapping concepts of adaptive capacity and vulnerability (Gallopín, 2006). The determinants of adaptive capacity are both local (e.g., strong social networks) (Hall, 2013) and larger scale (e.g., national socio-economic and governance frameworks).

The resilience concept incorporates many elements of vulnerability and adaptive capacity (Calgaro et al., 2014; Gallopín, 2006). A resilient community, organisation or enterprise has the capacity to adapt to the stressors and change it is exposed to, hereby reducing its vulnerability. In this context a resilience-based approach has been adopted as it is useful in understanding retail responses to crises because it considers the ability of a system to maintain and adapt its essential structure, identity, and functioning in the face of often unpredictable change (Adger, 2000). The debate regarding the process and outcome in resilience theory is valid but creates an artificial separation between these elements. Resilience research involves three interrelated components: adversity, outcomes and mediating factors (Van Breda, 2018). It is impossible to explore or study resilience without considering all three components. However, the issue with the outcome definition of resilience lies in its focus on merely observing positive outcomes in the face of adversity without providing an explanation for them. A declaration without an explanation has limited utility, and for this reason, the process definition of resilience is preferable. Conceptually, resilience represents a process that ultimately leads to an outcome, with the central emphasis of resilience research resting on the mediating processes, as illustrated in Figure 3.1 below:

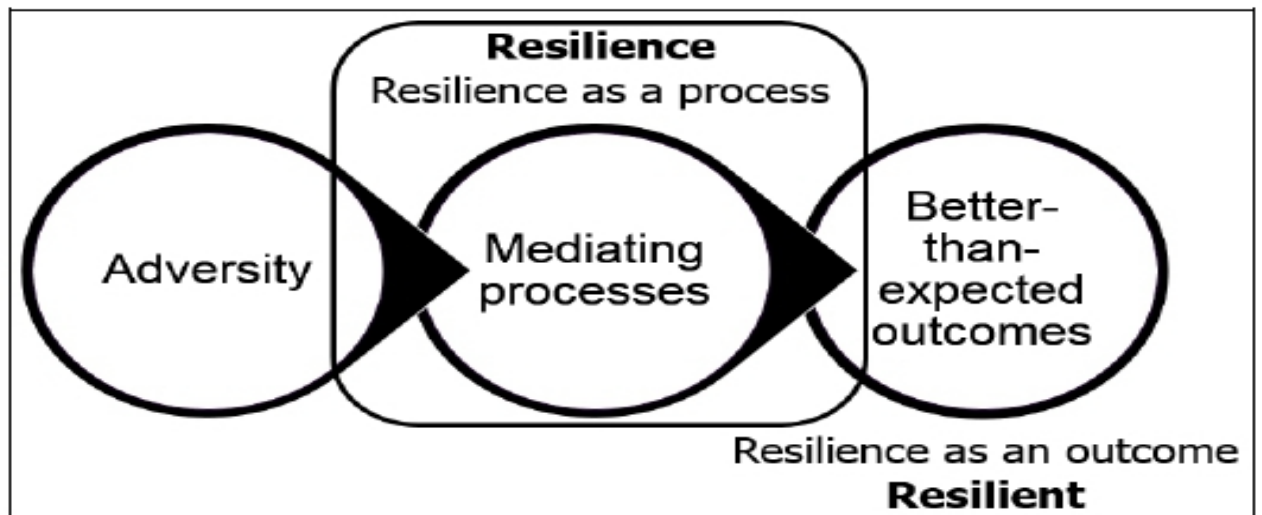


Figure 3-1 Resilience as Process and Outcome (Van Breda (2018))

Additionally, this theory offers potential solutions to effectively address and overcome such challenges (Christopher & Peck, 2004). SCRE theory focuses on understanding how supply chain systems can effectively adapt and bounce back from adversity, such as a pandemic. It emphasises the importance of protective factors, social support networks and the ability to cope with stressors. This perspective will be applied in this study's case of the retail sectors recovery mechanism from the COVID-19 pandemic.

3.2.2 Resource Dependency Theory (RDT)

RDT is used to underpin this exploratory study. RDT was introduced by Pfeffer and Salancik (1978) to argue that effective utilisation and appropriate allocation of resources enhance the recovery capabilities of retailers after disruption. The question that remains is that does its adoption enhance this capability. Answering this question requires a clear understanding of RDT theory in the context of recovery strategies to integrate and build resilience in retail supply chains. The concept of RDT asserts that leaders of firms rely on other businesses in the external environment for critical resources to create a competitive edge (Pfeffer & Salancik, 2003; Wu & Zhao, 2015). It is believed that certain benefits accrue to firms through their board members: for example, advice and expertise, and access to resources as depicted in Figure 3.2 below.

Fig. 3.9 Applying Resource Dependence Theory

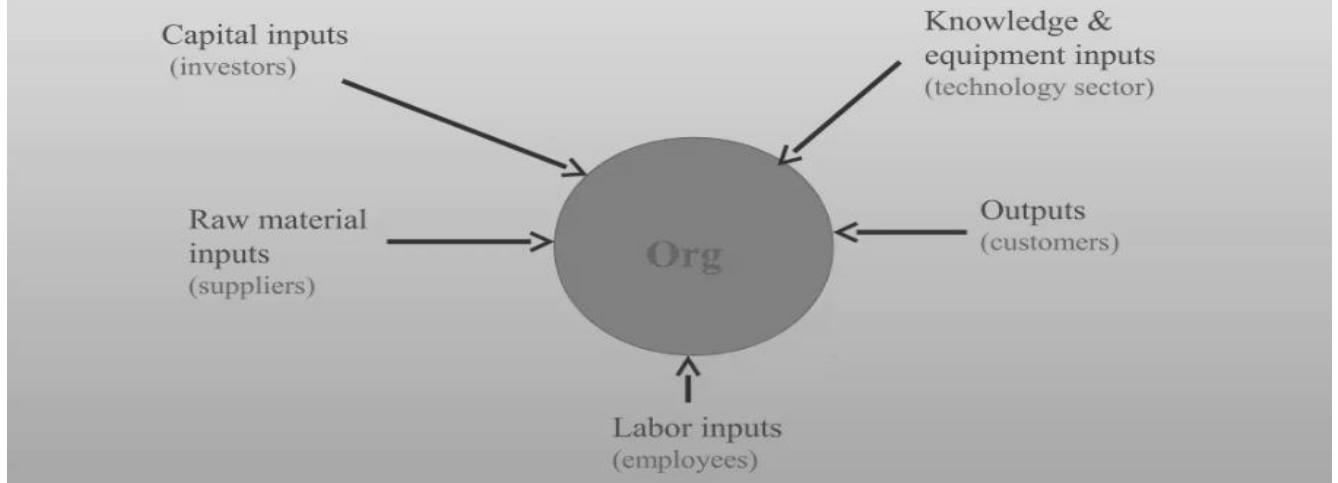


Figure 3-2 Applying Resource Dependency Theory

The resources include such technologies to enhance information sharing and collaboration and communication, people as resources (labour), availability of transport, timely supply of merchandise etc. This implies that the basis of organisational performance is the level of dependence on various resources (Bryant & Davis, 2012; Hillman et al., 2009; M Kulkarni & Nayak, 2023). According to Schnittfeld and Busch (2016) and Wolf (2014), the survival of an organisation depends on management's ability to acquire critical resources on a long-term basis. They concluded that the RDT had its foundation in three concepts: organisational effectiveness, interdependence, and external control. RDT is deemed appropriate for this study as it provides information on how an organisational leader could redesign their supply chain and mobilise resources to reduce uncertainties and build a strong resilient supply chain to resist SCDs, such as in the case of a pandemic outbreak like COVID-19. Davis and Cobb (2010) argue that organisations depend on resources summarised as follows:

- These resources ultimately originate from an organisation's environment.
- The environment, to a considerable extent, contains other organisations.
- The resources one organisation needs are thus often in the hands of other organisations.
- Resources are a basis of power.
- Legally independent organisations can therefore depend on each other.
- Power and resource dependence are directly linked:

- Organisation A's power over organisation B is equal to organisation B's dependence on organisation A's resources.
- Power is thus relational, situational, and potentially mutual.

A resource-based view (RBV) is also equally important in this study as it provides the theoretical rationale to explain how firms' resources and routines not only reduce the detrimental effects of supply chain disruptions but also formulate external-facing capabilities that lead to a competitive advantage. The common resources, as defined by Laksmana et al. (2020, p. 810) are very common (imitable), exchangeable, replaceable and easily acquirable by firms. The resources, so far, are argued to be valuable, rare, inimitable and non-substitutable (VRIN) to gain competitive advantage (Barney, 1991). However, a firm's competitive edge depends on the way these common resources are bundled and deployed. In this study, the RDT appears appropriate for this study to explain the resource dependence among supply chain partners during COVID-19. RDT, which is well-established in supply chain research (M Kulkarni & Nayak, 2023; Shook et al., 2009), is yet to be leveraged in COVID-19 pandemic-related challenges (Craighead et al., 2020). Resources, either common or rare, are always limited in any organisation (Laksmana et al., 2020) and this situation was further worsened during lockdowns. In comparison to RBV, RDT is a better option, particularly when it involves evaluating SCRE during a crisis as claimed by Sarkis (2020) who further propose that organisations with higher resource dependence and less control of external agents encounter more difficulties particularly when it comes to developing localisation, agility and digitisation to achieve resiliency (Nandi et al., 2021).

The aim of supply chain management is to guarantee that products and services are delivered from the point of origin to the consumer with no or minimal supply chain disruption. The flow of products and services could be disrupted by unpredictable events like resource scarcity, demand swings, severe disruptions from natural calamities like the COVID-19 pandemic, and labour strikes (Das, 2018). To prevent or lessen such disruptions, the supply chain's participants would need to cooperate, collaborate, and strengthen their business partnership. The RDT can be quite useful in determining how organisations in the supply chain are interdependent in the supply chain. According to RDT, developing interorganisational relationships is one way to acquire needed resources and to reduce uncertainty and dependence (Pfeffer & Salancik, 2003). The concept that applies to this study is building a resilient supply

chain that can assist in managing risk, leading to fewer occurrences of disruption (Tomlin & Wang, 2011). It is presupposed that the adoption and implementation of supply chain best practices could correlate with the enhanced agility of the organisation's supply chain against any disruption (Zhou et al., 2018). In turn, supply chain agility might then enable better management and mitigation of risk within the entire supply chain environment, resulting in much-enhanced supply chain performance and its resilience against any potential disruption.

Resource exchange hinges on the relative magnitude of the exchange and the criticality of the resources involved. The former pertains to the necessity of input and the extent to which it relies on its source for supply. The latter, however, can fluctuate over time as the organisational environment evolves (Pfeffer & Salancik, 1978). The primary objective of this research is to gain insights into the regulations and constraints that influence resource access during the COVID-19 pandemic. Previous studies related to COVID-19 have shown that consumers tended to hoard goods, causing a temporary surge in demand, which, in turn, shifted the power dynamics in favour of suppliers. This alteration led to adjustments in supply lead times and payment terms that favoured the suppliers' position (Craighead et al., 2020). This study shifts its focus to the relationship between retailers, suppliers, and distributors, where power dynamics may be influenced by relational imbalances. Drawing on RDT, the objective of this study is to empirically explore supply chain disruptions of COVID-19 and suggest both proactive and reactive strategies to mitigate them. Specifically, the study reevaluates the asymmetric dependence between suppliers, who have the capacity to provide the required products during times of high demand, and shippers or freight forwarders, who play a crucial role in delivering the needed products punctually.

In summary, the two theoretical lenses have been adopted as the basis of this study for their relevance:

Resilience Theory (RT): This framework is crucial for understanding how the retail organizations adapt and respond to disruptions, particularly in the context of supply chain resilience. Resilience Theory is appropriate for this study as it focuses on the adaptive capacities of systems under stress, aligning directly with the aim to explore post-disruption recovery strategies in retail supply chains.

Resource Dependence Theory (RDT): RDT complements Resilience Theory by examining external resource dependencies, acknowledging that each supply chain faces resource

limitations, especially during crises. It offers insights into how firms can leverage or secure critical resources—such as financial assets, human resources, and technologies—from external partners. This makes RDT particularly relevant for understanding the role of partnerships and dependencies in the recovery phase.

3.3 Supply Chain Management

Supply chain management (SCM) is viewed as a process that serves to generate a cost reduction in the budget or a mission to create greater operational efficiencies within an organisation, which implies that SCM performance has a direct effect on the overall performance of the organisation. Supply chain management (SCM) is widely recognised as an essential component of most businesses and is critical to company success and customer satisfaction. Apart from boosting customer service as customers expect the right products to be available to the right place/location at the right price, at the right time. According to SAPICS Magazine (2021), supply chains are a complex network of organisations, people, processes, and technology. The ever-busy machines that are used in manufacturing, warehousing, distribution, and transport are equally important to keep the supply chain moving and hence the need to manage them appropriately. Additionally, SCM helps reduce operating costs, ensure human survival by ensuring the medicines and equipment necessary for treatment will be available at the hospital because of excellent supply chain execution. The COVID-19 pandemic has highlighted the importance of SCM. According to Dan Swan of McKinsey Operations Practice, “Often times in the past supply chain was what I would call a necessary evil. You needed your supply chain there to get product to your customer. And now, I think we see it more and more as a real differentiator for companies” (McKinsey & Company Report, 2021, p. 4). Therefore, CEOs need to pay attention to supply chain and make sure they invest in resilience to make sure that the supply chain can deliver as it meant to do. Supply chain strategy is incredibly important. For companies to manage disruptions, they must first understand supply chain strategy to organise their supply chains to best mitigate the effects of a disruption. Supply chain variables are presented in Table 3.1.

Table 3-1 Supply chain Variables in Carvalho, Tavares, and crus Machado 2012

Supply chain state variable Dimension	Examples
Supply chain entities	Typology function/role, geographic localisation, number of variable alternatives
Material flow	Quantity, delivery frequency, transport mode
Information flow	Frequency, type (manual or electronic)
Management Policies	Inventory type and levels, overall process description, number of operations lot size, capacity for extra orders, % of defects, strategy type (make to order or make to stock)
Relational Links	Type of relation between entities, collaboration, channel leader at dot end, buying-selling relation, bilateral extensive coordination, long-term partnership, preferred suppliers among others
Lead Times	Production lead time, transit timers, time to supply for new suppliers (time required for new suppliers to complete a single cycle, beginning with the receipt of an order, and ending with the fulfilment of that order)

As shown above understanding these supply chain variables is crucial for building SCRE because they highlight the critical areas that influence a company's ability to respond to disruptions. By analysing factors like material flow, lead times, and relational links, businesses can identify vulnerabilities, improve coordination, and enhance flexibility. For instance, efficient management policies and strong relational links with partners ensure quick adaptations to unexpected changes, while monitoring information flow helps maintain visibility and control. Optimizing these dimensions enable companies to anticipate risks, reduce delays, and recover faster, ensuring stability and continuity during disruptions.

3.3.1 Supply chain risks, vulnerability, and resilience

Managing disruptions is a critical concern for both supply chain professionals and scholars. It is well-documented in the literature that supply chains frequently face unexpected issues that can result in adverse outcomes (Urciuoli et al., 2014). Examples include machinery failures, labour strikes, theft of products and explosions at seaports. Consequently, research highlights the importance of proactively selecting and planning cost-effective strategies to effectively

manage disruptions (Chen et al., 2019; Deane et al., 2009). Moreover designing effective ways to improve resilience in this hyper connected world requires an understanding of the elements that lead to supply chain disruptions (Patel, 2023). Implementing these strategies enhances a company's resilience, enables rapid responses to unforeseen events, and thereby bolsters competitive advantage (Khan et al., 2012). Key approaches identified in the literature include risk management and resilience, management strategies and information sharing. In today's era of globalisation, where the operations of numerous organisations are interconnected across continents, the supply chain confronts a plethora of risks. These risks, if not managed effectively, can detrimentally impact productivity, competitive positioning, and overall profitability. Disruptions to supply chain and material flows anywhere in the supply chain are unpredictable and rare but often is associated with quite damaging consequences. Examples such as how natural disasters, labour strikes, fires and terrorism have halted the flow of materials during pandemics such as COVID-19 that caught many companies off guard. The literature has suggested a lot of strategies to mitigate these risks although each strategy may be effective in a different way (Chopra & Sodhi, 2014; DuHadway et al., 2019; Raj et al., 2022; Talluri et al., 2013). For instance Chopra and Sodhi (2004) suggested several mitigation strategies that can either decrease or increase risks, as shown in Figure 3.3 below:



Figure 3.3 Mitigation strategies against a risk: Source (Chopra & Sodhi, 2004)

As Figure 3.3 shows above depicts, there is no such silver bullet strategy for protecting organisational supply chains. Instead, managers need to know which mitigation strategy works best against a given risk. As such one would suggest that the challenge particularly with risk management professionals is balancing is mitigating supply chain risks without eroding profits. There are more strategies that can potentially decrease the risks as opposed to the strategies that could increase the risks. Christopher (2005a) underscores the significance of supply chain vulnerability in today's uncertain and turbulent markets. Yet, it appears that many organisations have overlooked this critical aspect. According to the Business Continuity Institute's (BCI) research, which surveyed 519 organisations across 71 countries, a staggering 75% of respondents lack comprehensive visibility into their supply chain disruption levels (Mensah, 2014). While certain risks, such as loss of talent, skill shortages, transportation network disruptions, regulatory changes, and cyber-attacks, are deemed most significant, others, including pandemics and those depicted in Figure 3.4 also warrant careful consideration during business continuity planning.

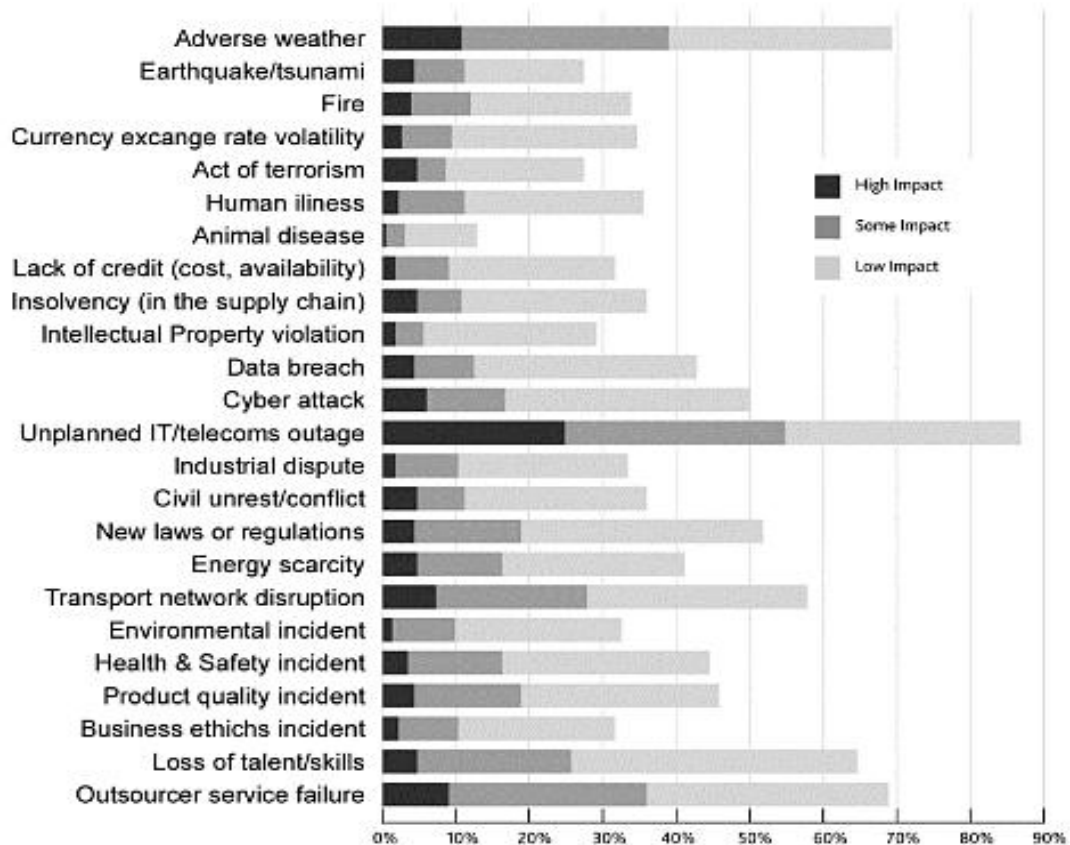


Figure 3-4 Causes of supply chain disruption: Source (Mensah et al., 2015)

supply chain systems are continually growing in complexity and length, mirroring the ever-changing and global business landscape (Asbjørnslett, 2009). According to Kleindorfer and Saad (2005)) and Ponis and Koronis (2012), the heightened interest in managing supply chain disruptions, resilience and vulnerability can be attributed to a growing awareness driven by recent research demonstrating the substantial losses, both direct and indirect, incurred as a result of supply chain disruptions (Castillo, 2022; Sharma et al., 2020). Supply chain vulnerability and resilience encompass a broader scope compared to integrated supply chain management (Peck, 2005). Traditional risk management systems often prove ineffective as they focus on predictable risks derived from statistical data, while disregarding unforeseeable risks stemming from unexpected events (Fiksel, 2015). Adopting a more proactive approach to address new and evolving risks and vulnerabilities within or impacting the supply chain system is a prudent step towards securing its resilience.

Resilience and vulnerability in the supply chain are closely intertwined concepts (Elleuch et al., 2016). As defined by Gallopín (2006), vulnerability is characterised by a system's capacity and preparedness to confront hazards or anticipated consequences. Pettit et al. (2019) validated

this relationship through empirical studies, underscoring that SCRE increases as capabilities grow and vulnerabilities decrease. As stated in the McKinsey Global Institute Report in August 2020, “Companies need a comprehensive understanding of their exposure, vulnerabilities, and potential losses to inform resilience strategies.” Despite the importance of these concepts, little effort has been made to clarify the current state of knowledge on SCRE and vulnerability.

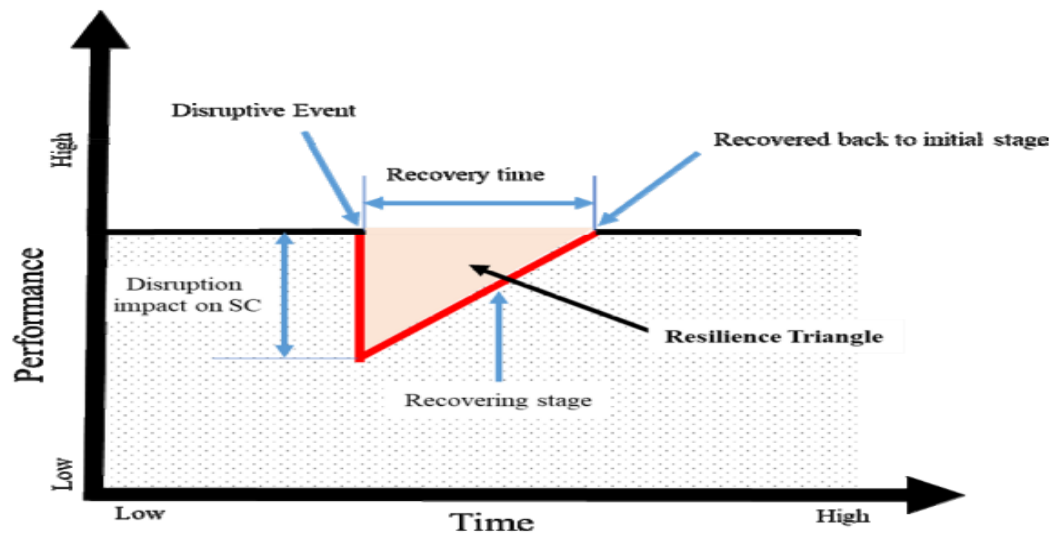


Figure 3-5 Illustrating the Resilience Triangle *Source Falasca et al. (2008)*

Falasca et al. (2008) introduced the concept of the “resilience triangle” (R-Triangle) to represent the measure of resilience in a supply chain, as illustrated in Figure 3.5 above. The primary objective of supply chain practitioners is to minimise the area of this triangle, as a larger triangle corresponds to a lower level of supply chain resilience. Furthermore, with regards to illustrating SCRE relationship with risks and vulnerability, Lambert and Knemeyer (2004) concluded that if resilience is increased in the network, then the SC capability increases and vulnerabilities decreases.

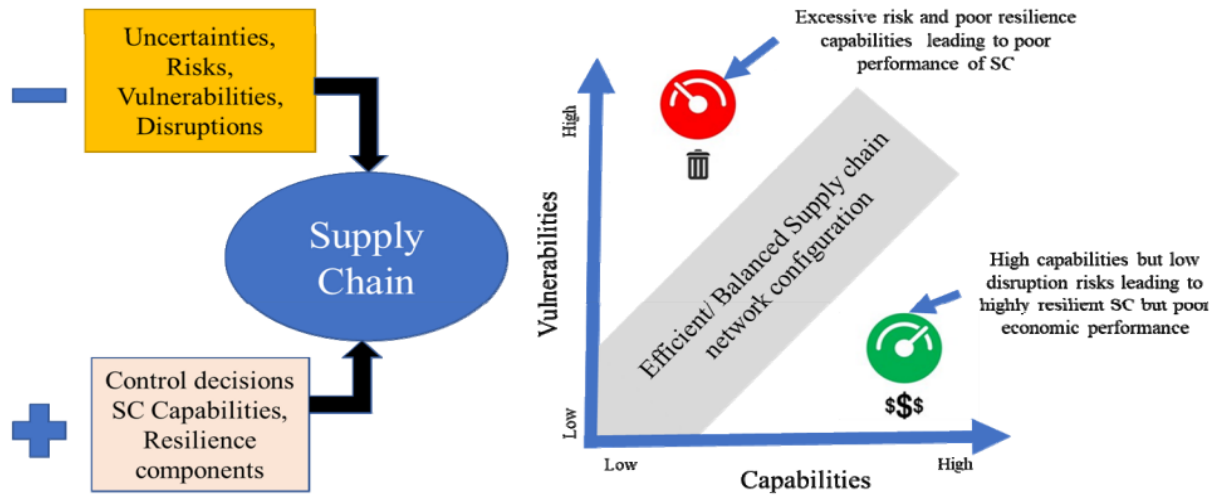


Figure 3-6 SCRE relationship with risks and vulnerability. Source: Lambert and Knemeyer (2004)

As demonstrated in their research, results of different combinations of low-high vulnerabilities with respect to capabilities on the performance of SC can be summarised as in Figure 3.6 above. In conclusion, wrapping up the definitions from the past, SCRE is ‘the resistance of a SC to withstand disturbances, anticipate the mitigation strategies and recover back into initial’.

3.3.2 Understanding Supply Chain Resilience

In the past, researchers have incorporated the concept of resilience into supply chain management from diverse perspectives. Initially borrowed from fields like psychology, sociology, and ecology, resilience has been explored and applied in the context of supply chains. Holling (1973) provided the first definition of resilience, describing it as the system’s ability to persist and adapt to changes and disruptions while maintaining its network relationships. Adopting a similar perspective Pertheban and Arokiasamy (2019) suggest that the term “resilience” can be conceptualised from two main perspectives, such as proactive capacity and reactive capacity (Pertheban & Arokiasamy, 2019). The proactive approach refers to acting before its final necessity, and the reactive approach places emphasis on recovering after any crisis takes place. From a supply chain perspective, these two capabilities enable us to “prevent or resist” being impacted by disaster and return to the original level of performance within an acceptable time frame after being affected by disaster or any other occurrence such as the COVID-19 pandemic. A supply chain can be resilient if it returns to its original stable situation or can sustain a new and stable situation better than its original performance (Ali et

al., 2017). To clearly understand and adapt to the change in an unstable situation, active interaction with the environment is highly required, either reactive or proactive. A reactive approach is able to meet the changes in the environment and react accordingly with business action, whereas a proactive approach helps to build on the projection and prevention of any environmental change that takes place (Wieland & Durach, 2021b). Table 3.2 below presents a comprehensive overview of resilience as presented in various studies, outlining different dimensions and aspects of resilience in supply chain management. It is worth noting that the concept of resilience in supply chain management has gained significant attention due to the increasing complexity and uncertainty of global supply chains. The ability to effectively manage and respond to disruptions and risks has become crucial for maintaining competitive advantage and ensuring business continuity.

Table 3-2 The Concept of Resilience

Resilience					
Number	Fields	Resilience in ecosystem science	Resilience in psychology and sociology	Resilience in economy and management	Resilience in supply chain management
1	Target impact area	Whole ecosystem. environment, flora and fauna, socio-natural ecosystem	Probabilistic view of human behaviour individual or group	Individual and collective attitudes and behaviours at different levels: individual, organisational, interorganisational system	Company/industries and supply chain network
2	Attributes, decision levels	Structure of nature	Child development, posttraumatic stress disorder (PTSD) and mental vulnerability	Macro-, meso-, microeconomics, business processes and operations	Strategic, operational, tactical decisions
3	Strategies	Resilience and stability through elasticity, amplitude, hysteresis, malleability, and damping	Self-esteem, personal competence, and tenacity, the tolerance of negative impacts, self-control, and spirituality	Reactive resilience, proactive resilience crisis/risk management	Anticipation, resistance, absorption, response recovery through elements like robustness, flexibility, visibility, agility etc.
4	Goals	Restoration of initial equilibrium after being in a disturbance	Self-reconstitution and self-development after disease	Initial/new working state, future resilient to disruptions	Maintain equilibrium in SC, back to initial state or more desired state
<i>Source: Adapted from Ponomarov and Holcomb (2009)</i>					

The definition of SCRE varies in the literature and has developed over time (Ali et al., 2017; Ponomarov & Holcomb, 2009). According to Rice et al. (2003) the phases of resilience encompass readiness, response and recovery. Table 3.3 below outlines definitions that have been put forward by various researchers. Despite an increase in SCRE, no clear definition has yet emerged. One would suggest the lack of clear-cut definition of SCRE is attributed to lacking theory of SCRE. The definition also depends on the context in which the SCRE is being used. From the literature, the term resilience, originating from the Latin word *resiliens*, denotes the capacity to formulate necessary readiness, response, and recovery strategies for managing disruptive risks and restoring to the original or enhanced state following crises (Chowdhury et al., 2019). This suggests that resilience encompasses both the ability to maintain performance amidst disruptions (from a stability perspective) and the capability to rebound from adversity with increased strength and resourcefulness (from a developmental standpoint). As resilience is regarded as an ongoing process, it serves as a strategic objective enabling organisations to become more robust, adaptable, agile, and consequently, competitive. Considering the COVID-19 supply chain disruption, this research will adopt a definition of SCRE proposed by Hohenstein et al. (2015)

[. .] the supply chain's ability to be prepared for unexpected risk events, responding and recovering quickly to potential disruptions to return to its original situation or grow by moving to a new, more desirable state to increase customer service, market share and financial performance (Hohenstein et al., 2015, p. 108)

This definition is appropriate to this research as it incorporates all the four phases of SCRE as suggested by Sawyerr and Harrison (2019). These include readiness, response, recovery and growth with Ivanov and Dolgui (2020) adding SC viability as an “ability to survive and exist after a disruption” (Ivanov & Dolgui, 2020). In other literature such as Gruchmann et al. (2024) SCRE(SCRES) constitutes the network ability to recover after and survive during such unexpected events. These are quite critical in assessing how organisations were prepared and responded to this pandemic and what strategies they adopted to recover and maintain growth. SCRE especially after the pandemic is more than just the ability to recover quickly (McKinsey & Company Report 2023). What is currently known is resilience enables supply chains to reduce their proneness to disruptions and recover faster (Lohmer et al., 2020). It further implies dealing with adversity and shocks, and continuously adapting for growth. Truly resilient organisations do not just bounce back better; they thrive in hostile environments. The McKinsey research on the financial crisis of 2007–08 shows that resilient companies not only

outperform their peers through a downturn and recovery—they also accelerate into the new reality, leaving peers further behind (McKinsey Global Institute Report 2020).

The social, psychological, and economic perspectives on resilience describe it as the capability of a social system to increase its capacity to learn from past disasters, protect itself better in the future, and reduce its level of risk (Adobor & McMullen, 2018; Melnyk et al., 2014).

The definitions of SCR according to various academics are presented in Table 3.3 below.

3.3.3 Definitions of Supply Chain Resilience

The diversity of these definitions reflects the diversity of perceptions towards this field. The literature reviewed indicated that higher levels of SCRE offer a host of several benefits like control, improved coherence and integration and logistical capabilities (Mandal, 2012; Scala & Lindsay, 2021; Stonkutė, 2015). In addition, further risk sharing across supply chain partners enhances the relationship between logistical capabilities and SCRE. lastly improved SCRE can lead to greater sustainable competitive advantage. In the context of this research, is defined as the ability of a supply chain to anticipate, absorb, and recover from disruptions while maintaining critical operations. It involves proactively identifying risks, assessing vulnerabilities, and implementing strategies to adapt and restore the flow of goods and services efficiently. By enhancing flexibility and response capabilities, firms can sustain continuity and emerge stronger, even in the face of unexpected challenges. Table 3.3 summarises some of the definitions put forward from literature.

Table 3-3 Definitions of Supply chain Resilience

Author	Definition	Year
Christopher and Peck	The ability of a system to return to its original state or move to a new, more desirable state after being disturbed (<i>page 2</i>).	2004
Ponomarov et al.	The adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function (<i>page 31</i>).	2009
Jüttner et al.	The apparent ability of some supply chains to recover from inevitable risk events more effectively than others, based on the underlying assumption that not all risk events can be prevented (<i>page 247</i>).	2011
Roberta Pereira et al.	The capability of supply chains to respond quickly to unexpected events to restore operations to their previous performance level or even to improved levels.	2014
Hohenstein et al.	SCRE is the supply chain's ability to be prepared for unexpected risk events, responding, and recovering quickly to potential disruptions to return to its original situation or grow by moving to a new, more desirable state to increase customer service, market share and financial performance (<i>page 108</i>).	2015
Junwei Wang et al.	A resilient system is a system with an objective to survive and maintain function even during disruptions, provided with a capability to predict and assess the damage of possible disruptions, and enhanced by the strong awareness of its ever-changing environment and knowledge of the past events, thereby utilising resilient strategies for defence against the disruptions.	2016
Elleuch et al.	Resilience is defined as the ability of a system to return to its original state or a more favourable condition, after being disturbed.	2016
Kamalahmadi et al.	The adaptive capability of a supply chain to reduce the probability of facing sudden disturbances, resist the spread of disturbances by maintaining control over structures and functions, and recover and respond by immediate and effective reactive plans to transcend the disturbance and restore the supply chain to a robust state of operations.	2016
Yao, Y., & Fabbe-Costes, N.	"Resilience is a complex, collective, adaptive capability of organisations in the supply network to maintain a dynamic equilibrium, react to and recover from a disruptive event, and to regain performance by absorbing negative impacts, responding to unexpected changes, and capitalising on the knowledge of success or failure (Yao & Fabbe-Costes, 2018, p. 260).	2018
Namdar et al. (2018)	The capacity of a firm to adapt to challenging situations and to swiftly respond without being impacted by adverse effects.	2019
Pettit et al. (2019)	The ability of an enterprise to survive, adjust and prosper after facing a disruption or a crisis.	2019
Dormady et al. (2019)	A resilient SC can endure the crisis and able to adjust flexibility to retrieve back to its sustainable state as soon as possible.	2019
Fattahi et al. (2020)	It is an ability of a system or an industry to recover effectively and quickly after being affected by a disruption event, and a resilient SC has the potential to retrieve itself into a more desirable condition.	2020
Wong et al. (2020)	An organisational processing capacity that enables a firm to preserve and obtain necessary resources and to effectively integrate and use such resources to manage operations disruptions.	2020
Sutcliffe et al. (2021)	It is the measure of variation in the system across three dimensions; 'control functions on SCN'; 'the extent to which a SC is capable of self-balancing during disruption' and 'the extent to which the system can develop capacity to learn and adapt'. A SC is resilient when the resilient dimensions/ elements/components fortify the 3 A's, i.e., 'aligned, agile and adaptable'.	2021
Shekarian et al. (2022)	The ability of a firm to adapt to a changing environment, effectively deliver its objectives, and prosper in a turbulent environment.	2022
Ghomi, V et al (2023)	The ability of a system to withstand change and to rebound.	2023

Although SC resilience is an emerging subject in much research (especially in light of the COVID-19 crisis), they note that “systematic studies on how it is defined and modelled are still rare” (Golan et al., 2020). Four stages of defining the resilience of a SC defined by The National Research Council (2012) are common to more than half of the texts collected:

1. **Plan** The company anticipates potential problems (disruptions) and sets up action plans for these scenarios. This can be done through the creation of documents (procedures, FMEA, insurance, etc.) or through measures in the field (safety stocks, distribution of production on different sites, etc.). The more the company secures its SC in this planning phase, the less the impact of the disruption on the system should be in the following stages (absorb, recover).

2. **Absorb** Over the period immediately following the disruption, the SC normally perceives its negative effects to their maximum. As with a mechanical shock in a car accident, a system will be expected to absorb the impact as much as possible to limit the damage. In the case of SC, observing the decrease in performance caused by the disruption might assess the absorption capacity.

3. **Recover** After the shock, there is a phase where the objective is to return to normal conditions. The system is expected during this recovery phase to improve as quickly as possible and under the best conditions. As an example, Menoni and Schwarze (2020) propose mitigation measures for this phase in the context of the COVID-19 pandemic.

4. **Adapt** Once the storm has passed, the company can learn from the ordeal it has gone through and evolve to become stronger. This transformation helps to increase resilience.

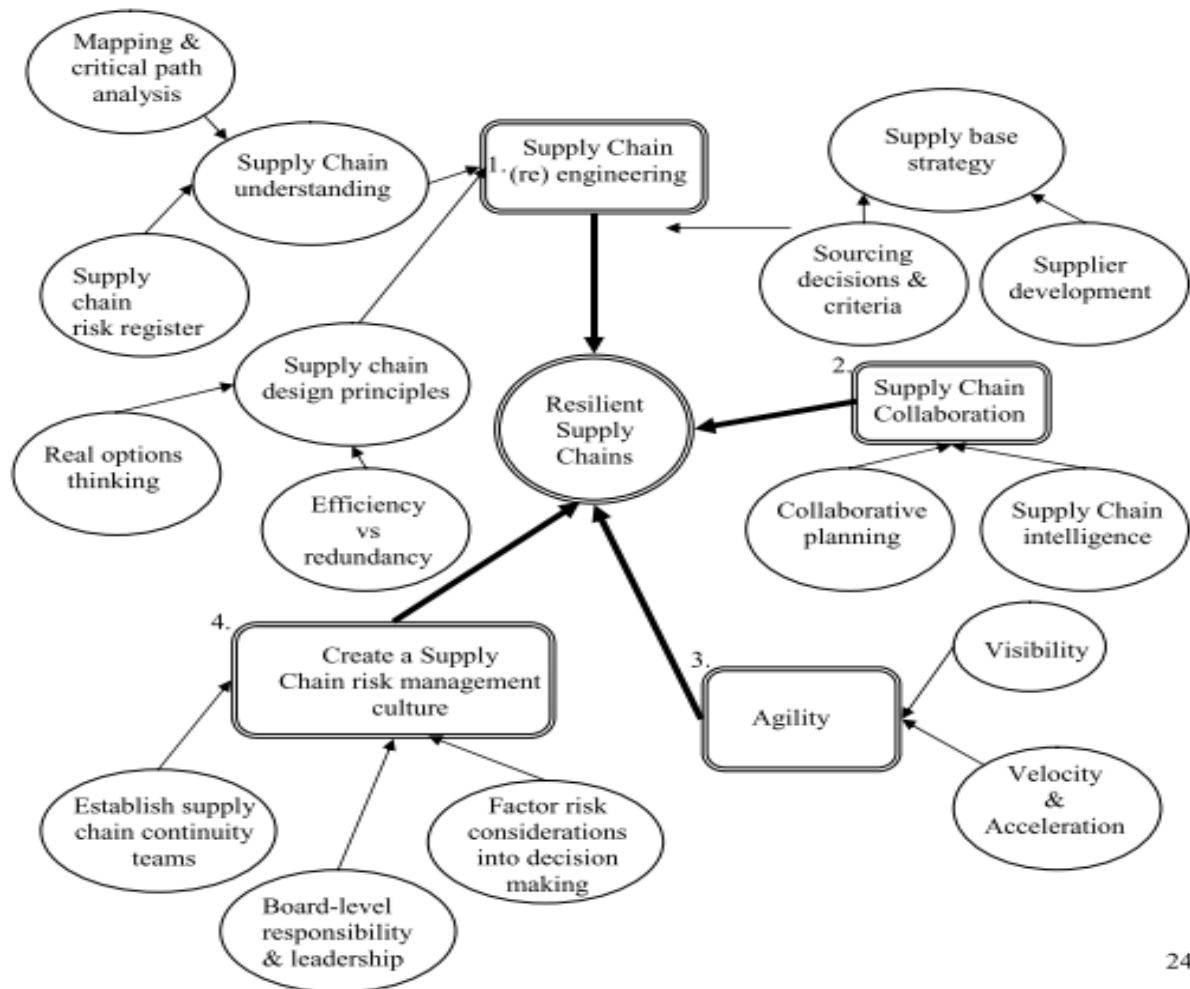
In essence, for the actors within the SC to ensure their functionality and success, they must strategise methods of absorption, recovery and adaptation to address disruptions of varying magnitudes, impacts and likelihoods. Accordingly, the The National Research Council (2012) National Research Council defines resilience as “the capacity to anticipate, plan for, absorb, rebound from, and effectively adjust to adverse circumstances.” Managing resilience entails assessing interdisciplinary options to devise policies that improve the system’s capacity to (i) anticipate adverse occurrences, (ii) withstand pressure, (iii) recover, and (iv) anticipate and brace for forthcoming challenges through essential adaptations.

3.3.4 Elements of SCORE

Supply chain resilience (SCORE) is often measured through various elements that contribute to developing resilient capabilities. However, the literature has used different terms, such as

dimensions, attributes, enablers, and enhancers, which has led to some confusion and complexity in understanding SCRE (I. Ali et al., 2017; Erol et al., 2010; Hohenstein et al., 2015). To address this, researchers have attempted to standardize terminology by referring to these characteristics as elements, with key examples being flexibility, velocity, visibility, agility, and collaboration. Building on the foundational work of Christopher and Peck (2004), this study identifies several core principles that underpin SCRE (Figure 3.7). These principles align closely with established supply chain management practices. First, resilience should be integrated into supply chain design, incorporating specific features that enhance the system's ability to withstand disruptions. Second, collaboration across the various entities within the supply chain is essential for effective risk identification and management (Ramanathan et al., 2022). Agility is also crucial, as the ability to respond quickly and effectively to unforeseen events provides a competitive edge. Finally, fostering a culture of vigilant risk management within the organization is critical, as the most significant risks often arise from the broader supply chain rather than internal factors. By aligning with these principles, organisations can better navigate uncertainties and maintain business continuity.

Figures 3.7 and 3.8 below shows the enablers of SCRE adopted from previous studies.



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Figure 3-7 Creating Supply Chain Resilience: Source Christopher and Peck (2004), P. 24

Authors	Efficiency	Redundancy	Collaboration	Flexibility	Velocity	Visibility	Robustness
Christopher and Peck (2004)	✓	✓	✓	✓	✓	✓	
Sheffi and Rice (2005), Sheffi (2005)	✓	✓	✓	✓	✓	✓	
Ponomarov and Holcomb (2009)	✓	✓	✓	✓	✓	✓	
Pettit et al. (2010, 2013)	✓	✓	✓	✓	✓	✓	
Blackhurst et al. (2011)	✓	✓	✓	✓	✓	✓	
Jüttner and Maklan (2011)	✓	✓	✓	✓	✓	✓	
Wieland and Wallenburg (2012, 2013)			✓	✓	✓	✓	
Source: Adapted from Scholten et al. (2014)			✓	✓	✓	✓	✓

Figure 3-8 Resilience enablers used in previous studies Source: Scholten et al., (2014)

Since the inception of SCRE phenomenon and as the SCRE literature advances, researchers frequently build on each other's work, adding or adjusting elements they believe are necessary some through theory ellboration and theory genetrations (Ramanathan et al., 2017). A good example that can be cited to substantiate the notion highlighted above, is that, for example,

collaboration had previously been hypothesised to have a positive relationship with SCORE. Christopher and Lee (2004), Pettit et al. (2013), Scholten and Schilder (2015) were the first to empirically test this hypothesis. Apart from demonstrating the importance of collaboration in SCORE their research revealed that the establishment of long-term relationships with suppliers increases visibility, transparency and velocity, all of which contribute to building resilience (Scholten et al., 2019). Despite fears that injecting resilience into the supply chain will create cost and reduce possible rewards, most experts surveyed believe that efficiency and resilience can coexist without major negative impact and ideally, should be complementary (World Economic Forum, 2013a).

3.3.5 Existing research on Supply Chain Resilience

The existing studies have attempted to study the phenomenon of SCORE in recent years (Table 3.4). Most of the studies have adopted a qualitative treatment, while others have relied on traditional multicriteria for SCORE (Zhang et al., 2023). While SCORE is studied at length, and few studies have quantified the extent to which each factor is important. This quantification would enable prioritising which factors to strengthen and which factors to minimise to enhance the supply chain capabilities of companies in the current pandemic. Studies already published have made an effort to investigate the phenomena of supply chain resilience. The majority of the research has used a qualitative approach, while some studies have also used conventional frameworks.

To gain a comprehensive understanding of the phenomenon of SCORE during the COVID-19 pandemic, the researcher chose to focus on publications from year 2020 to 2024 as shown below in Table 3.4. This period is particularly relevant because it captures the most recent developments and shifts in research focus prompted by the pandemic. The selected studies in this period offer insights into how the pandemic has influenced SCORE strategies, moving from pre-pandemic preparedness and disruption predictions to recovery and proactive adaptation during and after the pandemic. By concentrating on this timeframe, we can closely examine the evolving strategies and methodologies that have emerged in response to the unique challenges posed by COVID-19.

Table 3-4 Existing Research on Supply chain Resilience

No	Case study Cited	Purpose	Methodology	Limitations
1	Ivanov and Dolgui (2020)	The viability of intertwined supply chain networks is explored	A game theory model is used to analyse supply chain resilience	The multicriteria methodology is not adopted to quantify the extent to which each factor influences supply chain resilience
2	Adobor (2020)	The supply chain resilience is analysed qualitatively	A conceptual adaptive cycle framework is adopted	The multicriteria methodology is not adopted to measure the individual weights of each factor influences supply chain resilience
3	Messina et al. (2020)	Supply chain disruption factors are investigated	A conceptual information management framework is formulated in the paper	The supply chain disruption in the pandemic scenario is not explored by the study
4	Wang-Mlynek and Foerstl (2020)	A multitier supply chain risk management methodology is explored in the paper	A case study research design approach is adopted	The multicriteria methodology is not adopted to rank companies based on supply chain resilience
5	Piprani et al. (2020)	The factors influencing supply chain resilience are prioritised in the textile industry	A Fuzzy Analytical Hierarchy Process (AHP) method is adopted	The weights are not used to rank different textile companies in terms of supply chain resilience
6	Remko (2020)	Future scope for research in supply chain resilience is synthesised	A systematic literature review is performed to provide a brief overview	One of the major areas for future scope is formulating a hybrid multicriteria model to rank companies based on important criteria for supply chain resilience in the current pandemic scenario
7	Sabahi and Parast (2020)	The relationship between firm innovation and supply chain resilience is explored	A conceptual framework is formulated for studying the relationship	The multicriteria methodology is not adopted to quantify the extent of the importance of each factor influencing supply chain resilience
8	Sharma et al. (2022)	A framework for enhancing the survivability of supply chains in the current COVID-19 scenario is developed	A stepwise weight ratio assessment framework (SWARA) is adopted	The individual factors governing survivability and their relative importance are not quantified
9	Asamoah et al. (2021)	This paper investigates the relationship between social networks, supply chain performance and customer relationships	A qualitative survey is floated in Ghana with 110 Small Medium Enterprises (SME) respondents	The supply chain performance is not analysed by factor-wise weights

10	Ozdemir et al. (2022)	Exploring how well existing solutions served to build supply chain resilience in UK perishable goods market	A research model based on supply chain resilience literature is developed and tested with Covariance Based Structural Equation Modelling	The model gives us some clues about what subject to concentrate on, how they contribute and how they can be improved and there could be other hidden factors influencing the effectiveness of resilience-building effort
11	Seuring et al. (2022)	Investigating what measures/strategies Organisations in different regions utilise to respond, build resilience, and restore operations of firms and SCs given heterogeneous vulnerabilities of SCs	Delphi method using individual questionnaires and structured feedback a useful method for complex and interdisciplinary areas where little evidence-based literature is available	The content analysis faced a wide variety of answers, which the authors condensed to only ten constructs evident across all regions, while levelling out regional specificities and thus reducing the level of detail of the results
12	Zhang et al. (2023)	Identification of the most supply chain resilient company suitable for the customised preferences of partner firms in the context of the Chinese supply chain framework during the COVID-19 pandemic: a hybrid multicriteria approach	A hybrid multi-criteria model, specifically the Fuzzy Analytical Hierarchy Process (AHP), was employed to determine the weighting of each criterion. The analysis was then conducted using three distinct methods: Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Fuzzy Decision-Making Trial and Evaluation Laboratory (DEMATEL), and Evaluation Based on Distance from Average Solution (EDA).	The simulation model provides a platform to weigh different factors and select the most feasible company. Although the study area chosen in the paper is for the strategic business areas in Tianjin and Shanghai (the Chinese context only), this hybrid multicriteria model needs to be recalibrated and extended to all study areas (cities) in the world and may not be applicable to the environments of other parts of the world
13	Ivanov (2024)	An analysis the transformation of supply chain resilience research through the COVID-19 pandemic. Methodologically, the research uses a hybrid approach. based on a combination of elements of a bibliometric and expert analysis to compare the main topics of resilience research before, during, and after the pandemic.	Hybrid approach based on a combination of elements of a bibliometric and expert analysis to compare the main topics of resilience research before, during, and after the pandemic.	The results revealed a major shift from preparedness and disruption predictions in the pre-pandemic literature. towards recovery and proactive adaptation in the pandemic and post-pandemic research. There is need for great opportunity and an urgent need to develop a new research stream in supply chain resilience through the lens of viability and related concepts of socio-ecological resilience

The literature review compiled in the above Table 3.4 highlights the evolving understanding of SCRE and its recovery strategies during the pandemic from 2020-2024. Studies by Ivanov

(2024) and others emphasize a shift from pre-pandemic preparedness to pandemic-era strategies focused on recovery, proactive adaptation, and viability. Various methodologies, including game theory models, multi-criteria frameworks, and hybrid approaches, were adopted to analyse resilience factors such as disruption management, supply chain coordination, and firm innovation. These insights reveal and emphasise the importance of recovery strategies—such as adaptive frameworks, strategic partnerships, and agile risk management—in mitigating pandemic-induced disruptions. By understanding and adopting these strategies, businesses can enhance resilience, ensuring long-term stability and preparedness for future global shocks. This approach also enables the researcher to assess how the experiences and disruptions faced during the pandemic may shape future supply chain practices and resilience research, providing a timely and relevant context for understanding SCRE.

3.3.6 Volatility, Uncertainty Complexity, and Ambiguity (VUCA) in the context of the COVID-19 Pandemic.

“VUCA” is an acronym for Volatility, Uncertainty, Complexity and Ambiguity (Du & Chen, 2018; Kaivo-oja & Lauraeus, 2018). VUCA is used to describe the chaotic turbulent and rapidly changing business environment such as the COVID-19 pandemic (Murugan et al., 2020). More specifically, it has been used to describe events and actions taken at the global and national level to contain the spread of the transmission of the virus. Volatility refers to speedy and substantial change occurring over a period (Gao et al., 2021). If a situation is fluctuating at a speedy rate, it is termed as volatile. Uncertainty on the other hand refers to a situation or an event which is unclear. Similarly, if some occurrence is new, and nothing much is renowned about it, it is called uncertain. It follows then that due to uncertainty, volatility cannot be explained or predicted (Murugan et al., 2020). Complexity refers to multiple key decision factors and their interdependence. Complexity may occur with or without uncertainty. The COVID-19 complexity was linked with ambiguity about disease dynamics and control measures. If uncertainty and complexity occur together then it becomes very difficult to address a situation which is the case with COVID-19 pandemic. Similarly, ambiguity refers to lack of clarity of what actions need to be taken. People and companies may become reasonably certain about the possible factors causing an event or disruption and may also understand the complexities of factors involved, but still may not be sure about how to address them. Murugan et al. (2020) refers ambiguity in COVID-19 to describe an unclear causal relationship with no precedents available. The situation has many unknown unknowns, so there is little prediction

about the situation's results. Therefore, the approach followed to deal with ambiguity under COVID-19 will be to experiment, generate hypotheses and test them in the field for the results achieved. According to the *Harvard Business Review* a framework to understand VUCA concept has been developed, as in Figure 3.9.

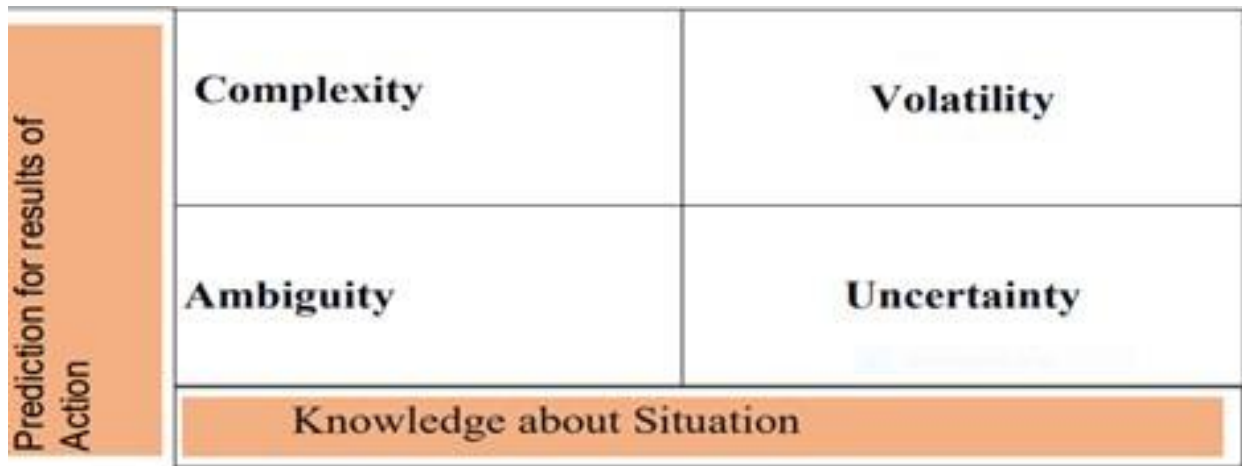


Figure 3-9 VUCA Framework, adapted from Bennet N LJ(Harvard Business review)

In the framework depicted above, the four VUCA parameters are arranged across four quadrants to represent the extent of understanding about a situation and the ability to predict the outcomes of actions. To start with **Ambiguity**, located in the lower-left quadrant, reflects limited knowledge about the situation and low predictability of outcomes. **Uncertainty**, in the positioned at lower-right quadrant, signifies a reasonable understanding of the situation but still limited ability to predict results. **Complexity**, placed in the upper-left quadrant, indicates limited knowledge about the situation, yet reasonable predictability of outcomes for known factors. Lastly, **Volatility**, in the upper-right quadrant, represents a reasonable understanding of the situation and reliable predictability of outcomes. Together, these quadrants offer a structured way to assess and address varying levels of challenges and unpredictability in decision-making.

According to Sherman (2020), in the modern, volatile environment, characterised by a lot uncertainties, responding rapidly to external changes is vital for firms' survival. Rapid response is a quality that, according to the data provided by Fortune 2022, only 6% of the top Fortune 1000 companies possess, with the remaining 94%, admitting being negatively affected by the COVID-19 outbreak (Sherman, 2020). The way forward in dealing with VUCA is to understand and embrace this concept and believe it as inevitable in the current technology-driven world. New challenges need new and different innovations according to consumer

needs. Converting VUCA challenges into an opportunity needs a transformative role of leadership in human resource management. To deal with VUCA in healthcare settings, the healthcare expenditure must be increased and new strategies in healthcare management need to be developed. As there is rapid expansion of technology in both retail and healthcare settings, every country needs good regulation, and a policy for data security and data protection. According to Gartner (2017), we are increasingly living in a “VUCA” world.

3. 3.7 Supply Chain Risk Management and Supply Chain Resilience

Risk in the supply chain is a dynamic concept. Pettit et al. (2010) define it as “a combination of state of a system and its sensitivity to hazards that could cause consequences”. According to Waters (2011), risks in the supply chain have been characterised as when “unexpected events might disrupt the flow of materials on their journey from initial suppliers to final customers”. Such risk is made up of triplets: hazard, state of the system and consequences. In the supply chain perspective, risk is multifaceted. Zsidisin and Ritchie (2008) and Elleuch et al. (2016) perceive risk as the probability of an accident associated with inbound supply failure, in which the outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety. Our supply chains are under unprecedented stress and this has become very visible (Neville, 2022). For examples, during the COVID-19 pandemic, the Australian retail sector showcased SCRE through various strategies. Major grocery retailers like Woolworths and Coles addressed disruptions from panic buying and labour shortages by limiting essential items, prioritizing high-demand goods, and collaborating with local farmers to stabilize fresh produce supply. Similarly, pharmacies such as Chemist Warehouse and Priceline managed shortages of critical medical supplies like face masks by partnering with local manufacturers and utilizing digital platforms for inventory management and distribution. Furthermore, retailers like Myer and JB Hi-Fi showcased their adaptability by accelerating their shift to omnichannel retailing, introducing 'click and collect' services and enhancing online platforms to maintain customer service during physical store closures.

Building SCRE can be regarded as the only solution to deal with the disruptions. Accordingly, it follows that firms should adopt appropriate methodologies and tools that enable them to identify, assess risk and their vulnerability in order to increase the resilience of their supply chain (Christopher & Lee, 2004; Natarajarathinam et al., 2009). Therefore, the risk is critical in supply chain, and its inclusion in supply chain is equally imperative.

3.3.8 Concept of vulnerability in supply chain

Elleuch et al. (2016) describe vulnerability as the status or degree of fragility of a system. It is the readiness with risk, characterised by the capacity of a system and its preparation to face hazard or anticipated consequences. This definition of vulnerability is echoed by (Pettit et al., 2010) who view it as “The potential for a system to be affected by internal and/external hazards”. Three characteristics that determine vulnerability: predisposition to risk, elasticity to with stand shock and strength building (Elleuch et al., 2016). Vulnerability for a specific company may depend on several factors such as industry location, operating strategies, suppliers, customers, political situation, and government policies. The increased causes of supply chain vulnerability were previously local and integrals. However, due to globalisation resulting in longer lead times (Mentzer et al., 2001; Natarajathinam et al., 2009), decentralisation, outsourcing, JIT, product /process complexity increase the number of risk exposure points. The causes have now become global and modular (Briano et al., 2009). It can be argued that resilient supply chains can be created by managing vulnerability causing factors (Kathryn et al., 2014). Existing research has not looked at vulnerabilities in the areas of data security, lack of appropriate digital technology, structural exposure, climate change and trade tensions.

3.3.9 Supply Chain Resilience against Disruptions

Recent studies on SCRE suggest that developing a resilient supply chain necessitates firms cultivating specific operational capabilities that are closely coordinated with supply chain partners. This alignment is essential for managing both anticipated and unforeseen disruptions (Christopher & Peck, 2004; Pettit et al., 2010; Ponomarov & Holcomb, 2009; Sheffi & Rice Jr., 2005). Although there is extensive literature on SCRES principles, research remains limited in terms of measuring SCRES and providing a comprehensive framework for SCRE (Kamalahmadi & Parast, 2016). Furthermore, there is no universally accepted definition of resilience. Ponomarov and Holcomb (2009) state that SCRES is the supply chain's ability to adapt to unplanned events, deal with disruptions, and get back to normal by keeping operations going at the desired level of connectivity and having full control over its structure and function. Other scholars, such as Tang (2006), Zsidisin and Ritchie (2008), Peck (2005), and Sheffi (2005), broadly define resilience as a system's ability to maintain functionality during significant disruptions and restore operations thereafter. Historically, some organisations have enhanced the resilience of their global supply chains to manage disruptions caused by

catastrophic events (Chowdhury et al., 2020a; Ivanov & Das, 2020). However, with the recent new instigator of SCDs emerging from the COVID-19/SARS-CoV-2 virus, most companies are struggling to cope with devastating effects. The complexity is how to deal with these sudden disruptions. Peter Drucker expresses the dilemma when he said:

“The greatest danger in times of turbulence is not the turbulence—it is to act with yesterday’s logic” (Fiksel, 2015, p. 3).

This quote further emphasises the need for adopting new strategies required to recover from the COVID-19 pandemic. However, the literature reviewed on the concept of risk management reveals that many practitioners still underestimate the relevance of supply chain risk management, or to some extent the risks are not fully addressed, failing to prevent negative impacts of supply chain disruptions (Macdonald & Corsi, 2013; Tang, 2006). Traditional risk management systems often remain ineffective because they identify only predictable risks based on statistical information but omit unpredictable risks that emanate from unpredictable events (Fiksel, 2015). Therefore, one would suggest that developing resilient supply chains is the best possible approach to overcome the problem that traditional SC risk management systems cannot react adequately to sudden disruption such as LFHI such as the COVID-19 pandemic (Kamalahmadi & Parast, 2016), and thus resilience is not about returning to business as usual but adapting new situations and new learning on how to deal with the disruption (Iyengar et al., 2021; Seuring et al., 2022).

The Suez Canal blockage in 2021 and Brexit are examples of two recent supply chain disruptions that illustrate the importance of a multisource approach in increasing resilience against supply chain disruptions. Lloyd’s List (2021) reported that the Suez Canal blockage disrupted approximately \$9 billion worth of goods each day that the canal was blocked. The impact is particularly pronounced for organisations whose operations rely on the timely arrival of goods; However, it is not always the case that all disruption brings negative effects. An SCD has a way of shining a light on an organisation, whether that be illuminating its strengths, testing assumptions, or even highlighting potential cracks in its operation. It is not surprising that the events of recent years have caused procurement professionals to re-evaluate where they insource and where they outsource their operations. As highlighted by authors (Fiksel, 2015; Sheffi & Rice Jr, 2005), SCRE cannot be developed by a single company, but the whole entire network, particularly in the retail sector where there is a significant stakeholder dependency.

The entire network needs to recognise risks and prepare collectively since SCs span globally and hence risks arise between firms (Colicchia & Strozzi, 2012).

The concept of SCRES is relatively new concept, but a critical component of Supply Chain Risk Management (SCRM) and contributes greatly to firms ability to response and recovery after disruptions occurred (Bai & Kumar, 2020; Ponomarov & Holcomb, 2009). The term consists of four components of the risk management cycle: preparedness, mitigation, response, and recovery (Jüttner & Maklan, 2011).

According to Fisher et al. (2010), the three key elements of resilience are robustness, resources and recovery. Creating and maintaining resilience is not a one-time event, but rather a process in itself (Ivanov & Dolgui, 2019; Pettit et al., 2013; Scholten & Schilder, 2015). It has been suggested that a resilient supply chain has the capacity to overcome disruption and continually transform itself to meet the changing needs (Kamalahmadi & Parast, 2016; Soni & Jain, 2011). Therefore, the concept of SCRES can be promising when cultivated and implemented effectively in the field of supply chain management (Ali et al., 2017; Ambulkar et al., 2015).

Figure 3.10 presents a diagram of a view tree of supply chain resilience.

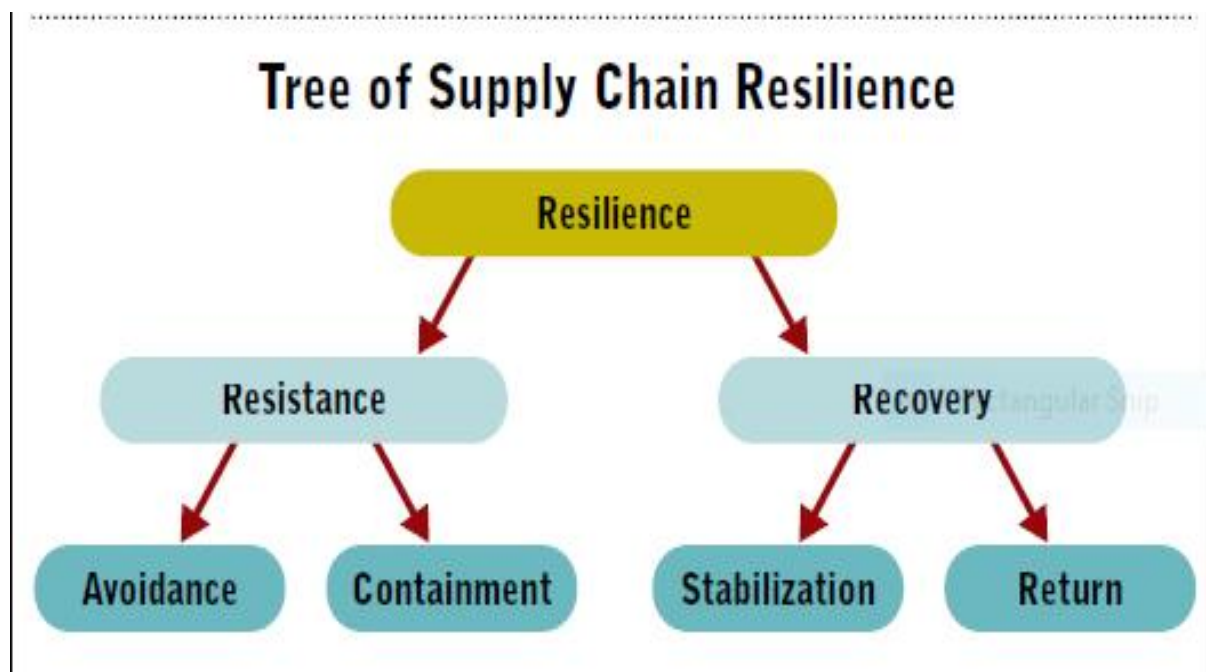


Figure 3-10 A view tree of supply chain resilience- (Resistance & Recovery) Source: Author

The above diagram depicts a tree view of supply chain resilience, which characterizes resilience into the capacities for resistance and recovery along with the respective phases: avoidance, containment, stabilization, and return. While firms would clearly prefer to possess a high capacity for both resistance and recovery, it is more likely that firms will have a mix of these qualities.

The fact that SCRE is one of the important core elements of SCRM, this perspective must be examined to determine how it should be incorporated into the resilience conceptual framework. This study is closely related to two streams of literature, namely, supply chain disruption and disruption recovery. Disruption recovery occurs after supply chain disruption. Decision-making about the recovery process is *reactive* to the disruptions (caused by risk events) and aims to resume firm operations and cash flow as soon as possible (Ivanov et al., 2017). Therefore, the ability of supply chains to recover quickly once faced with any disruption has become a topic of concern for practitioners and academics. This is because it is very difficult to deny that even after taking appropriate steps for risk mitigation by several firms, there exist certain disruptions that are out of the span of control. So, the concept of resilience holds tremendous importance and relevance in the current context, and after risk management, it is becoming the most important area of research in supply chains (Mandal, 2012). According to Fiksel (2015), a resilience supply chain benefits various firms across industries.

It is important to note that achieving resilience often involves associated costs. The investments made in equipment, resource procurement, personnel training, preparedness, and other expenses related to business continuity and adaptation can offset the value of enhanced resilience. Consequently, it is of paramount importance that supply chain managers conduct a thorough analysis of the costs and benefits of alternative approaches. They must identify relevant strategies and construct a solid business case for adopting or formulating a preferred resistance or recovery strategy to enhance resilience (Fiksel, 2015).

This study examines the resilience of both medium-sized and large retail firms, a relatively under-researched context, to define the characteristics of resilience and, concurrently, identify other factors contributing to a robust and efficient resilient supply chain. This comprehensive approach is crucial for an organisation to build resilience against disruptions. Below Figure 3.1 is a conceptual model introducing crisis's strategies.

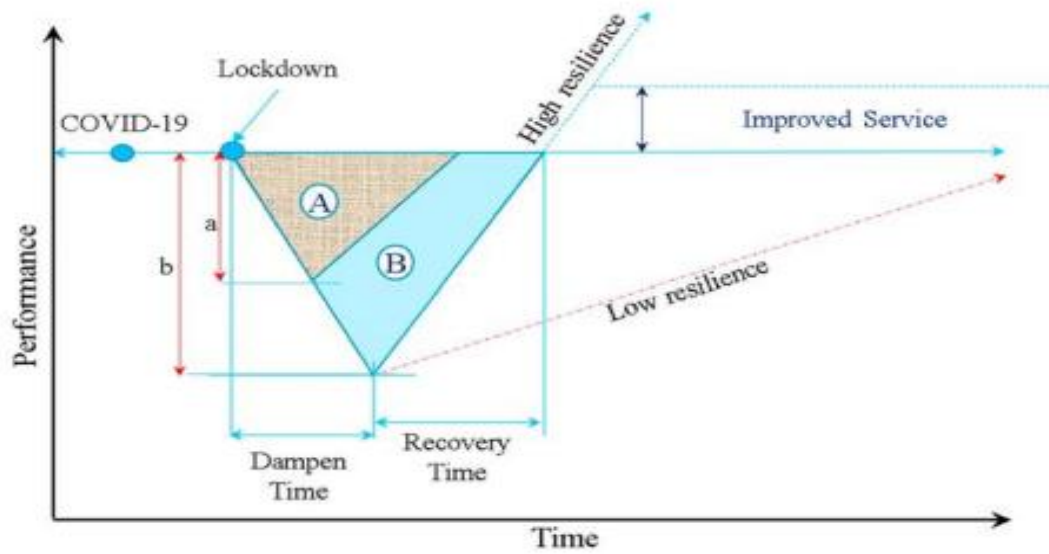


Figure 3-11 Conceptual model introducing crisis strategies.

A conceptual model proposals of strategies that can be adopted to deal with the disruption of a supply chain due to COVID-19 pandemic (Singh et al., 2021) is presented in Figure 3.11 above.

3.3.10 Supply Chain Robustness

Robustness is described as the ability to withstand a disruption (or a series of disruptions) to maintain the planned performance (Ivanov & Dolgui, 2020; Nair & Vidal, 2011; Simchi-Levi et al., 2018; Wang et al., 2018). Contrary to robustness, resilience that refers to the ability to withstand a disruption (or a series of disruptions) and recover the performance (Hosseini et al., 2019; Spiegler et al., 2012). Robustness is typically guaranteed by some redundancy such as structural diversification, flexible response options and systems adaptation condition improvements. It also considers proactive redundancy (e.g., buffer capabilities, back up suppliers or risk mitigation inventories). According to Durach et al. (2015) and Mackay et al. (2019), robustness is often seen as a component of resilience. Therefore, it is important to understand these concepts because misunderstandings about the relative utility of resilience or robustness may unintentionally result in greater supply chain vulnerability. Moreover, understanding the concepts will assist in determining how robust and resilient supply chain design and planning can be integrated with the principles of efficiency.

3.3.11 Strategies for Managing Supply Chain Disruptions

Diverse strategies to manage disruptions have been found in the literature (Urciuoli et al., 2014). The impact of supply chain disruptions on a retail company's bottom line can be

substantial, particularly under severe disruptions. For example, low-frequency but high-impact (LFHI) disruptions such as the COVID-19 pandemic can have significant effects. Such disruptions can significantly affect a firm's profitability by causing excessive downtime in production resources, creating supply chain disturbances both upstream and downstream, and ultimately leading to a decline in the firm's market value (Burke et al., 2007). These disruptions can introduce a range of challenges, including extended lead times, stock shortages, an inability to meet customer demands, and increased costs (Bastas & Garza-Reyes, 2022; Sarkis, 2020; Tukamuhabwa et al., 2017). Similarly, strategies for addressing supply chain disruptions during extraordinary events like epidemics or pandemics have primarily been explored in the context of humanitarian supply chains (Chowdhury et al., 2020b; Dasaklis et al., 2012). Various approaches, such as a flexible orientation (Altay & Pal, 2023), timely and efficient information sharing (Scholten & Schilder, 2015), the implementation of the triple-A supply chain components—agility, adaptability, and alignment (Dubey et al., 2017; Oloruntoba & Gray, 2006), adaptive recovery plans and employee support (Shekhar Singh, 2014), have proven effective in recovering from epidemic outbreaks or severe disruptions in humanitarian supply chains. Leadership also plays a crucial role in this context, as the right leadership style can facilitate swift recovery by fostering cooperation with various stakeholders (Salem et al., 2019). However, it is important to note that humanitarian supply chains differ significantly from commercial and business supply chains (Yadav & Barve, 2016), making the findings from humanitarian supply chain research less directly applicable to managing commercial supply chains.

Studies focusing on disruption risk have recommended various recovery strategies for commercial supply chains. Among these, relational strategies such as supply chain collaboration and information sharing are commonly suggested (Chen et al., 2019; DuHadway et al., 2019; Zhou et al., 2018). Both horizontal and vertical alliances contribute to rapid recovery from disruption risks (Chen et al., 2019). Collaborative planning with supply chain partners is deemed essential in this regard (Blom et al., 2022; A. Kumar et al., 2020). Supply chain information sharing, and connectivity are also highlighted as effective strategies for disruption recovery (Chen et al., 2019; Dubey et al., 2018; Kampstra et al., 2006) as these relational strategies enhance triple-A supply chain performance. Furthermore, the interconnected nature of the triple-A components means that improvements in one component can contribute to disruption recovery by influencing others (Haris Aslam et al., 2020; Wamba et al., 2020).

Tukamuhabwa et al. (2017) indicate there are 24 different strategies for achieving SCR. Some SCR approaches have already been analysed. However, the field is still under-researched. While resilience enhancers can include a wide range of organisational practices, the literature recognises the dominant impact of redundancy (Mackay et al., 2019; Polyviou, 2019), flexibility (Ivanov & Dolgui, 2019; Kamalahmadi & Parast, 2016; Masoud Kamalahmadi 2017; Tukamuhabwa et al., 2017), adaptability (H. Aslam et al., 2020; Ponomarov & Holcomb, 2009), improved visibility (Brandon-Jones et al., 2014; Christopher & Lee, 2004; Jüttner & Maklan, 2011; Talluri et al., 2013; Wei, 2010), collaboration (Jüttner & Maklan, 2011; Pettit et al., 2013; Scholten & Schilder, 2015; Stecke & Kumar, 2009) and data analytics capabilities (Acharya et al., 2018; Dubey et al., 2019; Fang et al., 2016; Hazen et al., 2018; Srinivasan & Swink, 2018).

To overcome a company's vulnerability to disruptions, it is imperative to formulate and implement strategies for managing disruption (Bret et al., 2021; Cohen et al., 2020; Paul et al., 2016). The literature has recommended and tested several such strategies. For example, inventory stockpiling, diversification of supplies and suppliers, and creating back up suppliers have been suggested as ways of managing disruption risk (Chowdhury et al., 2020a; Sopha et al., 2022; Tomlin & Wang, 2011). In addition, other strategies such as emergency sourcing (Ali et al., 2021; Grimmer, 2022), buffer inventory and reserve capacity (Darom et al., 2018; Paul et al., 2016), as well as collaborative strategies such as on time and quality information sharing (Chowdhury & Quaddus, 2016; Kamalahmadi & Parast, 2016), have also been suggested for purposes of disruption management. The proper configuration of resources and infrastructure is also required, along with disruption orientation, to ensure that firms can manage disruptions efficiently (Ambulkar et al., 2015). These strategies for managing disruption can make a supply chain more resilient (I. Ali et al., 2017; Arcadis Report, 2022; McKenzie, 2020; Tang, 2006).

Enhancing relational infrastructure also involves leveraging technology, improving internal and external process connectivity, and harnessing big data (Roscoe et al., 2020). Recent research on the impact of COVID-19 has reaffirmed that collaboration can expedite recovery (Blom et al., 2022; Paul & Chowdhury, 2020). Studies emphasise the need for an adaptive supply chain recovery strategy tailored to each disruption risk, necessitating adjustments in tactics and operations (Gligor et al., 2019; Khuan et al., 2023; Paul, Moktadir, et al., 2021). A flexible supply chain network structure is considered appropriate for formulating effective

disruption risk recovery strategies (Dubey et al., 2018; Gunasekaran et al., 2015; Ivanov & Das, 2020). This ability to redesign the supply chain network while considering the medium-to-long-term impacts of a disruption risk is known as viability and is recommended as an effective recovery strategy, especially in the context of the current COVID-19 pandemic (Ivanov & Das, 2020; Kiers et al., 2022; Seuring et al., 2022). In addition to relational and flexible strategies, the literature also offers other approaches. For instance, buffer strategies like backup and alternative suppliers (Al Masud et al., 2014; Chen et al., 2019; Magableh, 2021b), buffer inventory or materials (Darom et al., 2018), capacity expansion or utilising reserved capacity (Ivanov, 2017), and implementing a compensation policy for customer wait times (Shao & Dong, 2012) are suggested for disruption recovery. To recover from extraordinary outbreaks like COVID-19, Paul and Chowdhury (2020) recommend increasing production capacity by adding more shifts, hiring additional staff, purchasing additional machinery, and employing emergency sourcing for high-demand items. However, the question that has not been fully explored is are these recommended strategies applied in a similar way under the COVID-19 pandemic?

3.3.12 Proactive and Reactive SCRE Strategies

Melnyk et al. (2015) perceive SCRE as “the ability of a supply chain to both resist disruptions and recover operational capability after disruptions occur” (Melnyk et al., 2015). From this perspective, Melnyk et al. (2015) observe that resilience consists of two critical but complementary system components: the capacity for resistance and the capacity for recovery. For them, the resistance capacity is either the ability of a system to minimise disruption’s impact, evade it entirely (avoidance) or reduce the time between disruption onset and the start of the recovery from that disruption (containment) because of the proactive strategies. The recovery capacity is the system’s ability to return to functionality once a disturbance has occurred because of strategically implementing both the proactive and reactive strategies. We need to build SCRE and logistics capabilities deliberately (Thompson & Anderson, 2021). Although there are numerous definitions of SCRE in the SCM literature that come from multiple disciplines, there is an overall multidisciplinary consensus on the sorts of SCRE methods. Most researchers and practitioners agree with their classification into two major dimensions: proactive and reactive (Cheng & Lu, 2017; Dabhilkar et al., 2016; Hohenstein et al., 2015; Tukamuhabwa et al., 2017). The distinction is mostly based on their function in developing SCRE capabilities in various phases: pre-disruption, during disruption, or post-disruption, often taking into consideration whether they are used proactively to avoid a threat

or reactively to recover from it (Hendry et al., 2019). While particular disruptions can be prevented through proactive actions that limit the probability of occurrence (Chopra & Sodhi, 2004), others can only be addressed by proactively preparing for their inevitable occurrence or reactive actions after the disruption is detected (Sheffi & Rice Jr, 2005). A holistic understanding of this classification according to the time and space when a choice was taken, as well as whether it is intended to add redundancy or increase flexibility, can increase the effectiveness of supply chain responses to disruptions.

Ali et al., (2017) identify five key SCRES capabilities: anticipating, adapting, responding, recovering, and learning while Hohenstein et al. (2015) define the four SCRE phases as preparedness, response, recovery, and growth. Wieteska (2019) proposes five SCRE abilities: anticipating, responding, recovering, learning, and improvement. Tukamuhabwa et al. (2017) stress that certain methods can be either proactive or reactive, depending on when and why they are implemented.

The COVID-19 pandemic has created unprecedented disruptions to global supply chains not only in the retail sector but in manufacturing operations, posing significant challenges for manufacturing business continuity and SCRE (Belhadi et al., 2021; D Ivanov, 2021). The extant operations and supply chain management literature categorises manufacturing SCRE strategies as proactive (implemented pre-disruption) and reactive (implemented post-disruption) and indicate that some SCRE strategies are interrelated and reinforce each other. An overview of these is provided in Figure 3.12 (Belhadi et al., 2021; Tukamuhabwa et al., 2017).

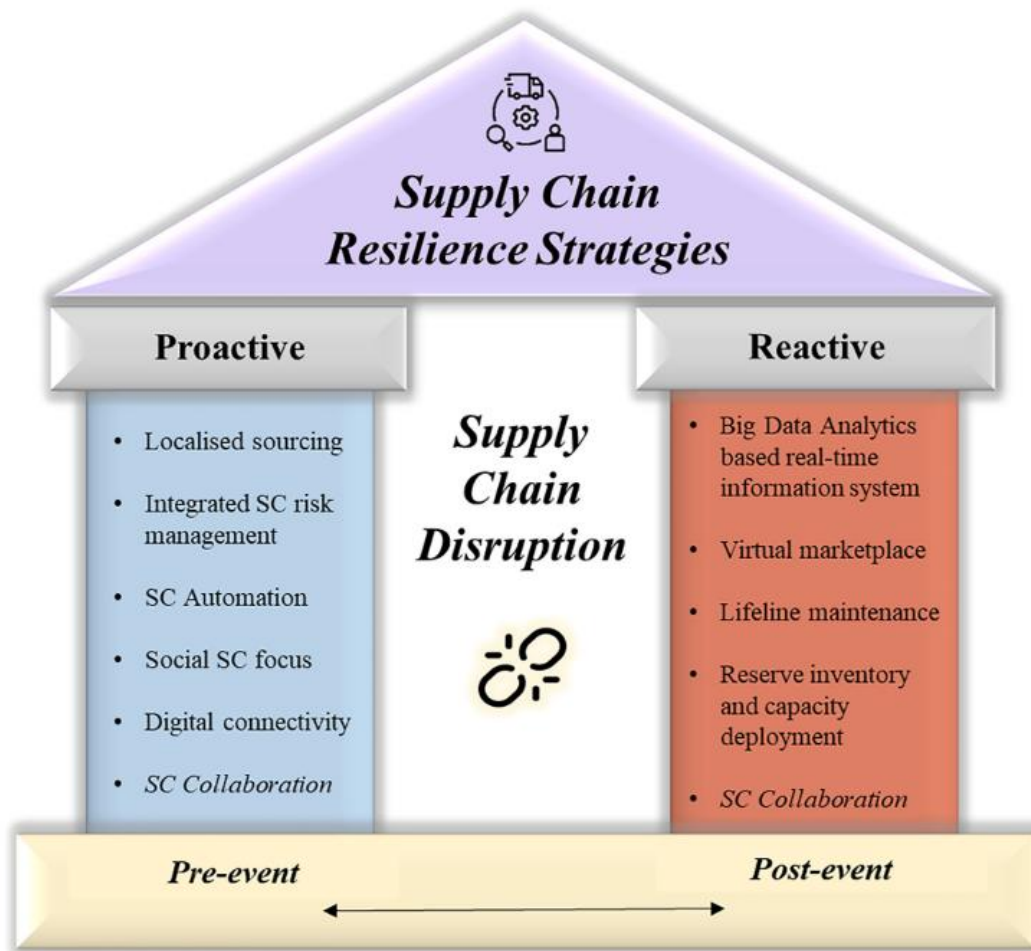


Figure 3-12 SC resilience Strategies (Source Author)

The response strategies observed during the COVID-19 pandemic at the manufacturing plant and supply chain levels have been compared with established SCORE strategies. These strategies can also be applicable in the retail sector. Response strategies play a critical role in the framework of supply chain resilience, bridging the gap between proactive measures and reactive recovery efforts. The reviewed literature on supply chain resilience, such as the works of Ponomarov and Holcomb (2009) and Scholten et al. (2014), emphasizes that resilience strategies encompass preparedness (proactive), immediate response to disruptions (responsive), and recovery actions (reactive). While this study primarily focuses only on proactive and reactive strategies, omitting response strategies may create an incomplete representation of resilience frameworks. The Response strategies, characterized by agility and adaptability, enable supply chains to mitigate immediate disruptions effectively before transitioning into full recovery mode. Good examples include the swift reallocation of resources, rapid decision-making under uncertainty, and leveraging real-time data for dynamic responses. Acknowledging the interconnectedness of these three dimensions—proactive,

responsive, and reactive—is essential to developing a comprehensive hybrid resilience strategy framework. Therefore, the integration of response strategies not only aligns with existing theoretical foundations but also strengthens the practical relevance of the research for supply chain managers facing disruptions like COVID-19. The reactive approach primarily emphasizes the ability to respond, recover (Ponomarov & Holcomb, 2009; Sheffi, 2015), and even to recover, learn, and grow (Ali et al., 2017) following a crisis. This involves developing capabilities that enable rapid recovery from disruptions (Ponomarov & Holcomb, 2009), securing the resources necessary for recovery (Bergami et al., 2022; Laksmana & Thai, 2020), and creating the capacities needed to manage disruptions (Rice et al., 2003).

Proactive elements of SCR focus on building and enhancing supply chain resources that help anticipate disruptions and avoid them (Deren & Skonieczny, 2021; Mwangola, 2018). Ali et al. (2017) argue that proactive strategies are based on developing the competencies necessary during the pre-disruption phase to ensure readiness and anticipate potential threats. According to Hollnagel (2011), proactive resilience enables companies to identify and defend against risks before they lead to negative outcomes. Pertheban and Arokiasamy (2019) further suggest that proactive approaches involve taking proactive actions before a full-blown crisis occurs.

3.3.13 Proactive SCORE strategies

The proactive strategies focus on anticipating future disruption events and creating cushion against negative impacts in advance of a disruption. The proactive approach is based on the risk management process such as risk identification, assessment, mitigation, and monitoring. Usually, such proactive practices will be implemented before risk events occur (Fan et al., 2023). According to Tomlin and Wang (2011), proactive strategies entail practices designed to methodically enhance SCORE by leveraging available resources. Proactive strategies are those in which a firm Tomlin and Wang (2011) focuses on building capabilities in the pre-disruption phase to anticipate threats and enhance readiness while on the other hand the reactive approach primarily revolves around the ability to respond and recover after a crisis. This involves building capabilities for quick recovery, ensuring access to necessary resources, and creating capacities to cope with disruptions. Table 3.6 below details the proactive resilience strategies identified in literature.

Table 3-5 Proactive Resilience strategies identified in literature in general.

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
Proactive strategies	1	Appropriate supplier selection/procurement	Taqi et al (2020), Zhu et al. (2020), (Scala and Lindsay, 2021), (Ivanov, (2020), Sharma et al (2020), Remko (2020), Pereira et al. (2014), Rajesh & Ravi (2015).	Using selection criteria that can help to minimise disruptions and their impact, such as political stability in suppliers' territories, quality resource capabilities (e.g., technological), financial stability, business continuity, reliability, etc.	Data-sharing technology, resources such as capital, assets, and money.
	2	Building logistics capabilities	Aslam et al., (2020), Blom T (2022), Ponomarov & Holcomb (2009), Khuan and Shee (2023).	On the logistics front, retailers ensured they had scalable resources in place, such as adequate inventory levels, transportation capacity and warehouses. As customers modified their shopping behaviour by making efforts to reduce theft and infiltration, minimising losses and disruptions, these strategies were both proactive and reactive.	IT integration, resources such as capital, assets, and money.
	3	Building security	Aslam et al. (2020).	Building security was used to build SCR through Protection of the SC (e.g., cyber security reduction of theft or infiltration). These were basically measures to protect against deliberate disruption.	Capital to invest in cyber protection, purchasing antivirus, computer, antivirus, security IT rooms.
	4	Building social capital and relational competences	OKuivalainen (2020), Ismail Gölgeci et al (2020).	The building of social capital and demonstrating stronger relational competencies (e.g., communication, cooperation, trust, reciprocity, etc.). Retailers establish a network of support, information, and required resources. Fostered adaptability provided a buffer against disruptions and contributed to the overall resilience of retailers. Providing each other with emotional support—this also involved creating solidarity and helping each other during the crisis. Social capital facilitated the sharing of critical information between retailers and suppliers.	IT integration to enable communication, sharing of resources such as transport consolidations. Sharing information through utilising IT integration.
	5	Co-opetition	de Sousa Jabbour et al. (2020), Crick and Crick (2020 pp 206–2013), Gernsheimer, Kanbach and Gast (2021), Granata et al. (2018), Mirzabeiki, He & Sarpong (2023).	This involved successful collaborative relationships in SCs that enabled resource sharing (e.g., warehouse and hardware) between operations of partners. Collaborative planning and forecasting allowed for more efficient resource sharing among competitors, ensuring a more stable supply chain. Majority of suppliers entered co-	Warehouses, capital, transport facilities. IT integration, collaborative planning.

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
				opetition to improve procurement and supplier relationship management efficiency. Business acumen, arm's length relationship, transparency/honesty, collaborative planning and forecasting enabled business continuity. Very few mentioned this as a strategy.	
	6	Creating appropriate contractual agreements	Chowdhury et al (2020)	Creating and maintaining collaboration between competitors to gain from synergies, e.g., sharing resources for building security and resilience, trade-off between cash and credit lines becomes more important and establishing shared resources with their secondary suppliers to manage raw materials and inventory.	Sharing resources, government websites for information on regulations, relief programs, consulting legal experts. Using Communication Protocols: drafting and signing Remote Work Agreements:
	7	Collaboration with the government/creating public-private partnerships	(Moosavi et al., (2021), N Haring et al (2021), O. Alhawari et al (2021), Hale et al., (2020), Y. Lu, J et al (2020).	Government implementation and declaration of business-friendly policies taking into consideration organisations of all type, sizes and Ownerships. This involves. Government relaxation of taxes and obligations and providing financial support allowing usage of state facilities. The government allowing temporary visas for other nationalities drivers to help fill driver gaps.	Communication.IT resources, financial resources.
	8	Creating a risk management culture	De Sousa Jabbour et al. (2020), Sanjoy Kumar Paul et al (2021), El Baz et al. (2021), Golan et al. (2020).	Ensuring that all organisational members embrace supply chain risk management, and this involves e.g., top management support and firm integration/teamwork. This strategy involves implementing efficient supply chain risk management strategies and streamlining their supply chain planning.	Competent management team and leadership style human resources, knowledge sharing, corporate culture. IT integration, resources such as capital to train personal and purchasing computer equipment.
	9	Increasing innovativeness	Feng et al. (2020), Pilawa (2022), Choi (2020), Roggeveen and Sethuraman, 2020), Pilawa (2022), Berry et al. (2020), Bolton et al. (2021), Beckers et al. (2021), S. Memona (2021).	This strategy involves motivation and capability to seek and invent new business ideas, e.g., new products, technologies, processes, and strategies that can reduce vulnerability.	Technological innovations, firm resources, new and upgraded software, computers, transport equipment, capital in terms of money, use of AI and blockchain.

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
	10	Increasing visibility	Aslam et al. (2020), Chowdhury et al. (2020), Lohmer J, (2020) Sarkis, J et al. (2020).	<p>The ability to see through the entire supply chain (all nodes and links), which helps to identify potential threats. Visibility helps retailers establish better communication and collaboration with their suppliers. Retailers Introduced a transport management system (TMS) to keep a grip on logistics supply chain.</p> <ul style="list-style-type: none"> •TMS software provides insight into transport flows, expected arrival times, transport performance and logistics costs •Big data analytics enhanced flexibility from increased visibility, retailers identify areas that need continuous improvement. •Data-Driven Decision-Making was improved through visibility of SC •Transparency for Customers •Cost Optimisation: Improved visibility enables retailers to identify inefficiencies and bottlenecks in the supply chain. 	Data technology, integration-functional integration, big data analytics, e.g., TMS websites and online marketplaces and social media platforms such as Facebook, Instagram, Twitter, and Pinterest to engage with customers. Analytics tools: Using data analytics tools helps retailers track customer behaviour, identify trends, and make informed decisions to improve their visibility strategies.
	11	Inventory management	Mirzabeiki, He and Sarpong (2021), de Sousa Jabbour et al. (2020), Altay, Nezih et al. (2023), Shekarian and Mellat Parast (2021), Shishodia et al. (2021).	Inventory management involved the modification, reviewing in inventory policies and planning parameters. Other firms started executing reduced inventory levels. Reserving safety stock to meet normal demand and further support the variability. Artificially inflate the positions of inventory. Other food retailers experienced a sharp reduction in inventory, increased product backlog. out appropriate inventory policies to deal with disruptions.	<p>Technology Integration: system-wide approach to minimise inventory risks, warehouses and trucks as resources were utilised to deliver the stock on time: Safety Stock Slack</p> <p>Capacity depended on the resource capabilities, demand forecasting tools such as inventory management software to prevent overstocking or understocking of inventory. Integrating technology solutions such as RFID, barcoding, and IoT to enhance visibility and traceability in the supply chain, making it easier to monitor inventory in real-time. Employee training and cross-training resources.</p>

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
	12	Knowledge management	Shashi, et al. (2020), Sabahi and Parast et al (2020).	Developing knowledge and understanding of supply chain structures (i.e., physical, and informational), and the ability to learn from changes as well as educate other entities gathering data by means of both formal group discussion and brainstorming with key members of a supply chain. Knowledge management identified errors, bottlenecks, opportunities to innovate and solutions that work are critical to managing continuity.	Training resources, social media updates.IT integration. demand forecasting tools such as inventory management software to prevent overstocking or understocking of inventory. Use of social media such as television newspapers, magazines, and other publications.
	13	Portfolio diversification	A Sharma et al, (2020), Zhu, et al 2020, Magableh, G.M. (2021).	Some firm diversified their portfolio as a Risk-Adjusted Returns strategy. Others indulged in different products to reduce dependence on products and suppliers.	Social media, training resources, capital to invest in other products, human resources expertise, IT integration with potential suppliers.
	14	Supply Chain collaboration	Shekarian and Mellat Parast (2021), Duong, L.N.K., Chong, (2020), Niemann and Meyer (2020), de Sousa Jabbour et al. (2020), Banchuen et al. (2017), Chen et al. (2017), Panahifar et al. (2018), Niemann and Meyer (2020), Chowdhury, Quaddus, and Agarwal (2019), Ali et al. (2017),	The ability to work effectively with other supply chain entities for mutual benefit, e.g., sharing information and other resources to reduce vulnerability. Firms increased their focus on supplier relationships and contract management. They also built strategic relationships and collaborated with all key partners at different tiers. •Collaboration between manufacturers and suppliers to overcome the challenges of the HGV driver shortage, shared resource and information sharing, focused on decision synchronisation communication, and goal alignment. Modified and entered into contracts agreements Higher level of international collaboration indirectly pushes global businesses to adopt sustainable practices.	Sharing trucks, IT integration, training resources, capital, warehouses, data analytics, collaborative planning tools. Blockchain technology, data analytics and AI. Training and skill development. Open communication channels.
	15	Supply chain network structure/design	Govindan et al (2020), de Sousa Jabbour et al. (2020), Leat and Revoredo (2013), Kristianto et al. (2014), Gong et al. (2015), Scholten et al. (2014), Cardoso et al. (2015),	Constructing the supply chain network for resilience, e.g., balancing redundancy, efficiency, vulnerabilities, etc. This involved investing in the capabilities and assets of network partners. Joint knowledge creation reconfigures the supply chain structure. The usual layers of SC networks are composed of suppliers, plants, distribution centres, warehouses, and customers and the typical material flows are often from suppliers to customers.	IT integration, sharing resources such as vehicle equipment, trainings. Large capital investments.

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
	16	Supplier development	Tang (2006), Leat and Revoredo (2013), Tukamuhabwa et al, (2017), Mukuch and Chari (2022).	Facilitating suppliers with incentives, e.g., financial, training, and technical knowledge to improve efficiency, commitment, and reliability. Investing in the capabilities and assets of network partners. Joint knowledge creation. Alignment of incentives. Developing trust.	Developing trust sharing facilities, training, and development programs.
	17	Sustainability compliance	Soni and Jain (2011), Dolgui et al. (2018)	Compliance to economic, social, and environmental requirements to mitigate associated supply chain risks, e.g., reputational risks and government directives. Business acumen, knowledge of circular economy principles.	Government facility and regulatory programs and policy documents.
	18	Use of information technology	Sarkis (2020), Frederico et al. (2023), Jiang and Stylos, (2021), Moosavi et al. (2021), Nguyen et al. (2021), Khuan et al. (2023), Salehi-Amiri et al. (2021), Grimmer (2022), Ivanov (2021), Taqi et al. (2020), Wagner (2015), Tsilika et al. (2020).	Information technology enhances connectivity and supports other resilience strategies, e.g., visibility and collaboration, which can help in signalling potential disruptions. IT integration enables firms to think outside of their own realm and provides higher visibility to the operations. Use of AI, data analytics.	IT integration. Human resources and capital to invest in computer equipment and software, knowledge of suppliers and customers, integrating the flow of products and information sharing across the SC. Building collaborative bricolage.
	19	Geographic location	Shishodia et al. (2019), Ivanov (2021), Gunasekaran and Subramania (2015).	Avoiding vulnerable locations and threats. The technical capability of suppliers, flexibility, variability in the cost of supplies, quality parameters and lead time.	The capital for relocation, human resources, assets, transport facilities and capital for investing in a new location, including government regulation compliance.
	20	Business Certification	Giacomarra et al. (2016), Massoud et al. (2010) NA Mancheri et al (2018)	Business certifications ensure that a business meets the requirements of the governing industry standards. Pursuit of these certifications reinforce the commitment to continuous improvement, thus reducing risks.	Government regulations policies and procedures documents, IT integration, capital, and assets.
	21	Knowing supply chain vulnerabilities	Adobor (2020), Ali and Gurd, (2020), Wong et al. (2020), Svensson (2002), Pettit et al. (2010).	The resilience can be enhanced through knowing the vulnerabilities and factors necessary for taking risk response measures, mitigating future risks, and restoring activities to overcome these vulnerabilities. These are mainly proactive measures to guard against the potential risks.	Use of social media equipment such as computers and the acquisition of relevant software to predict possible risks and threats.

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
	22	Globalisation	Gölgeci et al (2020), Barroso, Machado, and Carvalho (2015).	Although globalisation increases complexity, it offers opportunities for business growth. A positive impact of globalisation on firms' growth and adaptation is resilience.	Government regulations, policies and procedures documents, IT integration, capital, and assets.
	23	SC sustainability	DeSousa and Jabour (2020), Rowan and Laffey (2020), Zhang and Alipour (2021), Ibn-Mohammed et al. (2020), Queiroz (2020), Brandenburg et al. (2014), Fahimnia et al. (2014).	This can be applied through efficient usage of available resources. Both are proactive resource reservations. This involves real resource utilisation.	Government regulations, policies and procedures documents, IT integration, capital, and assets.
	24	Circular economy principles	Aranda-Usón et al. (2020), Chikwava, Shee, Millcock and Chapman (2022), Nandi et al. (2020).	Keeping the material within the supply chain. Increase in resource use efficiency. Circular economy principles can reinforce localisation capabilities to increase resilience.	Government regulations, policies and procedures documents, IT integration, capital, and assets.

The above proactive strategies adopted from the literature in general align with the readiness and growth phases of SCORE. Organisations must adopt a proactive stance to ensure resilience that is not only capable of absorbing and mitigating potential disruptions, but also of surpassing the original state through targeted enhancements for improved performance. This category encompasses practices focused on augmenting SCORE through external resources, as well as the exploration of novel methods for safeguarding business operations and fostering innovations (Tukamuhabwa et al., 2017).

By integrating these activities into their proactive strategy, managers embrace a forward-looking approach towards potential threats, thereby cultivating a predictive capacity for enterprises. According to Sull (2005), proactive strategies entail proactive anticipation and active readiness to enhance an organisation's preparedness for forthcoming changes, in line with previous research by (Giustiniano et al., 2018). Within the realm of supply chain management, Bode and Macdonald (2017) elucidate readiness as the outcome of a comprehensive self-assessment and preparatory process aimed at fortifying an organisation against supply chain risks, enabling swift responses to emerging threats. Proactive strategies are founded on fundamental organisational activities, such as awareness of potential disruptions, recognising and staying informed about potential disruptions, as emphasised by Bode and Macdonald (2017). Furthermore, such potential impact self-assessment means evaluating the potential consequences of disruptions and seeking avenues for self-improvement in terms of prevention capabilities, in alignment with Linnenluecke et al. (2012): that is, engagement in planning and preparing for emergency situations.

3.3.14 Reactive SCORE Strategies

Contrary to the previously described proactive strategies, reactive strategies encompass a comprehensive array of practices and potential managerial interventions activated in response to disruptions, aimed at ensuring the uninterrupted continuation of business operations. In other words, *reactive strategies* are those in which a company takes action exclusively when a disruption occurs (Tomlin, 2006). As noted by Shao and Dong (2012), once a disruption transpires, contingency tactics or reactive strategies become imperative to either partially or entirely mitigate the impact of the disruption.

Similarly, the reactive approach was notably employed during the onset of the COVID-19 pandemic, and its prospective application can be characterised “on an as-needed basis.” It centres on the rapid utilisation of internal supply chain resources that can be promptly deployed. In the context of SCRE, reactive practices are intricately linked with the response and recovery phases. The core of this strategy lies in the implementation of corrective measures as a response to disruptions, often requiring solutions that extend beyond the existing supply chain resources. Several practices that were previously associated with a “reactive exploration” approach prior to the pandemic have since evolved towards proactive resolutions. According to Ivanov et al. (2017), a reactive approach focuses on contingency decision-making in the face of unexpected disruption events. The reactive practices can facilitate disruption recovery processes; however, research on recovery management during disruption events is scarce (Ivanov et al., 2017).

An important question arises: when a supply disruption is identified, how can a company effectively respond to it? The critical issue is related to lost mitigation. In essence, once a supply disruption occurs, the company must swiftly determine which strategies or policies should be enacted to minimise the adverse impact on supply chain performance. The adoption of different disruption management approaches can lead to markedly distinct outcomes. For instance, in the case of the chip supply disruption in 2000, Nokia swiftly diversified its sources and gained a 3% increase in its global market share for mobile phones from 27% to 30% in 2000. Conversely, Ericsson withdrew from the mobile phone handset production market in January 2001, incurring a loss of 1.68 billion dollars (Latour, 2001). It is of paramount importance to identify the optimal reactive strategies for minimising revenue losses and retaining customers.

In relevant existing literature there has been limited coverage of comparative analysis and understanding of the impacts of disruption-reactive strategies, especially in the context of the COVID-19 pandemic. Hence, the development of a modelling methodology to comprehend how disruption-reactive strategies influence retail sector recovery speed and building of resilience holds substantial potential. To respond and bounce back from unexpected events, firms need to understand the extent to which previous information (i.e., information gathered prior to the disruptive event) can be applied to the current situation (Bode & Macdonald, 2017). A firm’s ability to quickly gather and interpret relevant information can reduce the impact of a disruptive event (Bode & Macdonald, 2017). However, as previous studies indicate, firm size,

existing relationships and structures have to be taken into consideration to understand adaptive capabilities of organisations (Carey et al., 2011). According to Chen et al. (2019), and supported further by Fan et al. (2023), reactive SCRE techniques are evaluated on key activities associated with disruptions such as rapid recognition, rapid information gathering and diagnosis and rapid alternative discovery of the quick emergence of a series of reactions capacity to assemble a formal reaction team fast finding alternatives. A few exceptions focus on recovery services during disruptions to public transportation (Li et al., 2015) and the use of mathematical tools to forecast recovery times (Ivanov et al., 2017). Recovery in post-disruption times should include technical, capacity, and business aspects, and it should be followed by a learning process for continuous improvement (Chen et al., 2019). The capability to recover from a disruption quickly has widely been viewed as a demonstration of SCRE (Blackhurst et al., 2011). The speed at which to recover has been identified as the most predominant factor in disruption recovery (Chen et al., 2019). This is understandable because the disruption poses direct threats to firms' short-term cash flow and affects firm survival.

Therefore, this study explores and analyses some of the reactive strategies adopted by Australian retail sector firms in the aftermath of the unprecedented disruption caused by the COVID-19 pandemic. Table 3.7 below shows and detailed the Reactive Resilience strategies identified in literature in general. These strategies were generally reactive in nature.

Table 3-6 Reactive Resilience strategies identified in literature in general.

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
Reactive strategies	1	Building logistics capabilities	Mandal, Bhattacharya, Korasiga, and Sarathy (2017), Ponomarov and Holcomb (2009) Chen (2019).	Building logistics capabilities as a strategy after supply chain disruptions involves a combination of various resources, processes, capabilities for supply and information flows, e.g., to reduce cycle times, increase delivery competence, knowledge management and customer service to quickly recover from a disruption. This was applied through proper risk management, including insurance and contingency planning, and securing information systems.	SCM software, advanced analytics, predictive modelling, financial resources, IT integration, and business continuity plans.
	2	Building social capital and relational competences	Johnson et al. (2013), Ponomarov and Holcomb (2009), Kuivalainen (2020), Gölgeci et al (2020), Polyviou et al. (2020),	The building of social capital and increases after disruption in general demonstrating stronger relational competencies e.g., communication, cooperation, trust, reciprocity	IT integration to enable communication, sharing of resources such as transport consolidations. Sharing information through utilising IT integration.
	3	Contingency planning	Bastas (2022), Ivanov (2020), Palmatier, Sivadas, Stern and El-Ansari (2020), Dahlberg and Guay (2015).	Anticipating potential events and specifying the measures to deal with supply chain risks and disruptions before they occur, e.g., by forecasting and monitoring early warning signals. Contingency planning is key to achieving flexibility in that it is impossible to predict any disruptive event with 100% accuracy. Decision synchronisation. Sustainable resource utilisation, reduce supply chain vulnerabilities. Operation of business from home. This strategy can be applied through developing relationships with multiple suppliers to diversify the supply chain. This can involve identifying alternative suppliers and maintaining open communication channels with them.	Data and analytics tools, communication platforms, TMS, employee training, financial resources.
	4	Contingency re-routing	Goldbeck, Angeloudis and Ochieng (2020), Chowdhury et al (2020)	Using alternative routes (transportation) as a contingency measure in case of the threat of disruption to the current route, e.g., turbulence and severe weather at sea. The plans include increasing production at alternative locations, temporarily	Resources and Technology integration through TMS as well as geographical location with accessible routes risk assessment, risk evaluation and management, collaborative management, first response, security, operations, stability.

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
				switching transportation, and shifting customer demand to alternative products.	
	5	Creating redundancy /Diversification	Sheffi and Rice (2005), Ivanov and Dolgui (2019), Shekarian and Mellat Parast (2021), Mackay et al. (2019), Polyviou (2019), Chowdhury, Quaddus, and Agarwal (2019), Alexander (2019), Sodhi and Tang (2021b).	This strategy was applied through having organisational resources that can be used during disturbances to replace lost resources or capital. Maintained spare capacity, multiple suppliers, and safety stocks to buffer against disruptions. Considered on-demand manufacturing and strategic stocks.	WMS, tracking systems, diversified transportation, financial resources, and scenario planning.
	6	Demand management	Hobbs (2020), Naghshineh and Carvalho (2021), Tang (2006), Urciuoli et al. (2014).	This strategy can be applied through mitigating the impact of disruptions by influencing customer choices e.g., dynamic pricing, assortment planning and silent product rollovers. Holding online meetings for advanced ordering, Influence customer choices and manage demand through dynamic pricing, assortment planning, and inventory optimization to mitigate disruptions.	Collaborative forecasting, inventory optimization tools, CRM systems, and employee training.
	7	Ensuring supply chain agility	Christopher and Peck (2004), Carvalho et al., Shekarian and Mellat Parast (2021), Liu et al. (2019), Scholten et al. (2020), Mutebi et al. (2021).	The ability to respond quickly to unpredictable changes in demand and/or supply. This was applied through Increase agility to respond quickly to demand/supply changes by diversifying suppliers, enhancing visibility, and adopting flexible supply chain networks.	SCM software, IT integration, advanced analytics, and strategic supplier relationships.
	8	Increasing flexibility	Sheffi and Rice (2005), Ivanov and Dolgui (2019), Shekarian and Mellat Parast (2021), Rajesh (2020), Magableh et al (2021), Kiers et al (2022), Shekarian and Mellat Parast (2021),	This was applied through adapt to changing requirements with minimal effort by localizing supply chains, introducing operational flexibility, and developing contingency plans.	IT integration, safety stock, and buffer inventory
	9	Increasing velocity/adaptability	Feizabadi et al., 2019); Tuominen et al. (2004).	Adaptability was highlighted through flexibility in procurement and logistics, capacity to handle surges in demand and ability to recover from pandemic including adjusting their expectations, demands, and	Information management tools, IT integration, and inventory optimization. Cross-Functional Collaboration: Employee Training: CRM systems to capture and analyse customer data.

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
				purchasing behaviours. Rapid product innovation promoted adaptability. Retailers have had to pivot swiftly to address disruptions in the sourcing of goods, transportation bottlenecks, and fluctuations in demand.	
	10	Increasing visibility	Aslam et al. (2020), Chowdhury, Quaddus, and Agarwal (2019), Dubey et al. (2017), Pettit et al. (2010), Brandon-Jones et al. (2014), Saenz & Lohmer (2020).	It is the ability to see through the entire supply chain (all nodes and links) which helps to identify potential threats. By recognising speed of recovery, the accuracy of the information is fundamental in building resilience. In other words, the Improve supply chain visibility to identify potential threats and manage disruptions effectively by ensuring accurate information flow.	Information management tools, IT integration, and CRM systems.
	11	Supply chain collaboration	Shekarian and Mellat Parast (2021), Duong and Chong (2020), Niemann and Meyer (2020), de Sousa Jabbour et al. (2020) Sanjoy Kumar Paul et al (2021), Ivanov, (2020), Ramanathan U et al (2021), Byabale et al (2023), Friday, Ryan, Sridharan, & Collins (2018) and SCRE literature Azadegan & Dooley, (2021).	The ability to work effectively with other supply chain entities for mutual benefit. This strategy can be applied through Collaborate with other supply chain entities to share resources, synchronize decisions, and build strategic relationships that enhance resilience. .	IT Integration, financial resources labour, material, and information resources, human, equipment, production, information, transportation, raw material, and utilities availability.
	12	Use of information technology	Jiang and Stylos (2021), Burgos & Ivanov (2021), blockchain: see Moosavi et al. (2021), Nguyen et al. (2021), Khuan et al. (2023), Salehi-Amiri et al. (2021), Grimmer (2022), Ivanov (2021), Taqi et al. (2020). Dhamija and Bag, (2020), Mastos et al. (2020), Khuan et al (2023), Katsaliaki et al. (2021), Sharma et al. (2020).	After disruption IT can be applied through enhancing connectivity and supports other resilience strategies, e.g., visibility and collaboration, which can help in coordinating responses to disruptions. It can also be applied through sharing medical resources and information related to COVID-19. It can also enable the digitalisation of service offerings and product delivery. As a reactive strategy the use of IT can also be applied during crisis through improving information sharing efficiently and effectively across supply chain partners.	ICT, AI 3 D printing ETC, Resources for Communication. Decision synchronisation, social media, financial resources, IT integration.

	No	Strategy	References (up to 2024)	How the strategy is applied	Use of resources to implement the strategy
	13	Suspension of operations and rationalisation	Ye and Abe (2012), Parsons (2020). “	During a disruption manufacturer, and even retailers, suspend their operations for weeks, due to delays or unavailability of required key input supplies. This can be applied through suspending operations to conserve resources and avoid accumulating further losses until economic conditions improve. Decision synchronisation. Improve responsiveness, social media.	Use of social media to provide updates during disruption, IT integration, financial resources, and HR.
	14	Diversification	Sellam (2023), Taqi et al. (2020), Kiers et al. (2022), Grimmer (2022); Sharma et al. (2022)	This strategy can be applied where organisations can create a network of additional suppliers of different sizes and capabilities and in separate locations, allowing organisations to proactively reduce their exposure to volatility and disruption. It is intended to build greater redundancy, flexibility, and agility to help supply chains weather unpredictable external shocks without too much disruption.	Digital transformation deploying advanced data automation solutions, human capital resources, organisational: Regulatory Compliance, cross-train employees to handle multiple roles within the organisation. Scenario Planning. Financial Resources.

The objective is to derive specific disruption-reactive policies and strategies, assess the varying impacts of these strategies on the recovery speed of the retail sector firms, and evaluate how these strategies contribute to building SCRE for future disruptive events. I also analyse the influence of specific parameters on the selection of reactive policies and aim to provide practical guidelines for managers to enhance their disruption management capabilities.

3.3.15 Supply Chain Disruptions and the COVID-19 outbreak.

Supply chain disruptions have been well studied in the operations management literature (e.g.,(Bhattacharya et al., 2013; Tang, 2006; Tomlin, 2006). Supply chain disruption is defined as the unexpected events that disrupt the normal flow of materials, goods, services and information through the operations and supply chain management (Craig head et al., 2007; Queiroz et al., 2022; Son et al., 2021). Within the recent occurrence of the COVID-19 pandemic it has been largely acknowledged that COVID-19 triggered the most serious economic crisis since World War II (Gölgeci et al., 2023). The pandemic has virtually impacted all industries, from retail sector, education, and healthcare to food, automotive, and consumer packaged goods industries. Therefore, the global scope and impact of this pandemic are likely to permanently shape how organisations approach SCR. Some speculations can be made in this regard. First, firms are likely to shift from an operational, short-term approach to SCR, to a strategic, or long-term one. Disruptions are the manifestations of SC risks, hence the need for strategies to treat such disruptive events (DuHadway et al., 2019).

The concept of SCDs reiterates that a disruption occurs particularly when the supply chain is radically and unexpectedly transformed through non-availability of certain production, warehousing, distribution or transportation, such as equipment failure (Blackhurst et al., 2005). Recently, a number of studies have attempted to explore the effects of the COVID-19 pandemic disease on the disruption of global supply chains through means of simulation models (Ivanov & Das, 2020). At the same time, supply chains are becoming increasingly dynamic in response to changing business environments and technology. This has created challenges in managing the flow of materials and created greater risk of SCDs (Yu et al., 2019). According to the research, the COVID-19 pandemic will have long-lasting effects on the international supply chain. Considering the systematic and extremely negative consequences of a disruption in the global supply chain, scholars, firms and institutions, such as the World Economic Forum (Ambulkar et al., 2015; Bastas & Garza-Reyes, 2022) have been paying increasing attention to

the creation of resilience mechanisms. Despite the absolute relevance of SCRE for all economies, not much is known about how to build such resilience (Jüttner & Maklan, 2011).

One of the of the disruptions' main side effects or consequences on supply chain is the exposition of vulnerabilities to the supply chains (Polyviou, 2019). However, whether potential or actual, SCDs are the enemy of all firms, because they affect the firm's profitability and performance (Azadegan et al., 2020; Singh & Singh, 2019). More importantly, disruptions affect the lives and livelihood of society. SCDs are succeeded by an average 40% drop in long run stock price performance (Hendricks & Singhal, 2005), and characterised by high uncertainty (Bode et al., 2011). Assuming the previous proposed strategies, it is important to note that to a certain extent they have reduced vulnerability that some firms have to disruptions.

Figure 3.13 illustrates the impact of the pandemic on SCs. The study considers three main aspects: the main causes of the disruptions, the challenges associated with the pandemic, and the trend of the crises. Three main interrelated factors led to the disruption of the SC operations: change in supply, fluctuation in demand, and the reaction of governments and countries to confront the pandemic.

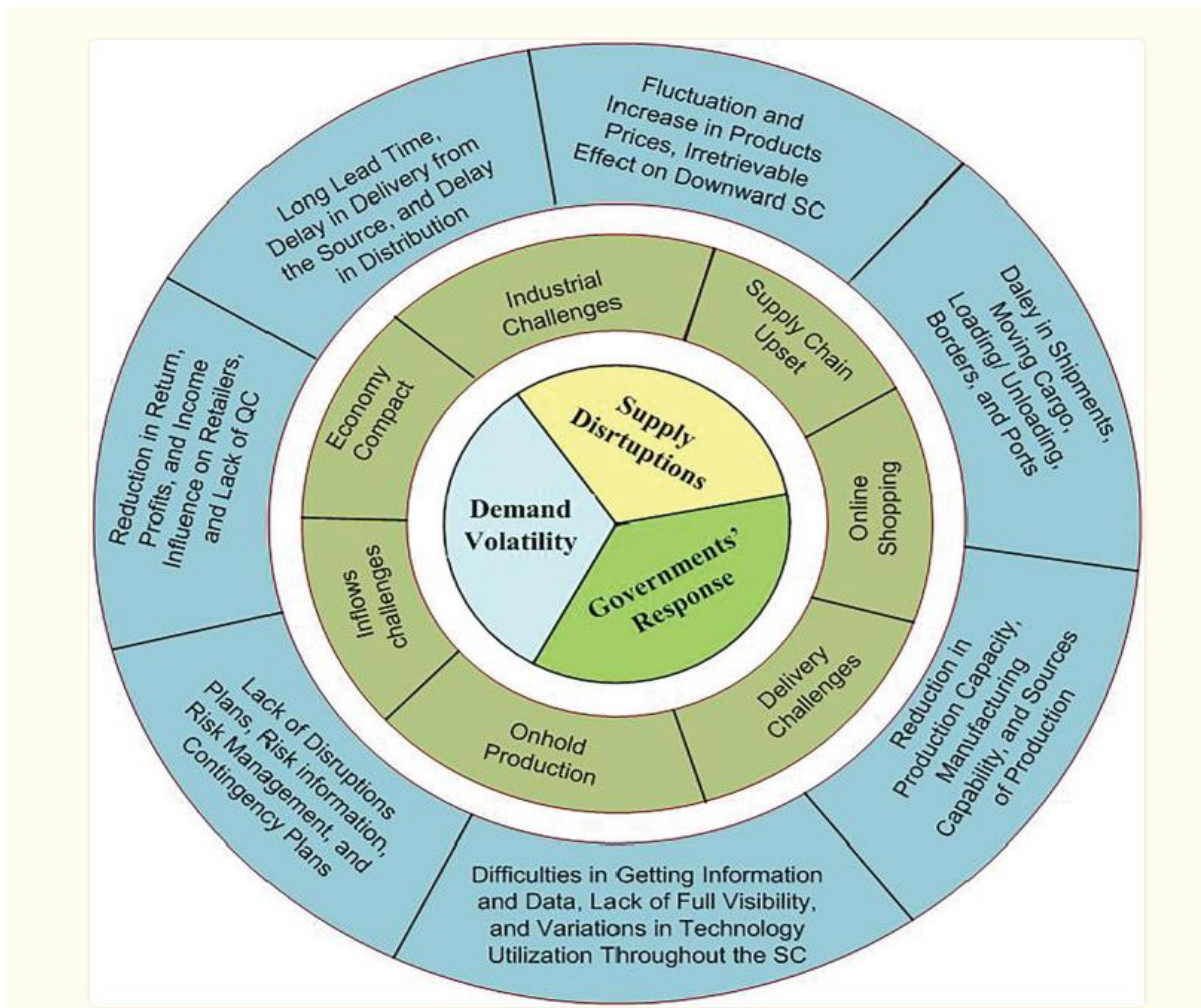


Figure 3-13 Impact of the pandemic on SCs: *Source* (Magableh, 2021a)

The SC activities, operations, processes, and management were significantly impacted by the pandemic. The closure of factories, restrictions at borders, travel bans, port closures, and suspension of transportation severely interrupted the entire supply network, leading to shortages of various products. Global supply chains (GSCs) connected to China, the USA and Europe were particularly affected, resulting in increased prices and panic buying. The surge in demand for essential items caused price fluctuations due to limited supplies. The high demand and congestion of orders resulted in vulnerabilities and shocks for both offline and online purchases. Moreover, meeting the massive demand while ensuring quality and continuity posed complex challenges. Many countries took proactive measures to protect their citizens, such as implementing lockdowns, social distancing, and quarantine measures. However, these decisions created tension and panic, further impacting SC operations and performance.

Consequently, there was a decline in production and significant contractions in international trade flows. The COVID-19 pandemic presented various challenges across multiple aspects of the supply chain, including industrial and economic disruptions, halted production, delivery complications, online shopping dynamics, and SC disturbances. Assembling final products required sourcing components from multiple locations, making the process more intricate when supply chains experienced disruptions. The supply and demand imbalances, coupled with government responses, introduced external and internal economic risks in both the short and long term. In response to the disruptions and protective measures imposed by governments, numerous manufacturing plants and factories suspended their operations.

Deliveries and distributions faced numerous hurdles, including difficulties in direct distribution, increased online orders, re-staffing of distribution centres and warehouses, and adjustments in inventory allocation across the network and distribution channels to enhance responsiveness. Consequently, the pandemic served as an opportunity for online businesses as online shopping surged, particularly for food and grocery products. Customer behaviour shifted towards increased reliance on online shopping, reducing visits to physical retail centres. Furthermore, the pandemic resulted in price spikes for freight, decreased interest in travel, and fluctuations in demand for various products, including both essential and luxury items. This led to the cancellation or modification of orders, putting organisations under pressure to lay off workers and halt production activities.

There is compelling evidence to suggest that both the frequency and intensity of highly cyclic and erratic nature of natural disasters causing disruptions are increasing (Adegoke Oke & Gopalakrishnan, 2009; Feng et al., 2010; Stecke & Kumar, 2009; Ye. Linghe, 2012). As such, research on disruptions is also inherently difficult since the disruptions themselves are unpredictable along several facets such as frequency, timing, and impact. Recently, the COVID-19 pandemic has put a strain across entire value chain and the impacts are felt across multiple industries (McKinsey Global Institute Report, Aug 2020). The disruptions provoked by the COVID-19 pandemic imposed huge challenges to supply chain managers, especially concerning the development of strategies to cope with effects, as well as to build viable responses to the resilience of the operations and SCM (Ivanov & Dolgui, 2020; Schleper et al., 2021; Van Hoek, 2020). It has further worsened the situation and exposed several firms' lack of risk management, agility, and resilience in their supply chains. Ironically, due to natural disaster's inevitable and frequent occurrences, there have not been significant mitigation

strategies to account for the new and changing environment, except for a few traditional ones (Gregory, 2020; Ivanov & Das, 2020; Kamalahmadi & Parast, 2016; Singh & Singh, 2019). At the same time, there has been a real shortcoming in understanding the full scope of vulnerabilities with the value chain (McKinsey Global Institute Report, Aug 2020).

3.3.16 COVID-19 pandemic and Its challenges

The novel coronavirus disease, also known as COVID-19, was discovered in December 2019 in Wuhan, in the Hubei province. The COVID-19 epidemic quickly spread around the world, becoming a true pandemic that impacted almost every region and further exacerbated the economic downturn (Das et al., 2022). On March 11th, 2020, the World Health Organization declared the novel coronavirus disease 2019 (COVID-19) a global pandemic, making it one of the deadliest epidemics in recent years. Anderson et al. (2021) described the pandemic as a textbook example of a black swan event: an extreme outlier that is hard to anticipate and, therefore, to manage (Anderson et al., 2021). The pandemic has sparked widespread inquiry into whether such a crisis can be effectively managed, particularly amid chaos and uncertainty. This global health emergency emerged unexpectedly, demonstrating significant and far-reaching effects.

At the beginning of the pandemic, the risks associated with COVID-19 were challenging for food supply chains to predict, and consequently were one of the most severe threats to the worldwide economy. According to the McKinsey survey results, the pandemic is the primary reason that 93 percent of companies plan to increase supply chain resilience, with technology serving as the long-term driver (McKinsey & Company Report, 2020). The pandemic has had an impact on supply chain operations, long-term economic development, and supply chain environmental performance, in addition to its effects on public health (Khan et al., 2020; Paul & Chowdhury, 2020).

To control the spread of the virus through lockdown restrictions, COVID-19 constrained SCs to their geographical boundaries and restricted operating activity within local areas. These restrictions have not only hampered the performance of global but also local SC operations by disrupting the link between demand and supply within regions (Chowdhury et al., 2020b; El Baz & Ruel, 2021; Salvato et al., 2020; Wieland & Durach, 2021a). Control restrictions imposed to curb the spread of coronavirus resulted in significant external and internal

disruptions to retailers' supply chains. Retailers' supply chains were severely disrupted because of control measures enforced to stop the spread of the coronavirus. As a result, the ability of retailers to respond to the pandemic's disruption and quickly restore operational activity within their businesses is crucial and hinges on resilient supply chain strategies.

Massive supply chain disruptions caused by COVID-19 taught businesses a painful lesson all over again (Linton & Vakil, 2020; Nikookar & Yanadori, 2021). It also exposed how fragile, inefficient, and cost-driven our supply chains were and undoubtedly tested the ingenuity, resilience and flexibility of supply chains globally (Ivanov & Dolgui, 2020; Magableh, 2021a). This also can be backed up by Weick and Sutcliffe (2007) when he mentioned that 'Unexpected events often audit our resilience' (Weick & Sutcliffe, 2007). Other researchers have highlighted that the COVID-19 pandemic has actually revealed the weaknesses of overreliance on lean delivery systems and just-in-time delivery (Bryce et al., 2020; Sarkis et al., 2020). However, on the positive side, the COVID-19 pandemic has also to some extent brought supply chain management to the forefront of people's minds. People are starting to realise and talk about supply chain as an essential service which has never been the case before.

Following the devastating effects, the most important factors for surviving and thriving in today's business environment are no longer just low costs, high-quality, or short delivery times, but also a company's ability to effectively respond to supply chain disruptions (Carvalho et al., 2012). The COVID-19 epidemic has disrupted nearly 97 percent of global supply networks, causing rapid, unanticipated, and in some cases irreversible disruptions (Institute for Supply Management (ISM), 2020). COVID-19 uncertainties, when combined with other characteristics of today's supply chains, such as being overly optimised and globalised, have created a runaway chain of disruptions throughout supply chains, causing massive material shortages or delivery delays that have severely impacted stock value and resulted in a loss of revenue for businesses.

This pandemic had a significant impact on the health market, particularly the pharmaceutical and grocery sectors, and was associated with significant short and long-term impacts that require recognition and adequate preparation to reduce their socio-economic burden (Ayati et al., 2020). Furthermore, this unprecedented pandemic has altered the operational conditions of many firms and supply chains on a massive scale. Firms have had to learn how to operate in an extremely volatile and unpredictable environment (Choi et al., 2020; Chowdhury et al., 2020b;

Ivanov, 2020; Singh et al., 2020; Supply Chain Resilience Report, 2020). During the pandemic, companies have extensively dealt with the concept of resilience, which became the central supply chain management perspectives. COVID-19's size and duration of impact are unknown, adding to the disaster's severity and complexity. As a result, any business discovered that its own SC resilience was lacking, with strategies that were insufficient, untested, or out of date. COVID-19 is teeming with unknowns. The Director of Fish Man Davison Centre for Services and Operations Management at Wharton Mr. Morris Cohen said:

“We’ve never seen a disruption like this where a large number of countries are telling their populations to stay home, not to work “ Matt Craven (2020).

In Australia, some businesses, especially in the hospitality sector, have failed to survive because of the slowdown in trade, while other businesses have had to fight extremely hard to supply the population's needs, including farms, retailers, third-party logistics, and members of healthcare sector supply chains (de Sousa Jabbour et al., 2020).

Other negative effects of the pandemic in the supply chain include demand volatility, bullwhip effects, and capacity issues, which affect both the demand and supply sides at the same time. The complexity of the COVID-19 pandemic necessitates a different approach than other disruptions. The dimensions of disruption are presented in Table 3.8.

Table 3-7 Dimensions of Supply chain Disruptions for COVID-19 Pandemic

Dimension	Typical Disruption	COVID-19
Scope	Limited scope: Fewer industries affected (e.g., a hurricane disrupts the petrochemical industry).	Widespread scope affecting both goods (like toilet paper and services such as haircuts, restaurants, meals). Closure of sporting events, cruise ships schools/universities.
Geography	Most disruptions are local or regional.	COVID-19 is widespread and global affecting all regions.
Demand vs Supply	Disruptions most often affect supply, sometimes demand.	Affects demand and possibly supply.
Prior Planning and Experience	Disaster planning has been done and prior experience is available.	Limited disaster planning for global pandemic, with limited prior experience (1918 Spanish Flu).
Financial System	Low to moderate correlation with global financial system.	High correlation with global financial system.
Term	Short-term needs for emergency services (e.g., flood rescues	Longer- term emergency services need (i.e., hospitals, beds, ventilators).

Human Impact and Behaviour	Localised human impact, with limited duration. Public fear is short-term, and most risks are visible (e.g., experiencing a tornado or earthquake).	Widespread human impact, with unknown duration and unknown impact. Public fear is longer-term, and risks are invisible/unknown.
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What is different about COVID-19 from other supply chain disruptions?

As shown in Table 3-8 above, geographically, SCD (Supply Chain Disruption) is often confined to a specific region or country. For instance, in the United States, hurricanes frequently impact Florida, earthquakes are common in California, and more recently, wildfires have caused widespread damage. Similarly, other regions have faced disasters such as typhoons, floods, and bushfires, as witnessed in Australia. However, a pandemic like COVID-19 is unique in that it affects and impacts the entire world.

According to Thompson and Anderson (2021), what makes COVID-19 so disruptive to the global supply chain is the combination of its suspected origin (China), its prolonged duration, and the scale of its impact. Multiple countries simultaneously battling the pandemic faced identical needs—ventilators, testing kits, ICU beds, and vaccines—causing demand to far exceed supply and exacerbating humanitarian supply chain challenges. Beyond geography, the scope of COVID-19's impact is virtually unparalleled.

Compared with past events causing supply chain disruptions, COVID-19 is unique in terms of its nature as an evolving crisis with an unknown duration (Fan et al., 2023). Furthermore, COVID-19 is unique in that it affects both products and services, altering both supply and demand. The demand for services has significantly decreased. Another feature that distinguishes COVID-19 from past disruptions is that there was no prior planning or experience. Planning and prior experience are guidelines for many disruptions, but experience with a disruption like COVID-19 was non-existent. These above unique features of COVID-19 make it a complex phenomenon. A shift in global supply chains, driven by a rise in the digitisation and automation of production processes, environmental and social awareness, and changing geopolitical dynamics, has made diversification increasingly essential. The COVID-19 pandemic has accelerated this shift, as companies and countries around the world are shifting their focus from supply chains designed for marginal efficiency to more strategic considerations of risk, resilience, and transparency. This push for SCRE has increased the pressure on some industries to reconfigure international production networks through nearshoring, regionalisation or diversification of their supply chains (Government of Western Australia, 2021).

3.3.17 How Proactive and Reactive Resilience Strategies were applied during the COVID-19 pandemic.

In recent years, scholars have dedicated extensive research to enhancing the resilience of SC more than ever before. Among the prominent works in this field, Ivanov's highly cited article (Ivanov & Dolgui, 2020) sought to predict the impact of pandemic outbreaks on SC performance. This study viewed the supply chain through the lens of resilience, examining how long it could endure a disruption and how quickly it could recover. Notably, factors such as facility opening/closing times, disruption propagation rates, and lead times were identified as significant determinants of SC resilience. Additionally, Ivanov and Das (Das et al., 2022) delved into the ripple effects of epidemic disruptions on supply chains, considering disruptions in production and distribution, as well as a decline in demand. Various recovery plans were also evaluated. Tukamuhabwa et al. (2017) emphasised that the effectiveness of strategies can vary between proactive and reactive approaches, depending on when and why they are applied. This study focuses on this approach to examine how both proactive and reactive strategies were applied during the COVID-19 pandemic. Furthermore, they highlighted the interrelated and mutually reinforcing nature of certain SCRE strategies. While the definitions of SCRE in the literature of supply chain management may differ across disciplines, to support Tukamuhabwa et al. (2017) there is evidence of consensus among researchers and practitioners on a dual classification of SCRE strategies: proactive and reactive (Ali et al., 2017; Cheng & Lu, 2017; Dabhilkar et al., 2016; Hohenstein et al., 2015; Tukamuhabwa et al., 2017). This classification is primarily based on the role of these strategies in cultivating SCRE capabilities across various phases, including pre-disruption, during disruption, or post-disruption, considering whether they are employed proactively to prevent threats or reactively to recover from them (Hendry et al., 2019).

Furthermore (Ali et al., 2017) identified five fundamental SCRE capabilities: anticipation, adaptation, response, recovery, and learning. While Hohenstein et al. (2015) outlined four key SCRE phases: readiness, response, recovery, and growth Tukamuhabwa et al. (2017) emphasised that specific strategies can be either proactive or reactive, depending on the timing and purpose of their application. Additionally, they indicated that certain SCRE strategies are interconnected and mutually reinforcing. It is worth noting that Hollnagel (2011) and Ali et al. (2017) introduced a third category of SCRE strategy, known as concurrent strategies, which involve rapid initial responses during disruptions or in the immediate post-disruption phase.

These strategies, due to their nature, may be considered as falling within the realm of reactive strategies.

During the initial lockdown in Australia food processing plants faced closures or operated at reduced capacity due to COVID-19 containment measures. The transportation of goods along the food supply chain was hindered by bottlenecks, primarily affecting land transport by trucks. The disruption in the road connections between suppliers, distribution centres (DCs), and customers resulted in decreased on time deliveries and service levels. The simulation focused on land transport, revealing the broader implications of interruptions in the supply chain. According to Burgos and Ivanov (2021) several SC issues in the Australia food retail sector were caused by the COVID-19 pandemic: (1) shifts in quantity demanded, (2) changes in demand patterns and market composition, (3) suppliers' output reduction due to capacity shutdowns, (4) inventory imbalances at DCs, (5) transportation and logistics backlogs, (6) the adoption of new distribution channels such as online sales, (7) capacity constraints at DCs, (8) increased lead times, (9) a rise in non-fulfilled orders, and (10) heightened hygienic regulations and traceability requirements. In response to these challenges, the food retail industry must adapt its supply chain to enhance resilience.

During the unprecedented challenges posed by the COVID-19 pandemic, small businesses across various retail sectors experienced a shift in their traditional business processes. This study explores the nature of digital responses adopted by these businesses to mitigate the pandemic's impact.

Literature on the subject affirms that many small businesses turned to digital solutions to navigate the challenges brought about by the pandemic. Notably, certain characteristics inherent to small businesses, such as their flexibility (Burgess et al., 2017) enabled them to swiftly respond by integrating digital strategies. Owners and managers highlighted the agility of small businesses in adapting quickly to the crisis through the implementation of digital solutions. Some, however, faced hurdles in adopting new digital technologies due to resource constraints, particularly in cases involving the introduction of e-commerce (Mandviwalla & Flanagan, 2021). Limited knowledge rather than time constraints appeared to be the primary obstacle for these businesses. High-end retailers adapted by transitioning face-to-face advisory services to an online format, as documented by Fletcher and Griffiths (2020). Services businesses, on the other hand, moved their face-to-face services online, with some also necessitating the establishment of new e-commerce facilities to support this transition

(Mandviwalla & Flanagan, 2021). Notably, businesses in the bulk products category predominantly opted for a repurposing response due to the loss of their B2B business. In response, they redirected their focus to offering products in smaller sizes directly to consumers. In summary, this research sheds light on the diverse digital responses exhibited by retail sector businesses during crises, emphasising the crucial role of adaptability and resourcefulness in navigating unprecedented challenges in line with RDT theory. A summary of the related research has been compiled from literature and presented in Table 3.9 below.

Table 3.9: Literature Summary on the impact of COVID-19 on the evolution of online retail

No	Study/Authors	Focus of Study	Key Contributions	Identified Gaps/Limitations	Post-COVID-19 Implications
1	Pantano et al. (2020)	Impact of COVID-19 on consumer behavior and online retail adaptation	Highlighted how retailers quickly adapted to digital platforms to meet changing consumer demands	Limited focus on smaller retailers; mostly analyzed large retail chains	Retailers need to continuously invest in digital capabilities for resilience
2	Sheth (2020)	Shifts in consumer shopping patterns due to the pandemic	Emphasized long-term changes in consumer behavior towards online shopping	Did not consider regional differences in consumer behavior shifts	Long-term shift towards online shopping necessitates new customer engagement strategies
3	Donthu & Gustafsson (2020)	Accelerated digital transformation in retail strategies	Highlighted the rapid shift to e-commerce to ensure business continuity during lockdowns	Lacks in-depth analysis of supply chain adjustments during the pandemic	Accelerated adoption of digital tools to sustain competitive advantage
4	Gao et al. (2021)	Adoption of online channels in response to pandemic constraints in China	Provided empirical evidence on the increased use of online platforms in China	Focused on China; and not other countries lacks insights into global retail adaptations	Online channels are crucial for future-proofing retail operations
5	Pilawa et al. (2022)	Omnichannel strategies and their evolution post-COVID-19	Explored how retailers integrated online (Omnichannel) and offline channels to enhance resilience	Limited to omnichannel approaches without exploring logistics challenges	Integration of physical and digital channels is key to meeting new consumer expectations
6	Rahman et al. (2022)	The role of AI in transforming online retail	Explored how AI tools have helped retailers predict demand and personalize online shopping experiences during the pandemic	Limited coverage of small retailers and implementation costs	Investments in AI can enable sustainable online retail growth
7	Zhang et al. (2023)	Supply chain resilience in e-commerce post-COVID	Investigated the strategies e-commerce companies used to enhance supply chain visibility and flexibility post-pandemic	Focused on large-scale e-commerce companies	Building resilient supply chains is critical for future e-commerce growth particularly after the COVID 19 pandemic
8	Moosavi et al. (2023)	Consumer behavior changes in the digital age	Highlighted the persistent shift in consumer behavior towards digital shopping even after the pandemic	Did not consider the digital divide in rural areas scenario	Retailers must address accessibility gaps for a more inclusive approach

9	Ivanov & Das (2024)	Disruption management in online retail logistics	Examined how retailers optimized last-mile delivery services amidst supply chain disruptions	Overemphasis on urban logistics; limited rural context	Prioritizing adaptable logistics strategies in omnichannel retail
10	Deloitte Report (2024)	Future trends in omnichannel retail post-COVID	Analyzed consumer expectations for seamless online and offline shopping experiences	Generalized trends without specific geographic or demographic analysis	Retailers should prioritize seamless integration of channels for loyalty

The above Table 3.9 summarizes recent literature examining the impact of COVID-19 on online retail. These studies highlight how the pandemic accelerated the shift to digital shopping channels, with a focus on consumer behaviour changes, digital transformation, and the evolution of omnichannel strategies. Key insights include the importance of continuous investment in digital capabilities and the integration of online and offline channels to build resilience. The table also identifies research gaps, such as limited focus on smaller retailers and regional differences, indicating areas for future exploration.

During the challenges brought about by the COVID-19 pandemic, organisations adopted a variety of strategies to bolster their resilience, especially in the domains of supply chain management, procurement, and supplier relationships. These strategies encompassed both responsive reactions to immediate disruptions and proactive measures geared towards long-term readiness. Reacting to the pandemic's impact, supply chain activities related to purchasing, sourcing, and managing supplier relationships underwent significant changes. Alterations in business processes, such as raw materials acquisition and component production, gained prominence. The closure of borders and the reduction of air connections made it imperative to explore local suppliers and elevate the importance of domestic sourcing in isolated regions while minimising reliance on foreign supplies. The shift towards local sourcing and, when necessary, nearshoring became a prevalent approach. Companies prioritised procuring raw materials and components from nearby suppliers to enhance supply chain stability. Nearshoring was frequently employed as a remedy when the local market could not meet supply chain requirements.

Conversely, a common strategy was to manage inventory levels both at company sites and supplier locations. To cope with uncertainties in the supply chain, businesses increased their stock of various materials, components, modules, and partially finished goods. This approach helped them reduce disruptions and maintain production. Throughout all stages of the supply chain, there was a concerted effort to boost inventory for raw materials, components, systems,

and semi-finished products. Challenges in obtaining direct production supplies and communication issues further intensified the need to streamline deliveries from multiple suppliers.

Moreover, in response to the crisis, the criteria for selecting suppliers underwent a significant transformation. While cost considerations receded in importance, the primary focus shifted to ensuring the continuity of supply and providing flexible payment terms. Businesses also placed a stronger emphasis on inventory management and nurturing supplier relationships. The pandemic put trust between trading partners to the test, necessitating adaptability. Trade disruptions, including contract renegotiations and shorter payment terms, prompted companies to prioritise the quality of existing relationships when making strategic sales decisions. Supplier Relationship Management (SRM) gained even greater significance within Supply Chain Management (SCM) under these uncertain conditions. Trust between trading partners faced considerable challenges during the economic downturn. Trade disruptions resulted in the revaluation of payment terms and contract negotiations. Decisions on selling strategic goods increasingly relied on pre-existing relationships and the quality of past cooperation.

One frequent reaction to the pandemic was the creation and enhancement of communication via online platforms. This shift in technology also influenced the digitalization of buying processes, leading to greater oversight of purchasing budgets. The most extreme measure taken by some companies was the temporary shutdown of production. Several factors contributed to this decision, including reduced demand, a shortage of raw materials, and the desire to limit the inventory of finished products. Conversely, other companies focused on sustaining production continuity in collaboration with their procurement departments to ensure the necessary resources for their production lines. This often entailed a complete reorientation of the production process, including shifting from overseas production to domestic production. The driving force behind this change was the rationalisation of product offerings and the introduction of new product categories at the expense of declining demand for certain goods.

Distribution is the supply chain process where pandemic-induced changes were most visible to consumers. Some changes resulted from the appearance of new product categories in the market, while some products were discontinued, leading to the rationalisation of product assortments. However, the most significant change pertained to sales and delivery methods. Companies that had not done so before began to develop multi-channel distribution. The e-

commerce market experienced significant growth, accompanied by enhanced services. In response to concerns for customer and employee safety, simplified contactless delivery methods were introduced, and formalities were minimised. Customer care also manifested itself through remote service practices, with communication and relationships with clients being developed via digital platforms. To meet customers' psychological need for interpersonal contact, companies not only implemented chat systems and sales forums but also reintroduced telephone contact, which had previously diminished in importance. Substantial changes also occurred in the realm of finished product inventory management and flow. Distributors started monitoring their suppliers' inventory levels more closely while maximising their own inventory levels. In many cases, decisions were made to decentralise distribution centres and revamp management approaches to flexibly respond to the heightened demand for e-commerce services.

The research conducted revealed that only a limited number of proactive practices were implemented during the pandemic. This was primarily due to the abrupt onset of COVID-19 and companies' immediate focus on addressing this threat. Proactive measures implemented by companies during this period were primarily concentrated in the sourcing domain. Diversifying the supplier base emerged as a critical factor for ensuring business continuity. Multiple sourcing strategies provided security in case of disruptions from one source and the ability to split order volumes among multiple suppliers. This approach was closely related to another practice—global sourcing, which aimed to expand the supplier base across different geographical regions.

Table 3.10 in Appendix E detailed the Reactive Resilience strategies identified in the literature as being applied in response to the Pandemic. The proactive approach is based on the risk management process in terms of such as risk identification, assessment, mitigation, and monitoring. Usually, such proactive practices will be implemented before risk events occur and Table 3.11 in Appendix F the Reactive Resilience strategies identified in the literature as being applied in response to the Pandemic These strategies encompass a set of practices and potential managerial actions that were deployed when confronted with disruptions to ensure the uninterrupted flow of business operations The combination of the utilization these strategies are discussed in Chapter 5 on the phase hybrid strategies

3.3.18 RDT and Resilience Theory: Fit with Supply Chains and the Phenomenon of SCORE

Existing literature highlights and confirms that companies employing proactive strategies effectively maintained operational continuity by leveraging pre-established resources and agile frameworks. For example, Ponomarov and Holcomb (2009) who assert that resilience-building strategies, such as resource prepositioning and flexible systems, enable faster adaptation during disruptions. Similarly, Ivanov and Das (2020) demonstrate that organizations capitalizing on digital twins and predictive analytics significantly improved their response times and recovery speed and capabilities during the COVID-19 pandemic. For those that utilised proactive strategies effectively, it was due to effective utilisation of resources already owned by companies and use of existing strengths and known solutions (Ocicka et al., 2022).

The application of RDT to resilience strategies during the COVID-19 pandemic revealed a dynamic interplay between proactive and reactive approaches in supply chain management. Theories enhance our ability to comprehend a phenomenon, ascertain the relationship among variables, and enable us to apply those outcomes in diverse contexts. Proactive strategies involved leveraging existing company resources and strengths, as well as known solutions to maintain operational continuity. Companies proficient in these proactive strategies harnessed their pre-existing resources effectively, emphasising preparedness and the ability to anticipate threats. By doing so, they sought to achieve disruption avoidance. Conversely, exploration practices were employed to identify novel solutions and capitalise on emerging opportunities. This exploration led to the exploitation of the resources already at the disposal of these companies. The reactive approach primarily focused on the ability to respond, recover, learn, and grow following a crisis, with an emphasis on building capabilities for swift recovery, ensuring access to the necessary resources, and developing disruption management capacities.

In this context, proactive resilience involved activities and strategies that enhanced the ability to anticipate disruptions and successfully defend against risks before adverse consequences materialised. These proactive efforts aimed to recognise, anticipate, and defend against risks in advance. Meanwhile, reactive measures concentrated on immediate response and recovery. Most activities in the upstream supply chain, such as purchasing, sourcing, and supplier relationship management, primarily took a reactive approach, highlighting the need for adapting business processes like raw material acquisition and component production. To effectively address disruptions, firms needed to align their resources and capabilities with the

changing environment, emphasising flexibility during product distribution as a crucial factor in dealing with disruptions. Retailers had to strategically utilise their internal resources and capabilities to meet demand and improve performance.

A firm's ability to utilise its resources based on the unique characteristics of consumer demand to operate faster than competitors during a disruption constitutes a competitive advantage and can even be a sustainability strategy (Hendry et al., 2019; Hohenstein et al., 2015). Internal resources and capabilities differ among firms, influencing their ability to respond to disruptions. Smaller companies struggled during COVID-19 mainly due to limited resources, with some ceasing operations and laying off staff. Supply shortages, increased demand, and reduced capacity further impacted profits and returns. To address these challenges, retailers decentralized decision-making, enabling a localized response to geographically varying conditions and disruptions. Low-level formalization, such as forming disruption task forces, was recommended to expedite decisions. Analytical scenario planning helped firms evaluate resource impacts on operations and demand fulfillment. Some firms adopted flexible strategies, including reducing production and creating independent product lines, which proved cost-effective and competitive. However, the success of such strategies depended on a clear understanding of disruptions and resource alignment with evolving conditions. Without this understanding, flexibility strategies risked failing to have an impact in terms of mitigating the challenges.

3.3.18.1 Theoretical alignment and relevance

This study integrates Resilience Theory (RT) and Resource Dependency Theory (RDT) to provide a comprehensive framework for understanding SCRE in the context of disruptions. Resilience Theory emphasizes the adaptive capabilities of organizations, enabling them to respond effectively during crises. On the other hand, Resource Dependency Theory focuses on the critical role of interdependencies and the strategic management of external resources. The integration of these theories offers actionable insights into enhancing SCRE by bridging adaptive strategies with efficient resource utilization. Organizations that adopted hybrid approaches—combining resource-sharing mechanisms (aligned with RDT) and adaptive strategies (rooted in RT)—demonstrated superior recovery capabilities during disruptions. This underscores the complementarity of RT and RDT in addressing the dual challenges of supply chain vulnerability and recovery.

RDT is deemed appropriate for this study, as it provides information on how an organisational leader could redesign their supply chain and mobilise resources to reduce uncertainties and build a strong resilient supply chain to resist SCDs, such as in the case of pandemic outbreak like COVID-19. Additionally, the RDT appears appropriate for this study to explain the resource dependence among supply chain partners during COVID-19. RDT, which is well-established in supply chain research (Shook et al., 2009), is yet to be leveraged in COVID-19 pandemic-related challenges (Craighead et al., 2020). Resources, either common or rare, are always limited in any organisation (Lakshmana et al., 2020) and that situation worsened further during lockdowns. Resource-based view (RBV), that concentrates on specific resources, can be measured based on the benefits gained through absorptive and operational capabilities, among other factors (Cheng & Lu, 2017). The RDT is a better option particularly when it involves evaluating SCRE where companies likely depend on others' resources during crisis as claimed by Sarkis (2020).

Resilience may also be seen as a way to overcome SC vulnerability (Tang, 2006). SC resilience is concerned with the system's ability to return to its original state or to a new, more desirable state after experiencing a disturbance, and avoiding the occurrence of failure modes (Carvalho et al., 2012): that is, to prevent shifting to undesirable states where failure modes could occur. To react effectively to the negative effects of disturbances, resilience strategies can be implemented with two manifolds: (i) to recover the desired values of the states of a system that has been disturbed, within an acceptable time and at an acceptable cost; and (ii) to reduce the effectiveness of the disturbance by changing the level of effectiveness of a potential threat. Resilience theory, when applied to the context of the COVID-19 pandemic, highlights the significance of proactive and reactive strategies to enhance an organisation's ability to withstand and recover from disruptions. These strategies are instrumental in promoting resilience, which is the capacity to adapt and thrive in the face of adversity. Here, we will explore how resilience theory is applied to proactive and reactive strategies during the pandemic. For proactive strategies in the context of resilience theory during the COVID-19 pandemic, we focus on building resilience before a disruption occurs.

These strategies encompass the following elements. Preparedness that involves identifying potential risks, assessing vulnerabilities, and developing contingency plans. Retailers invest in resources, technology, and training to enhance their readiness for future disruptions, allocating resources strategically to build robust supply chains, diversify sourcing options and stockpile

critical supplies. This allocation of resources aims to reduce dependence on a single source and enhance adaptability. Innovation and adaptation involve proactive organisations fostering a culture of innovation and adaptability. They continuously seek new solutions, technologies, and business models to stay ahead of evolving challenges. On the other hand, reactive strategies, as per resilience theory, come into play once a disruption has occurred. These strategies are focused on responding effectively, recovering, learning from the experience, and growing stronger. Organisations with well-defined response plans can mobilise resources, adapt operations and implement contingency measures swiftly to minimise the impact of the disruption.

Additionally, adaptive learning, collaboration, and information sharing, rebuilding, and reinvention are central. Post-crisis, reactive strategies focus on rebuilding and reinventing the organisation, which may include revisiting business models, diversifying product lines, and enhancing long-term stability. Therefore, resilience theory provides a framework for organisations to navigate the challenges of the COVID-19 pandemic through a combination of proactive and reactive strategies. Proactive strategies build resilience in advance, while reactive strategies help organisations respond effectively to immediate disruptions and recover with the aim of learning and growing stronger in the long term. This study will analyse these elements through the lens of resilience theory.

3.4 The Conceptual Research Framework

Figure 3-14 below illustrates the conceptual research model, highlighting the factors that influence both proactive and reactive dimensions of supply chain resilience. Although there is growing global interest in enhancing supply chain (SC) resilience due to its broad applications and impact on performance, the literature has been criticized for lacking clarity in defining the concept, challenges in its operationalization, limited empirical research demonstrating its real potential, and uncertainty about the proper unit of analysis for studying SC resilience (Tukamuhabwa et al., 2017). The conceptual model was introduced in this research mainly to provide a theoretical framework that guides the exploration of resilience strategies in the context of supply chain disruptions. The conceptual framework aims to guide the research, rather than one being empirically tested in this study. The use of proactive resilient strategies prior to a pandemic, coupled with the implementation of reactive resilient strategies, can be enhanced through the effective utilisation of resources. This, in turn, can significantly

contribute to supply chain recovery, ultimately leading to sustained recovery for the firm. This research is grounded in two fundamental theories, RT and RDT, and is further supported by the assertion of various researchers who contend that the Resource Dependence view of coping strategies can enhance our understanding of how to reduce uncertainty and enhance SCORE(Ambulkar et al., 2015; Bode et al., 2011; Cheng & Lu, 2017; Tushman & Nadler, 1978).

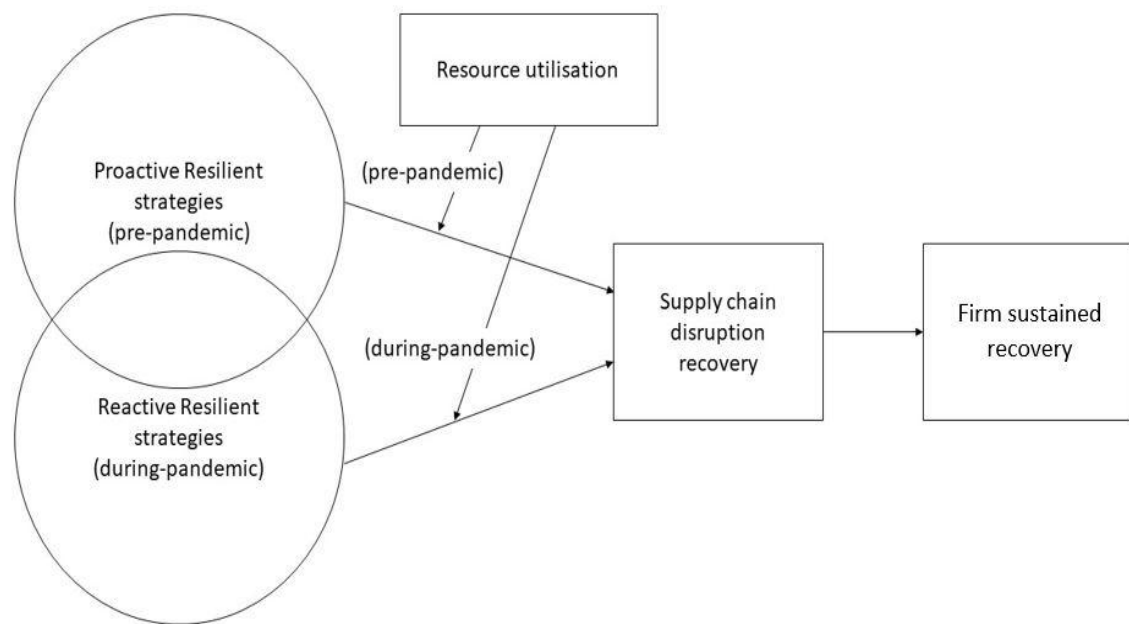


Figure 3-14 Conceptual research Framework

Figure 3.14 illustrates the primary independent and dependent variables concerning the recovery from supply chain disruptions and the resilience strategies proposed in theory, along with their interrelationships. The conceptual framework guiding this study delineates SCORE as the independent variable and the performance of supply chain disruption recovery as the dependent variable, ultimately contributing to sustained firm recovery. The recovery from supply chain disruptions is influenced by both proactive strategies implemented before the pandemic and reactive strategies implemented post-pandemic. The effectiveness of these strategies is closely tied to the availability and utilisation of resources, which, in turn, fosters supply chain disruption recovery and promotes sustainable firm recovery.

The correlation between the independent and dependent variables are discussed below.

3.4.1 Proactive resilient strategies (Pre-Pandemic)

Prior to the COVID-19 pandemic organisations adopted strategies that entailed practices aimed at systematically fortifying SCRE by leveraging existing resources. There are two primary categories of proactive practices that emerged post-COVID-19. The first category primarily relies on the exploitation of available resources, while the second category involves practices designed to enhance SCRE by employing exploratory capabilities to identify new external resources and innovative methods for managing business operations. These categories represent the prevailing trends in the development of proactive SCRES strategies. In response to evolving economic conditions, companies proactively explore the business landscape, thereby preparing themselves to navigate market uncertainties. By incorporating these activities into their proactive strategies, managers adopt a forward-looking approach to address potential threats. Many of the practices that emerged because of the pandemic are likely to evolve and play a crucial role in fortifying resilience and building anticipatory capacity during the post-COVID-19 phase.

3.4.2 Reactive resilient strategies (during pandemic)

In response to the challenges of the COVID-19 pandemic, SCRE strategies focused on reactive and exploitation-based measures were adopted. These strategies involve a range of practices and management actions that were activated to address disruptions, ensuring business operations continued smoothly. Introduced during the COVID-19 crisis, these approaches are described as "on-demand" and prioritize the quick mobilization of internal supply chain resources. Within the SCRE framework, reactive measures are strongly connected to both the response and recovery stages. This strategy focuses on corrective actions taken to manage disruptions, using solutions that extend beyond the supply chain's existing resources. Many of the previously exploratory reactive practices have now transitioned into more proactive approaches following the pandemic.

3.4.3 Resource Utilisation/Resource Capabilities (Facilitator)

Resource capabilities are defined as the ability of a firm to reconfigure, realign, and reorganise their existing resources in response to changes in the firm's external environment. Resources encompass both tangible and intangible assets that are owned or obtained by organisations such as retailers. According to Lyu et al. (2019), competitive advantage can be attained by effectively bundling physical resources alongside other resources within an organisation.

Similarly, resource or capability is defined as the ability of a firm to reconfigure, realign and reorganise their existing resources in response to changes in the firm's external environment (Ambulkar et al., 2015; Wei, 2010). This is a necessity for recovery from low frequency-high impact disruptions such as COVID-19. This bundling of resources enhances the value offered in the delivery of products and services, as argued by Laksmana et al. (2020). They further emphasise the significance of resource bundling in creating value during product and service provision. Therefore, this study explores how resources (tangible and intangible), or capabilities/competencies enhance SCRE, particularly internal social capital, material, machines, money, interpersonal relationships, commitment, respect, and employee tenure just to name a few. It is generally understood that the more the resources are deployed the faster will be the recovery process in line with RDT. It is another new level of insight on the first level of analysis of resilience-enhancing strategies (Polyviou, 2019). RDT has implications regarding the optimal divisional structure of organisations, recruitment of board members and employees, production strategies, contract structure, external organisational links, and many other aspects of organisational strategy.

3.4.4 Supply Chain Disruption Recovery

The speed of recovery from supply chain disruption has been identified as the predominant factor in building a resilient supply chain (Burgos & Ivanov, 2021; Fan et al., 2023; Ramanathan et al., 2022). COVID-19 has emerged as a significant risk event, exerting a profound impact on Australian retail sector supply chains (Grimmer, 2022; Larkin & Nankervis, 2021; Pilawa et al., 2022). The efforts of Australian retail sector firm such as pharmaceutical, groceries, restaurants, and distributors to resume their business can be viewed as a recovery process following the disruptions triggered by the COVID-19 pandemic crisis. Consequently, this research aligns closely with two prominent streams of literature: supply chain disruption and disruption recovery. The latter pertains to the restoration of operations following supply chain disruptions, with decision-making being reactive to crises caused by risk events, focusing on the swift resumption of firm operations and cash flow (Ivanov, 2017).

Supply chain disruption arises from unforeseen and unplanned events that impede the physical flows, such as materials and goods, within supply chains (Ali et al., 2022; Craighead et al., 2007; Ellis et al., 2011). Disruptions within a supply chain can negatively impact firm sales growth, cost efficiency, inventory performance (Hendricks & Singhal, 2005; Paul, Moktadir, et al., 2021) and overall firm value. Various crises, including those of regulatory, catastrophic,

and infrastructural nature, have raised substantial concerns for firms (Chowdhury et al., 2020b; Zsidisin & Wagner, 2010). Given the profound repercussions of supply chain disruptions, exacerbated by major disruptions like those induced by COVID-19, the literature has explored two primary approaches to disruption management: proactive and reactive strategies (Fan et al., 2023; Ivanov et al., 2017; Tukamuhabwa et al., 2017). According to Fan et al. (2023), the proactive approach focuses on anticipating future disruption events and creating protections to cushion against negative impacts. The proactive approach is based on the risk management process in terms of risk identification, assessment, mitigation, and monitoring. Such proactive practices will be implemented before risk events occur. Risk is a type of uncertainty that can produce unexpected negative consequences. It is a multidimensional concept and COVID-19's unprecedented impacts can be a good example.

On the other hand, Ali et al. (2021) and Fan et al. (2023) both suggest that reactive strategies centre around adapting to unforeseen disruptions by making contingency decisions. While these practices can aid in the recovery from disruptions, there is a limited body of research on managing recovery processes during such events (Ivanov et al., 2017). Notable exceptions have explored recovery services in public transportation disruptions (Li et al., 2015) and the application of mathematical tools to predict recovery times (Ivanov et al., 2017). Post-disruption recovery efforts should encompass technical, capacity, resource utilisation, technological advancement and business considerations, accompanied by a learning process for ongoing enhancement (Chen et al., 2019). The ability to swiftly recover from a disruption is widely regarded as an indicator of SCRE (Blackhurst et al., 2011). The speed of recovery is particularly crucial, given its prominence as the primary factor in disruption recovery, driven by the direct threats posed to short-term cash flow and overall firm survival (Bastas & Garza-Reyes, 2022; Chen et al., 2019).

3.4.5 Firm sustained recovery.

Firm sustained recovery is defined as a recovery process that not only restores supply chain operations to a new normal after a disruption but also integrates long-term strategies that enhance resilience against unforeseen disruptions (Sarkis et al., 2020). This differs from normal recovery, which focuses primarily on returning to pre-disruption conditions without necessarily incorporating strategies for sustained improvement. From this LIHF disruption, firms can make transition to further supply chain operations, although uncertainties and concerns remain all-time high. Sustainability strategy and practices contribute to supply chain resilience, for

example, by making sure ecosystem services are maintained, encouraging more sustainable ‘buy local’ actions, and building community trust.

In response to supply chain disruptions, companies employed a range of immediate recovery tactics designed to restore operational continuity. These approaches included diversifying suppliers, increasing safety stock levels, and utilizing digital tracking systems for real-time visibility. However, as recovery progressed, retailers shifted focus towards sustainable strategies that not only ensured resilience but also promoted long-term stability. For instance, by establishing partnerships within local supply networks, companies reduced dependency on vulnerable global sources, thereby enhancing both resilience and sustainability. This dual approach—balancing immediate recovery with sustainable long-term practices—illustrates how firms leveraged short-term adjustments to build a more adaptive and enduring supply chain structure (Ivanov & Das, 2020). Such strategic integration of short- and long-term practices underscores the importance of flexible, proactive planning in achieving both resilience and sustainable recovery. Risk reduction and crisis responses are reasons that the crisis represents a transformational opportunity by using sustainability to reduce risk and build resilience (Sarkis, 2020). Recovery is regarded as one of the most critical stages in SC resilience management (Blackhurst et al., 2011; Hosseini et al., 2019; Ivanov, 2020). The recovery capacity is described by Kamalahmadi and Parast (2016) as the ability of a system to find a return path (recovery) to a steady state of functionality (stabilisation) once a disruption has occurred. As such, the urgent requirement for sustainable recovery and rebuilding has arisen as an imperative concept in post-disaster discourse such as the COVID-19 pandemic (Gajendran & Oloruntoba, 2017b). The COVID-19 example clearly shows that the epidemic outbreaks represent a very specific and new setting for research in SC recovery. According to Dolgui et al. (2020) SCRE has a positive association with time to recover. With all the antecedents effectively managed and controlled, it can be postulated that as capabilities increase and vulnerabilities decrease (Pettit et al., 2013) thereby speeding up the recovery.

3.5 Summary of the Chapter

This chapter reviews the literature on SCRE, with a focus on how Australian retailers employed proactive and reactive strategies during the COVID-19 pandemic to enhance resilience. It examines various supply chain risk management concepts and identifies strategies used to

navigate the unique disruptions caused by the pandemic. Additionally, the chapter explores Resilience Theory and RDT, highlighting their importance in understanding the dynamic interplay between proactive and reactive approaches in supply chain management. The literature review identifies five main themes. It emphasises the significance of both proactive and reactive strategies in managing supply chain disruptions, noting that their effectiveness varies based on timing and context. The review also highlights the challenges in clearly defining and operationalising SCORE, as well as the lack of empirical research demonstrating its full potential. Furthermore, it discusses the necessity of reconfiguring resources to recover from high-impact disruptions and the crucial role of digital technology in building resilience. This study distinguishes itself by empirically examining how crisis disruption strategies were uniquely applied during the COVID-19 pandemic, utilising RDT and resilience theories. The findings underscore the importance of innovative combined approaches and the critical role of technology and resource capabilities in managing widespread supply chain disruptions. The chapter lays the groundwork by detailing the application of these strategies during COVID-19 and identifying new strategies, thus contributing significantly to the study. It culminates by developing a conceptual framework for sustainable SCORE, presenting hypotheses, and addressing the challenges faced by the retail sector post-disruption through the perspectives of resilience and RDT theories.

Chapter 4

Research Methodology

4.1 Introduction

This chapter offers a thorough examination of the research methodology used in the study. Section 4.1 explores the philosophical foundations of the qualitative research methodology adopted, outlining the theoretical framework that informs the research approach. Following this, Section 4.2 provides a rationale for the selected research methodology and design, with a particular emphasis on interviews as the primary data collection method. This section offers a rationale for selecting interviews as the preferred method to gather data and explores the research questions in-depth for both phase 1 and phase 2 of the interviews. Moving forwards, Section 4.3 presents an outline of the research design, elucidating the overall structure and plan for conducting the study. This section highlights the key elements and procedures incorporated into the research design. In Section 4.5, a comprehensive account of the data collection is provided, with specific techniques and procedures utilised to gather relevant data, ensuring a thorough exploration of the research questions. Furthermore, Section 4.6 delves into the data analysis methods implemented in this study. It outlines the strategies and techniques used to analyse and interpret the collected data, allowing for meaningful insights and conclusions. Section 4.7 focuses on ensuring research and data quality, emphasising the measures taken to maintain the rigour and credibility of the study. This section highlights the steps employed to validate the research findings and ensure the accuracy and reliability of the data. Finally, Section 4.8 offers a summary of the entire chapter, summarising the key points and providing a concise overview of the research methodology employed in this study.

4.2 Philosophical Foundations of Research Methodology

This section of the chapter explains the philosophical foundations of qualitative research to justify as well as explaining in detail why the topic of enhancing SCRE strategies during the COVID-19 pandemic in the Australia retail sector supply chain required the use of qualitative interviews to answer research questions. This study takes a constructivist approach to its research questions and uses an interpretive (inductive) paradigm to produce propositions in response to its findings.

During the past decade, there has been an increase in the use of qualitative research in both academic research and in organisations (Boodhoo & Purmessur, 2009; Spencer et al., 2004). Therefore, to fully comprehend qualitative research, it is necessary to have a basic

understanding of research history, traditions, and philosophical foundations. According to Cresswell (2007) the philosophy of qualitative research is “interpretive, humanistic, and naturalistic”. It emphasises the relevance of subjectivity. The ontological assumption is that there is no single reality: rather, it encompasses multiple realities for any phenomenon (Speziale et al., 2011)). The positivist paradigm reflects the principles of scientific enquiry of qualitative research. In business and management studies, the dominant research paradigm has been “positivist”, which promotes a “objectivist epistemology” (Su, 2018). Research, according to Amaratunga and Baldry (2001), is based on philosophical stances as a human action. Research philosophy, in Saunders et al. (2009) description, is a broad phrase that refers to the nature and evolution of knowledge. According to the researchers’ perspectives about the generation of knowledge, research philosophy can be divided into several research paradigms (Johnson & Onwuegbuzie, 2004). The research paradigm refers to the shared belief systems that govern the kind of information sought by researchers and how they interpret the evidence they gather (Morgan, 2007). There is a connection between ontology, epistemology, and methodology according to the metaphysical paradigm (Morgan, 2007). Similarly, Easterby-Smith and Thorpe (2012) stated that both ontological and epistemological assumptions are important in directing scientific and social scientific research. Whereas ontology is a field of philosophy concerned with the nature of the world and its existence (Guba & Lincoln, 1994a) (most popular examples being Objectivism’s Constructivism), epistemology is concerned with how best to explore the nature of the world (Easterby-Smith & Thorpe, 2012). In other words, epistemology is concerned with “how we know, what we know” (Crotty, 2003; Schwandt, 2001). Epistemology can be thought of as a justification of knowledge (Carter & Little, 2007). Ontology and epistemology are inevitably linked, as in Figure 4.1.

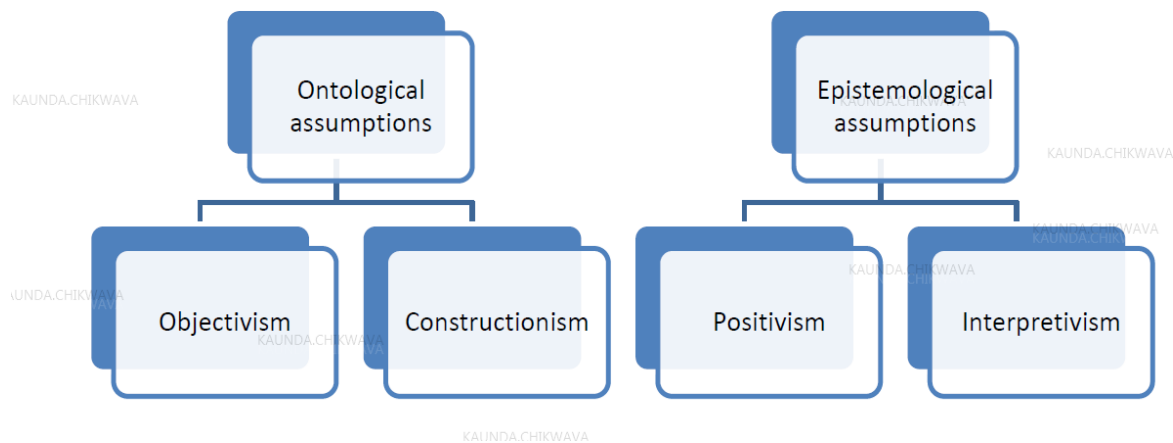


Figure 4-1 Illustration showing key philosophical paradigms in research methods Source: Burrell and Morgan (1979).

As in Figure 4.1, scholars such as Burrell and Morgan (1979) believe that research can be based on both positivism and anti-positivism. Such research should fall somewhere between the two techniques. Taking this as a starting point and considering the nature of the research phenomena at hand (i.e., SCRE), this study can be classified as being somewhere between post-positivism and constructivism. In this study, the interpretation and meanings linked to supply chain risk management concerns such as COVID-19 pandemic disruptions and resilience may vary based on the varied interpretations and meanings people attach to them in different socio-cultural environments. Some scientists, for example Walker et al. (2004), Ponomarev and Holcomb (2009), Kamalahmadi and Parast (2016), have recognised that different groups of individuals perceive resilience differently depending on how well their interpretation suits their understanding and goal.

4.3 Justification of Research Methodology

This research is exploratory in nature; thus, a qualitative investigation was conducted to purposefully select firms representing a cross-section of retail industry. According to Mohajan (2018), every research must employ an explicit, disciplined, systematic (planned, ordered, and public) methodology. Qualitative research, which collects and works with non-numerical data, is a method used to narrow down a vast field of research into one easily researchable topic (Creswell, 2013). It is inductive in nature, meaning that the researcher looks for meanings and insights in a situation (Corbin & Strauss, 2008; Levitt et al., 2017). The aim is to understand the phenomenon in its context with the objective of building a substantive theory from descriptive data. By selecting qualitative research for this study the research followed Golicic

and Davis (2012) assertion that qualitative method is effective for understanding the nature of personal experiences, providing insights that are difficult to obtain from quantitative methods, understanding underlying meanings in human interactions and relationships in organisational settings, and in researching areas where there is little previous knowledge.

Given the complex and context-specific nature of supply chain disruptions, a qualitative approach was adopted as it allows for a rich, detailed exploration of the experiences and strategies of industry practitioners. This method is particularly well-suited for addressing the research objectives, which aim to identify practical hybrid strategies that combine proactive and reactive measures. By focusing on the lived experiences of supply chain managers, the study provides nuanced insights that quantitative methods would not capture, thus ensuring a comprehensive understanding of the factors contributing to SCRE in the face of unprecedented disruptions. Qualitative research also helps interpret the meaning and provide an in-depth understanding of a particular situation or problem (Mello & Flint, 2009; Mohajan, 2018). As such, depending on the analytical approach used by the researcher, “qualitative data are analysed inductively from detailed parts to more broad viewpoints that may be labelled as categories, themes, dimensions, or codes” (Golicic et al., 2005, p. 21). Similar to the above notion, an exploratory Interview-based study was preferred as it was useful for defining propositions of a subsequent study (Seuring, 2008). Given that the current COVID-19 pandemic is a unique type of supply chain disruption, expert opinions seem to be an adequate source of information. Similarly, because this study aimed at the current COVID-19 pandemic situation faced by the Australian retail sector in particular, and specific research questions aim to uncover the specific strategies adopted by the firms to enhance recovery, an exploratory study was deemed appropriate. Semi-structured interviews were an appropriate choice for this timely study to successfully conduct an in-depth study to determine the short-term and medium-to-long-term impacts of the pandemic and to consider how retail companies and their stakeholders can minimise its impacts.

This study employs an interview-based methodology exclusively, rather than a case study approach. This decision was made to leverage the depth and richness of insights that interviews can provide, allowing for a detailed exploration of participants' direct experiences and perspectives on SCRE strategies during the COVID-19 pandemic. Interviews were chosen specifically for their ability to capture nuanced, context-specific information from key industry professionals, which is essential for understanding the complexities of supply chain disruptions

Key Phases for Qualitative Research Process

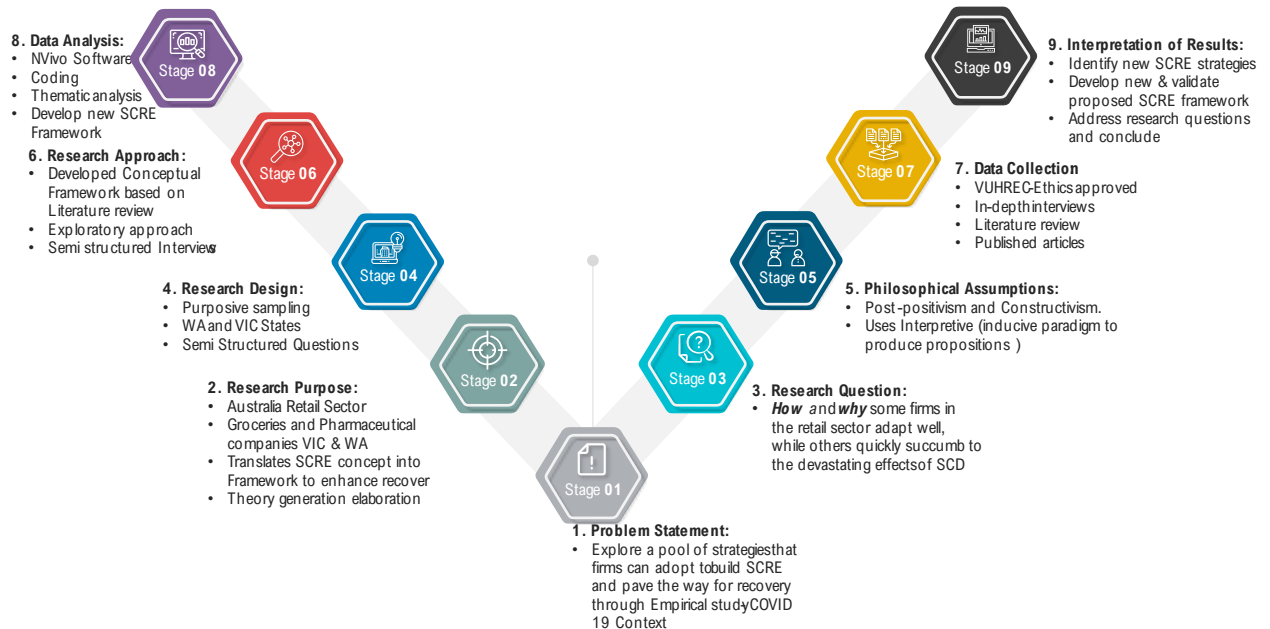


Figure 4-2 Key stages Guiding the Research Source (Author)

To direct the research in accordance with the stages, this study adhered to a framework consisting of nine stages. The subsequent explanation provides a detailed overview of how these stages served as guiding principles for the research (Figure 4.2) and are explained as follows:

- 1. Defining the Problem Statement (Stage 1):** This initial phase delved into the exploration of the organisational landscape's proactive and reactive strategies for building SCRE and enabling recovery during the COVID-19 pandemic.
- 2. Clarifying the Research Purpose (Stage 2):** Focusing on selected retail sectors in Australia, specifically groceries and pharmaceuticals in Victoria and Western Australia, this stage involved generating a conceptual framework to translate the SCRE enhancement concept into a framework for sustainable recovery.
- 3. Analysing Firm Adaptation (Stage 3):** This stage concentrated on understanding why some firms in the retail sector adapted well to the COVID-19 pandemic while others succumbed quickly. It also explored the impact of supply chain disruptions caused by the pandemic on the retail industry.

4. **Research Design (Stage 4):** The research design, the fourth stage, employed purposive sampling, specifically focusing on the pharmaceutical and grocery sectors in Western Australia and Victoria, Australia.
5. **Elaborating Philosophical Assumptions (Stage 5):** The fifth stage expanded on philosophical assumptions, incorporating post-positivism and constructivism into the research framework.
6. **Outlining the Research Approach (Stage 6):** This stage highlighted the chosen research approach, utilising an exploratory method through semi-structured interviews, which facilitated the development of a conceptual framework based on a comprehensive literature review.
7. **Detailing Data Collection Methods (Stage 7):** The seventh stage addressed the ethical considerations with Victoria University Human Research Ethics (VUHRE) approval and discussed how in-depth interviews were conducted despite the challenges posed by the COVID-19 pandemic.
8. **Conducting Data Analysis (Stage 8):** The eighth stage involved data analysis using NVIVO 12 software. This encompassed coding strategies and employing thematic analysis to interpret the results.
9. **Interpreting Results and Concluding (Stage 9):** The final stage encompassed the interpretation of results, where the SCRE strategies implemented during the COVID-19 pandemic were identified and analysed to address the research question. This interpretation was followed by a comprehensive discussion and conclusion of the research findings.

4.3.1 The qualitative approach model

In the context of this study, which aims to explore SCRE strategies during the rare COVID-19 pandemic, it is expected that the analysis performed with the NVIVO software will yield a substantive theory of the phenomenon, describing the interrelationships between variables and feedback loops, and capturing the dynamic nature of the subject under investigation, bringing the researcher full cycle to a deeper understanding of the core phenomenon. Figure 4.3 offers a qualitative approach.

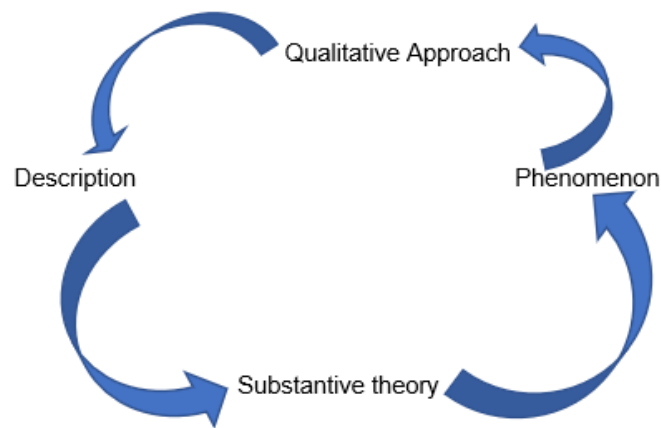


Figure 4-3 A qualitative approach model (Author)

Purposive sampling and semi-structured, open-ended interviews are examples of qualitative methods (Gopaldas, 2016). In this research, a qualitative research strategy was utilised to elicit descriptive qualitative responses from which research goals were addressed (Gajendran & Oloruntoba, 2017a). I was interested in collecting the broadest sweep of strategies that could be included in the resilience-building frameworks, particularly during the COVID-19 pandemic. The nascent state of the literature on SC resilience in general, and particularly in Australia, calls for a qualitative, exploratory study (Mohajan, 2018; Thornhill et al., 2009; Venkatesh et al., 2013). The qualitative method is less structured in description simply because it formulates and builds new theories and focuses on discovery (Leedy & Ormrod, 2001; Mohajan, 2018). Moreover, a qualitative approach was deemed appropriate for this study, where existing knowledge on SCRE drawn from literature particularly after COVID-19 pandemic is limited. Besides, an exploratory Interview -based study according to Aman and Seuring (2021), entails arguing the merits of further examining alternative hypotheses or propositions. Since this research focuses on the current COVID-19 pandemic crisis in the Australian retail sector, the specific research questions aim to identify the specific strategies that companies have used to build resilience in their supply chains and recover from the disruptions.

The interview approach offers an opportunity to study the phenomenon in its natural setting where complex links and underlying meanings can be explored enabling the researcher to study the whole supply chain (Adegoke Oke & Gopalakrishnan, 2009; Miles & Huberman, 1994; Patton, 2015; Yin, 1994). In addition, Creswell (1998) asserts that when the phenomenon under investigation is novel or complex, researchers must have a thorough grasp of it. As such,

qualitative techniques are best suited to attain this goal since they provide a detailed image of the dynamic or complicated object of investigation (Creswell, 1998).

In addition, generally, semi- or unstructured, open-ended, informal interviews were preferred to allow for more flexibility and responsiveness to emerging themes for both the interviewer and respondent (Jackson et al., 2007). Moreover this methodology is capable of providing a strong base for theory-building in emerging fields such as supply chain, leading to in-depth comprehension about complex phenomena by providing answers to the ‘**why**’ and ‘**how**’ questions (Eisenhardt, 1989; Yin, 2014), as well as explaining how a particular social phenomenon, or program operates as it does in a particular context. In addition, it also encourages creativity and innovative explanatory frameworks. Using the tenets of grounded theory, theoretical structure was extended using empirical data. The initial taxonomies of resilience enablers were created based on existing literature. They were then further refined and validated by themes arising from interviews (Venkatesh et al., 2016). An improvised new framework was created validating the initial framework.

4.4 Research Methodological Design

This study followed a qualitative, exploratory research design. A recap of the research questions introduced in Chapter 1 is provided here below: this follows Saunders et al. (2009) assertion that research questions are important in research design as they inform the choices of the research strategy, data collection techniques and analysis.

The research design is crucial in explaining and justifying the types of data to be collected, how and where they will be collected, and how they will be analysed, interpreted, and presented (Yin, 2003). The entire process of conducting qualitative research can be viewed as a formulation of an argument intended to persuade the scientific community of the plausibility of the findings (Abbott, 2004). In summary, a three-phase methodology was used in this study to elicit SCRE enhancing strategies, like that used by M. H. Ali et al. (2017); Tse and Tan (2011); Vanany et al. (2021).

While the study is structured around nine overarching stages, the methodology specifically employs three guiding phases within the qualitative approach. These phases are informed and guided by Resilience Theory (RT), which emphasizes the importance of adaptive responses to disruptions in supply chains. The RT guides the methodological design by providing a

framework to explore how organizations adapt and respond to crises like the COVID-19 pandemic. Additionally, Resource Dependency Theory (RDT) informs the data analysis by highlighting how resource availability and dependencies influence decision-making within supply chain management. RDT assists to identify the external constraints and inter-organizational relationships that affect resilience strategies. By aligning these two underpinning theories with the research design, the study ensures a comprehensive analysis of resilience strategies, thereby justifying the integration of RT and RDT into the methodological framework.

Phase one aims to identify SCRE-mitigating strategies and capabilities that would help the researcher elicit related information in the next two phases. To begin with, previous research on SCRE enhancing strategies and capabilities was reviewed thoroughly in order to better understand the definitions and their relevance, particularly to COVID-19 disruption (Chowdhury & Quaddus, 2016; Chowdhury & Quaddus, 2017; Christopher & Peck, 2004; Ivanov & Das, 2020; Ivanov & Dolgui, 2019; Kamalahmadi & Parast, 2016; Kochan & Nowicki, 2018; Ponomarov & Holcomb, 2009; Vanany et al., 2021). In the second phase, the results of 32 interviews with top executives from Australia's retail sector enterprises were triangulated with the findings of the literature study. The second phase of the interviews involved follow-up interviews after 4 years after the pandemic struck. This phase intention was to ascertain the recovery mechanism and determine the sustainable recovery going into the future.

In the framework of the COVID-19 pandemic, the Phase 1 goal was to interpret the SCRE improving strategy and resource capabilities from the perspective of the retail sector industry, focusing mostly on groceries and pharmaceutical firms, in line with the underpinning theory of RDT. The information gleaned from the interviews was used to explain the literature in question. During this phase, the data was analysed, and the recovery strategies were explained to provide new strategies applied during the unprecedented disruptions. The results are explained and discussed in Chapter 5.

In phase-III, the findings were verified and validated and are presented in chapter 5. This phase extended the previous research to investigate the actual practices implemented by the selected firms studied in response to the COVID-19 disruption. Furthermore, in this phase, a framework was proposed by combining all the resilience-enhancing strategies for faster recovery.

Propositions were developed by establishing the relationship between the antecedents and the outcome variables.

4.4.2 Research approach

This research adopts a research approach that is supported by the literature. Saunders et al. (2009) define the research approach as the choice between inductive or deductive methodologies. They argue that integrating both approaches within a single study can be advantageous. Deductive research starts with a theoretical framework derived from existing literature, leading to the formulation of testable hypotheses. Conversely, inductive research commences with empirical observations before establishing a theoretical framework, focusing on theory-building Kovács and Spens (2005). The debate persists on whether theory development should precede empirical data collection. Scholars like Koulikoff-Souviron and Harrison (2005) contend that prior theory restricts flexibility in data collection, fostering a predetermined mindset. In contrast, proponents such as Eisenhardt (1989); (Yin, 2018); YIN (2003) advocate for developing prior constructs to maintain focus during data collection and prevent information overload. Eisenhardt (1989) highlights the difficulty of starting theory-building research with no initial theoretical considerations. To strike a balance, researchers are advised to allow flexibility, enabling transitions between a strong theoretical foundation and a loose inductive design (Koulikoff-Souviron & Harrison, 2005).

In alignment with this discourse, our research initially employed a deductive approach by reviewing literature to identify knowledge gaps and formulate research questions guiding subsequent data collection. Subsequently, an inductive approach was employed during interview data collection and analysis, involving a deep exploration of issues related to the research questions without being constrained by prior theory. Some authors refer to this combined approach as an abductive approach (Dubois and Gadde (2002)). This research aimed not only to describe proactive and reactive strategies occurrences and utilisation but also to elucidate why and how they transpired (Ocicka et al., 2022; Seuring et al., 2022; Spieske et al., 2022). In a broader sense, the study embraced an inductive approach, seeking to generate explanations from analysis without a commitment to a preconceived general theory. Resilience theory and RDT served as a guiding framework, contributing to the interpretation and understanding of empirical data while allowing the development of a unique line of theorising about SCORE, extending beyond the concepts outlined in RDT by Ketokivi and Choi (2014).

4.4.2 Practical perspectives on gathering data.

The study employs an interview-based methodology exclusively, rather than a case study approach. This decision was made to leverage the depth and richness of insights that interviews can provide, allowing for a detailed exploration of participants' direct experiences and perspectives on SCRE strategies during the COVID-19 pandemic. Interviews were chosen specifically for their ability to capture nuanced, context-specific information from key industry professionals, which is essential for understanding the complexities of supply chain disruptions. Furthermore, semi-structured interviews can provide extensive and in-depth knowledge of the study object while also allowing the researcher to investigate the research issues in their natural setting (Dreyer et al., 2016; Junior L & Filho G, 2016; Pagell & Wu, 2009; Ramanathan et al., 2017).

Theory creation, theory testing, and theory elaboration are the three main methodological approaches to case research identified by Ketokivi and Choi (2014). Voss et al. (2002) similarly describe four types of research purposes: exploration, theory construction, theory testing, and theory extension/refinement which are important in guiding this research. According to Ketokivi and Choi (2014), theory elaboration is concerned with a general theory's contextualised logic. They point out that while a researcher may be able to apply an existing general theory by utilising a theory elaboration approach, it is possible that the context is not well-known or understood enough to generate sufficiently particular premises that may be used in conjunction with the general theory. In summary, theory elaboration is this study's scenario.

This theoretical elaboration approach not only enables the exploration of a broader range of variables than existing models allow but also draws attention to implementation issues that warrant further investigation (Childe, 2011). To address potential bias in data interpretation, we adopted a qualitative theory approach that emphasized thorough checks. This was achieved by utilizing a team-based data analysis process, which helped mitigate individual biases. Early drafts of our findings were shared with the firms interviewed, incorporating their feedback to enhance accuracy. This methodology is particularly well-suited for exploring new and complex areas, such as the unprecedented supply chain disruptions caused by the COVID-19 pandemic. The resulting hypotheses are often unique, testable, and empirically robust. Lastly, critical criteria for evaluating this type of research include paradigm-shifting insights, rigorous theory

testing (e.g., parsimony, logical coherence), and a strong evidentiary basis (Ramanathan et al., 2017).

4.4.3 Population sampling and justification

Purposive sampling was applied to strategically identify the retailers and the participants relevant to the phenomenon being researched (Becker et al., 2012). According to Coyne (1997), a good sample selection profoundly affects the ultimate quality of the research in qualitative research of this nature. The tactics used by retailers to reduce the distribution consequences of the COVID-19 epidemic served as the study's unit of analysis. Two cycles of purposive sampling were used to acquire participants. Etikan et al. (2016) define purposeful sampling as a sampling strategy in which a researcher intentionally selects a participant based on their characteristics and experience. In the first sampling cycle, purposive, **expert sampling** was used. As the name implies, expert sampling solicits the opinions of highly experienced or qualified persons (experts) in a specific sector (Etikan et al., 2016). According to Patton (2018:1), experts may provide essential insights into the underlying causes of problems, their successes and failures, and future trends to watch.

This study chose experts based on three inclusion criteria utilised in prior supply chain risk management and supply chain disruption studies. These criteria included years of experience, management level, and level of participation in the phenomenon being investigated. Table 4.2 summarises the selection criteria and references the original research that used the criterion. In the second sampling cycle of the interviews, snowball sampling was used. According to Tustin (2005), in **snowball sampling**, participants are initially selected through judgement sampling, and these participants then identify other individuals who meet the study's specific requirements. Bairagi and Munot (2019) point out that snowball sampling is beneficial when researching a population of undocumented participants where there is no complete list of the population available. Using snowball sampling, the researcher asked each interviewee who agreed to participate to help identify other colleagues within their network who also met the expert criteria established in the first cycle of participant selection.

The participant recruitment process commenced during the survey stage. Selected retailers expressed their interest by providing an expression of interest (EOI) through email and indicating a contact person's name. The selection of retail organisations was based on their utilisation and application of both proactive and reactive supply chain and logistics strategies

or their intentions to do so. Subsequently, the chosen retail organisations were contacted via email and extended an invitation to voluntarily participate in this phase of the study. In addition purposive sampling was employed for the interviews, involving the identification and approach of the most suitable respondents within an organisation (Bryman, 2016; Creswell & Poth, 2017; Yin, 2014). The goal was to include participants from various sectors within the retail industry. The 32 interviewees were strategically chosen to represent medium and large companies, encompassing both brick-and-mortar and e-commerce, as well as multi-model organisations.

All 32 participants held managerial positions, offering diverse perspectives across different retail subdivisions or sectors, aligning with the demographics targeted in the survey study (Larkin & Nankervis, 2021). A sample size of 30 to 36 retail participants from medium and large firms was proposed for the purpose with an expectation that it will represent a good cross-section of the Australia retail industry from Victoria state (VIC) and WA. These two states were chosen because they experienced extreme reactions to the COVID-19 pandemic, which can provide a good comparison of how the retail sector dealt with the effects of the pandemic. At the time of conducting this research, according to Inga Ting et al. (April 2020), the data on the percentage of COVID-19 tests showed Victoria had the highest positive test rates and WA had the lowest positive test rates within Australia (Inga Ting et al., April 2020). Table 4-1 shows a comparison of the responses of both VIC and WA during the COVID-19 pandemic.

Table 4-1 Comparing the responses of Western Australia and Victoria states in Australia to the COVID-19 disruption.

Disruption activity	Western Australia (WA)	Victoria (VIC)
State Government	Implemented strict border closures	Implemented strict lockdown measures
Case Management	Rapid contact tracing and testing	Contact tracing and testing
Lockdown Measures	Implemented short, targeted lockdowns	Implemented longer, state-wide lockdowns
Travel Restrictions	Restricted interstate and international travel	Restricted interstate travel
Business Restrictions	Implemented gradual easing of restrictions	Implemented phased reopening

Disruption activity	Western Australia (WA)	Victoria (VIC)
Public Health Messaging	Emphasised personal responsibility	Emphasised community responsibility
Vaccination Campaign	Rolled out vaccination program	Rolled out vaccination program
COVID-19 Cases	Kept cases relatively low and controlled	Experienced larger case numbers
Economic Impact	Limited economic disruption	Experienced significant economic impact

As shown in Table 4.1, the WA government implemented strict border closures that restricted interstate and international travel, while Victoria (VIC) implemented stringent lockdown measures. These measures, to a certain extent, did not negatively impact businesses in WA, which kept COVID-19 cases relatively low and controlled. In contrast, Victoria experienced a higher number of cases, leading to a significant economic impact on businesses. Consequently, WA experienced limited economic disruption, whereas Victoria faced substantial economic challenges. The survival and development of supply chains for retailers in these two states were notably different due to these contrasting measures.

Moreover, these two sectors were given priority status to ensure the goods are available to the communities during the pandemic lockdowns. Sampling of 18 to 20 medium to large retail firms from each category (Grocery and Pharmaceuticals) and their suppliers (dyadic supply chain) was preferred to offer a true overview of ground realities of operational strategies to overcome the disruptions for the entire supply chain. This allowed an opportunity to undertake an inter-group comparison of their recovery strategies. The proposed sample of medium and large firms satisfies the recommended minimum sample size of 18 to 20 cases where themes appear to mature and repeat within a sector. The study adjusted for the probable effects of three business characteristics when selecting organisations for participation: firm size, firm experience, and the industry sector in which the firm operates, as these three variables can theoretically be said to affect supply chain resilience. Large companies typically have greater resources, making them more resilient to supply chain disruptions (Ambulkar et al., 2015). Firms with more industry expertise are more likely to have dealt with supply chain disruptions before (Thornhill & Amit, 2003), which would improve SCORE (Ambulkar et al., 2015). is known to be linked to industry features as competitive structure, dynamism and technology

requirements (Gölgeci & Ponomarov, 2015). Additionally, past studies such as (Ambulkar et al., 2015; Blackhurst et al., 2011; Gölgeci & Ponomarov, 2015) have also empirically established the effect of firm size, firm experience, and the industry sector on SCRE. Besides, it is in line with other research using interviews as the data collection method (Manuj & Mentzer John, 2008).

As the COVID-19 pandemic affected all businesses across sectors, this study considered two selective and priority sectors: the grocery and pharmaceutical sectors, to explore their recovery strategies. A total of 32 medium and large Australian companies from the retail sector were interviewed. Due to the expertise of the interviewees and their role in the pandemic response, only a reasonable small number of interviews were necessary to capture the dynamic qualities of pandemic disruption. The retail sector was preferred because it exhibits great diversity by size of business, region, retail format, competition within sectors and nature of goods sold (The Productivity Commission Report No 56, 2011). Moreover, analysis of the literature uncovers the lack of studies that are specifically directed at investigating at the retail level, especially with regards to pandemics such as COVID-19. Besides, the retail sector also shows a greater level of vulnerability compared to other sectors (Martinelli & Tagliazzucchi, 2019; Wasileski et al., 2011). Their vulnerability is attributed to a greater impact of indirect damage after the disruption. Therefore, it is critical to understand resilience in retail sector supply chains in responding to pandemic-related disruptions. Interviews with multiple firms from retail sectors were conducted to provide more breadth on the topic. Specific types of retail firms were sampled to ensure that a large and diverse enough supply chain existed where severe disruptions could occur. It is against this background that the retail sector, particularly the medium and large companies, require more research. The study focused on the entire triad supply chain from producer, distributor, retailer, and customer for Australian retail sector enabling entire visibility of the supply chain.

4.5 Data Collection and Sources

In this study, data was collected from multiple sources. The primary sources included interviews and documents, such as email correspondence provided by participants, as well as published articles related to COVID-19 disaster recovery. Additional data sources included a review of firms' websites, news articles, available documents, and reports. Various methods were employed to recruit participants. Initial contacts were made through databases such as the

Australian Retailers Association (ARA), The Chartered Institute of Logistics and Transport (CILTA), The Chartered Institute of Procurement and Supply (CIPS), and the Supply Chain and Logistics Association of Australia (SCLAA). Referrals from previous participants were also utilized. Furthermore, LinkedIn, Facebook contacts, and the IBIS World list were used to identify potential participants.

The initial sampling method was followed by snowball sampling, where existing participants referred the researcher to other relevant experts in the retail sector. Consent was obtained from participants before their involvement in the research. Selected retailers were contacted directly via their corporate email addresses, and their consent to participate was requested. As part of the snowball sampling process, interviewees identified other potential participants and referred them to the researcher. Once a participant agreed to an interview, an interview date was scheduled, and a virtual meeting link was created on the participant's preferred telecommunication platform (e.g., Skype, Zoom, or MS Teams).

Before the scheduled interview, the researcher sent each interviewee an informed consent form and the interview protocol. All participants consented to have the meeting recorded for quality and transcription purposes, while the researcher agreed to adhere to the anonymity guidelines established before the interview. Snowball sampling techniques were primarily used to identify key informants in the retail sector. These informants were provided with an “Information for Participants Form” (see Appendix C) and a “Consent Form to Participate” (see Appendix B), which explained the research objectives, how their data would be used, and the benefits of their participation. They were informed that their participation was voluntary and that they could withdraw at any time without facing any disadvantages.

To ensure adequate preparation, all interviewees were provided with a copy of the semi-structured questionnaire (see Appendix A) at least three days before the interview. This allowed them sufficient time to research and prepare their responses effectively.

4.5.1 Semi-Structured Interviews- Phase 1

Interviews are one of the most common methods for data collection and are a very rich source of data when undertaken properly. Semi-structured interviews were chosen as they ensured the content focused “on the issues that are central to the research question and allowing for greater

flexibility than that of the survey interview “(Minichiello et al., 1995). In this study, the researcher relied on in-depth, semi-structured interviews with key informants as the primary source of information (Yin, 2014). Semi-structured interviews can be highly beneficial for learning what is occurring and exploring fresh perspectives in an exploratory study. They can also be used to investigate the relationships between the factors in an exploratory study. The interviews followed the protocol suggested by Yin (2017) which states that interviews are a “linear, but iterative process” (Yin, 2017). The study employs a semi-structured interviews with supply chain managers from retailers who provided the data for analysis. The semi-structured interviews enabled us to draw on the experiences and insights of respondents of the COVID-19 pandemic resilience and recovery strategies within the retail sector in Australia. Securing face-to-face interviews was not feasible and proved challenging because of the COVID-19 epidemic restrictions, physical distancing measures in place, restrictions, and lockdowns. However, given the fact that that digitalisation and online interactions are at the forefront of our adaptation to the pandemic, 91 per cent of interviews were performed via Zoom and only 9 per cent were conducted face-to-face.

Data collection occurred in two main phases, employing distinct approaches Phases 1 and 2. It is also important to note that despite the challenge of coordinating across different time zones (Victoria (VIC) and WA) and accommodating the respondents’ busy schedules, about 80% of the 32 interviews were successfully conducted via Team or Zoom platforms. During the initial phase, participants were briefed on the research objectives and interview protocols through email correspondence. The information provided, including overviews and interview protocols, was presented in English in a manner conducive to the participants’ comprehension. The primary goal of this phase was to garner a comprehensive understanding of the experiences and insights of seasoned supply chain experts and risk managers. Persons involved in managing the operations were selected for the interviews, since they have knowledge about the impacts of the COVID-19 pandemic—knowledge that can inform possible strategies for responding to its impacts. Specifically, participants were prompted to share details about the disruptions they encountered in their supply chains during the COVID-19 pandemic. They were asked to elaborate on the strategies they employed to navigate these disruptions, facilitate recovery, and shed light on how these strategies contribute to building resilience in the supply chain for the future. Phase 1 demographics are presented in Table 4.2. Its explanation is provided in the discussion after the table.

Table 4-2 Interviews and Informants Details: Demographics of the study participants

N o	Compa ny code	Age group (Years)	Sex	Business type	Industry	Position	Experien ce (years)	Interview duration (mints)	File size in KB
1	C1	46–50	M	Warehousing/ Automation	Warehousing and Automation	Vice President (GM Commercial)	6–10	57.55	120KB
2	C2	46–50	M	Retail Association	Retail	Director	6–10	30.12	44Kb
3	C3	41–45	M–	Groceries	Groceries	Snr Manager	6–10	58.11	50KB
4	C4	36–40	M	Retail Equipment suppliers	Retail	State Manager	6–10	25.5	41Kb
5	C5	36–40	F	Office Suppliers	Retail	Snr Manager	26–30	48.31	49KB
6	C6	36–40	M	Garment	Garment	Logistics Manager	21–25	35.29	44KB
7	C7	41–45	M	Food restaurant	Hospitality	CEO/Co-founder	11–15	32.16	42KB
8	C8	41–45	M	Distributor	Distribution	Operations Manager	21–25	44.49	38KB
9	C9	41–45	F	Suppliers of Construction material	Retail	CEO & Managing Director	less than 5	43.24	46KB
10	C10	41–45	M	Distributor	Distribution	Operations Manager	less than 5	32.03	43KB
11	C11	36–40	F	Pharmaceutical	Pharmaceutical	Logistics Manager	26–30	33.20	45KB
12	C12	46–50	M/F	Groceries	Retail	Scheduling Manager	6–10	45.57	47KB
13	C13	36–40	M	Groceries	Retail	Supply Chain Manager	31–35	38.36	48KB
14	C14	46–50	M	Garment and Clothing	Retail	CEO/Co-founder	21–25	52.19	50KB
15	C15	21–25	F	Warehousing	Warehousing and Automation	Victorian Logistics Operations Manager	6–10	33.10	40KB
16	C16	26–30	M	Suppliers of medical equipment	Distribution	CEO/Managing Director	less than 5	60.02	81KB
17	C17	41–45	M	Distributor	Distribution	Executive Director	26–30	37.22	
18	C18	36–40	F	Groceries	Groceries	Logistics Manager	6–10	45.55	47KB
19	C19	41–45	M	Groceries	Groceries	Operations Manager	6–10	33.31	
20	C20	36–40	M	3rd Party Logistics	3rd Party Logistics	Product Manager Warehouse Automation	6–10	29.50	38KB
21	C21	41–45	M	Pharmaceutical	Pharmaceutical	Pharmacist	less than 5	31.55	40KB

N o	Compa ny code	Age group (Years)	Sex	Business type	Industry	Position	Experien ce (years)	Interview duration (mints)	File size in KB
22	C22	41–45	F	Suppliers of Construction material	Retail	Distribution Manager	less than 5	42.10	49KB
23	C23	26–30	M	Groceries	Groceries	Medication Strategy Pharmacist	11–15	39.09	99KB
24	C24	41–45	M	Warehouse/ Automation	Warehousing and Automation	Information Technology Manager	11–15	60.03	58KB
25	C25	36–40	F	Garment	Garment	Executive Director	46–50	57.56	55KB
26	C26	36–40	M	Groceries	Groceries	Logistics Manager	less than 5	44	138KB
27	C27	50–55	M	Office Suppliers	Retail	National Supply Chain Projects Manager	6–10	38.23	44KB
28	C28	41–45	M	Distributor	Distribution	Supply Chain Manager	31–35	42.13	127 KB
29	C29	51–55	M	Shipping &logistics	3rd Party Logistics	CEO & Managing Director	6–10	49.15	51KB
30	C30	36–40	F	Pharmaceutical	Pharmaceutical	Senior Pharmacist	6–10	33.42	44KB
31	C31	41–45	F	Pharmaceutical Wholesalers	Pharmaceutical	State Operations Manager WA	11–15	33.31	48KB
32	C32	51–55	M	Garment and Clothing	Garment	CEO/Co-founder	26–30	51.40	53KB

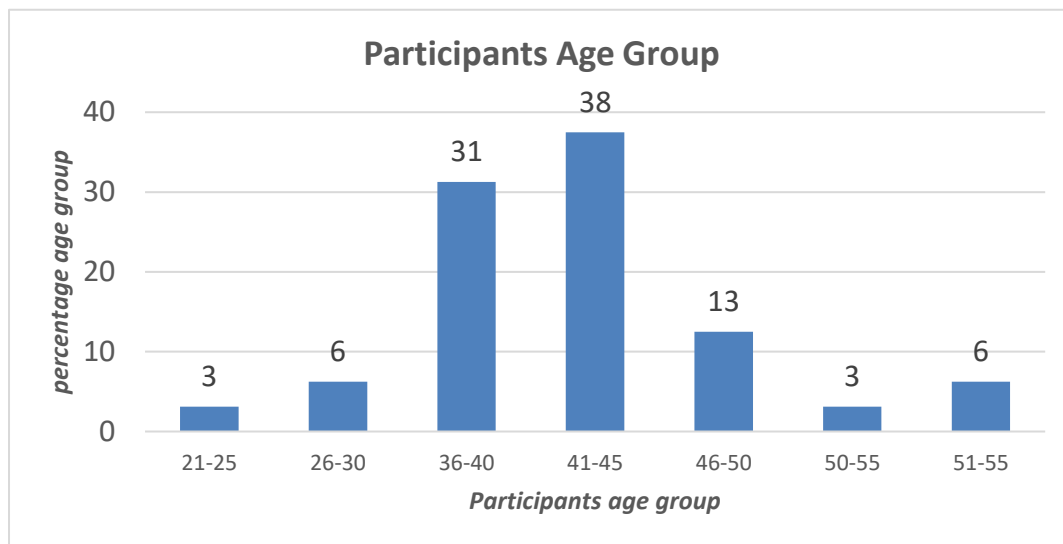


Figure 4-4 Study Participants' Age Group

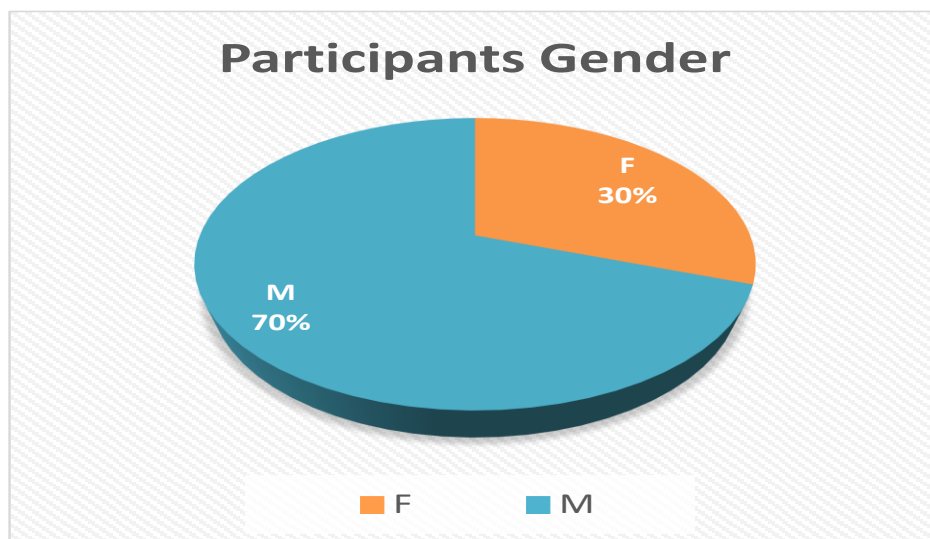


Figure 4-5 Study Participants Gender

Demographic analysis reveals key attributes of the participants, indicating an average age range of 41 to 45 years, constituting 38% of the sample (Figure 4.4). Figure 4.5 illustrates a gender distribution, with 70% of respondents being male and 30% female. This balanced representation ensures diverse perspectives from individuals of varying genders.

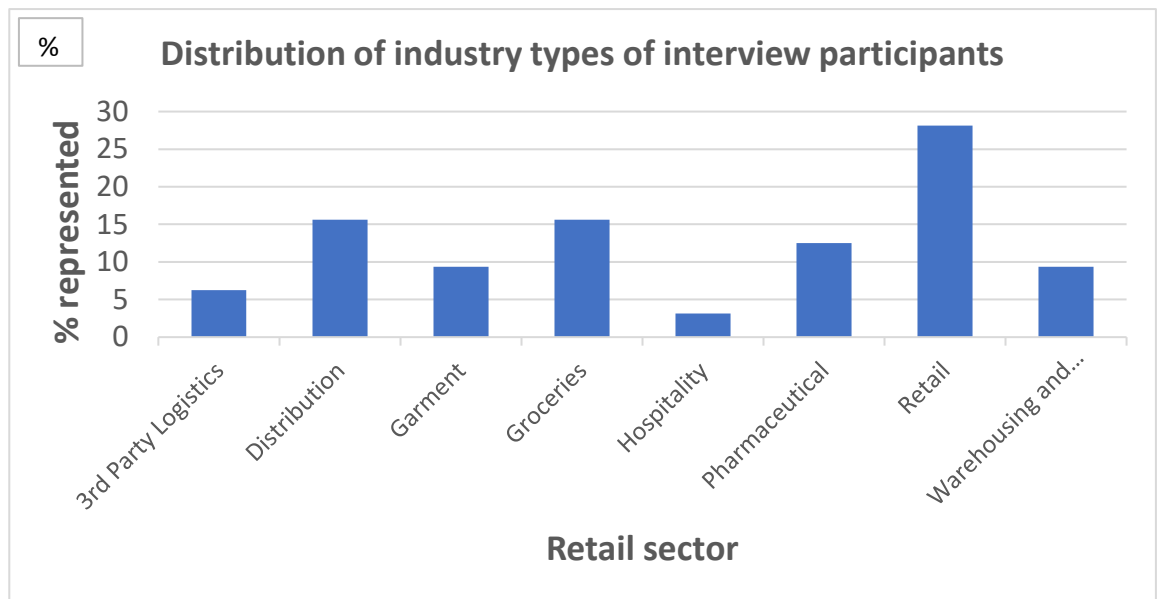


Figure 4-6 The distribution of industry

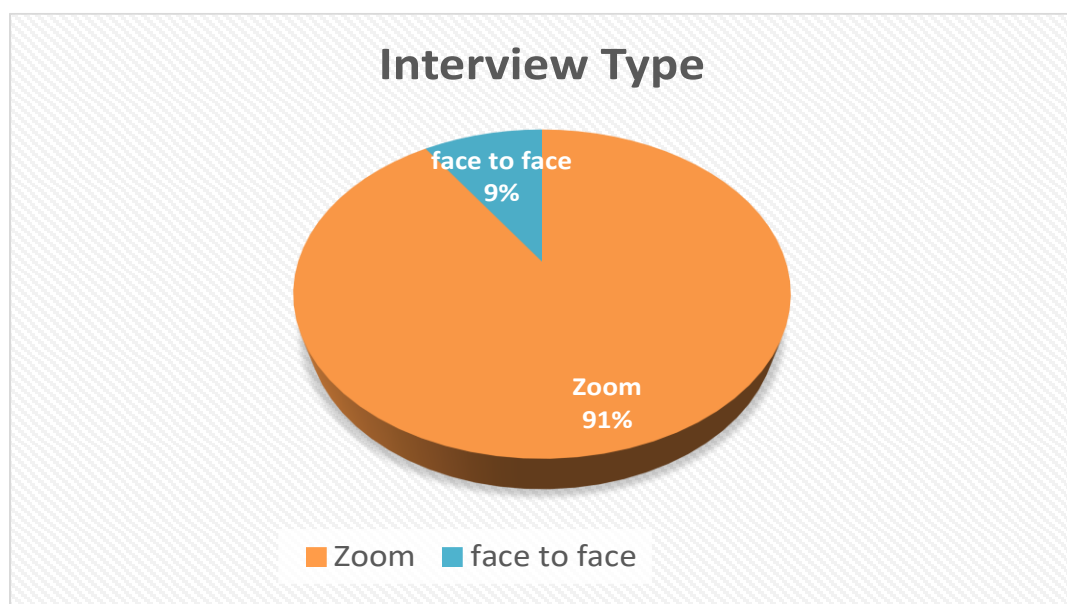


Figure 4.7 Method of Interview

Figure 4.6 illustrates the distribution of industry types among the interview participants within the Australian retail sector. Figure 4.7 shows the methods used to conduct the interviews. Due to the restrictions imposed by the COVID-19 pandemic, nearly 91% of the interviews were conducted via Zoom, with only 9% conducted face-to-face.

The graphical representation in Figure 4.6 indicates that 28% of participants were from the retail industry, while groceries and distribution each accounted for 16%. Additionally, the garment and warehousing sectors each contributed 9%, third-party logistics represented 6%, and hospitality constituted 3% of the participant pool. This diverse representation ensures a comprehensive perspective on how various retail industries and stakeholders in the supply chain responded to the challenges posed by COVID-19.

By specifically selecting participants from these sectors, the study offers a well-rounded overview, providing valuable insights into how the retail landscape in Australia responded to the pandemic. This facilitated a swift, sustainable recovery and contributed to building resilience in their supply chains.

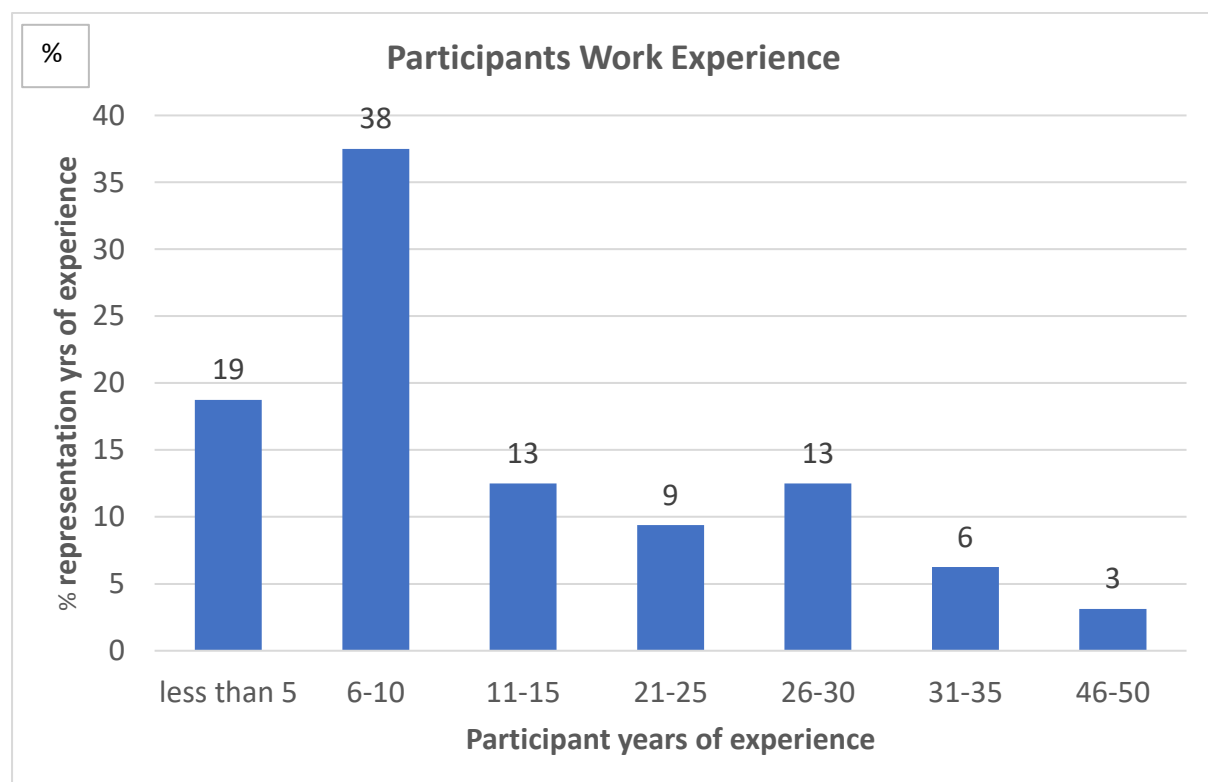


Figure 4-8 Participant's years of experience

Figure 4.8 shows that most of the participants (approximately 38 per cent) have between 6 and 10 years of work experience.

The interviews took place in between May 2021 and October 2021 during the pandemic, following the initial impact of the disruption. Interviews were conducted in a semi-structured fashion. Participants were provided with “information to participants form” and “consent form

to participate” which explained the research objective, how their data will be used and benefits it will offer. To ensure confidentiality, they were informed at the onset that the participation is voluntary, and they may choose to quit at point they feel uncomfortable without disadvantages of any form. The firm-specific supply chain management (SCM) skills were assessed through three questions focusing on the experience of supply chain managers in their current company or industry: (1) the number of years they have worked as a supply chain manager in their current firm, (2) the years of experience in other supply chain-related positions within the same firm, and (3) the years spent in a supply chain-related role within the broader industry, excluding time in the current firm. The questionnaire began with a definition of Supply Chain Resilience, emphasizing its growing significance.

The interviews (See appendix A for more details) probed informants regarding organisation’s background; types of risks the organisations and the entire supply chain have been exposed to, their preparedness for disasters; response to previous disasters and to what extent they were affected; how did they manage the previous disasters, are they proactive for future disasters and factors that contributed to the company’s vulnerability or success. The study sought to find out the mitigation strategies that are in place with the potential risks, and finally how the use of data-driven technology and the organisational resources have helped in the firm’s recovery path.

During the interviews, informants were urged and encouraged to recount events leading up to and during the COVID-19 pandemic crisis, as well as evaluate their organisation’s overall reaction, communication, flexibility, and coordination with stakeholders. Each interview lasted an average of 45 minutes and was digitally recorded and transcribed. The researcher conducted a total of 32 interviews across data collection periods in 2021, totalling over 60 hours of recording. Most of the interviews were conducted through Zoom due to COVID-19 as the face-to-face survey was not feasible at the time of the study because of physical distancing and lockdowns restrictions measures in place This also limited the target number of interviewees. A small number of interviews were conducted face-to-face, including site visits. Although most of the interviews were conducted by the researcher, for other interviews, a minimum of two researchers were present. Table 2 provides details about the interviews and particularities related to the interviewees and their organisations. We focused on collecting information from directors, CEOs, supply chain and risk managers, and decision-makers that were full-time or long-time employees.

4.5.2 Semi-structured interviews -Phase 2

The semi-structured interviews, detailed in section 4.5.1 of the data collection section, were conducted in two distinct phases. The first phase, conducted between July 2021 and October 2021, occurred at the height of the COVID-19 pandemic. Subsequently, the participants interviewed during Phase 2 were indeed the same interviewees from Phase 1. These interviewees were selected based on their direct involvement and diverse roles within the supply chain, rather than to fit a traditional triadic model of ‘supplier/manufacturer/customer.’ The selection criteria focused on their expertise, hands-on experience, and involvement in key supply chain processes, ensuring a broad perspective on the strategies and challenges encountered during disruptions. While these participants do represent different stages of the supply chain, the primary aim was to gather insights from seasoned professionals to understand resilience strategies rather than constructing a formal triadic representation. Maintaining consistency in the interviewees across both phases allowed for a deeper exploration of initial findings and provided continuity in the data, thereby enriching the study’s analysis. The primary objective was to gain a comprehensive understanding of the experiences and insights of seasoned supply chain experts and risk managers in the Australian retail sector. Participants were selected based on their direct involvement in managing operations and their knowledge of the impacts of the pandemic. They were prompted to share the disruptions encountered in their supply chains, the strategies employed to navigate these disruptions, and how these strategies contributed to building resilience for the future.

To make this research a unique longitudinal study, a second phase of follow-up interviews was conducted to ascertain recovery mechanisms and identify key performance indicators (KPIs) used by retailers to gauge full recovery. This phase was carried out between June and July 2024, a period generally believed to mark the cessation of COVID-19 effects and the recovery of most companies. During this phase, all initial 32 participants were approached via phone, email, to invite them for follow-up interviews. The second phase focused on three main questions:

1. What performance indicators demonstrated your company’s recovery from pandemic disruptions?

2. How confident are you that the current performance indicators demonstrate your company's progression into the future?
3. Do you still uphold the resilience strategies that helped you recover from the pandemic disruptions, or have they been changed since then?

Out of the 32 targeted interviews from phase 1, 11 participants responded, resulting in a 32% coverage. In the first phase of this study, a total of 32 participants were initially interviewed to explore the resilience strategies adopted in the Australian retail sector. For the second phase, the objective was to conduct follow-up interviews with all 32 participants to gain deeper insights and verify findings from Phase 1. Despite reaching out via emails and phone calls, only 16 participants agreed to participate in the second round, and ultimately, 11 of them completed the interviews. The researcher realised that data saturation was reached after these 11 interviews, as no new themes or insights emerged beyond what had already been identified. Therefore, the sample of 11 interviews was deemed sufficient to achieve the research objectives, as the additional responses were unlikely to yield further significant information. This approach ensured the validity of the findings while also maintaining methodological rigor, given the depth and richness of the data collected. The interviews were conducted via Zoom, Teams, and phone, as these methods were preferred due to convenience, cost-effectiveness, and time constraints. Table 4.3 Demographic of interview participants for Phase 2

Table 4.3 Demographic of interview participants in Phase 2

No	ID	Position	Experience (Years)	Gender	Interview Duration (In Min)	Interview Transcription file size (In KB).	Interview date
1	C1	Vice President (GM Commercial)	9	Male	16.13	37KB	5/07/24
2	C2	Director, Sustainability, and Impact:	10	Male	14.06	39KB	16/07/21
3	C9	CEO & Managing Director	4	Female	16	32KB	25/06/24
4	C10	Inventory Manager	10	Male	13.13	32KB	11/07/24
5	C11	Formulary inventory Manager	30	Female	12.02	61KB	25/06/24
6	C16	National Sales Manager	5	Male	19.47	33KB	5/07/24
7	C19	Group operations Manager	3	Male	12.27	26KB	21/06/24
8	C27	National Supply Chain Projects Manager	10	Male	12.4	38KB	12/07/24
9	C31	State Operations Manager WA	15	Female	responded in writing	20KB	1/07/24
10	C29	CEO & Managing Director	20	Male	24.32	44KB	12/07/24
11	C32	CEO/Co-Founder	26	Male	16.18	44KB	11/07/24

To maintain anonymity and confidentiality, the same coding and company IDs were used (e.g., C1, C2, C3, etc.). The average duration of the interviews was approximately 15 minutes, with the transcribed scripts totalling 406 KB, averaging 36 KB each. The audio recordings of the interviews were transcribed and loaded into NVIVO 12 for analysis, following the same procedures used in Phase 1. The qualitative research coding process advocated by Creswell and Poth (2017) and R. Yin (2014) was employed. The analysis adhered to the six phases proposed by (Braun & Clarke, 2006), as detailed in section 4.6.2., The results of Phase 2 are also detailed in the subsequent Chapter 5.

4.6 Data Analysis and Procedure (Phases 1 and 2)

The data analysis was an iterative process. By adopting an iterative process, this qualitative researcher acknowledges the dynamic and evolving nature of this research inquiry, allowing for a more nuanced and comprehensive understanding of the research phenomenon of what proactive and reactive strategies were used by selected retailers during the recovery period of the COVID-19 pandemic. This iterative process in qualitative research is a dynamic and evolving approach and it enhances the credibility and validity of qualitative findings, using semi-structured interviews with predetermined questions. To facilitate analysis, the transcribed

interviews were imported into NVivo 12. The initial analysis aimed to uncover patterns, themes, and key concepts within the collected data. This involved coding, wherein the researcher assigned codes to data segments, categorised retailers' strategies, into proactive and reactive strategies and extracted meaningful patterns. These codes were derived from strategies identified in the literature, specifically focusing on their relevance and effectiveness during the COVID-19 pandemic, based on existing Resilience Theory and RDT.

Throughout the analysis, constant comparison was employed, systematically comparing new data with previously analysed data. This iterative process facilitated the refinement of codes and categories and the identification of emerging themes. Notably, the primary strategies that emerged were not predetermined; instead, they organically evolved through the analysis process. The refinement and revision phase were exhaustive, ensuring that there was no need to revisit the data for additional information or clarification from interviews to validate the findings. The researcher reached a saturation point where new data ceased to provide additional insights into the research questions. This marked the conclusion of data collection. Grounded in the theories of RT and RDT, the researcher then pursued theoretical sampling, collecting additional data from the literature based on emerging theories or insights to further explore and validate the findings. The final analysis involved synthesising the refined strategies and patterns into a coherent narrative. The results for both Phases 1 and 11 were reported in a manner that captured the complexity and richness of the data, providing a comprehensive understanding of both proactive and reactive strategies employed by retailers in the context of the COVID-19 pandemic and the KPIs for recovery and organisation sustainable recovery.

4.6.1 Coding process

A qualitative approach was conducted to analyse the data (Miles & Huberman, 1994). To facilitate the analysis, the transcribed interviews were imported into NVivo 12, a computer software package for managing and analysing qualitative research data for both interview phases. Based on this coding scheme, a systematic coding process was used to code each document (Miles & Huberman, 1994). The researcher deductively coded data line by line from the transcribed interview transcripts for information (Creswell & Poth, 2017) by each of the interview participants. Employing an inductive approach, the researcher embarked on a meticulous data reduction process, systematically converting raw data into coherent and simplified thematic categories to derive meaningful insights for both phases. In line with established qualitative research methodologies (Creswell & Poth, 2017; Strauss, 1987), our

analytical journey commenced with a standard open coding procedure. This involved dissecting and categorising textual excerpts into meaningful segments, each adorned with a fitting descriptor to encapsulate its essence (Creswell & Poth, 2017; Yin, 2006). It is imperative to note that the formation of codes was intricately tied to the comprehension and interpretation of the underlying data (Richards, 2014). Coding, in essence, served as the compass guiding us through the labyrinth of patterns discernible through data abstraction.

The coding process unfolded in three distinctive modes: descriptive coding, topic coding, and analytic coding (Richards, 2014). Descriptive codes were instrumental in capturing characteristics or attributes, particularly those relevant to demographic information, which was integral for our pattern investigation. A recurrent practice, referred to as “in NVIVO” coding, entailed the direct utilisation of respondents’ verbatim statements as code labels. Topic coding was pivotal in classifying data according to overarching themes, while analytic coding assumed the role of fortifying emerging theories or corroborating existing ones. Our analytical approach seamlessly integrated all three types of coding, with new codes being crafted whenever the data subtly deviated from pre-existing ones. Following the initial coding phase, we meticulously scrutinised transcripts of each interview to unearth new thematic dimensions, refine existing codes, and delineate sub-categories (Richards, 2014). To ensure conciseness and eliminate redundancy, a thorough review and consolidation of codes was undertaken. This rigorous process culminated in the identification of key themes, necessitating the amalgamation of interrelated codes into broader groupings—a practice known as axial coding. Consequently, intricate patterns and relationships emerged across the corpus of data.

4.6.2 Thematic analysis

In terms of thematic analysis: The research analysis comprised six distinct stages, wherein interviews were conducted with 32 representatives (for Phase 1) and 11 representatives for Phase 2) from various sectors including pharmaceutical and grocery retailers, 3PL, and distributors. Employing the qualitative research coding process advocated by Creswell and Poth (2017) and R. Yin (2014) the analysis adhered to the six phases proposed by Braun and Clarke (2006): These are explained as follows (Figure 4.9):

1. Familiarisation with the Data:

In this initial stage, the researcher immersed themselves in the interview data. This process involved transcribing the interviews to enhance readability, making notes, and revisiting the data to develop a deeper understanding. Initial ideas and observations were documented during this phase.

2. Generating Initial Codes:

The second stage focused on systematically coding noteworthy features across the entire dataset. This process facilitated the organisation of data into codes, capturing relevant information associated with each code. The aim was to identify patterns and meaningful segments within the dataset.

3. Searching for Themes:

Following the coding phase, the researcher collated codes into potential themes. This involved grouping related codes to identify overarching patterns and concepts. Data relevant to each potential theme was gathered, laying the foundation for further analysis.

4. Reviewing Themes:

The fourth stage involved a comprehensive review of themes. The researcher assessed the application of themes in relation to code extracts and the overall dataset. This critical evaluation led to the development of a thematic map, providing a visual representation of the analysis and the interconnections between themes.

5. Defining and Naming Themes:

The ongoing analysis in the fifth stage aimed to refine the specifics of each theme. This involved generating clear definitions and names for each theme. The goal was to enhance precision and coherence in describing the identified patterns and concepts.

6. Producing the Report:

The final stage represented the culmination of the analysis process. It served as the last opportunity for in-depth exploration, involving the selection of vivid and compelling examples from the dataset. The researcher conducted a final analysis of chosen extracts, drawing connections between the findings, the research question and existing literature. The outcome was a scholarly report presenting a comprehensive overview of the analysis, enriched by the selected extracts and their relevance to the broader research context.

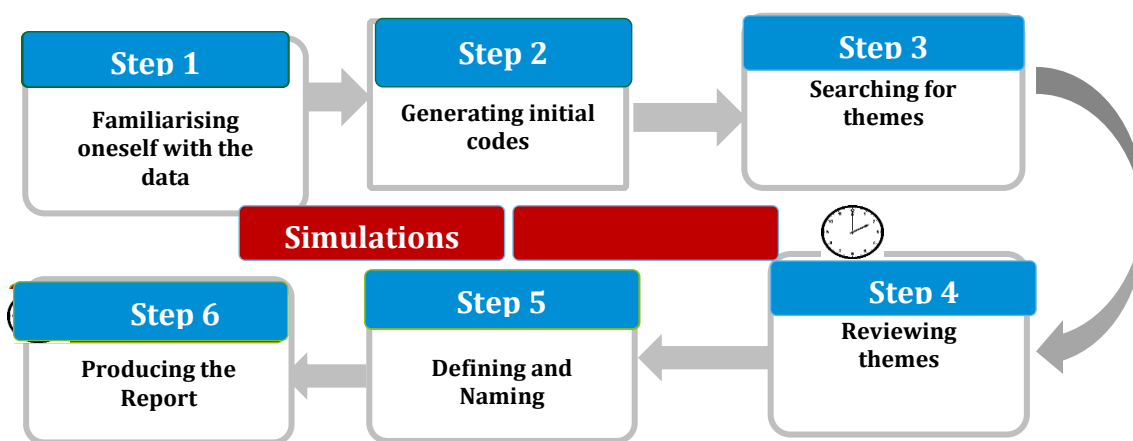


Figure 4-9 Data Coding Steps/Guidelines: Source Braun and Clarke (2006)

The six steps outlined above served as a guide throughout the coding process. The transcripts were reviewed multiple times, during which initial thoughts and ideas were carefully documented. NVivo12 software was used for coding, leading to the development of first-order codes. The researchers collaboratively conducted an interview and subsequently analysed the data. While coding was partially theory-driven to address the research questions, the researchers ensured that it did not impose restrictions or limitations (Braun & Clarke, 2006). The collected data were analysed in a series of steps, carried out simultaneously with data collection through the interviews that included four steps. Figure 4-9 shows data analysis and coding steps:

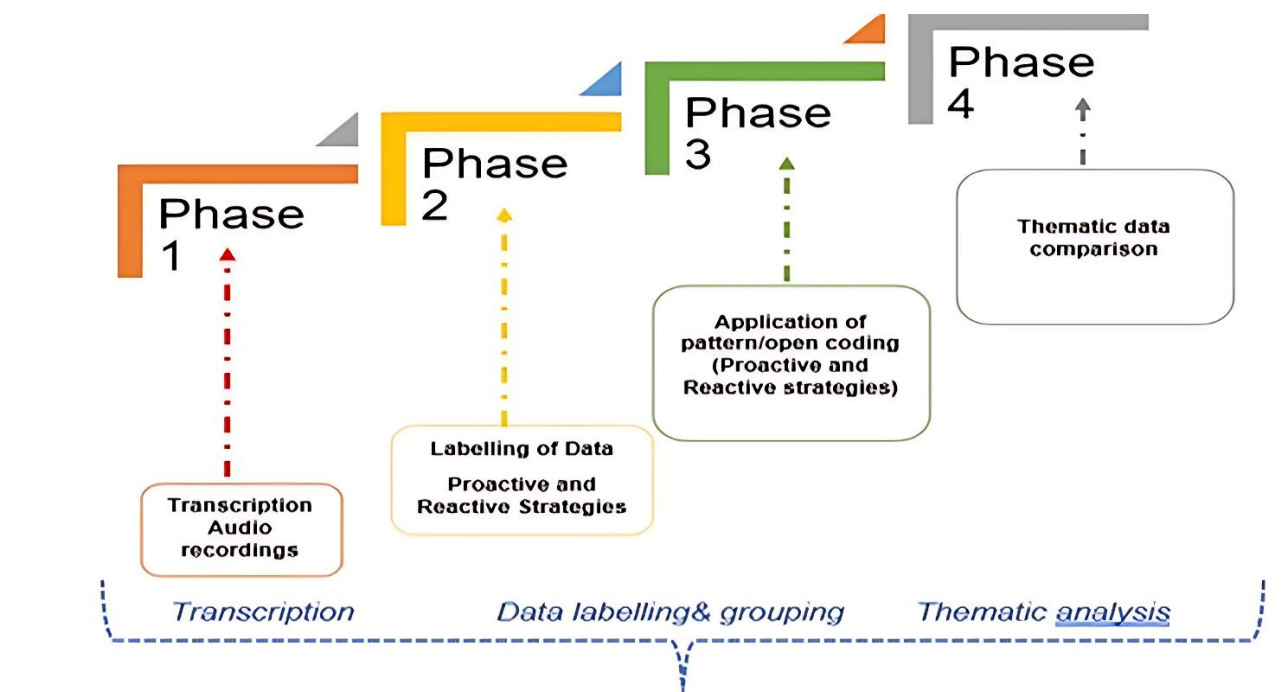


Figure 4-10 Data analysis and coding Steps source Author

As depicted in the above data analysis steps: **Phase 1** consisted of transcription: The data included audio recordings, handwritten notes or summaries, and written notes that were

transcribed word for word in English and subsequently translated into proper, meaningful English by the authors of this research. **Phase 2 involved** organising and labelling the data into easily retrievable sections and dividing the data into groups of retailers that were interviewed. **Phase 3** applied pattern coding following a thorough literature review that identified resilience strategies (that were divided into both proactive and reactive strategies) to reduce the data, identifying key themes emerging from the interview responses, and placing coded data into clusters under proactive and reactive strategies. The next step of coding involved some preliminary coding, also called open coding in grounded theory. Textual codes were used to identify the specific pieces of data that corresponded to different themes. After key themes were identified, re-coding was carried out to develop better-defined categories. This process generated many themes and categories, so refining and developing were subsequently performed. **Phase 4** consisted of thematic comparison, particularly in the context of the COVID-19 pandemic, to identify and add to which strategies were applied and how they were applied, consequently forming frameworks, and elaborating theory generation.

4.7 Reliability and Validity

One of the important criticisms directed against qualitative research is the lack of rigour and generalisability (Goffin et al., 2012). Näslund (2002) highlights the anecdotal nature of qualitative research, which can render it biased, as an often-cited criticism. In response to such criticisms, other researchers have established several criteria to evaluate the quality of qualitative research. There is a shift towards standardising qualitative research (Cassell, 2016). However, there is still no consensus among researchers as to what criteria should be adopted. On the one hand, some argue that qualitative research requires its own evaluating criteria, such as credibility, transferability, dependability and confirmability (Guba & Lincoln, 1994b). Ensuring the reliability and validity of findings is crucial to substantiate the contributions of this research to the field of supply chain management and resilience. There are those who argue that conventional criteria such as construct validity, internal validity, external validity, and reliability are applicable to both quantitative and qualitative research (Ellram, 1996; R. Yin, 2014). The issue of trustworthiness therefore incorporates characteristics such as credibility, transferability, dependability, and conformability. In this study, the researcher practised several techniques, previously proposed as best practice, to ensure the trustworthiness of the research. First, participants were selected who possess knowledge relevant to the study to signal trustworthiness (Lundberg et al., 2019). In addition, in line with Lapan et al. (2011) suggestion

of demonstrating authenticity and trustworthiness of the data, the researcher provides a chain of evidence in the results section so that the reader can see the source of a conclusion/finding in the form of verbatim quotes from the participants. Same participants were also used for interviews for phase 11 interviews. To manage interview impressions, particularly given that 91.5% of this study's interviews were conducted online—where body language and facial expressions are more difficult to interpret—I implemented several strategies to ensure the reliability of the data collected. First, I utilized *probing questions* to delve deeper into specific examples. These questions encouraged interviewees to elaborate on concrete actions, outcomes, and challenges, helping to balance overly positive or generalized statements by prompting more detailed and nuanced accounts of their experiences (Ellis et al., 2002). Second, I ensured *consistency in questioning* across all participants. By standardizing the interview framework, I minimized the risk of using leading questions that could bias responses toward overly favourable descriptions (Basch et al., 2020). Lastly, I employed *triangulation* with external data sources, where available, to confirm and ensure interviewee accounts and provide additional context to their statements on resilience and innovation (Ellis et al., 2002; Basch et al., 2020). This triangulation step offered an independent verification of their narratives and added depth to the analysis. By adopting these measures were designed to reduce the influence of impression management and encourage participants to provide realistic, balanced descriptions of their actions and experiences.

In addition, Zhang and Shaw (2012) guidelines were followed, to ensure a high level of completeness, clarity and credibility of the research method and results. We assess validity and reliability based on the information detailed in Table 4.4. These processes maximise the quality of the research methods, validity, and trustworthiness.

Table 4-4 Quality ensuring methods.

Specific criteria or concepts	Method	Results
Completeness	The ways of obtaining data for this research, including the list of participants in different stages of the study, are explained in detail (a summary of the stages of the study and data collection procedures).	The NVivo 12 computer program is introduced and applied as a tool for analysis. Size of samples of respondents for each stage of the study and data collection are provided.
Clarity	Details are provided on the measures used in the study, e.g., interview questions, and instrument used for collecting data using survey and focus group. The keywords used for coding the qualitative data, selected according to the research questions are provided.	The research questions of the study are clearly answered in the findings. The in-depth explanation of how the proactive and reactive strategies were applied in a unique way and the dominant strategies as evidenced by the number of responses under each strategy clearly demonstrated which specific strategies forms the basis of the theoretical framework proposed, and the capabilities that are needed by retail companies to pursue supply chain resilience and achieve sustainability of their SCs

		via a combination of both proactive and reactive strategies.
Credibility	The sampling procedure and selection criteria for cases, and respondents of interviews and surveys are detailed. The researcher practised several techniques, previously proposed as best practice, to ensure the trustworthiness of the research. First, selecting participants who possess knowledge relevant to the study can signal trustworthiness and believability.	Direct quotes from the interviewees and participants from the interviews were provided to justify the findings as evidence of discussion with experienced supply chain professionals as well as ensuring correctness of interpretation.

To ensure reliability of this study semi-structured interview qualitative research methodology protocol was developed and followed throughout the interview and fieldwork process to allow replicability. To ensure *trustworthiness*, I employed triangulation by cross-referencing interview responses with published industry reports and external data sources, which helped validate participant claims and added depth to the findings (Patton, 1999). On the other hand, *credibility* was enhanced through member checking; after transcription, participants were given the opportunity to review and confirm the accuracy of their responses (Lincoln & Guba, 1985). Similarly, *completeness* was achieved and ensured by including a diverse range of participants across different roles within the supply chain, providing a comprehensive view of the challenges and strategies observed (Morse, 1999). Finally, to maintain validity, I used consistent questioning and systematic coding procedures, ensuring that themes were developed objectively and based on recurring patterns across the data (Miles et al., 2014).

It is therefore fundamental to be thorough with the qualitative methodology and the results (Bryman, 2016). To ensure compliance with this requirement, the credibility of the study was therefore confirmed at a later point through a deductive analysis of qualitative findings with reference to literature. On the other hand, dependability was ensured by keeping complete records of data collection and analysis that are available at Victoria Library and through the researcher. Additionally, in this study, conformability was assured through good faith by dismissing personal values and theories. Saunders et al. (2009) highlighted that semi-structured interviews could be subjected to data quality issues such as biases by the respondents. As such, a high-quality digital recorder was utilised for audio recording and transcribing the interviews to ensure the quality of the data. In addition, care was taken to avoid bias at the design stage. Leading questions were avoided while conducting interviews. The reliability of coding is vital, as the coding process can be extremely subjective and dependent on the researcher's

comprehension and interpretation. According to Richards (2014), inter-rater reliability tests are a way of comparing the uniformity of the codes created by two different individuals on the same transcript (Richards, 2014). In this study the inter-rater reliability was tested accordingly: a second coder with a limited direct role was used to verify the codes. Additionally, a researcher with extensive qualitative coding experience assisted with coding transcripts for eight interviews and compared codes for discrepancies to confirm a general agreement in coding consistency.

4.8 Summary of the Chapter

The methodology applied in this study is explained in this chapter. The study philosophies, ontologies, epistemologies, and methodologies were rationalised. The employed qualitative method approach was justified. The decision to utilise a qualitative method approach was justified based on its capacity to illuminate the nature of personal experiences, offer insights beyond quantitative methods, discern underlying meanings in human interactions within organisational contexts, and explore areas with limited prior knowledge—such as the unique challenges posed by the COVID-19 pandemic. A structured framework comprising nine stages was clearly outlined, guiding the entire research process for both phases. Additionally, a series of online semi-structured interviews were conducted during the qualitative phase, owing to the impracticality of securing face-to-face interviews due to COVID-19 restrictions and physical distancing measures. A total of 32 interviews were successfully conducted via platforms such as MS Teams or Zoom, engaging retailers with expertise in risk management and supply chain experience among participants from Victoria (VIC) and WA, including a few experts from 3PL service providers. This was followed by follow-up interviews in Phase 2 that encompassed 11 interviews from the same participants. The study adhered to a framework consisting of nine stages that were explained in detail. The collection of data involved nine steps to collect qualitative data via a survey using semi-structured interviews with questions targeting Australian retail organisations and a few third-party logistics organisations. Securing face-to-face interviews was not feasible and proved challenging because of the COVID-19 epidemic restrictions, physical distancing measures in place, restrictions, and lockdowns. In this study, the data analysis was an iterative process that facilitated the refinement of codes and categories and the identification of emerging themes. The qualitative data was first transcribed and then thematically analysed with the help of the NVivo 12 qualitative analysis software, where the data reduction process transformed the data into orderly and simplified themes. Rigorous data

analysis was undertaken, leading to subsequent chapters where the overall findings and discussion are discussed in detail in Chapters 5 and 6. The discussion section will further scrutinise the outcomes derived from the findings, providing deeper insights into the research's implications.

Chapter 5

Thematic Analysis and Findings

5.1 Introduction

This chapter presents the findings from the thematic analysis of interview data, focusing on key themes that emerged in relation to resilience strategies within the retail supply chain. The interviews provide a nuanced perspective on the practicalities of how retailers adopted both proactive and reactive strategies to recover from the profound impact of the crisis. In this section, a comprehensive exploration ensues, detailing both the reactive and proactive resilience strategies adopted by retailers to fortify their supply chain capabilities during the pandemic based on the two theories underpinning this research: RT and RTD. The results are dissected to illuminate key strategies instrumental in facilitating recovery and progression in the post-COVID-19 era, with the overarching goal of fortifying supply chain resilience. First, the chapter delineates the characteristics of the sample and provides a succinct overview in Section 5.1 of the interviewed organisations as an introduction. Section 5.2 discusses the impacts of the COVID-19 pandemic. Section 5.3 discusses the proactive strategies applied to handle disruptions and vulnerabilities, ensuring a responsive and effective efficient supply chain, leading to building supply chain resilience. Section 5.4 highlights key lessons applicable beyond the COVID-19 pandemic. Finally, Section 5.5 offers valuable insights for navigating the complex terrain of SCRE in the face of future challenges, considering technological advancements and applications.

5.2 Interview Data Analysis Approach

The sample comprised 32 interviews of retail businesses in the state of Victoria (VIC) and WA. NVivo 12, a qualitative software, was used to analyse the interview data for coding. In this study, the unit of analysis is the retail firms within the retail sector, specifically focused on medium to large retail companies across grocery and pharmaceutical sectors. The selection of firms as the primary unit of analysis aligns with the research aim to understand resilience strategies employed by individual retail within the retail supply chain, particularly in response to the COVID-19 disruptions. This choice allows for an in-depth exploration of organizational practices and adaptive strategies at the retail level rather than at the broader supply chain or economic sector levels.

Details of the participants' demographics are available in Table 4.2 (Chapter 4). For the coding procedure and analysis until arriving at themes, the analysis started with initial coding by using predetermined constructs (e.g., risk management strategies) based on extant literature in supply chain risk and resilience strategies. In contrast to the grounded theory approach where the constructs/themes are usually generated, this research started with known and well-established constructs/themes. These constructs represent the code in the coding process. In other words, this research focuses on theory elaboration rather than theory generation/building and testing (Ketokivi & Choi, 2014). This suggests that theory elaboration focuses on contextualising the general theory: that is, resilience strategies during COVID-19 in this case. This research investigates each case where the evidence is sought to support the existing theory derived from the literature. The initial coding was created for those existing strategies and looking for evidence in transcripts. Each transcript was investigated thoroughly for proactive or reactive strategy, and a report was generated. In the final stage of analysis, the dominant strategies were listed based on their occurrences and some additional quotes were cited to strengthen the evidence. Then these strategies were further explained with criteria for each one with examples of who cited those in their resilience-building approach. Also, the newly emerged strategies were identified through thematic analysis and listed.

5.2.1 Organisational readiness to the disruption

During the participant interviews, it was evident that prior to the COVID-19 supply chain disruption, some companies in the retail sector demonstrated multiple aspects of organisational preparedness to responding to the disruption. Collaboration, adaptability, flexibility, visibility, supplier diversification and redundancy are commonly adopted organisational readiness associated with SCRE. In the past few decades, businesses have maintained the continuity of their operations in the face of AIDS, SARS, Avian Flu, Zika and Ebola, among other health crises, and for the most part, they have recovered quickly. This meant that some risk management systems (as proactive strategies) were in place to deal with impending disasters and SCD. However, with the COVID-19 pandemic, the extent and duration of the impact emerged from fragility, vulnerabilities, and operational inefficiencies. When COVID-19 struck, many consumer goods companies came to the abrupt realisation that some of their critical inputs were single-sourced, further amplifying risk. The consensus from all the interviewees was that COVID-19 caused a global shock, and many organisations were caught off guard. Very few companies or countries were prepared for such a disruption.

Words like “biblical”, “astronomical”, “global shock”, “devastating”, “historical” and “unprecedented” describe the level and severity of disruption caused by the COVID-19 pandemic in the retail sector.

One participant expressed the disruption magnitude as:

“We have never seen a disruption like this where many countries are telling their populations to stay at home, not to work.” (C21).

The director from the Retailers Association described how the retailers were affected by the pandemic crisis:

“Retailers faced severe supply chain disruptions during the pandemic, initially driven by surging demand for essentials such as pantry staples and hygiene products, which overwhelmed the system's capacity. Over time, the disruptions shifted to supply-side challenges, with international shipping routes and markets being disrupted, further hindering efforts to restock shelves efficiently” (C2).

The failure to cope with unexpected changes in demand, particularly for low-cost commodity items imported mainly from the Far East and China (with a six-week lead time), worsened the problem. China is the major global supplier of the personal protective equipment much needed in the fight against the virus. It also supplies components for a range of products found in local supermarkets. To make matters worse, international travel restrictions enforced by the Government to prevent the spread of the virus have had an impact on shipping and logistics activities, resulting in the inability to distribute, for example, PPE, even when it was available. Therefore, even though some organisations displayed many aspects of resilience, the sudden introduction of the virus spreading control measures such as lockdowns and company closures worsened the situation. It was evident from the interviews that the level of preparedness for most companies was lacking in the face of such a significant disruption caused by the COVID-19 pandemic. According to Gates (2018), the world needs to prepare for pandemics such as COVID-19 in the same way it prepares for war. The preparation includes building a resilient supply chain and at the same time a clear road map for a comprehensive pandemic preparedness and response system for companies to survive the disruption. Although there is no established roadmap available dealing with the unprecedented pandemic, it emerged from the interviews that leaders at all levels needed to act across the three phases ***Respond, Recover, and Thrive***.

5.2.2 Recovery strategies and the context

The COVID-19 pandemic caused long-term disruption, disruption propagations and high uncertainty (Ivanov & Das, 2020). Nothing of this scale and magnitude has ever been seen before. In the realm of supply chain management, the strategies to fortify and build SCRE resilience had long been a subject of discussion within the literature (Christopher & Peck, 2004; Dmitry Ivanov, 2021; Kamalahmadi & Parast, 2016; Khuan et al., 2023; McKinnon, 2014; Ozdemir et al., 2022; Ponomarov & Holcomb, 2009; Tukamuhabwa et al., 2017). Yet, when the unprecedented COVID-19 pandemic disrupted global operations, the application of these strategies took on an entirely unique dimension. This study contributes to the supply chain literature by answering the calls of several researchers who demanded further investigation of practical strategies that helped building SCRE under severe disruption (Blome et al., 2013; Chunsheng et al., 2020; Hohenstein et al., 2015; Nah & Siau, 2020; Orlando et al., 2022; Ribeiro & Barbosa-Povoa, 2018). Traditional models and theories were tested, requiring companies to devise innovative approaches to navigate tumultuous waters. Strategies that once seemed appeared theoretical and abstract were suddenly thrust into practical application, emphasizing real-time data, diversified sourcing, increased collaboration, flexibility, and digitalization to ensure supply chain continuity. The primary contribution of this study lies in its exploration of principles through the lenses of RDT and resilience theory. Furthermore, this research significantly enhances the understanding of COVID-19's impacts on supply chains, including response strategies, resilience-building efforts, operational restoration, and lessons learned for future disruptions.

5.2.3 Retailers' SCRE the COVID-19 pandemic: A word cloud analysis

The first step of the analysis was to assess the keywords in the interviews to highlight the relevant factors related to the research. The word cloud in Figure 5.1 visualises word frequency (Zikmund, 2013), providing an initial overview for formative purposes. According to DePaolo and Wilkinson (2014) word clouds or tag clouds are popular and engaging ways to display text data derived from NVivo in a visual form.



5.2.4 Proactive strategy analysis

Table 5.1 below illustrates the frequency of occurrence of various proactive resilience strategies employed to combat the crisis in general and COVID-19 pandemic in specific. The numbers expressed in percentages show the frequencies of occurrence of these strategies identified in the interviews during coding. For example, the frequency of occurrence of “use of digital technology” stated by the interviewee C1 is 20.9% (Table 5.1). These frequencies are organised from highest to lowest order in the last “Average” column. As someone would like to know the dominant strategies in the list, the author believes that those strategies having an average frequency above 1% emerged as dominant, while those falling below the average 1%, are believed to have lesser effect during COVID-19. It is worth mentioning that this cut off point at 1% does not mean that strategies below 1% have no values, rather they appear to be less dominant depending on the crisis types. In total 23 themes emerged from proactive strategies.

Table 5.1 Frequency of occurrence of proactive resilience strategies

Themes	Proactive Strategies Table C1 to C32 Nvivo Generated Thematic Analysis in Australia																																
Proactive Strategies	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31	C32	Average
Use of Digital Technology	20.9%	9.7%	21.8%	16.8%	0.0%	1.8%	0.0%	5.1%	3.9%	22.8%	8.2%	7.3%	9.9%	8.2%	16.4%	3.4%	1.7%	6.8%	10.7%	9.7%	15.8%	7.2%	32.4%	36.5%	0.0%	4.5%	1.7%	7.4%	15.4%	6.5%	7.2%	2.7%	10.1%
Increasing Visibility	6.6%	26.9%	2.1%	0.0%	19.1%	3.9%	0.0%	21.0%	5.1%	12.9%	6.0%	23.7%	7.3%	20.2%	0.0%	9.6%	16.6%	9.2%	2.0%	11.5%	10.9%	3.7%	0.0%	4.0%	2.3%	21.3%	9.0%	1.9%	1.8%	6.2%	6.5%	14.1%	8.9%
Increasing innovativeness	5.6%	0.0%	2.9%	20.6%	2.9%	21.4%	28.2%	3.8%	0.9%	10.4%	0.0%	0.8%	0.0%	0.0%	5.2%	6.7%	2.7%	2.1%	12.6%	3.6%	1.6%	8.9%	0.8%	4.7%	33.7%	2.7%	5.1%	2.1%	13.4%	1.9%	0.0%	5.2%	6.6%
Building logistics Capabilities	2.2%	0.0%	9.6%	3.0%	6.5%	1.8%	0.0%	0.0%	6.7%	2.4%	0.0%	3.4%	4.5%	10.6%	9.9%	4.1%	4.8%	5.8%	0.0%	9.6%	0.0%	0.0%	3.7%	0.0%	0.0%	0.8%	7.4%	8.9%	2.1%	2.7%	13.2%	2.0%	3.9%
Information Sharing/Collaboration	0.9%	1.5%	0.0%	0.0%	7.4%	3.9%	0.0%	10.7%	2.4%	5.7%	6.0%	5.5%	6.1%	10.4%	0.0%	4.0%	10.5%	3.5%	2.0%	9.9%	2.6%	3.7%	0.0%	0.5%	2.3%	13.3%	0.0%	1.1%	1.8%	0.0%	3.5%	4.8%	3.9%
Inventory management	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	6.0%	0.0%	13.5%	3.4%	4.3%	0.0%	4.6%	1.7%	5.3%	3.2%	4.4%	1.7%	10.9%	1.5%	4.8%	1.3%	0.0%	8.1%	1.8%	6.2%	0.0%	7.0%	0.0%	4.0%	3.0%
Chain Network structure-design	0.0%	0.0%	6.0%	1.2%	1.6%	0.0%	14.3%	1.1%	5.9%	0.0%	14.2%	2.3%	0.0%	1.2%	0.0%	0.0%	2.1%	0.0%	12.3%	0.0%	2.4%	4.3%	0.8%	1.2%	0.0%	4.1%	2.6%	5.6%	2.2%	0.0%	0.0%	1.4%	2.7%
Knowledge management	8.0%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	1.1%	6.6%	0.0%	0.0%	1.4%	6.3%	0.0%	7.3%	5.8%	0.0%	0.0%	0.0%	0.0%	0.0%	3.6%	0.0%	0.0%	0.0%	0.0%	7.4%	5.7%	0.0%	14.1%	2.6%	0.0%	2.2%
Creating appropriate contractual agreements	0.0%	0.0%	0.0%	0.0%	0.0%	8.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	3.5%	0.0%	1.6%	6.0%	8.4%	4.0%	0.0%	0.0%	1.8%	2.7%	0.0%	2.1%	0.0%	6.4%	0.0%	0.0%	8.3%	0.0%	0.0%	1.7%
Collaboration with GVT Pvt partnerships	0.0%	0.0%	0.0%	0.0%	2.9%	5.8%	0.0%	0.8%	2.9%	0.0%	0.0%	0.7%	2.5%	0.0%	0.0%	5.5%	2.0%	0.0%	0.0%	0.0%	0.0%	10.8%	2.6%	0.0%	0.6%	0.0%	0.0%	4.3%	3.8%	0.0%	3.7%	7.0%	1.7%
Building social capital and relational competences	0.0%	0.0%	2.0%	0.0%	2.7%	0.0%	0.0%	0.0%	2.5%	0.0%	0.0%	1.8%	4.5%	0.0%	8.0%	0.8%	0.0%	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	5.3%	6.3%	0.0%	0.0%	7.4%	1.0%	1.5%
Building security	1.2%	0.0%	2.6%	0.0%	1.5%	0.0%	0.0%	0.0%	3.4%	0.0%	5.1%	0.0%	0.9%	0.0%	0.0%	1.1%	0.0%	5.3%	0.0%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	2.0%	0.0%	4.4%	4.0%	1.2%	1.1%
Transparency	0.0%	13.3%	0.0%	0.0%	5.7%	0.0%	0.0%	4.1%	0.0%	1.9%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	1.0%
Creating a risk management culture	3.3%	0.0%	0.0%	0.0%	2.3%	0.0%	0.0%	0.4%	3.2%	0.0%	0.0%	1.4%	0.9%	0.0%	0.0%	0.8%	3.7%	0.0%	0.0%	0.0%	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	7.6%	0.0%	0.0%	0.0%	0.0%	0.6%	0.9%
Knowing Supply chain Vulnerabilities	1.1%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	2.1%	8.0%	0.0%	0.0%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.5%	0.0%	0.0%	0.0%	0.8%
Effective Communication	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	11.9%	0.6%	0.0%	0.0%	5.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%
Portfolio diversification	3.4%	0.0%	0.8%	4.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	2.2%	0.0%	4.9%	1.9%	0.0%	0.0%	0.8%
Due diligence	0.0%	12.1%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%	1.2%	0.0%	0.0%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.2%	0.7%
Appropriate Supplier selection procurement	0.0%	0.0%	0.0%	0.0%	1.8%	4.6%	0.0%	2.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	4.9%	2.9%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.7%
Supplier development	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%	1.5%	3.5%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Geographic location	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	3.6%	0.0%	0.2%
Co-opetition	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Business Certification	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%

Figure 5.2 shows the graphical presentation of strategies organised from highest to lowest frequency. As evidenced, the dominant strategies vary from the use of digital technologies (10.1%), increasing visibility (8.9%) and increasing innovativeness (6.6%) to the less dominant strategies such as transparency (1%). Subsequent analysis will focus on the strategies exceeding the 1% threshold in the development of the research framework.



Figure 5.2 Graphical presentation of proactive resilience strategies.

As previously highlighted, proactive practices refer to activities that build and enhance the ability to anticipate disruptions and defend against the risk before adverse consequences occur (Ocicka et al., 2022). During the COVID-19 pandemic, retailers adopted proactive strategies aimed at enhancing SCRE by systematically leveraging available resources. These strategies were in alignment with the preparedness and growth phases of SCRES, as discussed earlier. To ensure a consistent supply of goods, many retailers adopted more proactive approaches to procurement, planning, and advanced ordering. They took these measures to secure reliable supply sources in the face of severe supply constraints and significant supplier risks. In pursuit of resilience, organisations recognised the need to proactively prepare for potential disruptions and exceed their initial state through targeted performance enhancements. These strategies

included efforts by companies to enhance supply chain flexibility through redesigns of products, processes, and the supply chain network. Figures 5.2 and 5.3 depict results of the proactive strategies. For example, 91% respondents mentioned the use of information technology as a proactive strategy in their companies (Figure 5.2); and the respondents cited this 249 times (Figure 5.3).

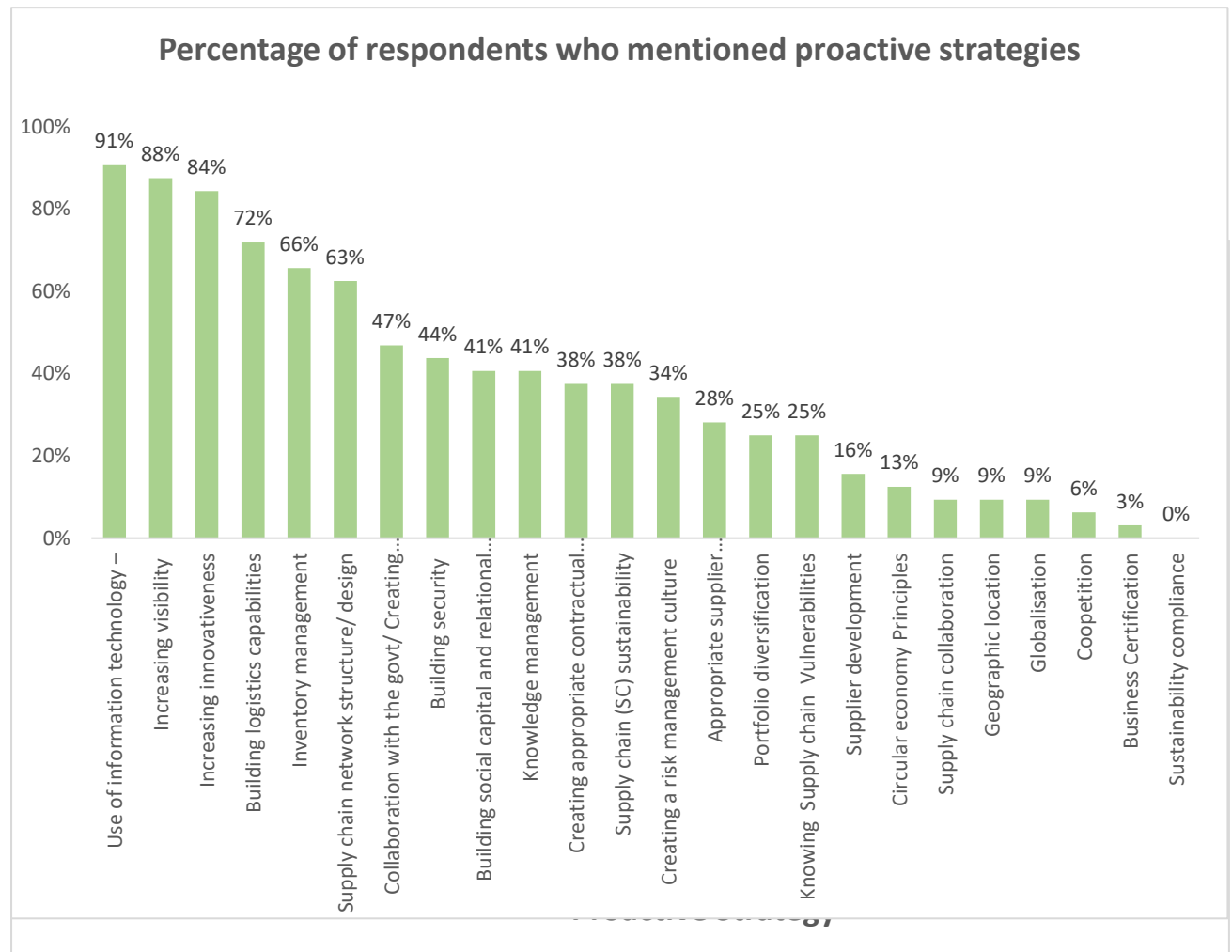


Figure 5.3 Total citations for each proactive strategy

It is important, therefore, that not majority of the proactive strategies were intensified during the pandemic and became reactive strategies to mitigate and adapt to the devastating effects of CPVID-19 pandemic.

5.2.5 Reactive strategies analysis

Table 5.2 illustrates the frequency of occurrence of various reactive resilience strategies employed to combat the crisis in general and the COVID-19 pandemic specifically. The numbers expressed in percentages show the frequencies of occurrence of these strategies

identified in the interviews during coding. For example, the frequency of occurrence of “Adaptability” stated by the interviewee C1 is 11.1% (Table 5.2). These frequencies are organised from highest to lowest order in the last “Average” column. The dominant strategies in the list have an average frequency above 1%, while those falling below an average of 1% are believed to have less effect during the COVID-19 period. It is worth mentioning that this cut off point at 1% does not mean that strategies below 1% have no value: rather, they appear to be less dominant depending on the crisis types. In total, 14 themes emerged from reactive strategies.

Table 5.2 Frequency of occurrence of reactive resilience strategies

Reactive Strategies Table C1 to C32 Nvivo Generated Thematic Analysis in Australia																																	
Themes																																	
Reactive Strategies	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31	C32	Average
Flexibility	12.4%	24.1%	3.0%	15.0%	10.1%	28.4%	42.5%	22.5%	17.0%	17.0%	25.5%	8.9%	9.8%	30.2%	17.7%	17.2%	12.9%	6.8%	22.2%	14.0%	16.4%	9.4%	7.3%	4.2%	34.4%	30.0%	27.1%	9.5%	21.4%	35.6%	16.2%	9.4%	18.1%
Adaptability	11.1%	25.1%	16.1%	16.8%	23.3%	18.1%	30.6%	13.7%	38.5%	20.4%	14.4%	11.8%	16.8%	13.0%	22.3%	12.2%	15.8%	21.1%	27.5%	5.2%	7.9%	28.1%	7.0%	13.8%	14.6%	16.8%	11.6%	24.2%	17.7%	14.1%	12.6%	22.7%	17.6%
SC Collaboration	6.4%	26.3%	11.0%	13.1%	17.7%	15.2%	13.1%	22.1%	5.3%	10.4%	9.2%	9.4%	14.9%	17.4%	22.0%	11.5%	15.9%	18.3%	18.6%	26.5%	1.5%	14.3%	18.6%	8.9%	23.6%	0.0%	4.3%	15.9%	25.9%	18.2%	13.6%	15.5%	14.5%
Visibility	17.4%	18.0%	8.7%	0.0%	21.5%	10.7%	0.0%	28.0%	10.3%	14.6%	11.6%	32.2%	26.3%	19.7%	10.7%	21.9%	15.7%	21.3%	1.5%	23.9%	8.6%	3.8%	6.8%	4.9%	4.1%	25.3%	19.0%	10.9%	6.7%	9.1%	17.9%	25.9%	14.3%
Use of Digital Technology	36.5%	6.5%	51.3%	23.0%	0.0%	1.5%	0.0%	6.4%	6.0%	16.9%	7.6%	16.6%	13.5%	6.7%	15.8%	8.7%	1.2%	9.7%	9.5%	16.5%	17.8%	7.4%	30.5%	55.0%	0.0%	9.2%	2.4%	13.1%	17.6%	7.2%	14.5%	10.2%	13.7%
Agility	5.7%	0.0%	4.3%	15.0%	15.0%	14.3%	13.9%	0.7%	13.3%	12.6%	6.4%	8.0%	9.2%	4.6%	0.0%	9.4%	15.8%	12.1%	4.9%	0.0%	6.8%	18.0%	2.3%	4.1%	6.9%	1.7%	3.1%	13.0%	3.0%	5.8%	5.5%	4.5%	7.5%
Demand management	4.9%	0.0%	3.3%	5.5%	3.6%	2.0%	0.0%	3.0%	2.3%	2.1%	7.8%	3.8%	2.0%	3.2%	5.4%	5.3%	11.4%	2.6%	3.3%	0.0%	22.1%	0.0%	12.6%	3.6%	1.9%	12.1%	14.5%	3.6%	0.0%	8.4%	0.0%	5.4%	4.9%
Diversification	3.9%	0.0%	0.0%	7.1%	4.6%	6.6%	0.0%	1.5%	3.2%	0.0%	1.9%	0.0%	3.3%	5.2%	0.0%	8.8%	3.0%	4.4%	6.4%	0.0%	7.6%	0.0%	2.1%	0.0%	11.8%	0.0%	3.4%	3.1%	2.6%	0.0%	0.0%	0.0%	2.8%
Contingency planning	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	1.5%	2.6%	6.6%	6.0%	0.0%	0.0%	3.5%	2.2%	3.9%	0.0%	6.0%	8.2%	0.0%	4.3%	5.7%	0.8%	2.7%	0.0%	1.7%	2.0%	0.0%	1.6%	10.5%	1.3%	2.3%
Building social capital & relational competences	0.0%	0.0%	0.0%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.0%	2.5%	0.0%	2.6%	0.0%	3.0%	3.1%	0.0%	0.0%	0.0%	4.5%	2.8%	4.6%	0.0%	1.9%	2.1%	2.6%	0.0%	0.0%	6.2%	0.0%	1.3%
Creating redundancy	1.1%	0.0%	0.0%	0.0%	1.4%	3.2%	0.0%	1.0%	0.0%	2.1%	9.1%	3.5%	0.0%	0.0%	0.0%	1.7%	0.0%	0.7%	0.0%	1.5%	7.6%	0.0%	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%
Contingency re-routing	0.0%	0.0%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.3%	3.7%	7.1%	0.0%	0.0%	0.0%	0.0%	4.1%	0.0%	0.0%	0.0%	0.0%	3.9%	0.9%
Suspension of operations	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	1.6%	0.0%	0.0%	0.0%	0.0%	3.1%	0.0%	0.0%	0.0%	2.9%	6.8%	0.0%	0.0%	0.0%	3.0%	1.4%	0.7%
Building logistics capabilities	0.8%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	5.2%	0.0%	0.0%	0.0%	0.3%

Figure 5.4 shows the graphical presentation of strategies organised from highest to lowest frequency. As evidenced, the dominant reactive strategies vary from the use of flexibility (18.1%), Adaptability (17.6%), Supply chain collaborations (14.5%) etc. to the less dominant strategies such as creating redundancy (1.2%). Subsequent analysis will focus on the strategies exceeding the 1% threshold in development of research framework.

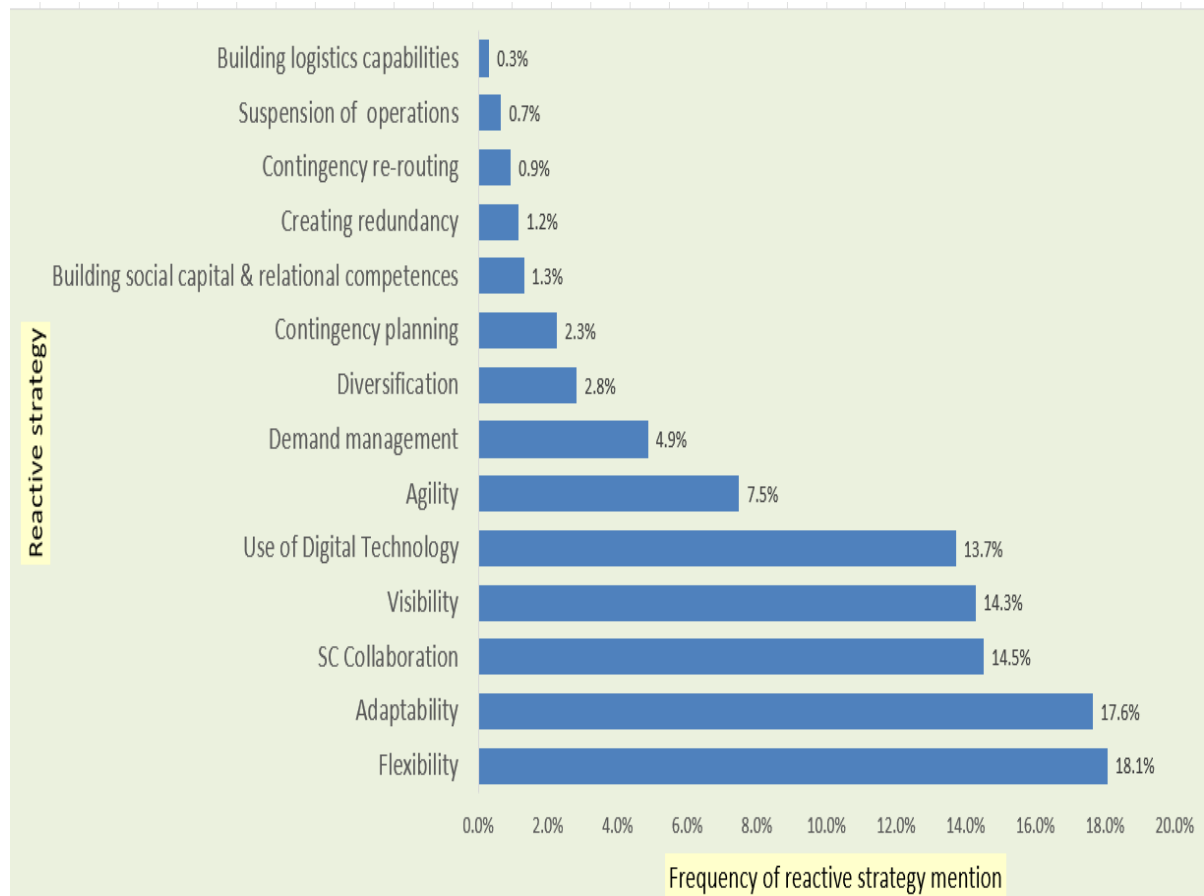


Figure 5.4 Graphical presentation of reactive resilience strategies

Reactive strategies were immediately implemented in response to the pandemic's challenges, focusing on exploiting available resources to maintain business continuity. These strategies, with their proven effectiveness, encompass a comprehensive array of practices and potential managerial interventions activated in response to disruptions, aimed at ensuring the uninterrupted continuation of business operations. In other words, reactive strategies are those in which a company takes action exclusively when a disruption occurs (Tomlin, 2006). As noted by Shao and Dong (2012), once a disruption transpires, these strategies become imperative to either partially or entirely mitigate the impact of the disruption. These reactive strategies, known for their effectiveness, encompass practices and managerial actions deployed during disruptions to ensure the uninterrupted flow of operations. In response to the challenges

posed by the COVID-19 pandemic, reactive-reliant SCRE strategies rooted in resource exploitation were implemented. This approach came into play during the COVID-19 outbreak, and its future nature can be described as “on-demand”. It strongly emphasises harnessing internal supply chain resources that can be swiftly mobilised. Within the framework of SCRE, reactive practices are closely linked with the response and recovery phases. The essence of these strategies revolves around taking corrective actions in response to disruptions, employing solutions that go beyond the inherent resources of the supply chain.

Figures 5.5 and 5.6 depict results of the reactive strategies. For example, 97% of respondents mentioned the use of supply chain collaboration as a reactive strategy in their companies; and the respondents cited this 206 times (Figure 5.7).

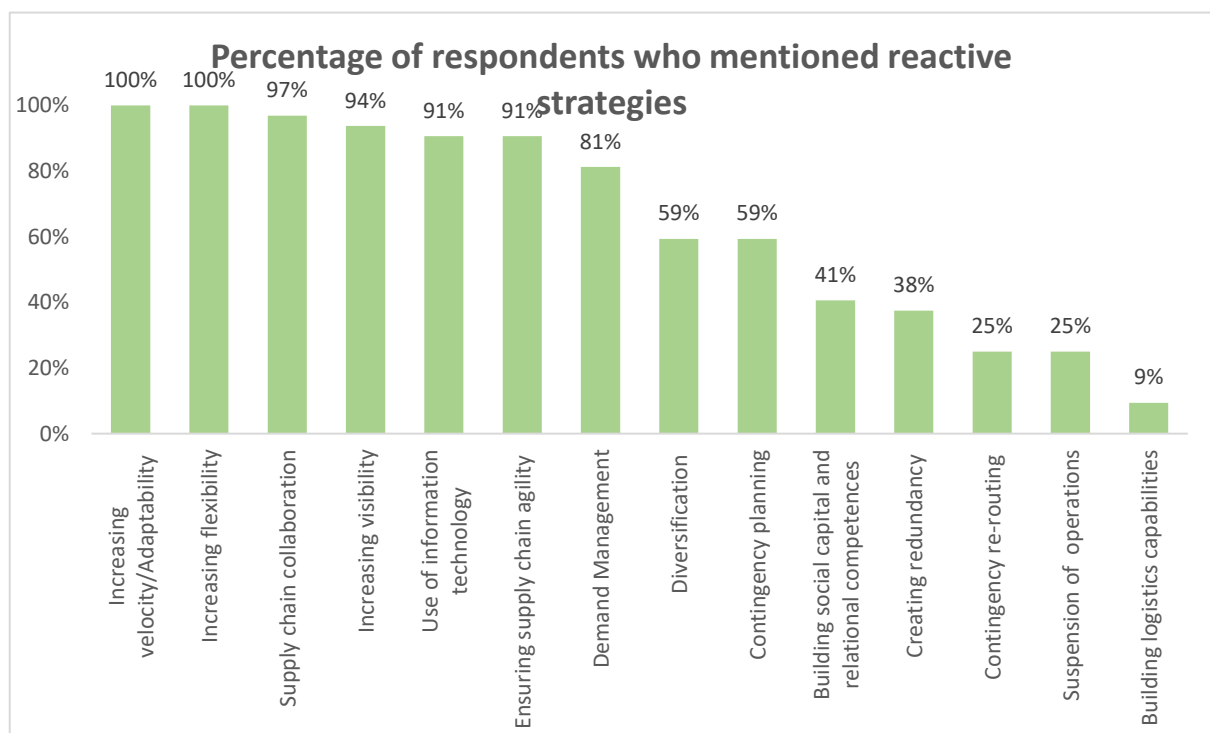


Figure 5.5 Percentage of respondents who mentioned reactive strategies.

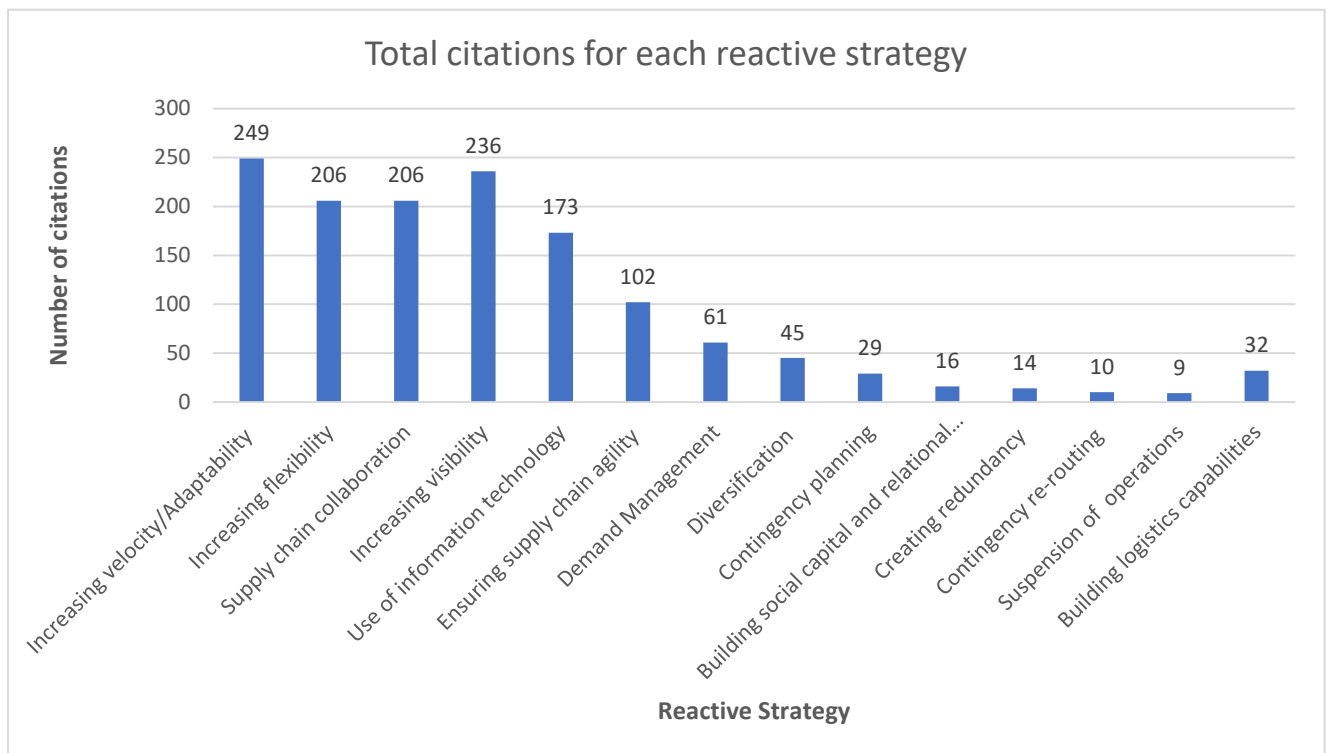


Figure 5.6 Total citations for each reactive strategy

The combination of both proactive and reactive strategies was grouped for hybrid strategies that are discussed in detail below. The analysis of the interviews showed and demonstrated a strong correlation between proactive and reactive strategies in recovery efforts. As for the proactive strategy—such as preparedness, risk mitigation, and resource planning—establishing a robust foundation enhances the effectiveness of reactive strategies during disruptions. Risk management, a key component of proactive strategies, plays a crucial role in decision-making and provides a sense of security about the chosen path. For instance, implementing proactive measures like building supply chain flexibility and incorporating redundancies can significantly reduce the severity and impact of disruptions. This reduction enables reactive strategies, such as rapid response and recovery efforts, to be executed more efficiently and effectively. Essentially, proactive strategies mitigate risks and provide the structural support and resources necessary for reactive measures to address challenges with greater precision and speed. According to Ever Stream Analytics (2024), "Carefully planned supply chain risk management strategies are helping leading organizations move away from the reactive model of the past... Instead, they are developing processes and capabilities to manage risks and disruptive events proactively as part of day-to-day operations." This interconnectedness underscores the importance of integrating both approaches for a comprehensive recovery strategy.

5.2.6 Hybrid strategies approach analysis

The research question (RQ1) investigates why some companies adapt well to the devastating effects of supply chain disruptions while others do not. The findings of this study revealed that organisations that adopted proactive risk assessment and mitigation strategies before the COVID-19 pandemic were better positioned to navigate uncertainties and secure their supply chain operations. However, it was established that a combination of both proactive and reactive strategies (i.e., hybrid strategies) was essential for recovery. This aligns with the suggestions of Wade and Bjerkan (2020) who noted that organisational responsiveness to COVID-19 has been largely reactive out of short-term necessity. They proposed a decision tree to help executives more proactively and strategically consider their potential responses to the COVID-19 crisis as shown in Figure 5.7.

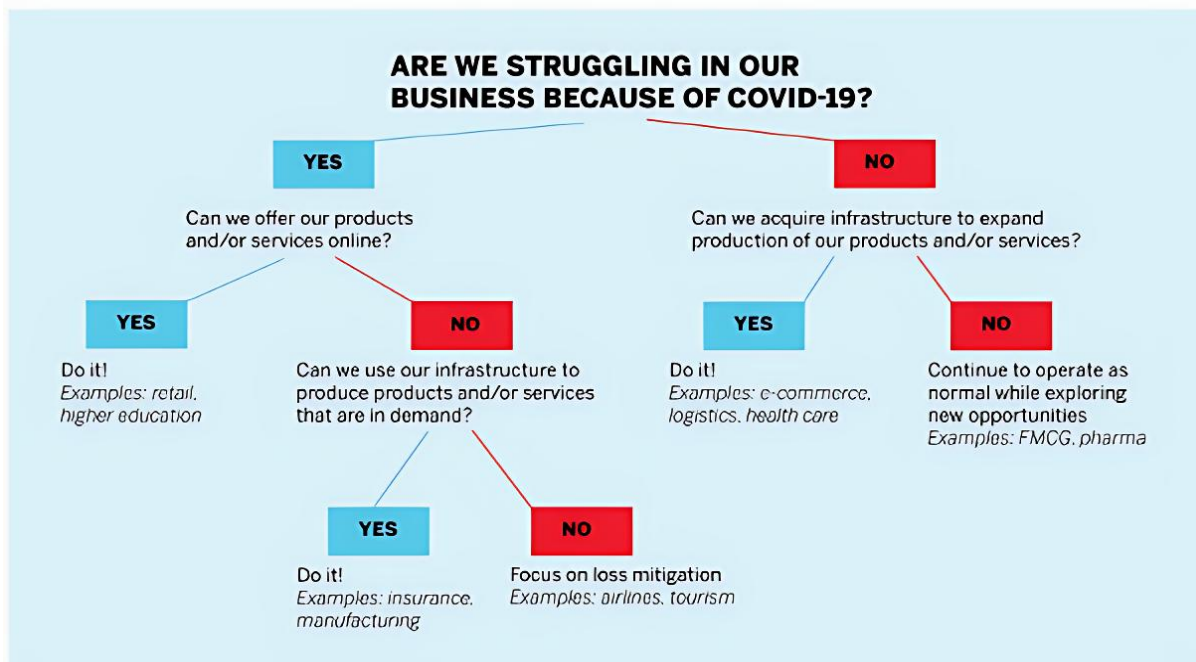


Figure 5.7 Decision tree to continue business as normal (Wade & Bjerkan, 2020)

The above findings suggest alternative strategies that retailers might adopt. For example, retailers can consider offering products or services through online channels, utilising existing infrastructure to produce in demand products or services, or increasing their capacity to produce and distribute these products and services. Responding strategically to the current crisis requires a high degree of creativity, openness to challenging assumptions, and a willingness to look beyond the obvious in addressing the threats and embracing the new opportunities created by the pandemic. A combination of both proactive and reactive strategies to create a hybrid of strategies to combat COVID-19 pandemic is the most effective approach. Table 5.3 outlines all those themes as hybrid strategies (themes) with their definition, sub-themes and supporting quotes derived from the interviews. Each sub-theme is supported by the corresponding interviewees number in brackets.

Table 5.3 Hybrid strategies emerged from thematic analysis.

No.	Hybrid Strategies (Dominant Proactive and Reactive)	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
1	Increasing innovativeness	A service innovation can be viewed as “a new process or offering that is put into practice and is adopted by and creates value for one or more stakeholders” (Gustafsson et al., 2020, p. 114). <i>Pilawa (2022); Beckers et al. (2021); Gustafsson et al. (2020).</i>	<ul style="list-style-type: none"> • Implementation of service innovations, incremental(C16) • Making operational adjustments (C12, C13, C14) • Integration between channels (C18, C22, C21) • Adopting new consumer behaviours preferences and market conditions (C21, C12) • Created new ways and changes for Customer Engagement (C11, C1, 12) • Addressed changing customer needs and introduced substitute products (C1, C32, C21, C22, C14) 	<p><i>“For example, to address the disruption in healthcare supply chains and services, one global pharmaceutical company partnered with a start-up to create a home delivery system for patients with heart disease”. (C11)</i></p> <p><i>“We worked in a room all together, an open room. Every single update was shared immediately in live time. We were very quick to be able to react to everything. It was communication. It was technology. It was innovation” (C16).</i></p> <p><i>“So, we’ve developed our product called Express, which is basically a very simple WMS that you can drop in 30 days. So, you can get that and that becomes a product” (C1).</i></p>
2	Building Logistics capabilities	Capabilities for supply and information flows, e.g., to reduce cycle times, increase delivery competence, knowledge management and customer service to quickly recover from a disruption. <i>Aslam et al., (2020); Blom T (2022); Ponomarov & Holcomb (2009); Khuan and Shee (2023)</i>	<ul style="list-style-type: none"> • Setting up access to transportation (C29, C12) • Developing multiple routes and distribution channels (C10, C26) • Ensuring availability of scalable logistics resources in place, e.g., transportation capacity, and warehouses (C10, C27) • Intensified security measures to reduce theft and infiltration (C25, C20) • Put measures to minimising losses and disruptions (C12, C15) 	<p><i>“We became a fulfilment centre. So, we can order it from a consumer into a completely 100 per cent operated fulfilment centre. So, anyone working in non-logistical roles in our organisation started working in logistics”. (C26)</i></p> <p><i>“So, we already developed a very strong online presence. We also developed a few stores to have the capability to take work and pick directly from store. So especially when it was initially done for regions like Darwin, Tasmania, and Cairns, remote we’d call them local”. (C27)</i></p>

No.	Hybrid Strategies (Dominant Proactive and Reactive)	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
3	Inventory management	<p>The inventory management system is a core component of an efficient and effective supply chain. It is ‘the part of supply chain management that plans, implements, and controls the efficient, effective, forward, and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption to meet customer’s requirements.</p> <p><i>Verma and Gustafsson (2020), Verma (2018, p. 3867), Chowdhury (2020), Tang and Zimmerman (2020)</i></p>	<ul style="list-style-type: none"> Balancing demand and supply to meet customer requirements (C23, C11, C12, C13, C14, C15, C16, C30, C17) Buffer stock creation to ensure a sufficient inventory reserve capable of meeting unexpected spikes in demand. (C26) Focus on placing inventories closer to end consumers, reducing lead times, and improving responsiveness to local market demands. (C1, C10, C11) Reserving safety stock to meet normal demand and further support the variability (C1, C11) Implemented alternative stock ordering and storing. (C23) Lead times increased, excess inventory due to order cancellation or reduced order. (C9) 	<p><i>“So, there are ward drugs available anytime and drugs issued per patient. Wholesalers restock ward drugs daily, using warehouse stock, while we maintain a buffer in case of shortages and adjust levels for potential issues (C11).</i></p> <p><i>“I mean in terms of inventory—because our goal is to make sure that we have enough stock for our customers to sell. So, one of the things that we did even before the pandemic was that we need to make sure that we have 16 weeks’ worth of stock with us”. (C26)</i></p>
4	SC Network structuring and redesign	<p>Constructing the supply chain network for resilience, e.g., balancing redundancy, efficiency, vulnerabilities.</p> <p><i>Novak and Loy, (2020); Rajesh, Ravi, and Venkata Rao (2014)</i></p>	<ul style="list-style-type: none"> Relocating SC sectors, e.g., localising, nearshoring, and diversifying suppliers, and other SC tiers e.g., relocating strategic manufacturing operations out of China (C2, C14, C19, C21). Centralising distribution (C12). Restructuring supply chains according to demand patterns, product value and regional locations 	<p><i>“I’m a big advocate for that online automation solutions to issues and visibility are a huge one in our transport network, and look, we’re not there at the moment, but that’s where we’re heading. One of the things we have been doing for us is we’re looking to get all the planning teams together into a centralised location” (C12).</i></p> <p><i>“The saying is, never waste a crisis. So, from this period, we’ve been able to resize our workforce, get more from less in terms of the productivity levels of our people” (C19).</i></p>

No.	Hybrid Strategies (Dominant Proactive and Reactive)	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
			<ul style="list-style-type: none"> • Diversification of SC at all stages (C3 C14). • Introduce multiple suppliers. • Segmentation of the SC- separation products with different risk characteristics. • Regionalising supply chain (C22, C14). • Introducing many suppliers, manufacturers, and warehouses located in diverse geographical regions (C22, C30, C32). • Reconfigure the supply chain structure: shortening the supply chain to ensure that products are close to where they are needed, moving inventories closer to consumers (C22 C23). 	<p><i>“So, some sites were already operating two shifts, but we had a couple of sites that were only operating one shift. So, we split them and put them on two shifts” (C22).</i></p>
5	Knowledge management	<p>Developing knowledge and understanding of supply chain structures (i.e., physical, and informational), and the ability to learn from changes as well as educate other entities.</p> <p><i>Shashi, et al (2020); Parast et al (2020).</i></p>	<ul style="list-style-type: none"> • Gathering data through formal group discussion and brainstorming with key, members to identify errors. (C9, C13, C22, C23) • Use of project management documentation tools and templates. (C22, C26.C31) • Implementing education and formal training (C11, C16, C18) • Third-Party Logistic companies utilised TMS to update their customers. 	<p><i>“I think that the key things that have been done and that we could do at the time were creating those community of practices to make sure that there were good communications and understanding about the opportunities and the situation and how we could navigate around that” (C9).</i></p> <p><i>“So, I think the companies that will succeed moving forward are the companies that recognise that supply chain resilience and a strong strategy and supply chain is the cornerstone of the overall business strategy. My new CEO in my new business said to me last week—our supply chain strategy is the cornerstone of my business strategy”. (C15)</i></p>

No.	Hybrid Strategies (Dominant Proactive and Reactive)	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
6	Creating appropriate contractual agreement	<p>Long-term and short-term contracts that can enable flexibility in supply to minimise shortages.</p> <p><i>Chowdhury et al (2020). Thompson (2021).</i></p>	<ul style="list-style-type: none"> redrafting and changing Operational procedures (C12, C13, C14, C16, C27) making changes to the service level agreement (C15, C16, C17, C23) making changes to the delivery contracts (C18, C19, C22, C25) centralising outsourcing contracts to improve delivery lead times and reliability of services. (C23) 	<p><i>"If we sign a new contract with someone and we don't tell the wholesaler that we've got a new contract signed with them or we're suddenly going to change to this, then we get into a bit of trouble because the wholesaler hasn't purchased enough for the fact that we're going to increase our usage of it" (C23).</i></p> <p><i>"So, "We have local contracts for some specialist drugs... sometimes from one pharmaceutical company, you might get a discount on another product... We also have niche contracts with specialist suppliers... and several special access scheme suppliers, where a drug is not licensed by the Therapeutic Goods" (C11).</i></p>
7	Collaborating with Government Partnership	<p>Trust between citizens and their governmental agencies is essential to alleviate the negative impacts of COVID-19 on society (including transportation networks and SCs).</p> <p><i>Moosavi et al., (2021); Urciuoli et al. (2014); Yang & Xu (2015); Gabler, Richey (2017);</i></p>	<ul style="list-style-type: none"> Government (GVT) implementation and declaration of business-friendly policies (C1, C32) Following and trusting government authorities' recommendations (C5, C28) Reciprocal trust between the government and its citizens (C16) Effective utilisation of GVT relaxation of taxes and obligations(C32) Government provided financial support to those who applied and requested. (C28, C16) Through partnership—effective utilisation of state facilities (C16, C32) Government allowed temporary visas for other nationality drivers to help fill driver gaps (C28) 	<p><i>"There needs to be more emphasis on local procurement. That emphasis needs to be shown through government policies. That needs to be incentivised to the local manufacturers to be able to compete with overseas because we know China is always going to come at us on a price notion" (C16)</i></p> <p><i>"So, if South Australia went into a lockdown and we had to close the stores, he took control and led the communications in everything to do with COVID-19. As far as adhering—if it wasn't clear the job was to contact the government and find it out and then give us instructions. So that was—anything to do with COVID, he was the lead person" (C28).</i></p>

No.	Hybrid Strategies (Dominant Proactive and Reactive)	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
8	Building Security	These are measures to protect the supply chain against deliberate disruptions, e.g., theft, terrorism, and the infiltration of counterfeits. <i>Aslam et al. (2020); Pettit et al. (2010); Urciuoli (2010).</i>	<ul style="list-style-type: none"> • Protection of the SC (e.g., cyber security (C11, C13, C16). • Reduction of theft or infiltration; Security gadgets, Data Integration (C16, C18). • Insure against various risks because of uncertainties, building security was to protect against any disruption (C20). • Improved security systems (C20, C26 C31). 	<p><i>" Yeah, I think—and we've spent a lot of time as a company in the last three to four months revisiting all our risk strategies, taking all the learnings from COVID and building—and again building another risk—refreshing our risk framework and then understanding what our mitigation plans are and then constantly managing that" (C28).</i></p> <p><i>"And we had to look at all sorts of things like firstly, vaccines that we might have on site that other people might want. So, we had to worry about security, had to worry about security of our staff. It's quite interesting going through those whole risk analysis" (C31).</i></p>
9	Transparency	A corollary of efficiency is the ability to demonstrate transparency in the supply chain for both internal and external stakeholders including consumers. <i>Leigh (2010); Evans et al. (2009).</i>	<ul style="list-style-type: none"> • Transparency relating to understanding the required level of inventory and costs of production. (C1, C16, C18) • Reporting and having accurate inventory data. (C2) • Development of trust relating to consequences of collaborative working practice. (C14) • Utilising technology and social media sharing information and Communication to enhance transparency (C1, C13, C18)) • Building trust and transparency to enhance visibility. (C1) • Adopted Radiofrequency Identification (RFID)to make supply chains more transparent (C2) 	<p><i>Tell me when that arrives... They get a notification as soon as it's booked in. Technology enables real-time updates, including access to the latest specifications via the portal. Changes are visible instantly" (C13).</i></p> <p><i>"Yeah. I think we've been well served by how proactive and how much we've made sure that everything is clear to all parties. So, we never withhold information". (C18).</i></p> <p><i>"Transparency is the key. And, with things like our values that we actually do take seriously, they're not just a logo on a website somewhere that nobody's ever read. We do take things like keeping promises and a deal is a deal of all those things are things that we actually live by. So, we've made it our central aim is to always make sure that those things are adhered to and that we do complete all our obligations to customers" (C18).</i></p> <p><i>"I think in terms of supply chains, what we saw mostly the large supermarkets doing was saying very clearly and very transparently" (C2).</i></p>
10	Increased Visibility	Visibility refers to the transparency of an organisation's supply chain; it	<ul style="list-style-type: none"> • Knowing what goods movement are taking place, maintaining 	<p><i>"And the visibility part is exactly that, if you are not in touch with the trends of what's happening, it's going to be too late</i></p>

No.	Hybrid Strategies (Dominant Proactive and Reactive)	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
		<p>requires an end-to-end view of the entire supply chain and its operating assets.</p> <p><i>Ponomarov and Holcomb (2009); Pettit et al. (2010); Tukamuhabwa et al. (2015); Negri et al. (2021)</i></p>	<p>continuous updates. (C1, C14, C15, C5, C26).</p> <ul style="list-style-type: none"> Invested in tracking movements technology, e.g., RFID. Giving customers a clearer picture through increased visibility (C17, C18). Retailers introduced a transport management system (TMS) to keep a grip on logistics supply chain (C14, C15, C18). Others particularly 3PL companies utilised TMS applications and used it to update their customers. Visibility increased control and flexibility when it comes to goods movements (C20, C28). Effective sharing of information and communication (C8). 	<p><i>for you” (C1)</i></p> <p><i>“There are two things that helped a fair bit. One of them is we’ve had reasonably good visibility of our DIFOT (delivery in full and on time) and availability and short supplies out into “our market for a while through some reporting and quite a complicated spreadsheet produced by our peak body” (C17)</i></p> <p><i>“A company must map its suppliers by tier to have an end-to-end view of the supply chain and identify vulnerabilities and vital to have a clear understanding of exposures beyond supply. We developed our metrics that will tell you what’s happening and without that visibility, you are blind and therefore—enhanced visibility is key to future supply chain success” (C1)</i></p> <p><i>“So, communication was our biggest strategy. Keeping people communicated, informed, and very quickly” (C5).</i></p> <p><i>We have good visibility with freight forwarders, tracking milestones to know container locations in real-time. This integration allows limited prioritization of freight, ensuring critical items move faster. The system was in place beforehand and has held up well” (C27).</i></p>
11	Use of Digital Technology	<p>Digital transformation: A process that aims to improve supply chain activities by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies</p> <p>Information technology enhances connectivity and supports other resilience strategies, e.g., visibility</p>	<ul style="list-style-type: none"> Retailers adopted technology to access near real-time data (C15, C16, C6, C8) Utilised technology to collaborate with partners (C2, C14, C16, C23) Invested in technologies such as analytics and AI to inform demand forecasting (C16, C7, C8) Utilised enhanced technology communication tools to boost 	<p><i>“Investments in technology and automation in distribution centres are now at the forefront of most chief supply chain officers’ agendas” (C31).</i></p> <p><i>“We can no longer rely on retrospective sort of reporting and so forth like that. Without the data and the technology, you cannot be proactive. You cannot have a proactive approach. You’re always having a reactive approach” (C30).</i></p>

No.	Hybrid Strategies (Dominant Proactive and Reactive)	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
		and collaboration, Use of AI, Data analytics ((Vial, 2019:) <i>Sarkis (2020), Burgos & Ivanov (2021); Moosavi et al. (2021); Nguyen et al. (2021), Khuan et al., (2023);</i>	fulfilment to quicker, cost-effective last mile deliveries (C1, C3, 5, C6, C7, C21, C22, C28, C31) <ul style="list-style-type: none"> Adopted IoT technology fulfil inventory stock requirements (C1, C4, C15, C17, C18, C21, C30, C31) 	<i>(C1) There are two key technologies: analytics, like MicroStrategy for data presentation, and integration. During the pandemic, integration bypassed ERP, giving customers direct access to inventory to ensure order fulfilment” (C1).</i>

No.	Hybrid Dominant Strategies Main Themes	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
12	SC Collaboration	Collaboration in supply chain management is defined as a long-term relationship between supply chain partners to gain mutual benefits (Banchuen et al., 2017; Chen et al., 2017; Panahifar et al., 2018). (Niemann & Meyer, 2020). <i>Ponomarov and Holcomb (2009) (Niemann W & Meyer A, 2020) (de Sousa Jabbour et al., 2020) Shekarian, M (2018).</i>	<ul style="list-style-type: none"> Collaborate with stakeholders (C11, C1, C5, C15, C14, C28), adopting collaborative communication, timely information sharing, knowledge, and resources (C12, C17, C20, C2). Built strategic relationships and collaborated with all key partners at different tiers (C10, C12, C14, C21, C23). Collaboration between manufacturers and suppliers to overcome the challenges of the HGV driver shortage (C11, C32). Planning and executing SC operations towards common goal (C1). Establish ecosystem partnerships organising (C14, C11). 	<p><i>“Well, what helped is the close relationship that we have with the key stakeholders. In other words, the senior clinicians. So, because we have an ongoing close relationship with all the specialists in the area, the anaesthetists, and the intensivists, which means that we can quickly make an informed decision. So, the quickest thing is to simply go up and say, ‘Look, we can’t get this. What is the best option?’ So, it is that strong and multidisciplinary partnership that we have (C11).</i></p> <p><i>“We have a good relationship with company personnel and as well as distributors—Relation is key to solve any problem”(C14).</i></p> <p><i>“What that was able to do for us was establish relationships with Chinese nationals that allowed us, in March, when the roles reversed in Australia, we were one of very few in the country who could actually procure stock very, very quickly from China when there was a huge surge in demand” (C6)</i></p> <p><i>A new system was implemented to enhance visibility, supported by a global solution provider whose expertise and global reach were invaluable during COVID-19. While challenges arose, the provider collaborated effectively, leveraging their domain knowledge and influence to address shared problems and achieve solutions together internationally (C28).</i></p>

No.	Hybrid Dominant Strategies Main Themes	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
			<ul style="list-style-type: none"> Renegotiation of supplier contracts in relation to volume, price, and payments that helpful to increase supplier production (C13, C17). Cross sector Collaborative communication, and goal alignment (C28, C13). Sharing Information (C1, C2, C3, C4, C5). 	<p><i>“And people forget the supply chain is a supply chain. It is all interconnected. And if you don’t have the ability to understand what’s happening in other parts, you’re going to be very siloed (and you’re going to hit a problem that suddenly, you’re too late to respond to(C1)</i></p> <p><i>“I can have certain people that I can just know that’s the only person I need to ask or talk about that requirement. They can get onto their colleagues in England tonight or the US overnight or wherever it’s going to happen, because I have that established relationship” (C13).</i></p>
13	Increased Flexibility	<p>Flexibility refers to the ability of a firm to flexibly respond to long-term or fundamental changes in the supply chain and market environment by adjusting the configuration of the supply chain and can be achieved by having multiple interchangeable resources.</p> <p><i>Ponomarov and Holcomb (2009); Pettit et al. (2010) Tukamuhabwa et al. (2015:) Magableh (2021).</i></p>	<ul style="list-style-type: none"> Predefining people’s job responsibilities (C10, C11). Enforcing supplier flexibility and having alternatives/ sources. Localising supply chains (C1, C12, C13). Underutilised resources transferred across a variety of products (C12, C13, C16, C27). Modified sourcing tactics and scaling service operations (C12, C23, C18). Operation of business from home (C8, C16C13 C16). Adopted flexible arrangements their logistical and supply chain activities (C16, C25, C27, C28). Introduced operational flexibility (C11). Implementation of virtual marketplace practices for 	<p><i>“We run our facilities at high-capacity levels. And being in the middle of the supply chain and dealing with major retailers and suppliers, we are a bit like the tail being wagged with dog is that we have very little upfront visibility of what stops coming our way, what promotions are going on at the customer, what quantities of stock are going to arrive beyond the next week’s horizon. So, we must be responsive” (C11).</i></p> <p><i>“There are two things that helped a fair bit. One of them is we’ve had reasonably good visibility of our DIFOT (delivery in full and on time) and availability and short supplies out into our market for a while through some reporting and quite a complicated spreadsheet produced by our peak body” (C17).</i></p> <p><i>“Survival strategy including launching an all -in transformation was one-way firms could break the COVID-19 Exit while accepting that COVID-19 has changed many things for all of us, and the full potential of our organisation as well. One significant strategy that appeared to have worked well is flexibility”. (C13)</i></p> <p><i>“What they did is they reorganised physically, stock, and they separated what was COVID stock and what wasn’t COVID stock, and they redefined peoples’ jobs in the procurement department where they allocated a specific number of people to look at just the</i></p>

No.	Hybrid Dominant Strategies Main Themes	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
			<p>online engagement with customersC27).</p> <ul style="list-style-type: none"> Developed a flexible logistic network and opt for alternative routes (C30, C27, C28). Intensified strong degree of partnership working (C32, C4). 	<p><i>COVID drugs. So yes, that shows flexibility, and then of course, once that subsided, they went back to their normal things. So, they reorganised the way we handle medication” (C11).</i></p>
14	Adaptability	<p>Adaptability is defined is the capacity of a company to modify its resources in response to long-term variations is known as adaptability (Feizabadi et al., (2019); Tuominen et al. 2004). Adaptability involves the creation and development of new structures, processes, and capabilities that enable stakeholders to maintain or enhance their strengths in response to specific situations they encounter.</p> <p><i>Feizabadi et al. (2019); Tuominen et al. (2004).</i></p>	<ul style="list-style-type: none"> Companies resetting their risk management plans (C15). Agility and alignment (C12). Firm innovativeness (C16, C18, C20, C22). Staff hard work, working extra hours (C24). Adapting to new ways of working (C12, C15.C17, C22, C30). Making supply chain restructure changes (C31). Integrated supply chain structure that provided high level of digitisation (C20, C22). Maintaining continuous updates. (C17, C18). Third-party logistic companies utilised TMS applications to update their customers (C23, C24, C18). 	<p><i>“The only way out is to make sure that you’ve got the capability within your business or your organisation or your value chain to adapt to rapidly changing unforeseen circumstances that’s the new capability that businesses will need, I think” (C2).</i></p>

No.	Hybrid Dominant Strategies Main Themes	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
15	Agility	<p>Agility relates to the ability of an organisation's supply chain to respond quickly to unforeseen events that result in changes to demand and/or supply. Can also be defined as an organisation's capacity to rapidly adapt its tactics and operations, either proactively or reactively, as articulated by (Gligor & Holcomb, 2012)</p> <p><i>Ponomarov and Holcomb (2009); Pettit et al. (2010:4); Tukamuhabwa et al. (2015) Vermeulen al. (2019).</i></p>	<ul style="list-style-type: none"> • Monitoring flow of material and information across a supply chain to ensure that procurement production, delivery schedules are met (C9, C15, C18, C20). • Adopting faster/quicker decision-making (C16). • Technological integration (C1, C32, C15). • Close partner engagement (C27, C18, C14). • Collaborative planning and forecasting through creating (C29). • End-to-end time taken to delivering products and services through velocity (C29, C30, C15). • Reduction of batch sizes, versatile workers, trace, and track delivery of orders, (C29). • Adopted and utilised digital technologies such as sensors, barcodes collaborative portals that enabled, agility, visibility, and velocity (C24, C27, C13). • Retailer shifted to online services and omni channel and adopted interior solution to the pandemic effects (C30). 	<p><i>"There's a new normal and that new normal is you need to be innovative; you need to be nimble; you need to be agile; you need to be online" C16.</i></p> <p><i>"I think probably the key one is not so much what we do differently, but the learning probably is how do we take the agileness of what we've just been going through and make that just normal business as opposed to, I think historically we wouldn't have been as agile as we are now" (C29).</i></p> <p><i>"That's one thing that Woolworths and Kohl's did well. They enhanced all their channels, not just their physical selling channel but the online selling channel to ensure that the goods were fulfilled". (C24)</i></p>

No.	Hybrid Dominant Strategies Main Themes	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
16	Demand management	<p>Developing knowledge and understanding of supply chain structures (i.e., physical, and informational), and the ability to learn from changes as well as educate other entities</p> <p><i>Ponis & Koronis (2012); Scholten et al. (2014); Shashi et al (2020) Sabahi, Parast et al (2020)</i></p>	<ul style="list-style-type: none"> Balancing demand and supply to meet customer requirements (C23, C11, C12, C13, C14, C15, C16, C30, C17). Stocked critical products., safety stock or low-capacity utilisation (C5, C8, C14, C15). Fluctuation in demand vs supply (C8, C10). Promoting and selling products that are available on the shelves of retailers. Implementation of buffer stock (C26). Focus on placing inventories closer to end consumers (C32), reducing lead times, and improving responsiveness to local market demands. (C1, C10, C11). Other firms started executing reduced inventory levels due to low demand (C10). Reserving safety stock to meet normal demand and further support the variability (C1, C11). Fluctuation in demand vs supply (C8, C10). Lead times increased (C9). 	<p><i>“So, we created a predictive algorithm that basically looked at the last x number of days usage and so we just chose some sort of broad range - so we looked at the last three, seven, 14-, 28- and 60-days usage and had the report flagged to us any that would get into trouble based on our current stock holdings and how much we could reorder and so forth” (C23).</i></p> <p><i>“So, we had to apply some logic to yeah, let’s get some limits put on the stock that’s going out. So, the stock control team analysed what products were going out quickly and that was pasta and flour etc”. (C15)</i></p> <p><i>“So, it’s not down to me to ensure that we have sufficient safety stock of each product. I just must make sure that what comes into the buildings is effectively stored and effectively processed to get it out to satisfy orders”. (C10)</i></p> <p><i>“We are ahead of keeping of our inventory. So obviously we had everything in plan but something - like the demand skyrocketed sometimes on certain items”. (C27)</i></p> <p><i>“Certainly, they did set up something whereby for critical drugs we are now able to see the stock levels of certain things state-wide across all the hospital network, which was never there before”. (C30)</i></p> <p><i>“Our goal is to make sure that we have enough stock for our customers to sell. So, one of the things that we did even before the pandemic was that we need to make sure that we have 16 weeks’ worth of stock with us”C26)</i></p> <p><i>“So, the idea is that they use the stock from the warehouse somewhere else. But we keep our own buffer because what if they run out? So, there is a buffer. Yes, there’s a buffer within and, we have a buffer if we know there’s going to be a potential problem, we’ll also increase stock levels. So yes, we have a buffer” (C11).</i></p>

No.	Hybrid Dominant Strategies Main Themes	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
17	Diversification	<p>The access to a wider supply base enables firms to inject in supply chains additional production lines and quickly shift volumes and production in case of disruption</p> <p><i>Sharma et al, (2020) Zhu, et al (2020) Magableh (2021).</i></p>	<ul style="list-style-type: none"> • Working closely with current suppliers and diversifying suppliers (C20, C1, C14, C20). • Spreading risks across multiple sources and geographic regions. • Increased their range of offerings to customers (C15). • Sourced multiple suppliers instead of relying on a few e.g., China (C11, C12, C25). • Conversion of existing face-to-face services to e-services (C25, C26, C19, C28). • Design and development of new e-services. • Introduction of e-commerce facilities (C1, C20). • Developing new alternative/supplier, multiple (C10) suppliers/multiple manufacturers and warehouses located in different regions (C12). 	<p><i>“We have diversified, and we have partnered with other suppliers that do other products in the healthcare that is ongoing so that we can, obviously, nurture our business portfolio and create other contracts and other products that are for the longevity” (C12).</i></p> <p><i>“Organisations have realised the risk of relying on a single supplier or a single geography. The production of many products is concentrated in one country—sometimes in one city or one organisation—and that makes supply chains extremely vulnerable. (C18)</i></p> <p><i>“I know of companies that went broke because they could not get stuff into Australia. They had to shut their doors. They shut everything and ran out of, and they lay people off, they basically ended up closing the business down because the whole supply chain was based out of China” (C10)</i></p>
18	Contingency planning/Re-routing	<p>Business continuity is the planning of giving the organisation the ability to deal with and recover from any unexpected event</p> <p><i>Bastas (2022); Ivanov, (2020).</i></p>	<ul style="list-style-type: none"> • Having alternatives in place in case of problem (C22). • Keeping customers updated to increase visibility (C10, C5, C15, C16). • Having cash buffer as contingency (C19, C17 C24). • Refreshing risk framework and then understanding what 	<p><i>“If we had a to have been sourcing a lot of our finished goods from overseas, I think we would have been in a lot more trouble just with all the international shipping issues that have been going on. So, we’re very lucky that we have domestic manufacturing. That’s really helped”. (C22)</i></p> <p><i>“So, we already had initiatives in place to receive electronic information in of what shipments were heading our way, provide electronic information on orders that we ship out to customers with the normal track and trace capability of seeing where shipments are</i></p>

No.	Hybrid Dominant Strategies Main Themes	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
			<p>the mitigation plans (C28, C9).</p> <ul style="list-style-type: none"> • Having BCP plan in Place (C24, C23). • Planned strategies to secure those supplies for Business continuity. • Restructuring supply chains according to demand patterns, product value and regional locations(C22). • Load new and/or updated Business Continuity Plans (BCPs) (C31, C5). • Developing alternative routes (e.g., traffic jam, roadworks, or crowd (C14, C19, C22). 	<p><i>at any point, in time in between those inbound and outbound flows”(C10)</i></p> <p><i>“Our Safety Stock safety stocks or their planning was made in such a way that they didn’t face problems.” (C24)</i></p>
19	Building social capital & relational competences	<p>Social capital is defined as ‘the sum of the actual and potential resources embedded within, available through, and derived from the relationships possessed by an individual or social unit ‘</p> <p><i>Michael Knemeyer (2019); Ismail Gölgeci et al (2020)</i></p>	<ul style="list-style-type: none"> • Maintaining of existing and seeking out new relationships (C23, C32, C22, C6). • Maintained stronger relational competencies e.g., communication, cooperation, trust, reciprocity, etc. retailers (C11, C15, C20, C13). • Establish a network of support, information, and required resources (C15). • Fostered adaptability, provided a buffer against disruptions, and contributed to the overall resilience of retailers (C18, C19, C20). • Provided each other with emotional support. This also 	<p><i>“We tried to take a proactive approach, and that proactive approach is a combination of existing relationships and maintaining and seeking out new relationships with the vendors themselves and the wholesalers making—for streamlined communication with them” (C23)</i></p> <p><i>“This is why we choose credible supplies because they have been around for many, many, many years. Their values and the importance of their survival is to make sure they’re transparent and ethical” (C32)</i></p>

No.	Hybrid Dominant Strategies Main Themes	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
			<p>involved creating solidarity and helping each other during the crisis (C12).</p> <ul style="list-style-type: none"> • Exchange of resources such as equipment and sharing assets (C14, C12, C16). • Social capital facilitated the sharing of critical information (C18). • Introduced learning and training materials, information sharing through social media channels (C32, C20). 	
20	Creating redundancy	<p>Redundancy in supply chain management generally is defined as having excess capacity throughout the entire supply chain to maintain operations and prevent a slowdown or failure of facilities in the event of an unforeseen disruption. It enhances the efficiency of a supply chain by providing additional resources, including the utilisation of multiple suppliers and surplus resources,</p> <p><i>Bodi (2011); Ponomarov & Holcomb (2009).</i></p>	<ul style="list-style-type: none"> • Focusing on multiple suppliers. (C1, C14, C15, C5, C26). • Moving inventories closer to consumers. • Structural redundancy-back up facilities capacity suppliers (C32, C12). • Buffer stock (machinery equipment and logistics options (C10). • Creating buffer stock and safety stocks reshoring (C32, C25). • Development of other distribution centres/warehouses to develop new replenishment process. • Focusing on product availability rather than brand (C25, C32). • Moving inventories closer to consumers (C10, C22). 	<p><i>“So, we had documented plans in place. We also split a couple of sites and put them on to two shifts that were previously one shift. So that then we had redundancy, that if one shift went down with a case, they would have a second shift. Who would have reduced capacity, but at least they could keep getting orders out and prioritise key customers that we have for distribution that outlines exactly under what scenarios, what we must do and who we should be calling and who gets isolated and all that kind of thing” (C22)?</i></p> <p><i>“We obviously held stock levels in all DCs around Australia. We maintained three to four weeks of stock worth based locally to or to allow for that change in demand”. (C12)</i></p>

No.	Hybrid Dominant Strategies Main Themes	Definition of the Hybrid Themes & References	Sub-themes	Evidence/Excerpts
			<ul style="list-style-type: none"> • Utilising spare stocks, multiple suppliers and extra excess inventory, spare capacity, multiple sourcing (C15, C17). • Developed having multiple facilities in different geographical (C10, C12, C17). 	

The following section details each hybrid strategy, elaborating on how each strategy was applied.

5.3 Phase 1 Hybrid Strategies—Detailed Discussion on each Strategy

5.3.1 Increasing innovativeness.

Traditional innovation research often characterises innovation as a novel combination of new and existing knowledge. Innovativeness is positively associated with global SCORE (Bettiol et al., 2021; Golgeci & Serhiy, 2013). During the pandemic, retailers leveraged innovation as a key component of their recovery strategies, with over 93% of responses highlighting its pivotal role, as detailed in Table 5.4.

Table 5.4 Increasing Innovativeness

Strategy	Criteria	Evidence	Comments (Proactive/reactive)
Innovativeness	<ul style="list-style-type: none"> • Implementation of service innovations, incremental(C16). • Making operational adjustments (C12, C13, C14). • Integration between channels (C18, C22, C21). • Adopting new consumer behaviours preferences and market conditions (C21, C12). • Created new ways and changes for Customer Engagement (C11, C1, C12, C25). • Addressed changing customer needs and introduced substitute products (C16, C17) C32, C21, C22, C14). • Introduction of e-commerce facilities(C25). 	<p><i>“We worked in a room all together, an open room. Every single update was shared immediately in live time. We were very quick to be able to react to everything. It was communication. It was technology. It was innovation” (C16).</i></p> <p><i>“These healthcare industries have done the same thing for a long time. We want to come in and change the customer service, change the customer journey, change the way they do their products, increase quality and the rest of it and supply chain. We want to be able to change the mindset of the people in these markets and industries” (C16).</i></p> <p><i>“So, we said we’re going to get our own drivers and we’re going to do a campaign that if anyone lived within 30 kilometres of Moorabbin, we’re going to drop it to their door free of charge. For about two to three months, we ran this campaign where we dropped thousands of masks at people’s doorstep because of the supply chain problems with Australia posts” (C25).</i></p>	Innovativeness emerged as a powerful strategy that enabled retailers not only to weather the storm but helped them stay stronger and more resilient. It emerged that retailers with a proactive and innovative approach were better equipped to navigate the turbulent waters of the pandemic.

This approach was dominant and instrumental in navigating the challenges posed by the crisis. During the COVID-19 pandemic, particularly service innovativeness may be the key differentiator between successful retailers and those that end up filing for bankruptcy or closing the business. The interview analysis findings reveal that retailers implemented innovativeness primarily through service innovations, which became a cornerstone of competitive advantage. For example, one pharmaceutical company partnered with a start-up to create a home delivery system for patients with heart disease, addressing disruptions in healthcare supply chains and services. This proactive approach helped retailers navigate the challenges posed by the crisis. Additionally, retailers interviewed engaged relevant stakeholders, including customers, suppliers, and distributors, to effectively communicate new strategies tailored to address emerging needs and concerns. They enhanced their service offerings through incremental operational adjustments, aligning with evolving market demands and safety protocols. These modifications played a crucial role in maintaining customer satisfaction and loyalty.

One pharmacist confirmed that they turned the COVID-19 pandemic crisis into a growth opportunity through innovativeness. This sentiment was echoed by another respondent who mentioned:

“We worked in an open room, sharing updates live. It was communication, technology, and innovation” (C16).

This innovative approach enabled swift adjustments to evolving consumer preferences and external factors.

During the pandemic retailers confirmed that recognising the growing importance of digital platforms embraced the introduction of online channels to broaden their reach and adapt to changing consumer behaviours. For example, some retailers who had not operated an online channel before the pandemic quickly opened web shops at the beginning of the lockdown. This innovativeness facilitated greater accessibility and convenience for customers. As online interactions became increasingly prevalent, retailers focused on elevating their professionalism in digital spaces. One interviewee highlighted the efficiency of this approach, stating,

“Why waste time going to a store when it can be delivered?” (C1).

This involved refining the online presence, enhancing the user experience, and optimising digital marketing efforts to foster customer engagement and trust. Innovative retailers also

found creative ways to engage with their customers in a socially distant world. Virtual shopping experiences, live streaming and interactive online events became the norm, maintaining customer loyalty and fostering brand resilience. One Executive Director commented on the importance of proactiveness:

“Being proactive and thinking outside the box is crucial as a form of innovativeness helped them to recover. The quicker you act, the better off you are” (C25).

By adapting to changing consumer behaviours, optimising supply chains and engaging customers creatively, retailers were able to recover and build supply chain resilience.

The insights from research underline the importance of reimagining the servicescape, especially in times of crisis. While physical retailers can innovate by creating alternative service scapes, e-retailers inherently possess an advantage in crisis resilience due to their digital nature. One co-founder emphasised the importance of local manufacturing and standards compliance:

“They shifted their business to local manufacturers instead of China by being proactive and innovative” (C32).

As the retail landscape continues to evolve, the lessons learned during the pandemic emphasise that innovativeness remains a powerful strategy for recovery, growth, and resilience in an ever-changing world. During the pandemic, supply chain management shifted from traditional planning strategies to innovative organisational transformation techniques. Innovativeness was crucial for retailers not only to weather the storm but to emerge stronger and more resilient. As the retail landscape continues to evolve, the lessons learned during the pandemic emphasise that innovativeness remains a powerful strategy for recovery, growth, and resilience in an ever-changing world. During the pandemic or other crises, supply chain management should switch from traditional planning strategies to innovative organisational transformation techniques.

5.3.2 Building logistics capabilities

Logistics emerged as a significant challenge during the pandemic, as retail products faced obstacles in reaching the market. Regular COVID-19 testing for cargo drivers and their assistants, along with the fear of virus contraction among officials, caused delays in the movement of goods. The suspension or reduction of passenger flights necessitated alternative modes of transport amidst travel restrictions and border closures. Building logistics capabilities became one of the critical recovery strategies, as highlighted in Table 5.5.

Table 5.5 Building Logistics Capabilities

Strategy	Criteria	Evidence	Comments (Proactive/reactive)
Building Logistics Capabilities	<ul style="list-style-type: none"> • Meeting customer requirements through timely logistics and continuous updates (C23). • Trucking transportation collaboration due to driver shortage and shipping containers (C9). • Others, particularly Third-Party Logistic companies, utilised TMS applications and used them to update their customers Visibility increased control and flexibility when it comes to good movements (C5, C20, C2). • Increased postal deliveries and strengthened reliance on through party logistics providers (C5). • Modified logistics network under COVID-19 lockdown policy (C19). 	<p><i>“There was another thing within our supply chain that we had to implement, and that is... But we already had it there. So, it was quite easy to fast track and mobilise. And this is things such as contactless delivery. I can’t even tell you how many parcels. We upscaled the contactless delivery component of our supply chain, to ensure that our drivers had POD sign off options, and that type of thing” (C5).</i></p> <p><i>“Then we had scalable third-party logistics providers as well. And these were plans for order dispatch delivery were created. We needed to heighten that because guess what’s happening. We see key supply chains such as postal deliveries being impacted as a result, because it’s just gone manic” (C15).</i></p> <p><i>“And it might be that we are delivering to a particular area, and we can consolidate those deliveries” (C5).</i></p> <p><i>But whenever they are sending one pallet with one truck, small truck, they must pay more. So now what we have introduced is, we have taken off the suppliers’ transportation part from them (C3).</i></p>	<p>Reduction of passenger flights due to lockdown/shutdown and border closures caused the cargo to move back through the sea route that caused a rise in demand for sea freight which caused the vessel space shortage leading to a rise of freight costs beyond other companies reach about 150% (Khuan, 2023).</p>

During the pandemic, logistics capabilities were bolstered through various strategies to ensure customer requirements were met and goods were delivered on time. One respondent highlighted the importance of continuous updates and contactless delivery, stating.

“We had to fast track and mobilise contactless delivery. We upscaled the contactless delivery component of our supply chain to ensure that our drivers had POD sign-off options” (C5).

Although this strategy can be applied as both proactive and reactive its application helped mitigate delays caused by COVID-19 testing and safety protocols. Soon after the COVID-19 pandemic began the trucking industry faced significant challenges due to driver shortages and shipping container issues. To address these problems, companies collaborated with third-party logistics providers to create plans for order dispatch and delivery. One interviewee mentioned:

“We had scalable third-party logistics providers. Plans for order dispatch delivery were created. We needed to heighten strategy” (C15).

This collaboration allowed companies to manage the increased demand for goods transportation effectively. Third-party logistics companies utilised Transportation Management Systems (TMS) to provide real-time updates to customers, enhancing visibility, control, and flexibility in goods movement. The increased reliance on postal deliveries and third-party logistics providers was also crucial, as traditional postal services struggled to cope with the surge in demand. One interviewee mentioned:

“Postal deliveries being impacted as a result because it just went manic” (C15).

This underscores the strain on postal services and the necessity for alternative solutions.

Modifying logistics networks under lockdown policies was another essential strategy. Consolidating deliveries to specific areas helped optimise resources and maintain efficiency. Furthermore, the use of multimodal transport was evident which provided several means of transport available for the same route (truck, plane, helicopter, bicycle etc) thus making it more likely that at least one mode can use a route. In this case several carriers can be contacted at the same time to be able to temporarily transfer the load from one carrier facing difficulties to another, this logistics capability was more convenient due to uncertainties of dedicated mode of transport. Flexible transportation with either multimodal or multi-carrier transportations was adopted as both a proactive and reactive strategy. To back up this assertion one respondent noted:

“We can consolidate deliveries to a particular area and use any different type of transport to ensure goods arrive to the customer” (C5)

This indicates a proactive approach to overcoming logistical challenges. International cargo transporters faced significant disruptions due to the suspension of commercial flights, leading to a shift towards sea freight. This change caused a rise in demand for vessel space, escalating freight costs beyond the reach of many companies. Respondents confirmed setting up access to multiple transportation modes, carriers, routes, and distribution channels to facilitate product delivery. As one interviewee confirmed:

“We had scalable third-party logistics providers and made plans for order dispatch delivery with them. We needed to heighten strategy” (C5).

In summary, various logistics adjustments were made to ensure products were delivered to the right place on time, despite the disruptions and difficulties caused by the COVID-19 pandemic. The measures taken by companies, including contactless delivery, collaboration with third-party logistics providers and utilisation of advanced TMS applications, played a crucial role in maintaining the flow of goods and meeting customer expectations during a challenging period.

5.3.3 Inventory management

The inventory management system is a core component of an efficient and effective supply chain. It is described as “the part of supply chain management that plans, implements and controls the efficient, effective, forward, and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customer’s requirements” (Singh & Verma, 2018). During the COVID-19 pandemic, inventory management involved the modification, planning parameters and reviewing related policies. Almost 85% of the respondents mentioned inventory management as key to the recovery process.

Table 5.6 Inventory management

Strategy	Criteria	Evidence	Comments (Proactive/reactive)
Inventory management	<ul style="list-style-type: none"> Balancing demand and supply to meet customer requirements (C 8, C23, C11, C12, C13, C14, C15, C16, C30, C17). Buffer stock creation to ensure a sufficient inventory reserve capable of meeting unexpected spikes in demand in the supply chain. (C17, C26). Focus on placing inventories closer to end consumers, reducing lead times, and improving responsiveness to local market demands. (C1 C10, C11 C17). Other firms started executing reduced inventory levels due to low demand. (C17, C30). Reserving safety stock to meet normal demand and further support the variability (C1, C11). Fluctuation in Demand vs supply (C8, C10). Lead times increased- retailers reported excess inventory due to order cancellation or reduced order (C9). 	<p><i>“Forecasting... for our retail stores, we’ve optimized stock levels using a Reorder Point program. When stock drops to a certain level, it generates a report for replenishment, triggering purchasing and manufacturing” (C8)</i></p> <p><i>“What we had tended to do prior to COVID was to stick to our general policy of holding three weeks’ of stock and have one week on order” (C17).</i></p>	By effectively leveraging these resources and strategies, retailers successfully adopted inventory management as a recovery strategy, optimising inventory levels, improving supply chain efficiency and driving business growth post-pandemic.

Some firms started executing reduced inventory levels, reserving safety stock to meet normal demand and further support the variability. Other food retailers experienced a sharp reduction in inventory, increased product backlog, and went for appropriate inventory policies to deal with disruptions.

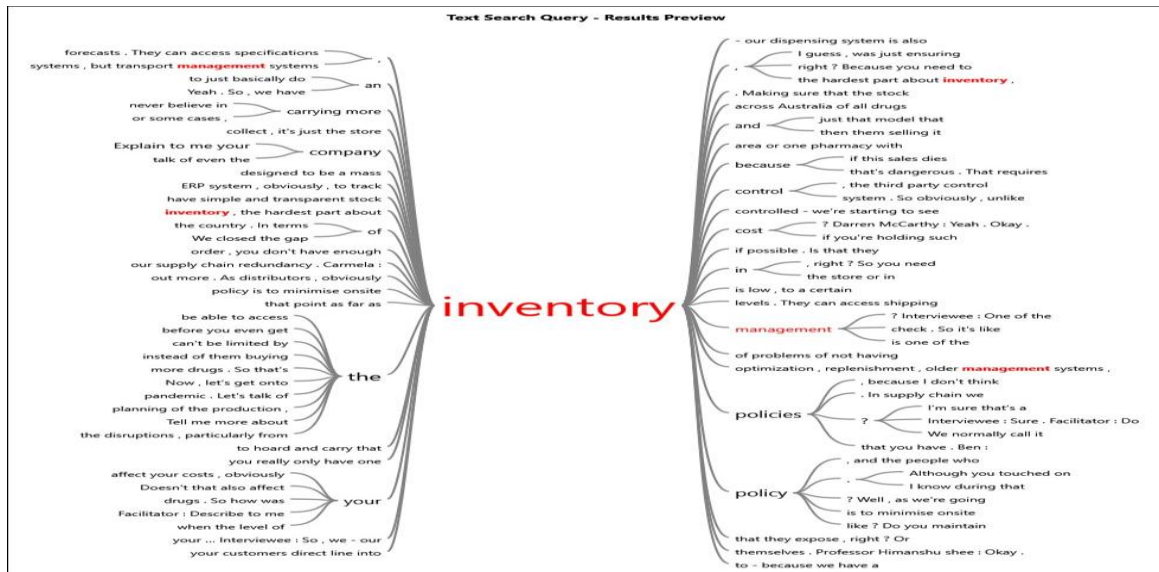


Figure 5.8 Word tree showing inventory management.

According to the interview participants, approximately 70% acknowledged inventory management as a key strategy for recovering from the pandemic and bolstering supply chain resilience. Others mentioned various approaches, including modifying and reviewing inventory policies and planning parameters, executing reduced inventory levels, reserving safety stock to meet normal demand, and supporting variability. Prior to COVID-19, the amount of stock was sufficient for their customers' requirement. However, when COVID-19 pandemic struck, the amount of inventory shot up to buffer for any uncertainties.

Some respondents had this to say:

“What we had tended to do prior to COVID was to stick to our general policy of holding three weeks’ of stock and have one week on order”. (C17)

“I mean in terms of Inventory—because our goal is to make sure that we have enough stock for our customers to sell. So, one of the things that we even before the pandemic was that we need to make sure that we have 16 weeks’ worth of stock with us”. (C26)

“Now, because a lot of that product is coming from either Europe, or the US and they all must go through Asian ports on the way here. We’re finding that the predictability of our schedules is very compromised at the moment. So, the difficulty we have is that we might come dangerously close sometimes to being out of stock, which that’s happened recently a couple of times. And then we get a glut of stock so that suddenly we’ve got seven or eight weeks”. (C18)

Some even mentioned artificially inflating inventory position. Some modified their inventory policies and planning parameters. Other reacted through efficient management of delivery lead

time by using real-time order tracking. Two respondents explicitly stated that their firms have been executing reduced inventory levels across the supply chains. In addition, their firms have also been reserving safety stock to meet normal demand and further support the variability. However, their firms did not have enough inventory buffers for the level of disruption caused by the COVID-19 pandemic. These respondents further argued that demand and supply are significantly high during these uncertain times, making it difficult to manage the required level of inventory. In this case they developed a reorder point software to balancing the demand and supply that would automatically trigger a re-ordering.

One operations manager had this to say:

“We’ve gone through the inventory management—this is the optimum level of stock that you require on the shelf at any one day. So, we’ve now developed a program called Reorder Point where when they sell a particular level, we know it generates an automatic report to us to say we need to send this stock to our internal customers. So, it’s a replenishment program in the event that then goes back to purchasing and manufacturing to say you need to manufacture”. (C8)

Food retailers witnessed a significant reduction in inventory alongside increased product backlog. To proactively manage inventory, they invested in advanced inventory management software systems. These systems optimise inventory levels, track real-time stock movements, and automate replenishment processes. Often, these software solutions integrate seamlessly with other business systems like point-of-sale (POS) systems and supply chain management software, providing comprehensive insights into inventory performance.

By effectively leveraging these resources and strategies, retailers successfully adopted inventory management as a recovery strategy, optimising inventory levels, improving supply chain efficiency, and driving business growth post-pandemic. Building a strategic inventory stock during the COVID-19 pandemic is considered the most important strategy that helped to build SCR, and flexible and strategic sourcing comes afterward.

5.3.4 Supply chain Restructuring and Redesigning.

Restructuring and Redesigning supply chain emerged as another hybrid strategies during the pandemic (Table 5.7). This was implemented through minimising complexity of network and simplifying the criticality of nodes to become flexible. This helped the retailers balancing the redundancy, efficiency, and vulnerabilities of logistics.

Table 5-7 Supply chain Restructuring and Redesigning

Strategies	Criteria	Evidence	Comments (Proactive/Reactive)
Supply chain Restructuring and Redesigning.	<ul style="list-style-type: none"> • SC structural changes (C3, C14). • SC network adjustment (C2, C14, C19, C21). • Diversified business Portfolio (C22). • Culture, quality, leadership. (C19). • Communication—shared important updates and built trust and loyalty culture (C12, C13). • Through minimising complexity of network and criticality of node (C12, C21). • Shared important updates and build trust and loyalty (C12). 	<p><i>“And this slip indirectly COVID-related, but products might have gotten out of stock, but it was things like the mouse plague where they just couldn’t keep up with the production. One of the things that we did was to redesign So, some sites were already operating two shifts, but we had a couple of sites that were only operating one shift. So, we split them and put them on two shifts” (C22)</i></p>	Segmenting the SC by separating items with distinct risk characteristics (not produced in the same plant, not sourced from the same vendors), as well as regionalising supply chains, helps to lessen the impact of disruptions.

There was increased emphasis on the core process and structure of supply chain activities and examining the value of added role of processes structure. This strategy follows Cheng and Lu (2017), who emphasised that recovery speed plays an important role: SCR can be achieved by redesigning the supply chain to attenuate adverse incidents and disruptions.

Different approaches and approaches or parameters of supply chain can improve resilience. It was evident from the interviews that to minimise the impact of a disruption and maintain efficiency which ultimately build resilience, one strategy identified was to redesign the network of the SC including diversification at all levels. Redesigning included centralising distribution centres and the procurement process.

Some interview participants had this to say:

“I’m a big advocate for that online automation solutions to issues and visibility are a huge one in our transport network, and look, we’re not there at the moment, but that’s where we’re heading. One of the things we have going for us is we’re looking to get all the planning teams together into a centralised location” (C12)

“The saying is, never waste a crisis. So, from this period, we’ve been able to resize our workforce, get more from less in terms of the productivity levels of our people” (C19)

“And this slip indirectly COVID-related, but products might have gotten out of stock, but it was things like the mouse plague where they just couldn’t keep up with the production. One of the things that we did have to do. So, some sites were already operating two shifts, but we had a couple of sites that were only operating one shift. So, we split them and put them on two shifts” (C22)

These strategies can be described as both proactive and reactive. Retailers in Australia strategically harnessed the power of reconfiguration and redesigning within their supply chain structures and processes as a key strategy particularly for post-pandemic recovery. Different aspects of the SC structure can enhance its robustness. To reduce the impact of an interruption on the functioning of a supply chain, one driver could be designing the SC network with diversification at all levels. A SC with many suppliers, manufacturers and warehouses located in diverse geographical regions will be able to adjust more easily in the event of an interruption to one node of its network. Segmenting the SC by separating items with distinct risk characteristics (not produced in the same plant, not sourced from the same vendors), as well as regionalising supply chains, helps to lessen the impact of disruptions for example, the United States, European Union, and India have regionalised their healthcare industry supply chains in response to the COVID-19 pandemic by restricting exports to ensure local supply.

A few respondents highlighted that they made adjustments that entailed redesigning proactive plans, developing, and implementing new response teams, and new processes and tools not only to recovery from the disruption effects but also to increase the company’s resiliency. Recognising the imperative need for flexibility and agility, many retailers embarked on an extensive overhaul of their supply chain networks. This transformation involved diversifying their supplier base, reducing dependence on single source suppliers, and embracing digital technologies to enhance visibility and traceability. Furthermore, the reconfiguration extended to inventory management, with a heightened focus on-demand forecasting and data analytics to ensure optimal stock levels. By making these substantial adjustments Australian retailers were able to fortify their supply chains, mitigate vulnerabilities exposed by the pandemic, and position themselves to not only survive but thrive in a dynamic and rapidly changing business environment.

5.3.5 Knowledge management

To be resilient, organisations need to develop appropriate management policies and actions that assess risk continuously and coordinate the efforts of their supply network (Kleindorfer & Saad, 2005). Therefore, as a way empowering and enriching their employees with knowledge leading retail companies should provide training to employees, suppliers and customers about security and supply network risks to raise awareness and reinforce the importance of SCRE (Blackhurst et al., 2005; Rice & Caniato, 2003). Furthermore, knowledge and understanding of supply chain structures—both physical and informational—are important elements of supply chain resilience. Supply chain partners must share a common understanding and awareness of the risks that could occur within their operations. An equally important strategy is to take note that retailers in Australia strategically employed knowledge management as a vital strategy for recovering from the challenges posed by COVID-19 (Figure 5.8).

Table 5-8 Knowledge management

Strategies	Criteria	Evidence	Comments (Proactive/reactive)
Knowledge management	<ul style="list-style-type: none"> Gathering data—through formal group discussion and brainstorming with key members to identify errors, bottlenecks opportunities to innovate and solutions that work is critical to maintain continuity (C1). Use of project management documentation tools and templates (C12, C13). Implementing education and formal training (C14, C15, C16). 	<p><i>“And fortunately, I guess we kind of started thinking about that, putting that type of stuff in place in 2018 before the pandemic hit. So, when the pandemic hit, it was funny because a lot of the things that we started talking about all of a sudden came to fruition, right? Because there were no stores. All the stores, especially in this part of the world were locked down and now you have to be an online retailer”. (C1)</i></p> <p><i>“The challenges Australia faced is being faced because the whole world is facing the issue. You need to understand what’s happening on an international level and how does that impact Australia and need to have the knowledge of how to solve the issue at hand”. (C16)</i></p>	<p>After dealing with disruptions such as COVID-19 pandemic in SC firms need to ensure that the three Ts for successful implementation of SC have been used (Time, Transparency and Trust). Time means focusing on adding value processes with transparency relating to understanding the required level of inventory and costs of production which are reliable and fair and Trust relating to consequences of collaborative working practices.</p>

	<ul style="list-style-type: none"> • Others particularly third-party logistic companies utilised TMS applications to update their customers. Visibility increased control and flexibility when it comes to good movements (C15, C16, C20, C28). • Learning from previous disasters (C9). 		
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Knowledge management in this context revolved around developing a comprehensive understanding of their supply chain structures, both in terms of physical logistics and informational flow, border closures and social distance. The uncertainties during COVID-19 necessitated this strategy adoption. This is proactive strategy as was evidenced by the approaches and advanced technologies that business was talking about before the issues became real during the COVID-19 pandemic. One respondent echoed:

“So, I think the companies that will succeed moving forward are the companies that recognise that supply chain resilience and a really strong strategy and supply chain is the cornerstone of the overall business strategy. My new CEO in my new business said to me last week, our supply chain strategy is the cornerstone of my business strategy”. (C15)

Retailers focused on fostering a culture of learning, encouraging teams to adapt and evolve in response to changing circumstances, and sharing these insights with other stakeholders across the supply chain. This approach involved formal group discussions and brainstorming sessions with key members of the supply chain to gather valuable data. This was made possible using social media. In terms of knowledge management one supply chain manager responded:

“I think that the key things that have been done and that we could do at the time were creating those community of practices to make sure that there were good communications and understanding about the opportunities and the situation and how we could navigate around that”. (C9)

Other respondents also echoed this sentiment:

“So, at the start of it, I was having discussions with people about... Retrospect’s a great thing, but without knowing how long this was going to go on or if it’s going to go on forever, just knowing that there’s going to be a significant period, six to 12 months where there’s going to be some really significant ups and downs”. (C13)

“The way we prepare for disasters is that we keep up our skills. In the event of an emergency, it is very apparent that people want to step up and help. Unfortunately, we can’t have them do that unless they are trained”. (C9)

Additionally, education and formal training including use of project management software for information sharing helped in the recovery process. Other training activities were held to raise awareness of the workforce regarding the COVID-19 pandemic disease and the importance of compliance with the new rules and regulations. By actively engaging in knowledge management, retailers were able to identify and rectify errors, alleviate bottlenecks, pinpoint opportunities for innovation and implement effective solutions. This proactive and knowledge-driven approach was instrumental in not only managing supply chain continuity but also in positioning retailers to thrive in an environment characterised by uncertainty and dynamic shifts in demand.

5.3.6 Creating appropriate contractual agreements.

Creating appropriate contractual agreements emerged as a crucial strategy for retailers to recover from the pandemic's disruptions. Retailers proactively renegotiated agreements with suppliers, allowing for flexibility in order quantities based on fluctuating demand. Although similar strategies were employed earlier during the COVID-19 pandemic, the urgency of the situation accelerated the process of creating these agreements, as retailers were eager to engage with any suppliers capable of delivering essential products on time.

This approach involved striking a balance between cash flow and credit lines, which was vital for maintaining financial stability. Retailers increasingly established shared resources with secondary suppliers to better manage raw material inventory, thereby mitigating supply chain risks. The emphasis on adjusting and negotiating win-win contractual agreements is illustrated by the experience of one participant, who described this experience:

“So, the cost of inventory, we actually pushed a lot of that back onto our suppliers and negotiated extended terms. We had some really hard conversations with our suppliers because we weren’t getting paid. We were waiting for money from customers who were potentially bad debts. We weren’t getting paid. So, we had to tell

our suppliers, 'Well, we're not going to pay you. We want you to wait an additional month or even two months before we're going to pay you that stock.' (C19)

These adjustments in contractual agreements created a win-win outcome, enabling retailers to adapt more effectively to the challenges posed by the COVID-19 pandemic and enhance their supply chain resilience. A notable example of this adaptive strategy was the decision to localize production, which not only addressed disruption issues, such as lockdowns, but also helped companies win consumer loyalty and establish greater transparency in their supply chains—a competitive advantage that can distinguish businesses from their competitors.

5.3.7 Collaboration with the government and creating public–private partnerships.

Governments and policymakers play a vital role in managing pandemics and their aftermath (Moosavi & Hosseini, 2021). According to Haring et al. (2021), government actions and public guidance can significantly shape how individuals perceive the risks associated with a pandemic. The study highlighted the importance of trust between citizens and governmental agencies in mitigating the negative effects of COVID-19 on society, including impacts on transportation networks and supply chains. Similarly, for survival, it is crucial that organizations and employees trust and follow government recommendations, particularly during a crisis. The advantages of following such guidance are clear, as those who trusted and complied with government advice experienced faster recovery compared to those who did not. This emphasizes the need for individuals and organizations to place trust in governmental directives. The benefits of this adherence are significant, as it has been established that those who complied, trusted, and followed government recommendations benefited and recovered more quickly than those who did not. This should serve as a strong motivation for individuals and organisations to trust and follow governmental recommendations.

The study revealed that government support during the COVID-19 pandemic emerged as a crucial strategy for recovery in the retail industry. According to Thompson and Anderson (2021), the reaction of government institutes to combat the spread of the COVID-19 virus has impacted the operational capacity and operations of retail supply chains and caused large-scale confusion among retailers. Similarly, from the interviews the participants indicated that because the government faced a never-before-seen phenomenon, regulations and restrictions were implemented carefully considering the ripple effects of such restrictions on businesses. For example, the governments in the states of Victoria and Western Australia reacted differently. In some cases, some participants retailers were left with large amounts of stock and

more stock scheduled for arrival without the ability to trade, which impacted their cash flow and storage capacity: Regulatory frameworks and governmental policies have a big impact influential on the environment particularly how that businesses operate in inside the complex web of global supply chains such as the pandemic. Government liaison activities also between producers and organisations that cater to food-insecure communities—for example, food pantries and shelters—highlight the importance of collaboration with Government. These organisations have played a significant role during the pandemic, as demand for food has risen sharply due to sudden rises in unemployment. Food pantries have felt a double hit during the crisis, as usual sources of supply suddenly dried up when restaurants and food service operations closed, forcing new supplier arrangements with food service wholesalers and even farmers. Our interviews focused on medium to large retailers for whom financing is usually not a critical obstacle to supply chain resilience. However, what emerged is that these companies recognised that other parts of their supply chain may not be as fortunate. Hence, companies needed to provide financing or technical support to help the weaker links within their extended supply chains. Such cross-company collaboration can be an important element for implementing a resilience strategy, since the resilience of a supply chain is only as good as its weakest link, for example one manager responded:

“There needs to be more emphasis on local procurement. That emphasis needs to be shown through government policies. That needs to be incentivised to the local manufacturers to be able to compete with overseas because we know China is always going to come at us on a price notion”. (C16)

On the same note one responded echoed:

“Australia’s COVID-19 response has been characterised by effective actions, policies, and leadership practices—implemented through strong collaboration between the public and private sectors—that are transferable and repeatable elsewhere” (C19).

This can be associated with adaptive leadership. The findings of this study highlight the significant role played by government initiatives in facilitating the resilience and recovery of supply chains. These measures included financial aid, tax relief, subsidies and grants targeted at affected industries, including the retail sector. Such support helped alleviate financial burdens, enabling businesses to sustain their operations and maintain their supply chains during the crisis.

Asked about Government support during COVID one manager responded:

“The Australian government did the same thing. They basically gave anybody that was unemployed money, and we know that when people are given money, they will spend that money. So, suddenly, they were—the consumption was accelerated. Therefore, just a lot of demand globally hitting all at the same time” (C28).

Government support also extended beyond financial assistance-policies and regulations were implemented to facilitate flexibility and agility in supply chain operations.

One respondent had this to say regarding Government regulations:

“There was panic buying everywhere. But being that we are such a very strong partner to government, there were also rules and regulations provided to us in managing this. There were some essential providers that had a higher rank as well. Because they needed it” (C5)

Furthermore, governments introduced relaxation of certain regulations or expedited processes to enable faster decision-making and facilitate imports and exports and transportation logistics. These measures played a pivotal role in mitigating disruptions and ensuring the continuous flow of essential goods. Additionally, governments acted as coordinators and facilitators, bringing together various stakeholders to collaborate and address supply chain challenges. They established task forces or committees involving industry representatives, experts, and relevant agencies to exchange information, identify bottlenecks, and develop strategies to overcome them. This collaborative approach fostered resilience and facilitated effective recovery.

Government support also extended to communication and public awareness efforts. Authorities utilised official channels and social media platforms to provide timely and accurate information about restrictions, guidelines, and available resources. They provided financial support through government agencies e.g., Job Keeper, that was helpful to the companies.

One respondent confirmed:

“Then that’s when I guess the strategy or the can-do attitude, what do we do? We had Job Keeper, but people forget. Job Keeper, it was great to support businesses” (C32)

This proactive communication helped businesses and consumers stay informed, make informed decisions, and adapt to the evolving situation. However, these government measures would be effective in those companies that had adaptive leadership who were able to make decisions at strategic, tactical, and operational levels that influenced and drove company direction. For example, most organisations centralise critical decisions essential for restoring order, such as developing and enforcing new protocols and procedures to continue operating safely or

shutting down physical operations beforehand and resetting strategic priorities on new projects to accommodate remote working.

A Victorian Logistics Operations Manager interviewed retorted:

“A CEO knows how important to have effective leadership during a crisis. So, she invested in senior leadership in supply chain and then a structure with senior people in supply chain roles. So, I think the importance of having supply chain experts on the board and C-level suite executives was critical during the crisis” (C15)

By providing financial assistance, implementing supportive policies and regulations, facilitating coordination, and promoting effective communication, governments played a vital role in building resilience and enabling the recovery of the retail industry. A lack of government incentives and subsidies can also be a barrier for companies to implement a resilient supply chain strategy. Our interviewees mentioned that the various governments they deal with reacted to the pandemic in ways that are all over the map. While this uncertainty is to be expected and can be accommodated, nevertheless, such differences heavily influenced their time to recovery. Unorganised and slow acting governments that fail to provide quick aid for struggling companies or for laid-off workers may turn this pandemic into a full-scale economic recession. Governments have their own objectives and interests in setting up policies that either can become obstacles or can provide support to companies wanting to build resilience. These findings emphasise the importance of continued collaboration between governments and businesses to develop robust strategies for future disruptions and ensure the long-term resilience of supply chains. This effective utilisation of government support resonates with Khuan et al. (2023) who identified government issuing government permits to resume operations in fact provided a solution to RDT perspective increase supplier dependence.

5.3.8 Building security

Building security measures, implemented both before and after the COVID-19 pandemic, have become crucial for retailers to safeguard their supply chains against intentional disruptions such as theft, terrorism, and counterfeit infiltration. During the pandemic, building security played a vital role in strengthening SCORE through various protective measures, including enhanced cybersecurity, theft reduction and infiltration prevention.

An interview participant highlighted that technology served as the cornerstone of their recovery mechanism. As such, they prioritised protecting their organisation by increasing cybersecurity, reducing theft and infiltration, integrating data, enhancing capabilities, and safeguarding against various risks. Due to the uncertainties brought on by the pandemic, building security

emerged as a dominant proactive strategy to protect against disruptions, especially as many companies relied heavily on technology for survival (C20). Additional security concerns included acute shortages of medical supplies and other high-demand products needed to prevent the spread of COVID-19 (C26). In response to these challenges, companies had to consider various security aspects, such as safeguarding vaccines on site and ensuring staff security, which involved comprehensive risk analysis.

Responding to the strategies one respondent said:

“And we had to look at all sorts of things like firstly, vaccines that we might have on site that other people might want. So, we had to worry about security, had to worry about security of our staff. It’s quite interesting going through those whole risk analysis” (C31).

Respondents (C20, C26, C31) confirmed that improved security systems were a significant part of their risk management strategies during the pandemic.

5.3.9 Transparency

A corollary of efficiency is demonstrating transparency in the supply chain for internal and external stakeholders, including consumers. If a supply chain is transparent, then it is likely that it can be made more efficient (Leigh, 2010). The more visible the activities are in the supply chain, then the more likely mistakes or errors will be avoided, and problems and high costs can be remedied.

During the pandemic, retailers utilised transparency as a crucial strategy to recover and maintain their operations. Table 5.7 below details how transparency was utilised during the pandemic.

Table 5.9 Transparency

Strategy	Criteria	Evidence	Comments (Proactive/reactive)
Transparency	<ul style="list-style-type: none"> • Transparency relating to understanding the required level of inventory and costs of production. (C1, C16, C18). • Reporting and having accurate inventory data. (C2). • Development of trust relating to consequences of collaborative working practice. (C14). • Utilising technology and social media sharing information and communication to enhance transparency (C1, C13, C18). • Building trust and transparency to enhance visibility. (C1). 	<p><i>So, we have local contracts for some specialist drugs... sometimes from one pharmaceutical company, you might get a discount on another product... We also have niche contracts with specialist suppliers... and a number of special access scheme suppliers, where a drug is not licensed by the Therapeutic Goods” (C11).</i></p> <p><i>“Yeah. I think we’ve been well served by how proactive and how much we’ve made sure that everything is clear to all parties. So, we never withhold information”. (C18).</i></p> <p><i>“Transparency is the key. And also, with things like our values that we actually do take seriously, they’re not just a logo on a website somewhere that nobody’s ever read. We do actually take things like keeping promises and a deal is a deal of all of those things are things that we actually live by. So, we’ve made it our central aim is to always make sure that those things are adhered to and that we do complete all of our obligations to customers” (C18).</i></p> <p><i>“I think in terms of supply chains, what we saw mostly the large supermarkets doing was saying very clearly and very transparently” (C2).</i></p>	<p>By understanding inventory levels and production costs, maintaining accurate data, fostering collaborative trust, utilising technology, and adopting RFID, retailers could create a transparent and resilient supply chain. This approach not only ensured the continuity of operations but also strengthened the relationships with their customers and partners, paving the way for a more robust and adaptable future.</p>

One significant aspect of transparency was understanding the required level of inventory and the associated costs of production. Retailers recognised that having clear insights into their inventory levels and production costs was essential to navigate the uncertainties posed by the pandemic. One respondent described it as

“Transparency relating to understanding the required level of inventory and costs of production” (C16.)

Accurate reporting and inventory data were fundamental in achieving this transparency. By maintaining precise inventory records, retailers could make informed decisions, ensuring that they could meet consumer demand without overstocking or understocking. This accurate data was instrumental in fostering trust and reliability in their supply chains. For instance, “Reporting and having accurate inventory data” (C2) became a cornerstone for effective inventory management during the pandemic.

The development of trust through collaborative working practices was another key element. Furthermore, transparency in collaboration allowed all parties involved to understand the consequences of their actions and decisions, leading to more cohesive and efficient operations. One respondent highlighted the importance of this approach: “Development of trust relating to consequences of collaborative working practice” (C14). Technology and social media played a pivotal role in enhancing transparency. Retailers leveraged these tools to share information and communicate effectively with their stakeholders. The use of real-time data and notifications enabled retailers to keep everyone informed about changes and updates.

As one interviewee explained:

“tell me when that arrives. So, you’re waiting. Tell me when that’s going to get there... All that information in real-time” (C13).

This proactive approach ensured that all parties had access to the latest information, fostering a transparent and responsive supply chain. Building trust and transparency also enhanced visibility across the supply chain. By being open and clear about their operations, retailers could assure their customers and partners of their commitment to fulfilling obligations and maintaining high standards.

As an operations manager noted:

“Transparency is the key... we do complete all of our obligations to customers” (C18).

The adoption of Radiofrequency Identification (RFID) technology further contributed to making supply chains more transparent. RFID enabled retailers to track products in real-time, providing greater visibility and control over their inventory. This technology allowed for more efficient and accurate management of goods, which was particularly vital during the pandemic.

One respondent confirmed:

“I think in terms of supply chains, what we saw mostly the large supermarkets doing was saying very clearly and very transparently” (C2).

To summarise, transparency was a multifaceted strategy that enabled retailers to recover from the pandemic. By understanding inventory levels and production costs, maintaining accurate data, fostering collaborative trust, utilising technology, and adopting RFID, retailers could create a transparent and resilient supply chain. This approach not only ensured the continuity of operations but also strengthened the relationships with their customers and partners, paving the way for a more robust and adaptable future.

5.3.10 Increasing visibility

This strategy can also be applied under both proactive and reactive strategies. Before the pandemic, supply chain risk management adopted by companies often only applied to top-tier suppliers. Increasing visibility within the supply chain is critical for both proactive and reactive strategies. Before the pandemic, supply chain risk management typically focused only on top-tier suppliers, leaving lower-tier suppliers invisible and potentially causing disruptions throughout the entire supply chain. This limited oversight made them susceptible to shocks involving their “invisible” lower-tier suppliers, which can rapidly instigate issues throughout the whole supply chain. The literature revealed that visibility is concerned with the information flow in terms of inventory and demand levels within the supply chain at a given time (Brandon-Jones et al., 2014) and enables supply chains to be more transparent (Christopher & Peck, 2004). Mattia Donadoni (2019) and Magableh (2021a) both suggest that visibility refers to the transparency of an organisation’s supply chain; which requires an end-to-end view of the entire supply chain and its operating assets. However, when the COVID-19 pandemic hit, the interviews revealed that there was an increased or heightened visibility of the supply chain that enabled organisations to swiftly identify and appropriately address operational issues reacting to the pandemic disruption. Based on the responses of the participants about 91% of the 32 interviewed companies highlighted the need for systems that help them to gain more accurate information in real-time and enable them to dig deeper into the SC during the COVID-19 pandemic disruptions as shown in Table 5.10:

Table 5-10 Visibility

Strategies	Criteria	Evidence	Comments (Proactive/reactive)
Increasing Visibility	<ul style="list-style-type: none"> Knowing what goods movement are taking place maintaining continuous updates. (C1, C14, C15, C5, C26). Giving customers a clearer picture of where products are in SC update through gathering data to increase visibility (C17, C18). Others, particularly third-party logistics companies, utilised TMS applications and used it to update their customers. Visibility increased control and flexibility when it comes to good movements (C20, C28). Effective sharing information and communication (C8). 	<p><i>“And the visibility part is exactly that, if you are not in touch with the trends of what’s happening, it’s going to be too late for you” (C1).</i></p> <p><i>“There are two things that helped a fair bit. One of them is we’ve had reasonably good visibility of our DIFOT (delivery in full and on time) and availability and short supplies out into our market for a while through some reporting and quite a complicated spreadsheet produced by our peak body” (C17).</i></p> <p><i>“A company must map its suppliers by tier to have an end-to-end view of the supply chain and identify vulnerabilities and vital to have a clear understanding of exposures beyond supply. We developed our metrics that will tell you what’s actually happening and without that visibility, you are blind and therefore – enhanced visibility is key to future supply chain success” C1)</i></p>	<p>This strategy was used as both as a Proactive and reactive strategy with retailers having used Information to increase viability however after lock- downs there was more increased visibility requirements as retailers wanted to have real-time data to update their customers accurately. Increased visibility within the supply chain empowered Australian retailers to respond effectively to the challenges posed by COVID-19 pandemic. Visibility allows organisations to identify and prepare for a broad range and amplitude of risks.</p>

Increased visibility during the pandemic empowered Australian retailers to respond effectively to disruptions. Visibility enables organisations to identify and prepare for a wide range of risks, allowing for a more proactive approach. Effective sharing of information across the supply chain, both upstream and downstream, helped retailers reduce negative impacts. Accurate information sharing with supply chain partners was crucial in reducing internal and external risks. Cheng and Lu (2017) highlighted that improved visibility could indicate resource distribution, impending disruptions, and their impacts throughout the supply chain.

Tracking and tracing facilitated awareness of opportunities, impacting management’s consideration of alternative actions. Organisations could respond to disruptions deliberately and with data-driven insights rather than hastily reacting. One respondent stated, “Communication was our biggest strategy. Keeping people communicated, informed, and very quickly” (C5), highlighting the importance of visibility into operations through tracking and tracing during the pandemic.

Retailers developed metrics enhanced by digital technology to increase visibility. A respondent mentioned, “A company must map its suppliers by tier to have an end-to-end view of the supply chain and identify vulnerabilities. Without that visibility, you are blind, and therefore, enhanced visibility is key to future supply chain success” (C1). Creating visibility on a weekly and daily basis helped optimise inventory and order fulfilment. Tracking data provided insights into average speeds, transit times, and fleet locations, enabling retailers to manage bottlenecks and consider alternative processes. Figure 5.10 shows the visibility strategy generated from NVivo analysis.

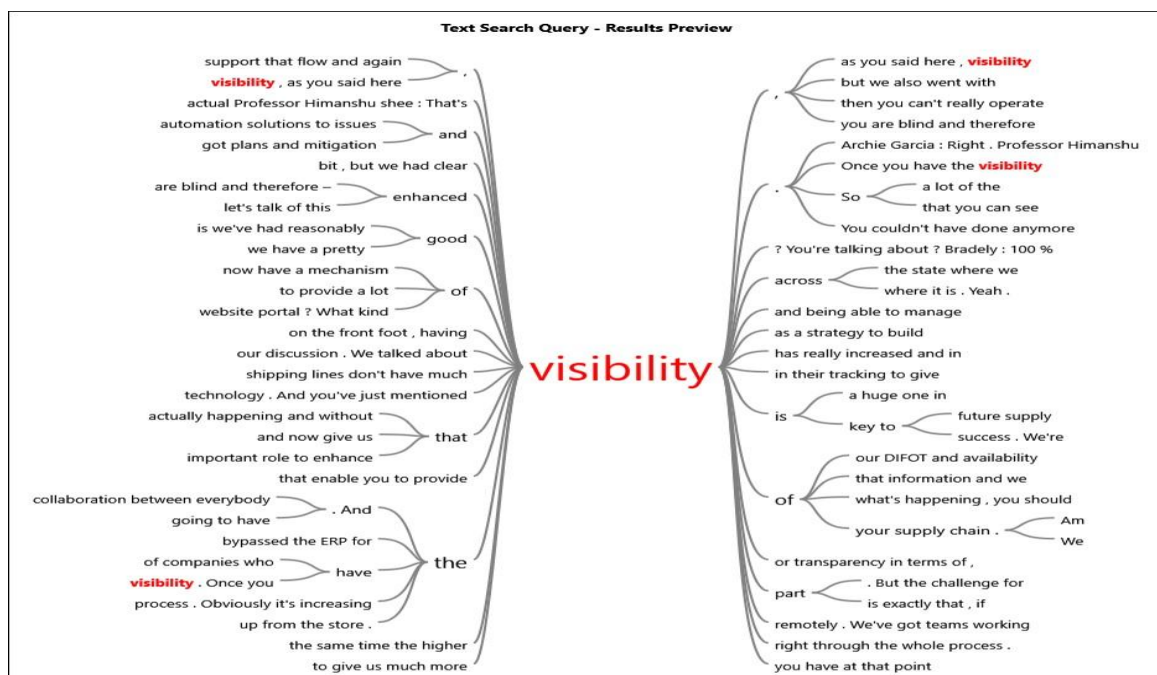


Figure 5.9 Visibility

It emerged that increased visibility was crucial for helping Australian retailers recover from COVID-19 challenges and build supply chain resilience. As highlighted from the interviews through monitoring every step of the supply chain, retailers could identify disruptions or bottlenecks in real-time and take proactive measures. Tracking and tracing technology during the COVID-19 pandemic provided comprehensive views of supply chain operations, including real-time data on product locations, speeds, and transit times. One operations manager responded:

“There are two things that helped a fair bit. One of them is we’ve had reasonably good visibility of our DIFOT (delivery in full and on time) and availability and short supplies out into our market for a while through some reporting and quite a complicated spreadsheet produced by our peak body” (C17).

This information made it clear which processes were efficient, and which needed improvement as all retailers battled through the survival and recovery process. Most third-party logistics (3PL) companies and retailers, armed with data-driven insights derived from the proactive strategies adopted prior to the pandemic, could strategically manage around bottlenecks, and explore alternative processes. Increased procurement and supply chain visibility through sharing critical information with partners and suppliers fostered better decision-making and responsiveness. One general manager interviewed shared his experience:

“We also did a lot of research ourselves. We developed metrics and measures to understand what’s happening, and without visibility, you are blind. Enhanced visibility is key to future supply chain success” (C1).

Visibility allowed retailers to maintain better control over their inventory. By tracking inventory levels at various points along the supply chain, retailers could adjust their stockpiles to meet customer demands accurately, preventing both stockouts and overstocking. Retailers leveraged analytics, artificial intelligence (AI) and other advanced technologies alongside human intelligence to analyse data from supply chain tracking systems. This data-driven approach enabled quick and efficient decision-making. Real-time monitoring systems provided up-to-date information about the supply chain, allowing retailers to respond to disruptions in a calculated manner, minimising negative impacts on operations.

One executive director commented,

“We’ve had reasonably good visibility of our DIFOT (delivery in full and on time) and availability and short supplies out into our market for a while through some reporting and quite a complicated spreadsheet produced by our peak body” (C17)

Visibility also allowed retailers to evaluate alternative processes and supply chain routes, choosing the most resilient and cost-effective solutions.

Another respondent highlighted:

“We have good visibility across where our freight forwarders are. We’ve spent a lot of time integrating them, so we know where our containers are at any given time” (C27).

Communication was also a critical component of visibility. One respondent emphasised, “One of our biggest things is communication. Being open and transparent with our customer base and providing honest communication internally and with suppliers” (C8). This digital transformation enhanced operational flexibility, mitigated risks, improved decision-making,

and set benchmarks for performance metrics and identifying bottlenecks. Digitalised logistics technologies provided the necessary visibility and transparency to navigate complex supply chains effectively.

In conclusion, increased visibility within the supply chain empowered Australian retailers to respond effectively to COVID-19 challenges. This proactive approach not only helped address immediate issues but also contributed to developing a more resilient and adaptable supply chain for the future. Visibility and transparency equate to knowledge, which is power. This approach enabled retailers to monitor and trace movements precisely and efficiently, generating value throughout the supply chain through open communication. Visibility ensures confidence in the supply chain, preventing overreactions, unnecessary interventions, and ineffective decisions during risk events. This aligns with Christopher and Peck (2004) and Faisal et al. (2006), who captured visibility, velocity, and flexibility as important building blocks for a resilient supply chain.

5.3.11 Use of information technology

One of the key strategies that was highlighted from the interview is the use /role of technology that transformed business to new normal. The interview highlighted that information and communication technologies have emerged as valuable tools for addressing COVID-19 induced challenges and enhancing SCORE and agility (Figure 5.11).

Table 5-11 Use Information Technology

Strategies	Criteria	Evidence	Comments (Proactive/reactive)
Use of Information Technology	<ul style="list-style-type: none"> • Change their business model completely from services to online retail to new, online platforms., which meant they could switch to selling liquor online (C14, C1, C15, C5, C26). • Adoption of e-commerce in most of the business introduced e-commerce if they had not previously implemented it. (C12, C13, C14, C16, C16). • Invested in analytics to increase visibility (C1, C11, C28.C30). • Information technology helped in improving information sharing efficiently and effectively across supply chain partners (C12, C13, C18, C20, C22). • IoT technology helped suppliers' full retailers inventory stock requirements using critical information (C13, C16, C18, C26, C28). • Implement ERP and other Warehouse management systems (C1, C13, C16, C22). • Retailers are looking to manage the evolution from multi-channel, through omnichannel, towards unified commerce (C7, C16, C8, C22, C25). • Used sharing medical resources and information related to COVID-19 (C9, C12, C13). • Technology has enabled the digitalisation of service offerings and product delivery (C1, C18, C2, C4, C17, C23). • Use of mobile phone apps to improve the stock management (C26, C8, C9, C15, C28, C32). 	<p><i>"So, there's two technologies that people are invested in, and one is the same one that we've had a look at, which is the analytics. So, it's a company called MicroStrategy, which specialises in being able to take data and being able to present it, right? The other part is integration. And integration specifically in the pandemic, you almost bypass the (Enterprise Resource Planning (ERP) to allow your customers direct line into inventory, right? Because you need to know what is available to be able to promise to fulfil". (C1)</i></p> <p><i>"So, from a configuration, simplicity, agility, we were ready, but we also invested heavily on analytics. So, we partnered with a company called MicroStrategy because we've got a lot of data available in WMS(C1)"</i></p> <p><i>"Investments in technology and automation in distribution centres are now at the forefront of most chief supply chain officers' agendas" (C31).</i></p> <p><i>"We can no longer rely on retrospective sort of reporting and so forth like that. Without the data and the technology, you cannot be proactive. You cannot have a proactive approach. You're always having a reactive approach" C30.</i></p> <p><i>"First of all, the ones who say they have full visibility are misguided—the maths is just impossible! You can focus on certain areas to build a pretty good idea of the full picture, and that is what we do. We have been using technology to map supply chains as deep as we believe we can" (C1).</i></p>	What is known is a digital technology that can be utilised to address supply chain resilience against disruptions. But the "how" part of the question remains unexplored. This research revealed how the use of digital technology under COVID-19 scenario was revealed.

One of the key strategies that was highlighted from the interview is the use or role of information and communication technology that transformed business to the new normal. What emerged from the interviews is that COVID-19 not only accelerated digital transformation and automations., but it has also made business realise the importance of utilising technologies to build resilience. Therefore, business SCRE became the key determinant of survival in a pandemic, hence the adaptive capacity of systems in an organisation not only enhances resilience but also serves as foundation for organisational resilience. Figure 5.11 presents a word cloud of information and communication technology generated through NVivo.



Figure 5.10 A word cloud showing use of technology from NVivo 12 transcripts.

Companies that were aware of the fundamental changes in customer behaviour and adapted to these changes with technological solutions have survived until the end of lockdowns. Retailers that incorporated digitalisation and e-commerce increased their sales and made the most advantage of the circumstances. The first theme concerned the increased importance of using technology and digital transformation to communicate with customers and clients although it was already highlighted in the literature. For example Ivanov et al. (2019) highlighted that what is known is a digital technology that can be utilised to address SCRE against disruptions. However, the ‘how’ part of the question remains unexplored. First, retailers confirmed that some high-end retailer took the opportunity to change their business model completely from

services to online retail (shifting existing business practices to online). Some adopted use of e-commerce as part of their digital responses. This is because e-commerce adoption varied widely throughout the services sector, seemingly independent of their digital responses. This contrasts with the other two general sectors, where new e-commerce facilities were needed in all cases to help implement their digital responses. The creation of digital supply networks (DSNs), where functional silos are broken down and organisations enable end-to-end visibility, collaboration, agility, and optimisation proved to be one of the ways that technology assisted in recovery process. The use of e-commerce in the services sector generally related to the method of payment that had already been established in each business. Some businesses operated on a subscription model (especially personal services businesses) or via invoice (typically communication, property, and business services businesses). These transactions most likely already occurred by bank transfer, and thus did not require the adoption of e-commerce via websites. The rest of the businesses introduced e-commerce if they had not previously implemented it. What emerged from the interviews is that soon after the COVID-19 pandemic started there was a sudden use or shift to of e-commerce as part of their digital responses. The COVID-19 pandemic is a perfect example of how digital technologies were utilised not only to recover but to build supply chain resilience. It enabled gathering data to create supply chain visibility and facilitated companies to collaborate. Therefore, some retailers invested in analytics.

Asked about how technology contributed one supply chain manager said:

“So, there’s two technologies that people are invested in, and one is the same one that we’ve had a look at, which is the analytics. So, it’s a company called MicroStrategy, which specialises in being able to take data and being able to present it, right? The other part is integration. And integration specifically in the pandemic, you almost bypass the ERP to allow your customers direct line into inventory, right? Because you need to know what is available to be able to promise to fulfil” (C1).

“By the very nature of the business that we’re in anyway with or without COVID, there’s an increasingly rigorous demand to be technology compliant, to exchange data with our customers and suppliers electronically” (C10).

For those that recovered quickly, they confirmed that they had to adapt to changing work demands and digitally transform their businesses (Holmström et al., 2019; Jiang & Stylos, 2021). Asked how the digital technology helped in their recovery process, a senior pharmacist commented:

“We can no longer rely on retrospective sort of reporting and so forth like that. Without the data and the technology, you cannot be proactive. You cannot have a proactive approach. You’re always having a reactive approach” (C30).

As highlighted in the recent similar research one CEO was quoted by Patchett (2021):

“The pandemic was an accelerated learning event. Organisations realise that new technologies can enable much-needed agility—from improving demand predictions, to boosting fulfilment to quicker, cost-effective last mile deliveries”.

Looking into the future most companies are now looking into investing into digital technology and by so doing organisations put themselves in good stead to safely support consumers in their time of need—whenever the next industry disruption may be. The COVID-19 pandemic also created additional vulnerability as organisations accelerated the shift to digital operations. This finding resonates with the findings of Dolata (2009) who suggested that e-commerce platforms and digital logistics can exert a direct, incisive, and generally disruptive pressure to change on the overall functionality of existing retailers, their technological structures and serviceability (Dolata, 2009). In line with the findings of this study Jiang and Stylos (2021) reiterated that e-commerce platforms and digital logistics transformations can exert a direct, incisive and generally disruptive pressure to change on the overall functionality of existing retailers, their technological structures, and serviceability (Jiang & Stylos, 2021). A successful digital procurement journey can be achieved by being realistic about the company’s starting point and investing wisely in technology with a balanced allocation of resources to processes. In terms of investing in technology one state operations respondent reiterated:

“Investments in technology and automation in distribution centres are now at the forefront of most chief supply chain officers’ agendas” (C31).

The research therefore revealed that different innovative technologies, such as digital twin (Burgos & Ivanov, 2021), blockchain (Moosavi et al., 2021), artificial intelligence (AI) (Nguyen et al., 2021), and IoT (Khuan et al., 2023; Salehi-Amiri et al., 2021), are valuable tools that could be used in managing SCs in the occurrence of SC catastrophic disruptions, like the COVID-19 pandemic (CIPS Report, 2020; Grimmer, 2022; Dmitry Ivanov, 2021; Taqi et al., 2020). AI can be used to evaluate the effectiveness of different strategies and develop response plans by implementing optimisation algorithms. Furthermore, blockchain and IoT can enhance the transparency and traceability of SCs, which is critical for SC resilience and sustainability. Information technology can predict a pandemic by detecting the first sign of an

outbreak and providing warnings to businesses to increase their readiness for a potential pandemic.

Three main ways were identified and emerged as technology contributions to both recovery and boosting supply chain resilience.

Increased visibility across the retailers supply chain allows organisations to forecast, simulate and effectively respond to disruption while also improving compliance. Digital tools act as early warning systems, thanks to the real-time visibility that they provide. The results of the interview show that that digitalisation within organisation within the retail sector is an ongoing process (Rinaldi & Bottani, 2023), which was expected to be accelerated by the pandemic. This outcome is in line with the current literature, which highlights that any technology that facilitates social distancing, reduces business travels, and possibly increases food security (e.g., by providing reliable traceability data) is welcome in the retail sector. In addition to companies' own supply chains, they will also need tools to increase transparency over the extended operations of their suppliers, as the trend towards stronger due diligence laws continues. The pandemic was an accelerated learning event. Organisations realised that new technologies could enable much-needed agility—from improving demand predictions, to boosting fulfilment to quicker, cost-effective last mile deliveries.

Enhanced flexibility. Digital technology enabled organisations to switch seamlessly between alternative suppliers and distribution centres during the COVID-19 pandemic disruption as well as diversifying their supplier base away from reliance on single suppliers. “China plus one”. Advanced technologies provided timely, accurate information about alternative supply routes and prospective partners to allow for data-informed decision-making. Data, information, and knowledge are critical assets to the performance of logistics and supply chain management, because they provide the basis upon which management can plan logistics operations, organise logistics and supply chain processes, coordinate, and communicate with business partners, conduct functional logistics activities, and perform managerial control of physical flow of goods, information exchange and sharing among supply chain partners.

Identifying distribution capacity

Understanding the distribution capacity embedded in supply chains enabled and facilitated businesses to respond effectively to surges in demand by increasing capacity and rapidly scaling up production. The findings revealed that, during the COVID-19 pandemic,

pharmaceutical companies faced significant challenges in determining the availability of medical supplies and delivering them to areas of greatest need. Participants highlighted that public health officials, hospital administrators, and others frequently encountered persistent misallocations and shortages of critical items such as ventilators, personal protective equipment, and other essential supplies—often with severe, life-threatening consequences. The adoption and timely implementation of Industry 4.0 strategies and smart manufacturing technologies played a key role in mitigating many of these bottlenecks and logistical issues. Specifically, technologies such as blockchain, the Internet of Things (IoT), and radio frequency identification (RFID) sensors enhanced traceability and transparency within supply chains. one respondent had this to say”.

“So, from a configuration, simplicity, agility, we were ready, but we also invested heavily on analytics. So, we partnered with a company called MicroStrategy because we’ve got a lot of data available in WMS” (C1).

Another manager responded:

“We can no longer rely on retrospective sort of reporting and so forth like that. Without the data and the technology, you cannot be proactive. You cannot have a proactive approach. You’re always having a reactive approach” (C30).

These digital technologies according to the interviewed respondents were being used to interact with customers, manage relationships with them, and manage and/or support the sales activities during the COVID-19 pandemic. Others confirmed that in the future, monitoring systems based on IoT applications can be integrated with satellite technology and AI. Such arrangements could save time, resources, and energy—especially at moments when it is important to know in real-time where critical materials are situated in complex supply chains to enhance visibility and traceability. Figure 5.12 shows how the use of technology facilitated the recovery process during the COVID-19 pandemic to build SCRE.

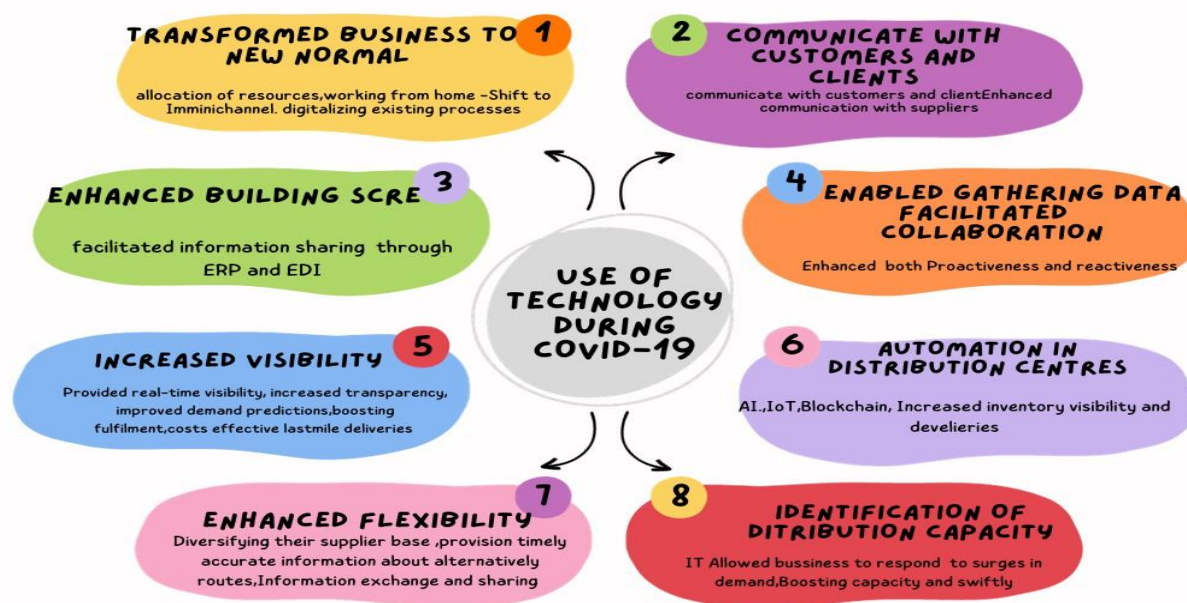


Figure 5.11 How the use of technology facilitated the recovery process (Source: Author)

To conclude the discussion on digital technologies from the interviews, what emerged from the retailers' interviews is that the emergence of COVID-19 in 2020 majorly impacted global supply chains, restricted the movement of goods, and forced many staff to work from home to slow the spread of the virus. As a reaction to this, supply chain firms and retailers have had to adapt and find alternative ways of operating, including digitalising existing processes. As retailers' supply chains recover from the impact of COVID-19, we expect to see a sudden acceleration of interest in digitalisation and automating tasks and processes traditionally conducted by humans. It is evident that retailers such as pharmaceuticals and grocery firms will increasingly look to Industry 4.0 technologies as sources of innovation to increase their resilience in the wake of an extreme disruption. Leveraging Industry 4.0 across key functions of the supply chain will enable organisations to gain a competitive advantage and build SCRE that will help them resist future disruptions. Going forward we can see that organisations are increasingly looking to their supply networks for innovative new ways to achieve process improvement, increase performance, and innovate their business models. Hence the growing interest in Industry 4.0 technologies to increase flexibility, optimise decision-making, raise quality standards, and improve efficiency and productivity—to increase the overall value proposition to better meet customers' demands. Those who are “digitally ready” to design, control, and communicate with these emerging digital technologies will set the pace for uptake, leading to significant implications for future investment, consumption, growth, employment, and trade.

Moving forward to increase operational efficiencies there is a need to adopt and embrace automation in the supply chain. From robotics to AI, Warehouse Management Systems (WMS) to the IoT, more than 90 per cent of organisations either have, or are planning to, install automation technology in their supply chain in 2023.

Additionally, new advancements in supply chain technologies are revolutionising the way companies manage their operations and navigate unforeseen disruptions. The traditional linear supply chain model is undergoing a profound transformation, giving rise to digital supply networks (DSNs). These networks break down functional barriers and establish interconnectedness between organisations and their entire supply network. This fosters end-to-end visibility, collaboration, agility, and optimisation. By harnessing cutting-edge technologies like the IoT, AI, robotics, and 5G, DSNs are purposefully designed to anticipate and effectively address future challenges. Whether it is an unprecedented event like the COVID-19 pandemic, trade conflicts, acts of war or terrorism, regulatory changes, labour disputes, sudden surges in demand, or supplier insolvency, organisations that adopt DSNs will be well-prepared to handle unexpected disruptions.

5.3.12 Supply chain collaboration

Collaboration in supply chain management is defined as a long-term relationship between supply chain partners to gain mutual benefits (Banchuen et al., 2017; Chen et al., 2017; Panahifar et al., 2018). Collaboration among organisations in a supply chain network is what integrates the network as a whole and makes a holistic approach, needed to build supply chain resilience, possible (Sheffi & Rice Jr, 2005). There is consensus in the literature that collaboration is an essential element of building supply chain resilience. When organisations plan together and take a “we” not “us” approach when dealing with SCDs, the approach strengthens their relationship and subsequently enhances resilience against disruption (Niemann W & Meyer A, 2020). The retailers collaborated closely with suppliers, distributors, and logistics partners to exchange real-time information on inventory levels, demand fluctuations, and supply chain disruptions.

Furthermore, collaboration in supply chain relates to capability of two or more autonomous firms to work effectively together, planning and executing supply chain operations towards common goals (Cao et al., 2010; Christopher & Peck, 2004). In our analysis, it became evident that the retail sector’s ability to recover from the pandemic and bolster SCRE was heavily

reliant on extensive collaboration, communication, and cooperation among all stakeholders within the supply chain. This approach can both be categorised under proactive and reactive. Prior to COVID-19, for example, food supply chain collaboration was for profit whereas during the COVID-19 collaborative efforts were for survival and building resilience. Collaboration with other supply chain entities ensures the exchange of information between partners, which reduces uncertainties and complexities (Pettit et al., 2010; Weber, 2021). Retailers forged new partnerships with carriers and freight forwarders during the pandemic-fuelled scramble to secure space on ships. Those who collaborated, maintained, and strengthened the existing collaboration (Figure 5.12), they seized the bricolage opportunity to diversify to areas that thrive during or immediately after the pandemic (e.g., ventilators, personal protective equipment, masks, hand sanitisers and gel).

Table 5-12 Supply chain collaboration.

Strategy/Theme	Criteria/Sub-theme	Evidence
Collaboration and information sharing	<ul style="list-style-type: none"> • Collaborate with stakeholders (C11, C1, C5, C15, C14, C28). • Timely information sharing, knowledge, and resources (C12, C17, C20, C2). • Planning and executing SC operations towards common goal (C1). • Establish ecosystem partnerships organising video calls and workshops through teams and zoom to check progress and share projections and initiative (C14, C11). • Renegotiation of supplier contracts in relation to volume, price, and payments that helpful to increase supplier production (C13, C17). • Interconnectedness and decision synchronisation (C1, C2). • Cross sector Collaborative communication, and goal alignment (C28, C13). • Contracts agreements(C13). • Increase focus on supplier relationships and contract management. 	<p><i>“Well, what helped is the close relationship that we have with the key stakeholders. In other words, the senior clinicians. So, because we have an ongoing close relationship with all the specialists in the area, the anaesthetists, and the intensivists, which means that we can quickly make an informed decision. So, the quickest thing is to simply go up and say, ‘Look, we can’t get this. What is the best option?’ So, it is that strong and multidisciplinary partnership that we have (C11).</i></p> <p><i>“We have a good relationship with company personnel and as well as distributors—relation is key to solve any problem” (C14).</i></p> <p><i>“What that was able to do for us was establish relationships with Chinese nationals that allowed us, in March, when the roles reversed in Australia, we were one of very few in the country who could actually procure stock very, very quickly from China when there was a huge surge in demand” (C6)</i></p> <p><i>“We implemented a new system to give us much more visibility, we also went with a global solution provider that partner was invaluable during the COVID-19 situation. One, they were a domain expert. They had global visibility. They had global clout to get things done and they really worked with us. It wasn’t without problem, but they worked very much in partnership with us in terms of understanding our problem, us understanding theirs and working together to solve that. So internationally that worked well” (C28)</i></p> <p><i>“And people forget the supply chain is a supply chain. It is all interconnected. And if you don’t have the ability to understand what’s happening in other parts, you’re going to be very siloed (and you’re going to hit a problem that suddenly, you’re too late to respond to” (C1)</i></p> <p><i>“I can have certain people that I can just know that’s the only person I need to ask or talk about that requirement. They can get onto their colleagues in England tonight or the US overnight or wherever it’s going to happen, because I have that established relationship” (C13).</i></p>

During the COVID-19 pandemic border closure resulted in greater difficulties in collaborating with supply chain partners during the recovery. Despite this, interviews with a total of approximately 31 respondents, representing about 97% of the participants, with a total frequency average of about 14.28 % underscored the pivotal role played by supply chain collaboration and information sharing in facilitating recovery. Notably, the strategies for collaboration and information sharing varied among companies, with many opting to establish ecosystem partnerships that fostered synergies among network partners. This resonates with Tomlin's suggestion that collaboration advance coupled with advance information sharing could be used to deal with certain risks, for instance labour disputes: if a firm has advance information that a strike is imminent then mitigation inventory may be built in advance (Tomlin, 2006). The findings from this interview revealed that similar vulnerabilities to specific sorts of disruptions such as the COVID-19 disruption, like transportation bottlenecks or regulatory changes proactively existed across different industries. Retail companies can get new perspectives and insights on resilience tactics that cross industry boundaries by cooperating with organisations from various industries. The relationships businesses build with their suppliers serve as one of the main cornerstones of a resilient supply chain.

A solid supplier relationship management (SRM) strategy explores strategic alliances in addition to transactional connections. Organisations can collectively assess risks, create backup plans, and establish transparent communication channels by working closely with their suppliers. Companies C13 and C28 confirmed the importance of communication and add that good business relationships with suppliers to ensure that disruptions are handled quickly, are fundamental. These synergies encompassed shared experiences and resources, particularly during the challenges posed by COVID-19. During the pandemic some respondents confirmed that collaboration and timely information sharing not only improve flexibility of supply chains but also allowed for the pooling of resources among network partners, resulting in a more efficient and responsive supply chain recovery. This collaborative effort led to the formation of interconnected networks, where the constant exchange of information ensured business continuity. Collaboration during the pandemic extended beyond mere cooperation; it involved the purposeful integration of supply chain processes. Companies demonstrated their commitment to this collaborative approach by forming ecosystem partnerships and engaging with strategic suppliers and external service partners. Figure 5.12 shows a word cloud on collaboration generated from NVivo.

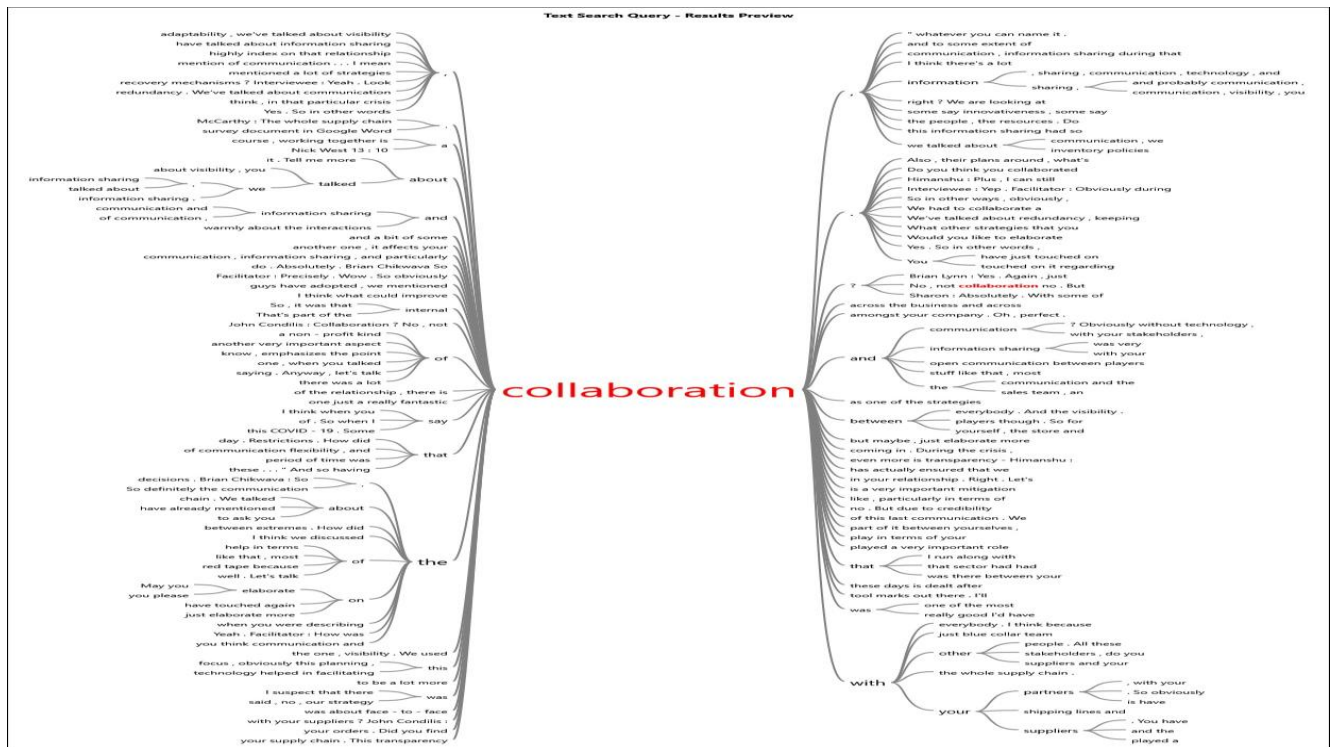


Figure 5.12 Word tree showing collaboration.

These partnerships yielded several benefits, including enhanced delivery flexibility, improved product quality, more robust information sharing, and expedited material flows between buyers and suppliers.

One responded echoed:

“The supply chain is interconnected; lack of visibility leads to silos and delayed responses. Collaboration across stores, sales, and manufacturing prevents overstock and excessive discounting” (C1)

Furthermore, these initiatives necessitated a review of contract clauses and the cultivation of stronger partnership relationships, ultimately contributing to achieving competitive corporate performance. Australia, as a nation, adopted a data-driven approach in its response to the pandemic. It effectively collected and transparently shared data from various sectors to establish a single source of truth upon which crucial decisions were based. The federal government’s proactive communication and transparency regarding the data supporting its decisions fostered trust and collaboration between policymakers and citizens. This approach aligns with the findings of de Sousa Jabbour et al. (2020) highlights how retailers shared information and set common targets among supply chain members, organising video call workshops to monitor progress and share projections. These initiatives significantly improved visibility and velocity within the supply chain. One logistics operations manager respondent C15 retorted:

“So, a lot of it was about face-to-face collaboration with just blue-collar team members. I know that the supply chain—so more of the stock control teams and more of the supply chain people in our team did a lot of work with suppliers that had never really been done before, to get them to be more flexible and to work with them much more closely on obviously inbound volumes” (C15).

Additionally, collaboration and information sharing emerged as critical factors in the retail sector’s recovery from the pandemic and the development of supply chain resilience. The establishment of ecosystem partnerships, engagement with strategic suppliers, and transparent data-sharing practices were pivotal in achieving these objectives, ultimately reinforcing the industry’s ability to adapt and thrive in challenging times.

One supply chain and logistics manager commended.

“Well, probably what helped is the close relationship that we have with the key stakeholders. In other words, the senior clinicians. So, because we have an ongoing close relationship with all the specialists in the area, the anaesthetists, and the intensivists, which means that we can quickly make an informed decision. So, the quickest thing is to simply go up and say, ‘Look, we can’t get this. What’s the best

option?’ So, I think it’s that strong and multidisciplinary partnership that we have” (C11).

This approach resonates with the insights from McKinsey & Company Report (2020) that highlighted that:

“Australia’s COVID-19 response has been characterised by effective actions, policies, and leadership practices—implemented through strong collaboration between the public and private sectors—that are transferable and repeatable elsewhere” (Child J et al., 2020).

Emphasising the importance of collaboration one supply chain supply chain manager of a distribution company narrated:

“A new system was implemented to enhance visibility, supported by a global solution provider whose expertise and global reach were invaluable during COVID-19. While challenges arose, the provider collaborated effectively, leveraging their domain knowledge and influence to address shared problems and achieve solutions together internationally” (C28).

Furthermore, to avoid limited delivery services and interruption of supplier payment retailers feel that developing strong cooperation with the distributor and company personnel is important. For example, C14 mentioned that:

“We have a good relationship with company personnel and as well as distributors—Relation is key to solve any problem”. (C14)

One key manager also said:

“Relationships improved immensely during this time; during the time of... Not that the relationships were bad before they were excellent. There was a new heightened level of humanity and engagement of... We need to just cut to the chase.” (C5)

By establishing ecosystem partnerships and fostering collaboration with suppliers and other key stakeholders within the supply chain, numerous advantages were realised. These included increased delivery flexibility, enhanced product quality, improved information sharing, and expedited material flows between buyers and suppliers, created value through new products. Furthermore, these collaborative efforts were instrumental in driving competitive corporate performance. Collaboration within the SC through strategic partnership was crucial. After experiencing disruptions, one interviewed company confirmed they adapted their recovery strategy to horizontally ally with their partners during the recovery period, by either horizontally or vertically affiliating themselves with other firms in the industry. Collaboration, whether through the cluster effect or the formation of a strategic alliance, proven to be an

effective aspect in post-disruption management, significantly affecting recovery performance. There were different reasons why collaboration was adopted by different sectors of retail services as shown in Table 5.13.

Table 5.13 Retailers Business Collaboration as a strategy

Interview participant	Before COVID-19 pandemic	During COVID-19 pandemic	Post COVID-19 pandemic
Food Restaurants(C7)	For profit business	Consolidate existing supply chain due to increased demand due to lockdowns. Develop substitute products with the available raw materials.	Maintain and strengthen existing collaboration and improving efficiency as well as profits.
Garment and fashion (C13, C14, C25, C32)	For profit business	Socially responsible business.	Diversified business seizing on bricolage opportunities, maintain collaboration to create win-win situation.
Pharmaceutical/Medical Equipment wholesalers (C6, C21; C23, C11, C16, C30, C31)	For both profits and customer satisfaction	For survival and serve society and fulfilling other government directives.	Maintain the collaborative existing collaborating building resilience and contingency plan and back for profits as well.
Food retailers supply chains (C3, C18, C24, C19)	Collaboration for profits	Searching for survival and fulfilling customer requirements.	Maintain and strengthen existing collaboration, seize on bricolage opportunity to diversify to areas that thrive and strengthening relationship balancing supply and demand.
Shipping and logistics, Warehousing and Distribution (C1, C10, C9, C12, C17, C15, C20, C22, C24, C26, C28)	Mainly for profits	For recovery and fulfilling customer requirement to maintain business -Introduce new transport modes during the pandemic period.	Maintain and strengthen existing collaboration and improving efficient as well as profits.
General Retail Including construction and Sport equipment retailers (C2, C4, C5, C8, C27)	For profit with some focus on health and fitness	Sudden loss of business, look for alternative business options and diversifying portfolio linking with food business.	Slow revival with stronger bricolage opportunity to link with the food sector and back for collaborative for profits.

Applying the RDT, it is evident that collaboration leverage on the resources and knowledge partners such as suppliers and customers integrating the flow of products and information across the supply chain. From the findings it is evident that collaboration can help to gain a competitive edge, allowing retailers to navigate constant disruptions, accelerate their time-to-

market, reduce costs, and enhance ability to meet new regulations. Looking ahead, particularly in the face of future crises akin to the COVID-19 pandemic, collaboration stands as a cornerstone of a resilient supply chain, one that aspires to be both responsive and agile. Information sharing emerges as the most effective strategy for enhancing visibility and mitigating risks within a supply chain. The overarching objective of collaboration within a supply chain is to cultivate a shared understanding of the supply chain's strategy. When this shared knowledge is achieved, relationships within the supply chain take on profound significance. Therefore, to reduce risks and build a more resilient supply chain retailers needed more cooperation between the parties involved to achieve objectives by working together to complete duties.

5.3.13 Increasing flexibility

Flexibility is the capacity to adjust to shifting conditions and can be used to deal with unpredictable market demand in the event of a disruption (Fiksel, 2015). Flexibility is the ability to change positions to respond to an abnormal situation better and to quickly adapt to significant changes in the supply chain. Flexibility can be achieved by having multiple interchangeable resources (Magableh, 2021a). Supply chains need to have the flexibility to evolve to operate in a world of constant change, unpredictability, and interconnection. In the view of Rajesh (2016), flexibility in a supply chain is the ability to manage changes quickly without undue effort and loss. It can be related to a system, product, or process. With system flexibility under the COVID-19 pandemic it is the redundancy in capacity, inventory, sourcing capabilities, and coordination and integration levels. During the COVID-19 pandemic, system flexibility involved redundancy in capacity, inventory, sourcing capabilities and coordination levels.

The interviews revealed that flexibility was a widely utilised strategy. Table 5-14 shows that 18% of the total frequency from the NVivo analysis mentioned applying flexibility as a reactive strategy. During the COVID-19 pandemic, system flexibility was seen in redundancy in capacity, inventory, sourcing capabilities, and coordination levels. The interviews revealed that flexibility was a crucial strategy, with nearly 100% of respondents confirming its importance for survival. Flexibility allowed retailers to react swiftly to the rapidly changing dynamics of the pandemic, adapting their supply chain operations in response to lockdowns, surges in demand, and global supply chain disruptions.

Table 5-14 Ensuring supply chain flexibility.

Strategies	Criteria	Evidence	Comments (Proactive/reactive)
Increasing Flexibility	<ul style="list-style-type: none"> • Predefining people's job responsibilities (C10, C11). • Looked for alternatives/sources (C11, C22). • Flexible pricing strategy for responsive pricing (C22, C16, C17, C22, C23). • Localising Supply chains (C9). • Sourcing flexibility—multiple supplier strategy (C11, C12, C13, C16). • Re-routing strategies re-routed shipment and modified sourcing tactics (C13 C18, C22, C29, C32). • Operation of business from home (C13, C11, C4). • Introduced operational flexibility and innovativeness (C11). • Developed contingency and backup supply plans (C13, C14, C15). • Flexible supply chain contracts-long-term short-term contracts (C13, C18). • Change planning(C11). • Sharing Information (C1, C2, C3, C4, C5). • Modified logistics network under COVID-19 lockdown policy (C14, C22, C27, C32). • Develop a flexible logistic network and opt for alternative routes (C13, C22, C9, C18). • Adapted and served a new and different group of customers to stay in business (C11, C8, C14, C15). 	<p><i>"We run our facilities at high-capacity levels. And being in the middle of the supply chain and dealing with major retailers and suppliers, we are a bit like the tail being wagged with dog is that we have very little upfront visibility of what stops coming our way, what promotions are going on at the customer, what quantities of stock are going to arrive beyond the next week's horizon. So, we have to be pretty responsive". (C11)</i></p> <p><i>"Survival strategy including launching an all -in transformation was one-way firms could break the COVID-19 Exit while accepting that COVID-19 has changed many things all of us, and the full potential of our organisation as well. One significant strategy that appeared to have worked well is Flexibility". (C13)</i></p> <p><i>They reorganized stock, separating COVID and non-COVID items, and reassigned procurement roles to focus on COVID drugs, showing flexibility before returning to normal operations" (C11).</i></p>	Flexibility allowed Australian retailers to react swiftly to the rapidly changing dynamics of the pandemic. They quickly adjusted their supply chain operations in response to lockdowns, surges in demand for specific products, and disruptions in the global supply chain for them to survive.

Flexibility allowed Australian retailers to adjust their supply chain operations rapidly in response to the pandemic's challenges. For instance, predefining job responsibilities and reorganising stock to distinguish COVID-related items exemplified operational flexibility.

One respondent shared:

“We reorganised physically, separating COVID-19 stock and redefining job roles to handle medication specifically related to COVID-19 a flexibility strategy we adopted” (C11).

This strategic reorganisation enabled retailers to manage the sudden shifts in demand and supply effectively. Additionally, localising supply chains was another critical aspect of flexibility. Retailers reduced reliance on single sources, often from overseas like China and Europe, and instead explored multiple sourcing channels. This diversified approach ensured alternative options in case one supplier or region experienced disruptions to further substantiate this strategy. A respondent highlighted:

“We started prioritising local suppliers and manufacturers to reduce lead times and transportation costs” (C13).

The interview also revealed more about the adoption of this strategy. For example, sourcing flexibility was evident as retailers developed multiple sourcing options to ensure alternatives were available if one source failed to deliver. This is notable because border closures were also erratic due to uncertainties of the COVID-19 pandemic. This included forming supply alliances with suppliers in various countries and nearshoring to localise supplier’s post-lockdown.

“We diversified our suppliers and sourced locally to ensure continuous supply” (C11).

In further exploring flexibility, the results of the interviews revealed that flexibility allowed Australian retailers to react swiftly to the rapidly changing dynamics of the pandemic given its unique characteristics. During the COVID-19 pandemic particularly the large retailers like Coles, Woolworths and IKEA quickly adjusted their supply chain operations in response to lockdowns, surges in demand for specific products, and disruptions in the global supply chain. The interviews revealed that although disruptions affected smooth operations, the organisation’s flexibility enabled the retailers to continue serving customers and minimise disruptions. Elaborating further some retailers demonstrated flexibility through diversifying their suppliers and sourcing options. For instance, one respondent mentioned:

“We reorganised physically stock and separated what was COVID-19 stock and what wasn’t. They redefined people’s jobs in the procurement department” (C11).

This demonstrated flexibility to make sure that they balance the supply and keep their customers happy despite the disruptions. Furthermore, retailers also adapted by developing

“Flexibility played a pivotal role in the recovery and enhancement of supply chain resilience” (C13).

Text Search Query - Results Preview

flexibility

about

- as an organisation . So for us that be the kind of innovativeness your company's point of view . Normally definitely . Brian : Yes . We've learned they're directing . When you talked yes , obviously you've already mentioned best it can . Brian Chikwava more willing to embrace change They had issues with leasing you in terms of agility and source that for us . But communication and the restructure , the innovative COVID drugs . So yes , that shows Facilitator : So let's look at your honest with us and give us and really having so much drug . So again , there's layers of ... So There was a lot to business . So in terms will say a moderate amount Senada . When you talk of communication so we are very flexible . So own flexibility . Technology is giving receive the product . Himanshu : So : 41 So we us the ability that gave us a bit more that one . When we come to

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- really technology but we were able to - they just highlighted . In terms of some extent . that . And Let's come to strategy as well , apart from sure that we , obviously , with the organisation . . So yeah , so we talk post COVID - 19 , There's a theme , what we call that , but specifically , do you the other countries . So I think through that fine . Brian Chikwava Excellent . to adapt to unforeseen changes . How would like to have our own you've already touched on and - on

flexibility

- agility in dealing with . Okay , coming and that collaboration with other stakeholders , then of course , once that communication , information sharing going forward again , we just need I can tell you one of it is usually described as being on your part ? David : Well , we've the question before this question . Our we normally describe this as being which is being defined as being And I guess we try and Interviewee : Yeah . Facilitator : You were quite Technology is giving that flexibility as We normally define it is being Well , that's quite insightful . One person We're very nimble , very nimble . That's Interviewee : Yep . Facilitator : ... we define it changes , to be able to the communication and information sharing . That person comes in . You need to be because we are big as an from the vendors themselves ? There was has increased significantly . It's nowhere near helped a lot in terms of my organisation was the one order to make sure that the workplace . And previously they've of the workforce , quite a big on industrial relations . So supply chain part of the whole supply chain . strategy to say let's move our there . So that's alternate suppliers and actually make sure that okay , do this or let us say , if our Yates in us is defined as being a main part . We own introduced during this period ? Darren : the main key , because you your supply chain after the ways of doing things made your which was going to be my

Flexibility in terms of re-routing strategies were employed to manage disrupted supply routes. Retailers developed flexible logistic networks and opted for alternative routes to maintain the flow of goods and ensure they meet customer expectations despite the difficult situation.

“We had to reroute shipments and develop alternative logistics networks under the COVID-19 lockdown policies” (C13).

Furthermore, operational flexibility and innovativeness were crucial in adapting to the new market conditions. Retailers implemented dynamic pricing strategies, modified logistics networks, and adapted to new customer groups to stay in business. One respondent stated:

“Flexibility was a significant strategy that allowed us to survive by adapting to changing market demands and operational challenges” (C13).

Flexibility was also evident by how retailers handled and modified their supply chain contracts, including long-term and short-term agreements, providing retailers with the ability to adapt to changing circumstances. Retailers who developed contingency and backup supply plans were better prepared to handle unforeseen events.

“We had to create flexible contracts and backup plans to ensure we could respond to any disruptions” (C13).

The flexibility demonstrated by Australian retailers during the COVID-19 pandemic highlighted the importance of agility in managing supply chain disruptions. By diversifying sources, emphasising local production, optimising inventory, and fostering collaborative partnerships, retailers were better equipped to withstand disruptions, ensure business continuity, and build a more resilient supply chain for future challenges.

To summarise how flexibility was utilised it is important to note that flexibility was mainly used as a strategic approach and played a pivotal role in the recovery and enhancement of SCRE for Australian retailers during the COVID-19 pandemic. Flexibility allowed retailers to react swiftly to changing dynamics, adapt to new market conditions, and maintain operations despite significant disruptions. This approach not only helped address immediate issues but also contributed to developing a more resilient and adaptable supply chain for the future.

5.3.14 Increasing velocity and adaptability

Adaptability is the capacity of a company to modify its resources in response to long-term variations (Feizabadi et al., 2019). It involves creating and developing new structures, processes, and capabilities that enable stakeholders to maintain or enhance their strengths in response to specific situations (Tuominen et al., 2004). Supply chain adaptability (SCA) refers to the ability to modify operations in response to challenges or opportunities (Pettit et al., 2010). This can be reactive, minimising damage, or proactive, maximising opportunities during disruptions.

The COVID-19 pandemic underscored the importance of adaptability, with almost all respondents confirming its role in their survival strategies. Adaptability allowed companies to adjust to new market conditions, such as lockdowns, border closures, and shifts in consumer.

Table 5-15 Increasing Velocity and adaptability.

Strategies	Criteria	Evidence	Comments (Proactive/reactive)
Increasing adaptability	<ul style="list-style-type: none"> Companies resetting their risk management plans (C15). Agility and alignment (C12). Firm innovativeness (C16, C18, C20, C22). Staff hard work, working extra hours (C24). Adapting to new ways of working (C12, C15, C17, C22, C30). Making supply chain restructure changes (C31). Integrated supply chain structure that provided high level of digitisation (C20, C22). Maintaining continuous updates. Giving customers updates and increase transparency and visibility (C17, C18). Third-party logistics companies utilised TMS applications to update their customers (C23, C24, C18). 	<p><i>“This transparency collaboration with your partners is have that agility and adaptability strategy.” (C8)</i></p> <p><i>“This centralisation of logistics department you’re talking about, is it as part of responding to the COVID-19 or is something that was in plan already” (C9)</i></p> <p><i>“And now you’ll be able to kind of flex and adapt because you’ll have 10 of these instead of one. So those are the type of things that people have to think about and kind of bash their silos a little bit and just think about the supply chain as a problem, as opposed to specific things of their own” (C1)</i></p> <p><i>I’ve got to say, we’re very lucky that our distribution and operations teams have always been very responsive... When new things come in, something would be announced at 9:00 in the morning, and we’re all on the phone at 9:30, ‘Right. What do we need to do?’... But it was taking resources away from operations... because our teams were focused on putting the new COVID regulations in” (C17).</i></p>	Resetting risk management plans, agility and alignment, innovativeness, adapting to new ways of working, supply chain restructuring, integrated supply chain structure, maintaining continuous updates, and utilising TMS applications.

The interviews revealed that adaptability allowed Australian retailers to react swiftly to the rapidly changing dynamics of the pandemic. For instance, resetting risk management plans and integrating new ways of working were crucial.

One respondent mentioned:

“We had to reset our risk management plans and adapt to new working methods to manage the crisis effectively” (C15).

In order for a company to adapt to the situation, agility and alignment within the supply chain were also vital. Companies had to innovate and restructure their operations to remain competitive. One manager responded:

“Our firm innovativeness adaptation and supply chain restructuring helped us navigate the disruptions” (C16, C18).

This included leveraging digital platforms for real-time tracking and predictive analytics to anticipate market shifts. These technological advancements enabled companies to respond quickly to changes through adapting best means of survival, such as shifting to online sales channels and offering contactless delivery options as a form of adapting to the situation and survive. Employees had to adjust and adapted to working from home which was previously not happening. Maintaining continuous updates and transparency with customers was another key aspect of adaptability. Effective communication ensured that customers were aware of the status of their orders and any changes in the supply chain.

“Providing continuous updates and maintaining transparency with our customers helped us manage their expectations during the pandemic” (C17, C18).

Utilising third-party logistics (3PL) companies and Transportation Management Systems (TMS) was essential for updating customers and increasing control over supply chain operations. This increased visibility and flexibility, allowing companies to adapt to changing circumstances.

“Our use of TMS applications provided better visibility and control over our supply chain, which was crucial during the pandemic” (C23, C24).

Evidence from interviews indicates that adaptability was crucial for addressing the sudden changes brought by the COVID-19 pandemic. Consumers adjusted their expectations, demands, and purchasing behaviours, prompting retailers to embrace digital transformation and

service innovations. This adaptability enabled retailers to meet consumers' needs for convenience, timeliness, and safety in their purchasing activities. One CEO of a retail association suggested:

“The only way out is to ensure your business can adapt to rapidly changing circumstances” (C2).

Increasing velocity within the supply chain also became paramount. Traditional supply chain models with long lead times and just-in-time inventory were vulnerable. Retailers streamlined operations, reduced delays, and embraced automation to accelerate order processing and fulfilment. Adaptability involved reconfiguring supply chains by identifying new suppliers, developing suppliers and infrastructure, and creating flexible management systems responsive to market changes. Several respondents highlighted the importance of adapting and pivoting communication and engagement with clients through new technologies.

“We had to adapt our communication methods and engage with clients through new technologies to continue trading” (C15).

This adaptability ensured business continuity and enhanced supply chain efficiency. Therefore, adaptability and increased velocity were instrumental in the recovery and development of SCRE for Australian retailers during the COVID-19 pandemic. By diversifying suppliers, adopting digital platforms, embracing predictive analytics, and maintaining continuous updates, retailers were better equipped to withstand disruptions and ensure business continuity. These strategies not only helped address immediate challenges but also built a more resilient and adaptable supply chain for the future.

5.3.15 Ensuring supply chain agility.

The foundation of a flexible supply chain strategy is rooted in agility (Ponomarov & Holcomb, 2009). Resilience is intrinsically linked to agility, as it reflects the ability to quickly and flexibly adapt or respond with speed to both favourable and unfavourable external conditions. In this context, Tukamuhabwa et al. (2017) highlight that agility enables a supply chain to quickly react to unforeseen events that disrupt demand or supply. Similarly, Shashi et al. (2020) define agility as a system's capacity to rapidly adjust to changes by altering its stable configuration. Furthermore, maintaining supply chain agility depends on proactive management by companies of risks (Rehman et al., 2020). To mitigate risks related to inventory management, supply chain managers can collaborate with highly responsive suppliers to enhance supply chain agility. The foundation of a flexible supply chain strategy is rooted in agility (Ponomarov

& Holcomb, 2009). There was evident from the interviews that those companies that had supply chain that is agile reacted quickly and successfully to unforeseen disruptions of the COVID-19 through market developments, or changes in consumer preferences. There was evidence from interviews that other organisation formed cross-functional groups that can promptly analyse and respond to shifting circumstances that are crucial. Additionally, labour shortages, pressure from buyers for quick delivery, and low levels of financial flow may have created huge challenges for the retailers supply chain to maintain the business during COVID-19 and beyond—hence, they had to be agile to meet the customer demands. Interviews indicated that companies with agile supply chains reacted quickly and successfully to the disruptions caused by COVID-19, adapting to market developments and changes in consumer preferences. Table 5.16 presents evidence of this.

Table 5-16 Supply chain agility.

Strategies	Criteria	Evidence	Comments (Proactive/Reactive)
Ensuring supply chain agility	<ul style="list-style-type: none"> Monitoring flow of material and information across a supply chain to ensure that procurement production, delivery schedules are met (C9, C15, C18, C20). Adopting faster/quicker decision-making (C16). Technological integration (C1, C32, C15). Close partner engagement (C27, C18, C14). Collaborative planning and forecasting through creating (C29). End-to-end time taken to delivering products and services through velocity (C29, C30, C15). Reduction of batch sizes, versatile workers, trace, and track delivery of orders, developing contingency plans, calculate inventory needs (C29). Adopted and utilised digital technologies such as sensors, barcodes collaborative portals that enabled, agility, visibility, and velocity (C24, C27, C13). Retailer shifted to online services and omni channel and adopted interior solution to the pandemic effects (C30). 	<p><i>"I think probably the key one is not so much what we do differently, but the learning probably is how do we take the agile ness of what we've just been going through and make that just normal business as opposed to, I think historically we wouldn't have been as agile as we are now" (C29).</i></p> <p><i>"We were ready from Core WMS because we kind of grew up in that world where things can change, and you don't know what customer you're going to have to service. So, from a configuration, simplicity, agility, we were ready, but we also invested heavily on analytics" (C9)</i></p> <p><i>"And previously they've had to adapt rapidly and, on the fly, and have management processes that are more flexible and agile". (C10)</i></p> <p><i>"The Australian transport businesses were very unprepared for the situation, didn't know how to adjust. In fact, we probably changed over more carriers during COVID than at any other time in the last five years, literally to try and find the people that we could work with and that could be safe, cost effective but also agile". (C32).</i></p> <p><i>"We managed it through agility communication, again, in understanding, "Hey, what is your requirement? When do you need it? What is the timeframe? Are you just storing it, or do you need it right now?" (C5)</i></p>	During the wake of COVID-19, firms in this retail industry engaged in various agile responses through sensing (i.e., identifying and assessing relevant threats and opportunities) and seizing capabilities (i.e., acquiring, combining, and modifying resources).

Agility emerged as important from both proactive and reactive strategies' perspective and also became an essential strategy for retailers during the COVID-19 pandemic recovery process. Agility, defined as an organisation's capacity to rapidly adapt tactics and operations (Gligor & Holcomb, 2012), played a critical role in navigating supply chain disruptions. Nearly 91% of

respondents attested and confirmed to the vital role agility played in their survival strategies. One supply chain expert commented:

“There’s a new normal, and that new normal is you need to be innovative, nimble, agile, online, and adaptive” (C16).

Retailers interviewed attested to utilising agility to adapt to rapidly changing circumstances caused by the pandemic. This included pivoting product offerings to focus on essential items such as groceries, cleaning supplies and personal protective equipment (PPE) as demand for these essential products surged. By quickly identifying shifting consumer preferences and adjusting their product mix, retailers met customer needs and maintained revenue streams. A managing director emphasised the importance of agility, stating:

“The key is learning to make agility a normal part of business, not just a response to the crisis” (C29).

Although this strategy has been used in the literature and identified as one of the crucial antecedents of Supply Chain Resilience, the key in these findings is how it was used in a situation like the Low-Frequency-High-Impact (LFHI) type of crisis like COVID-19 pandemic. Retailers diversified sourcing by exploring local and regional suppliers to reduce dependence on international sources. Technologies like AI and data analytics were adopted to forecast demand more accurately and optimise inventory levels. Some retailers reconfigured their distribution networks to improve responsiveness and resilience, allowing them to reroute products to areas with higher demand or supply shortages. This agile move ensured that retailers could respond effectively to the unique challenges presented by the pandemic.

Monitoring the flow of materials and information across the supply chain was vital to ensure that procurement, production, and delivery schedules were met. Fast decision-making and technological integration enabled companies to react swiftly.

One respondent noted:

“We invested heavily in analytics for agility, ensuring we could quickly adapt to changes” (C9).

Collaborative planning and forecasting through creating close partner engagement allowed for synchronised responses to shifting circumstances.

One Inventory manager confirmed:

“Our cross-functional teams could promptly analyse and respond to changes, which was crucial” (C10).

To maintain continuity of operations despite difficulties of some retailers also adopted digital technologies such as sensors, barcodes, and collaborative portals to enable agility, visibility, and velocity. These tools facilitated real-time tracking, monitoring, and communication within the supply chain, providing the transparency needed for quick decision-making.

“Digital technologies enhanced our agility and visibility, allowing us to adapt quickly” (C24).

Further to the findings of how agility was applied during the COVID-19 pandemic some retailers confirmed having shifted to online services and omni channel strategies which were another critical aspect of agility form to remain competitive and continue with operations. Retailers embraced interior solutions to the pandemic’s effects, expanding their online presence and adapting to new customer behaviours. One interviewee commented.

“We shifted to online services and adopted omni channel strategies to stay competitive” (C30).

In summary, the COVID-19 pandemic forced retailers to reimagine their strategies and operations, with agility emerging as a vital strategy adopted for survival and recovery. The ability to swiftly adjust product offerings, diversify supply sources, employ advanced technologies, and reconfigure distribution networks allowed retailers to respond effectively to the pandemic’s unique challenges. Agility became the cornerstone of their efforts to recover from disruptions and build more resilient supply chains capable of withstanding future shocks.

5.3.16 Demand management

Supply chain recovery is fundamental to supply chain disaster management and resilience. Developing knowledge and understanding of supply chain structures and the ability to learn from changes, as well as educate other entities, is crucial. Demand management involves balancing supply and demand to meet customer requirements (Figure 5.17).

Table 5-17 Demand Management

Strategies/Theme	Criteria/Sub-theme	Evidence	Comments (Proactive/reactive)
Demand Management	<ul style="list-style-type: none"> Balancing demand and supply to meet customer requirements (C1 C23, C11, C12, C13, C14, C15, C16, C30, C17). Implementation of buffer stock (C26). Focus on placing inventories closer to end consumers, reducing lead times, and improving responsiveness to local market demands (C1 C10, C11). Other firms started executing reduced inventory levels due to low demand. (C30). Reserving safety stock to meet normal demand and further support the variability (C1, C11). Fluctuation in demand vs supply (C8, C10). Implemented alternative stock ordering and storing protocols. Lead times increased (C9). 	<p><i>“So, we created a predictive algorithm that basically looked at the last x number of days usage and so we just chose some sort of broad range - so we looked at the last three, seven, 14-, 28- and 60-days usage and had the report flagged to us any that would get into trouble based on our current stock holdings and how much we could reorder and so forth”. (C23)</i></p> <p><i>“So, we had to apply some logic to yeah, let’s get some limits put on the stock that’s going out. So, the stock control team analysed what products were going out quickly and that was pasta and flour etc.” (C15)</i></p> <p><i>“We are ahead of keeping of our inventory. So obviously we had everything in plan but something - like the demand skyrocketed sometimes on certain items”. (C27)</i></p> <p><i>“Certainly, they did set up something whereby for critical drugs we are now able to see the stock levels of certain things state-wide across all the hospital network, which was never there before”. (C30)</i></p> <p><i>“Our goal is to make sure that we have enough stock for our customers to sell. So, one of the things that we did even before the pandemic was that we need to make sure that we have 16 weeks’ worth of stock with us”. (C26)</i></p> <p><i>“So, the idea is that they use the stock from the warehouse somewhere else. But we still keep our own buffer because what if they run out? So, there is a buffer. Yes, there’s a buffer within and also, we have a buffer if we know there’s going to be a potential problem, we’ll also increase stock levels. So yes, we have a buffer”. (C11)</i></p>	<p>This strategy was used both as a proactive and reactive strategy</p> <p>Through a proactive adaptation of inventory management strategy resources effectively, retailers were able to adopt inventory management as a recovery strategy to optimise inventory levels, improve supply chain efficiency, and drive business growth in the post-pandemic landscape.</p> <p>A centralised source is required to control distribution.</p>

Soon after the COVID-19 pandemic hit Australia and the announcement of the lockdown policies, panic buying led to food shortages, shocking the supply chain’s rhythm, and causing

an imbalance between supply and demand. Labour shortages further caused supply side disruptions, particularly in the food supply chains. Respondents interviewed emphasised the sudden rise in demand for products like toilet paper, food, and pharmaceuticals. In response to these sudden changes in operational activities, approximately 88% of the interview participants acknowledged adopting demand management as a recovery strategy.

Demand management involves balancing supply and demand to meet customer requirements. One respondent highlighted the need for accurate and efficient usage of storage space, stating,

“I have to maintain accurate and efficient usage of the storage space that’s available by constantly providing reports to the operation on how to shuffle stock around, looking at recent demand history and supply history” (C10).

This approach helped retailers manage the fluctuating demand during the pandemic.

The reviewed literature observed significant disruptions in global supply chains, particularly imports from China (Magableh, 2021a). Delays due to lockdowns and events like the Suez blockade impacted the delivery of imported materials. Participants echoed this, indicating that import delays restricted their ability to maintain optimal stock levels. As a reactive strategy, they implemented alternative stock ordering and storing protocols to reduce disruption.

Creating buffer stock was a critical element of demand management during the pandemic. Retailers adopted a “just-in-case” strategy, hoarding inventory to avoid losing sales. This approach ensured a sufficient inventory reserve capable of meeting unexpected spikes in demand or supply chain disruptions. One logistics manager explained:

“We created a predictive algorithm that flagged products that would get into trouble based on our current stock holdings and reorder capacity” (C23).

There was evidence that some had to use the buffer stock. Commenting on the use of the buffer stocks including adoption of technology-driven software “Economic Order Quality” (EOQ), one logistics manager from hospital pharmacy said:

“So, in our system there will be a level called a maximum and a minimum level, so it means that when we have that minimum level automatically that prompts our staff to order more drugs, So the idea is that they use the stock from the warehouse somewhere else. But we still keep our own buffer because what if they run out? So, there is a buffer. Yes, there’s a buffer within and, we have a buffer if we know there’s going to be a potential problem, we’ll also increase stock levels. So yes, we have a buffer” (C11).

This strategy helped retailers manage the uncertainties caused by the pandemic, ensuring they could meet customer demands despite supply chain disruptions.

To improve responsiveness, some retailers placed inventories closer to end consumers, reducing lead times. One respondent noted:

“Our goal is to make sure we have enough stock for our customers to sell. We had everything planned, but sometimes demand skyrocketed and had to balance between demand and supply” (C27).

This approach involved expanding distribution networks and enhancing flexibility and resilience in the supply chain. Furthermore, demand management also included collaboration with suppliers to ensure a consistent supply of essential goods. Retailers engaged in closer collaborations with suppliers to maintain a steady flow of products.

“We set up something for critical drugs to see stock levels state-wide across the hospital network, which was never there before” (C30).

During the process of managing the demand, the COVID-19 pandemic revealed the importance of leveraging data analytics and forecasting tools. Retailers invested in these technologies to gain insights into evolving consumer behaviours and demand patterns.

One manager of a distribution firm interviewed said:

“We usually order stock at least once a week for all our major suppliers and micromanage that” (C17).

This data-driven approach empowered retailers to make informed decisions regarding inventory management, product assortments and pricing strategies. Dynamic pricing strategies were adopted to adjust product prices in real-time based on fluctuations in demand and supply. This agile pricing approach helped maximise profits while efficiently managing inventory. One respondent highlighted the effectiveness of dynamic pricing, stating:

“We had to apply some logic to put limits on the stock going out, analysing what products were going quickly” (C15).

Retailers also expanded their digital presence to meet the surging demand for online shopping. Services like click-and-collect and kerbside pickup provided customers with safer shopping options. Personalised promotions and loyalty programs played a crucial role in retaining existing customers and attracting new ones.

To summarise, demand management involved the implementation of buffer stock creation to ensure a sufficient inventory reserve capable of meeting unexpected spikes in demand or disruptions in the supply chain and attempting to balance supply and demand. Australian retailers employed a multifaceted approach to demand management, encompassing data-driven decision-making, supply chain diversification, technology integration and customer-centric strategies. These measures enabled them to recover from the challenges posed by the COVID-19 pandemic and build resilience for future uncertainties and disruptions.

5.3.17 Diversification and dual sourcing

Diversification and dual sourcing involve the strategy of spreading risks across multiple suppliers and geographic regions to mitigate disruptions. This approach includes both proactive and reactive elements. Urciuoli et al. (2014) suggest that having multiple suppliers, especially from different countries or regions, provides a fallback plan if one supplier fails. This strategy aligns with the need for flexibility in both short and long-term contracts, as highlighted by Sheffi and Rice Jr (2005), Tang (2006), and Tomlin (2006). These authors emphasise that access to a broader supplier base allows firms to introduce additional production lines and swiftly adjust volumes and production in response to disruptions.

During the COVID-19 pandemic, some retailers interviewed highlighted that they intensified their diversification strategies following restrictive measures such as lockdowns. Others focused more on localised suppliers to ensure easier accessibility and delivery. Before the pandemic, reliance on China, the “world’s factory” (Zhu et al., 2020), was prevalent, but the shutdown of Chinese plants and factories forced many retailers to seek alternatives. Thompson and Anderson (2021) noted that almost no industry sector in the USA does not rely on China. The pandemic highlighted the risks of this dependency and shifted the focus of Australian retailers from international to domestic sources to address urgent shortfalls of COVID-19 products. A senior operations manager of a distribution company commented:

“I know of companies that went broke because they could not get stuff into Australia. They had to shut their doors and lay people off because the whole supply chain was based out of China” (C10).

This sentiment was echoed by many CEOs and risk managers who urged their supply chain teams to find sources independent of China. There was also increasing pressure from investors and government bodies to avoid overreliance on any single source.

Table 5-18 below details how diversification and dual sourcing were utilised during the pandemic.

Table 5-18 Diversification and Dual Sourcing

Strategies	Criteria	Evidence	Comments (Proactive/reactive)
Diversification/Dual sourcing	<ul style="list-style-type: none"> Developing new alternative/supplier, multiple suppliers/multiple (C25). Manufacturers and warehouses located in different regions. Regionalising supply chain. Working closely with current suppliers and diversifying suppliers (C20, C1, C14). Spreading risks across multiple sources and geographic regions. Increased their range of offerings to customers to reduce their reliability on specific income streams (C15). Sourced multiple suppliers instead of relying on a few e.g., China (C11, C12, C25). Conversion of existing face-to-face services to e-services (C25, C26, C19, C28). Design and development of new e-services. Introduction of e-commerce facilities (C1, C20). Developing new alternative/supplier, multiple (C10). Suppliers/multiple manufacturers and warehouses located in different regions (C12). 	<p><i>"We have diversified, and we have partnered with other suppliers that do other products in the healthcare that is ongoing so that we can, obviously, nurture our business portfolio and create other contracts and other products that are for the longevity" (C12).</i></p> <p><i>"We're always on the lookout for new suppliers. We're very conscious of what's happening in China. We're nervous about it and we trade with China. So, we're consciously trying to find new suppliers in different countries. And that's, that's what we're trying to do" (C25).</i></p> <p><i>"Organisations have realised the risk of relying on a single supplier or a single geography. The production of many products is concentrated in one country—sometimes in one city or one organisation—and that makes supply chains extremely vulnerable" (C18).</i></p> <p><i>"I know of companies that went broke because they could not get stuff into Australia. They had to shut their doors. They shut everything and ran out of, and they lay people off, they basically ended up closing the business down because the whole supply chain was based out of China" (C10).</i></p>	<p>This can be applied as both proactive and reactive strategy. Those who were successful embarked implementing various countermeasures of local sourcing to secure material supply. This was applied through diversifying the geographic locations of suppliers, placing more emphasis on suppliers that are physically closer to production and distribution centres, and strengthening relationships with current partners., equipment reuse, diversification of the supply, diversification of the demand and deployment of distributed manufacturing systems.</p>

As indicated in the above table the interview results revealed that most retailers employed various strategies to diversify their supply chains during the COVID-19 pandemic. It emerged from the interview analysis that developing new alternatives and partnering with multiple suppliers and manufacturers located in different regions was a common approach. This ensured

that companies could spread risks and avoid disruptions from relying on a single source, such as China. One respondent from a healthcare supplier noted:

“We have diversified and partnered with other suppliers that do other products in healthcare to nurture our business portfolio and create other contracts” (C12).

On the same note, a senior operation manager of a distribution company commented that:

“I know of companies that went broke because they could not get stuff into Australia. They had to shut their doors. They shut everything and ran out of, and they lay people off, they basically ended up closing the business down because the whole supply chain was based out of China” (C10).

Further analysis revealed that due to lockdown regionalising supply chains became crucial as well during the pandemic. Interviewed participants focused on sourcing from suppliers closer to their production and distribution centres to enhance accessibility and reliability.

“We’re always on the lookout for new suppliers, consciously trying to find new suppliers in different countries” (C25).

This proactive approach aimed to reduce dependence on international suppliers, particularly those in China. In response to the disruption caused by the pandemic interview results show that Australian retailers increased their range of offerings to customers to reduce reliance on specific income streams. This included introducing new product lines and expanding e-commerce facilities. Evidence to support this came from one respondent who highlighted the importance of diversification, stating:

“Organisations have realised the risk of relying on a single supplier or a single geography” (C18).

Further analysis of interviews scripts confirmed that retailers implemented various countermeasures, such as local sourcing, to secure material supply. Diversifying the geographic locations of suppliers and placing more emphasis on suppliers physically closer to production and distribution centres helped mitigate risks and to slowly recover from the sudden disruptive impacts of the COVID-19 pandemic. Another respondent mentioned:

“We have diversified and partnered with other suppliers to nurture our business portfolio and create other contracts and products for longevity” (C12).

The diversification strategy also involved shifting from single sourcing to multiple sourcing as evidenced by retailers looking for alternatives when China shut down its plants, illustrating the

global impact of these disruptions. One logistics manager emphasised the importance of a diversified logistics network:

“Organisations have realised the risk of relying on a single supplier or a single geography. The production of many products is concentrated in one country—sometimes in one city or one organisation—and that makes supply chains extremely vulnerable.” (C18).

In addition to geographic diversification, retailers expanded their product offerings and explored new sales channels while leveraging digital technologies. The approach to recovery included introducing new categories or products in high demand, such as clothing retailers selling face masks and hand sanitisers. The supplier portfolio was diversified using different criteria, including distance to destination (geographic diversification), type of countries and regions, and quality of the product supplied. However, the interviews confirmed that the focus was mainly on the availability of the product, with quality not being prioritised compared to the pre-COVID-19 pandemic period. Those who were relying on a single supplier like China, Korea, Taiwan, and Europe had to look and evaluate source selection and develop an alternative supplier.

A senior scheduling manager reported:

“We have diversified, and we have partnered with other suppliers that do other products in the healthcare that is ongoing so that we can, obviously, nurture our business portfolio and create other contracts and other products that are for the longevity” (C12).

Other indicated also that they ventured into alternative sales channels, expanding e-commerce operations, and partnering with online marketplaces. Retailers optimised their supply chains by diversifying sourcing options, increasing inventory visibility, and implementing advanced forecasting techniques. This ensured operational continuity and mitigated risks leading to recovery. Leveraging digital technologies, retailers adapted to changing consumer behaviours by investing in e-commerce platforms, mobile apps, and digital marketing strategies. They used data analytics to identify trends, anticipate consumer demand, and optimise product assortment and inventory management.

In summary, diversification and dual sourcing were critical strategies for retailers during the COVID-19 pandemic. By spreading risks across multiple suppliers and geographic regions, retailers could mitigate disruptions and ensure supply chain resilience. These strategies,

combined with digital technology and innovative approaches, enabled retailers to recover from the pandemic's challenges and build a more robust and adaptable supply chain for the future.

5.3.18 Contingency planning and contingency re-routing

Contingency planning is a critical aspect of business continuity, providing organisations with the ability to deal with and recover from unexpected events (Bastas & Garza-Reyes, 2022; Ivanov et al., 2018). The interview results revealed that the COVID-19 pandemic highlighted the importance of having robust Business Continuity Plans (BCPs). Of the companies interviewed, 35.8% had BCPs in place but found them inadequate for the magnitude of the disruption caused by the pandemic. Meanwhile, 27.6% were revising their BCPs, and 16.3% were in the process of formulating them. Only 5.7% did not plan to establish a BCP. In general, contingency planning involves having alternatives ready to mitigate disruptions. This strategy includes developing alternative routes, having a cash buffer, refreshing risk frameworks; and understanding mitigation plans. For instance, one respondent mentioned:

“If we had been sourcing a lot of our finished goods from overseas, we would have been in a lot more trouble with all the international shipping issues. Domestic manufacturing as a contingency really helped” (C22).

Table 5-19 details interview results how the contingency planning was applied.

Table 5-19 Contingency planning and re-routing

Strategies	Criteria	Evidence	Comments (Proactive/reactive)
Contingency planning and contingency re-routing	<ul style="list-style-type: none"> • Having alternatives in place in case of problems (C22). • Giving customers a clearer picture of where products are in SC update through gathering data to increase visibility (C10, C5, C15, C16). • Having a cash buffer as a contingency (C19, C17, C24). • Refreshing risk framework and then understanding the mitigation plans (C28, C9). • Having BCP plan in place (C10, C31, C5). • Developing alternative routes in case the main route is inaccessible (e.g., traffic jam, roadworks (C15, C20). 	<p><i>“If we had a to have been sourcing a lot of our finished goods from overseas, I think we would have been in a lot more trouble just with all the international shipping issues that have been going on. So, we’re very lucky that we have domestic manufacturing. That’s really helped” (C22).</i></p> <p><i>“So, we already had initiatives in place to receive electronic information in of what shipments were heading our way, provide electronic information on orders that we ship out to customers with the normal track and trace capability of seeing where shipments are at any point, in time in between those inbound and outbound flows” (C10).</i></p> <p><i>“Our safety stock safety stocks or their planning was made in such a way that they didn’t face problems” (C24).</i></p> <p><i>“The health department, which is the Western Australian Health Department or the New South Wales Health Department or the South Australian Health Department all require wholesalers to have a BCP. Why? Because we are an essential business to the community” (C31).</i></p>	Contingency planning allowed businesses to diversify their supply sources and establish backup suppliers. This strategy was applied both as proactive and reactive strategy. The exploitation of existing resources was instrumental in immediate response and stability, ensuring that the company could continue operations with minimal disruptions.

The analysis of the interview revealed that contingency planning allowed businesses to diversify their supply sources and establish backup suppliers. This strategy was applied both proactively and reactively. Leveraging existing resources was instrumental in ensuring immediate response and stability, enabling companies to continue operations with minimal disruptions.

One director commented:

“The health department requires wholesalers to have a BCP because we are an essential business to the community” (C31).

The interview results also show that during the COVID-19 pandemic, contingency planning was prominently manifested through resource exploitation and exploration practices. Resource

exploitation involved leveraging existing strengths, utilising established supply chains, and applying known solutions to sustain operational continuity. This approach mitigated disruptions and maintained stability. In line with this assertion, one VP of a consumer products company stated:

“We were not as prepared to manage supply as you would have hoped we would be”
(C32).

Simultaneously, exploration practices focused on creative problem-solving and capitalising on emerging opportunities. Companies engaged in proactive exploration to identify and implement innovative solutions, allowing them to adapt dynamically to evolving circumstances of the disruption caused by the COVID-19 pandemic. This approach combined resource exploitation and exploration to create a comprehensive and adaptive contingency plan. Retailers that successfully implemented both practices demonstrated resilience crucial for weathering the challenges of the pandemic. In the context of retailers, the results revealed, contingency planning involved assessing vulnerabilities in supply chains, workforce availability and critical operations. These were triggered by the lockdown policies implemented to curb the spread of COVID-19. Retailers diversified their supply sources and established backup suppliers to reduce the risk of shortages and maintain production and distribution continuity. One respondent noted:

“We have diversified and partnered with other suppliers to nurture our business portfolio and create other contracts and products for longevity as contingency”
(C12).

Investments in backup systems for IT infrastructure and data storage ensured the continuity of essential digital services and prevented data loss, enabling remote work and online operations through social media such as Teams and Zoom to facilitate working from home. Due to lockdown, other workers were also advised to be on standby as contingency planning. The interview also revealed that contingency planning also involved re-routing strategies, which refer to using alternative transportation routes in case of disruptions which has also been discussed in Section 5.3.2. This applied to logistics optimisation, with companies finding alternative routes and modes of transportation to ensure timely delivery of goods.

The COVID-19 pandemic disruptions meant that carriers often had to send ships on alternate routes, adding significant transit time. This put flexibility at the top of logistics providers’

priorities. By having contingency plans in place, businesses were better prepared to maintain their essential functions and services. One logistics manager mentioned:

“We managed through agility, communication, and understanding requirements and timeframes” (C5).

Lastly, contingency planning and re-routing were essential strategies for retailers during the COVID-19 pandemic. These strategies enabled businesses to mitigate disruptions, maintain continuity, and ensure resilience in their operations. By leveraging existing resources, exploring new solutions, and diversifying supply sources, retailers could navigate the unprecedented challenges of the pandemic and position themselves for future growth and stability.

5.3.19 Building social capital and relational competencies.

Social capital is defined as the sum of actual and potential resources embedded within, available through, and derived from the relationships possessed by an individual or social unit (Gölgeci & Kuivalainen, 2020). Social capital is widely recognised as a fundamental resource for firms, affecting resource exchange in network relationships by providing access to tangible and intangible resources, opportunities and facilitating learning (Gill, 2014). Building firm resources and capabilities rests significantly on the availability of social capital. It emerged from the interviews that during the pandemic and due to uncertainties, the importance of building social capital and relational competencies became even more pronounced. For example, communication, cooperation, trust, and reciprocity allowed retailers to establish a network of support, information and resources that proved invaluable during the unprecedented challenges of COVID-19.

The evidence that came from the interviews revealed that maintaining existing relationships and seeking out new ones was crucial for retailers during the pandemic because each organisation needed help that could make the organisation to survive. This proactive approach facilitated streamlined communication and cooperation with vendors and wholesalers. One respondent emphasised this strategy:

“We tried to take a proactive approach, combining existing relationships and maintaining and seeking out new relationships with the vendors and wholesalers for us to survive” (C23).

Furthermore, it also emerged that building social capital involved fostering stronger relational competencies such as communication, cooperation, trust, and reciprocity. These competencies helped retailers navigate the crisis by creating a supportive network. Retailers exchanged resources, provided mutual support, and shared critical information with suppliers, enhancing their collective ability to respond to disruptions. One respondent highlighted:

“We choose credible suppliers because they have been around for many years. Their values and survival depend on being transparent and ethical” (C32).

The proactive approach to building social capital also involved creating learning and training materials and sharing information through social media channels such as Zoom, email, Teams, Instagram or even updating each other on developments as there was a lot of uncertainty during the pandemic and organisations relied on information circulating through social media. This facilitated continuous learning and adaptation among supply chain partners. The importance of effective communication, trust and information sharing was paramount, enabling retailers to rapidly access necessary resources for recovery. This included fostering cooperation, reciprocity, and mutual support among supply chain partners, which played a pivotal role in shaping network relationships. Social capital not only facilitated access to resources but also created opportunities for learning, collaborative decision-making and developing innovative solutions. Retailers and their partners provided each other with emotional support, fostering solidarity and unity during the crisis. These strong relationships helped in immediate crisis management and contributed to long-term risk mitigation. On the logistics front, retailers ensured they had scalable resources such as adequate inventory levels, transportation capacity and warehouses. As customers increased home consumption, having these resources readily available allowed retailers to adapt to changing demand patterns and maintain supply chain continuity. Security measures extended beyond physical assets to encompass digital protection. Retailers invested in cybersecurity to safeguard their supply chains against cyber threats and data breaches, reducing theft and infiltration to minimise losses and disruptions.

In conclusion, building social capital and relational competencies, along with enhancing logistics capabilities, empowered retailers to recover from the COVID-19 pandemic and build a more resilient supply chain. These strategies emphasised trust, collaboration, adaptability, and protection against physical and digital threats, creating a robust foundation for future challenges. Social capital served as an enabler of formative capabilities for SCRE (LeBlanc, 2015), highlighting its critical role in navigating and overcoming the pandemic’s disruptions.

5.3.20 Creating redundancy.

Redundancy in supply chain management involves having excess capacity throughout the entire supply chain to maintain operations and prevent a slowdown or failure of facilities during unforeseen disruptions. It enhances the efficiency of a supply chain by providing additional resources, including utilising multiple suppliers and surplus resources acting as “shock absorbers” (Bode et al., 2011; Sopha et al., 2022). Redundancy is often critiqued as a costly option because the additional stock is only used when unanticipated events occur (Tukamuhabwa et al., 2017). However, redundancy as a resilience capability is essential for coping with crises such as demand surges or supply shortages (Christopher & Lee, 2004). Implementing redundancy strategies, such as inventory backup, multiple suppliers and protected suppliers can significantly improve a firm’s performance in a turbulent and complex business environment such as the one created by the COVID-19 pandemic.

The interview results indicated that redundancy was initially used as a proactive strategy, which involved planning recovery post-disruption by maintaining safety stocks and backup suppliers but intensified during the pandemic as retailers needed to meet the demand for certain products, which spiked. A total of 1.2% average frequency which is about 12 interviews mentioned the application of this strategy which represents about 38% of the total of the respondents. Other respondents highlighted the importance of building safety stocks to ensure enough time to react to disruptions. One respondent mentioned:

“We had documented plans and split sites into two shifts to ensure redundancy. If one shift went down, the second shift could keep orders going” (C22)

Table 5-20 details redundancy as a strategy and how it was applied.

Table 5-20 Creating Redundancy.

Strategies	Criteria	Evidence	Comments (Proactive/reactive)
Creating redundancy	<ul style="list-style-type: none"> • Focusing on multiple suppliers. (C1, C14, C15, C5, C26). • Having safety stock, capacity reservations (C22). • Shortening the supply chain to ensure that products are close to where they are needed. Moving inventories closer to consumers (C12). • Structural redundancy-back up facilities (C12). • Back up capacity suppliers. • Buffer stock (machinery, equipment, and logistics options) (C12, C1, C11). • Creating buffer stock and safety stocks. • Reshoring. • Development of other distribution centres /warehouses to develop new replenishment processes (C9, C10, C22). • Focusing on product availability rather than brand. • Organisations implemented safety stocks to reduce the risk of production line stoppages (C12, C11). 	<p><i>"We obviously held stock levels in all DCs around Australia. We maintained three to four weeks of stock worth based locally to or to allow for that change in demand" (C12).</i></p> <p><i>"We implemented documented plans, split sites into two shifts for redundancy, and ensured continued order distribution with reduced capacity, prioritizing key customers and outlining response protocols" (C22)</i></p> <p><i>"We obviously held stock levels in all DCs around Australia. We maintained three to four weeks of stock worth based locally to or to allow for that change in demand" (C12).</i></p>	<p>This strategy approach emphasising on redundant resources such as safety stock and emergency backup suppliers are primary solutions for enhancing supply chain responsiveness. A good example is having multiple facilities in different geographical and political regions which can help reduce the probability of simultaneous disruptions at multiple locations. Proactive redundancies can be expressed as investments in insurance. Insurance investment is a proactive investment towards anticipated future demand.</p>

Additionally, what emerged out of the interviews is that retailers introduced backup suppliers, backup depots and transportation channels/modes, inventory and capacity buffers, and capacity expansion. Another crucial aspect of redundancy that emerged is that some retailers started focusing and give more attention to multiple suppliers to ensure continuous material flow, survival building inventory or having redundant suppliers. One participant emphasised:

"We held stock levels in all DCs around Australia, maintaining three to four weeks of stock worth locally to allow for changes in demand" (C12).

This approach helped manage the supply chain disruptions caused by the pandemic, ensuring product availability, and reducing the risk of production line stoppages. Conversely, redundancy also involved creating buffer stock and safety stocks, developing new replenishment processes, and reshoring. One respondent explained:

“We created buffer stocks and reshored production to reduce dependency on international suppliers and mitigate risks” (C11).

This strategy helped retailers adapt to the supply chain challenges posed by the pandemic, ensuring they could meet customer demands despite disruptions. Furthermore, redundancy extended to transportation routes, with retailers diversifying logistics by using multiple transportation providers and alternative routes. This ensured the delivery of products even when traditional routes were affected. One participant highlighted the flexibility provided by redundancy, stating:

“We had documented plans in place and split sites into shifts to ensure redundancy. This allowed us to keep orders going even if one shift went down” (C22).

This approach ensured continuous operations and prioritised key customers during the crisis. The creation of redundancy in supply chains during the COVID-19 pandemic involved both “Buy” and “Make” strategies. The “Buy” strategy included creating buffer stocks outside existing frameworks, while the “Make” strategy involved collaboration with the Australian Government to establish new supply chains for essential items like PPE. This strategy required close collaboration and support from the government and other organisations willing to help.

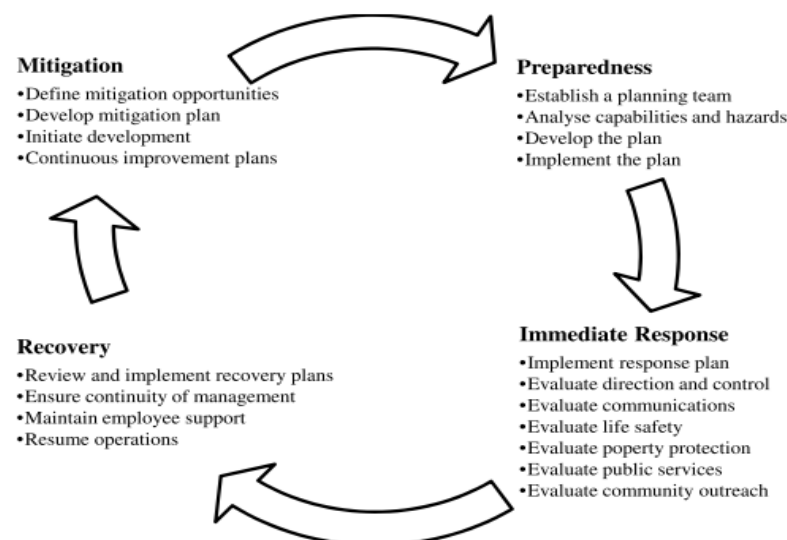


Figure 5.14 Disaster Management Processes (Adapted from Helferich and Cook (2002)p.53)

Figure 5.15 captures how the essence of effective and efficient disaster management is the application of a long-term perspective to the processes of making proactive decisions to lessen the impact of unforeseeable events combined with reactive decisions to overcome the impact (Natarajarathinam et al., 2009), analogous to definitions of resilience in academic research.

In conclusion, creating redundancy is a vital strategy for enhancing supply chain resilience. By focusing on multiple suppliers, maintaining safety stocks, and diversifying logistics, retailers can ensure continuous operations during disruptions. This approach not only helps in immediate crisis management but also contributes to long-term resilience against future uncertainties. As highlighted by Sopha et al. (2022), redundancy offers a robust framework for navigating supply chain disruptions and building a resilient supply chain capable of withstanding future shocks.

5.4 Phase 2 Detailed Results Analysis:

As highlighted in the methodology section, phase two interviews were conducted to identify the key performance indicators (KPIs) that could help recover from the COVID-19 pandemic. Following the detailed discussion of Hybrid (Proactive and Reactive) strategies in section 5.3, it is crucial to integrate the results of phase- 2 into this discussion. The findings from both phase 1 and phase 2 are instrumental in shaping the modified conceptual framework. While phase 1 focuses on hybrid strategies along with resource utilization in executing these strategies, phase 2 results revealed how the hybrid strategies demonstrated the disruption recovery leading to a sustainable business continuity. Resource allocation ensured firms' response to evolving challenges. Identifying KPIs such as lead time variability, inventory turnover rates, and customer satisfaction deems essential for immediate recovery and long-term business sustainability.

The modified framework, informed by literature and empirical data, provides a robust means for understanding and implementing recovery strategies in supply chains. By incorporating new insights from phase 2 interviews, this framework addresses KPIs that the managers focused on for a quick recovery. This integrated framework is pivotal in guiding firms through recovery while fostering long-term sustainability and resilience.

5.4.1 Performance Indicators Demonstrating Recovery from Pandemic Disruptions

Table 5.21 contains the results that will be discussed in detail.

Table 5.21 KPIs for Firm Recovery and Progression

No	Category/Themes	Main Themes	Sub-themes	Interview Excerpts	Comments
1	KPI for recovery from pandemic	Sales and financial metrics: <ul style="list-style-type: none"> • Inventory management • Operational efficiency • Full capacity of resources: • Sovereign capability • Digitalisation and visibility projects, as an indicator of recovery • Tracking standard metrics 	<ul style="list-style-type: none"> • Cushioning Earnings Before Interest and Taxes (EBIT) during downturns (C9). • Managing costs as a percentage of sales (C2). • High service levels and improved stock availability. • Improved inventory record accuracy (C1, C10, C9). • Ensuring local manufacturing capabilities (C2). • Improved profits (C2, C19). 	<p><i>"I think from our perspective it was trying to cushion our EBIT and making sure that we didn't have a catastrophic downturn in profitability." (C9).</i></p> <p><i>"The indicator that we were back was our top-line sales. We are going to crack \$3 billion, so we're back" (C19).</i></p> <p><i>"Our inventory record accuracy improved which was an unexpected benefit during this time." (C1, C10, C9).</i></p> <p><i>"Now that we've got all the full capacity of our resources, it's a clear indication that we've recovered" (C10).</i></p> <p><i>"We managed to maintain our profit margins and even saw an increase during and after the pandemic" (C2).</i></p>	Companies have introduced new KPIs and focused on getting the basics right rather than reinventing the wheel. Companies focused on financial stability (EBIT) and operational efficiency while improving sales.
2	KPI for progression/confidence in current KPIs.	<ul style="list-style-type: none"> • Crisis preparedness • Focus of fundamentals • Tracking business performance 	<ul style="list-style-type: none"> • Implementation of Standard Metrics (C9, C10, C29). • Enhanced confidence in handling future disruptions (C9, C19). • Concentrating on foundational aspects (C32, C9). 	<p><i>"The performance standards that we're measured against are constantly changing." (C10).</i></p> <p><i>We've started to measure standard KPIs that we didn't previously track." (C9).</i></p> <p><i>"We've become more conscious that there's never going to be normal. There's an ongoing need to be flexible and strategize for alternative issues." (C10).</i></p>	The introduction of new KPIs and focusing on foundational aspects enhanced confidence in future performance. There were some KPI that were previously ignored but all of a sudden, they have now been given attention as companies look into the future for continual survival.

The Table 5.21 revealed that the interviewees demonstrated their companies' recovery by using several key performance indicators. Financial stability was their priority to secure companies' future. For example, they focused on increased sales volume while maintaining operational efficiency, improved service levels and inventory availability as their ongoing strategies. Sales and financial metrics were pivotal to them, with top-line sales figures being a primary indicator.

Moreover, tracking standard metrics, follow up with the suppliers while keeping tab on improved business performance are other measures helped them maintained continuity in business. One group operations manager highlighted:

“The indicator that we were back was our top-line sales. We are going to crack \$3 billion, so we’re back” (C19).

Another CEO responded that her company focused on cushioning Earnings Before Interest and Taxes (EBIT) to maintain profitability during downturns.

“I think from our perspective it was trying to cushion our EBIT and making sure that we didn’t have a catastrophic downturn in profitability” (C9).

The national supply chain of one of the retailers retorted that maintaining profit margins and even seeing an increase in profitability during and after the pandemic. Operational efficiency also played a crucial role, with improvements in inventory accuracy and service levels. This was evident from the interviews as one of the inventory managers highlighted:

“From a personal point of view, inventory accuracy has improved. We’ve got access to a more comprehensive inventory and resource pool” (C10).

Other retailers mentioned that the key indicators for recovery have been an initiation of several projects, including digitalization, tracking and visibility. Other confirmed that their organisations returned to high service levels:

“We returned to mid-90s in our delivery on time which was critical for our service proposition” (C9).

Cost management was another significant factor, with companies monitoring cost ratios to ensure financial health. One Group operations manager highlighted.

“When your sales drop, both our workforce and our fixed and variable costs go half. So, it’s about hitting that sweet spot with cost ratios” (C19).

From the interview, another indication of recover was the resource availability which also signalled faster recovery from the pandemic.

One Interviewee emphasised:

“Now that we've got all the full capacity of our resources, it's a clear indication that we've recovered” (C10).

While on the same note interviewee C2 highlighted the importance of ensuring local manufacturing capabilities for critical supplies as a future preparedness measure. One of the sales managers echoed this sentiment:

“We have been able to maintain an agile and quick-response team to handle any future disruptions” (C16).

The thematic analysis of the follow-up interviews reveals several key insights about the recovery of companies from pandemic disruptions and their future strategies. One prominent theme is the focus on financial resilience and operational efficiency. Companies emphasised maintaining financial stability, such as cushioning (Earnings before interest and taxes) EBIT during downturns, which was crucial for mitigating the impact of the pandemic. This was paired with efforts to enhance operational efficiency, evidenced by improved service levels and inventory management. For instance, achieving high delivery on-time rates and increased accuracy in inventory records were highlighted as significant indicators of recovery.

5.4.2 Firm sustainable recovery

Firm sustainable recovery is defined as a recovery process that not only restores supply chain operations after a disruption but also integrates long-term strategies that enhance resilience, environmental responsibility, and adaptability for future disruptions Sarkis et al (2020). The Table 5.22 presents key strategies that contributed significantly to firm sustainable recovery. While asked about how confident they were regarding the current KPIs going forward, most respondents expressed high confidence in their current performance indicators, which now included standard metrics that were previously ignored. Suddenly, there are KPIs that have now been given attention as companies look into the future for continual survival.

One respondent mentioned:

“We’ve started to measure standard KPIs that we didn’t previously track” (C9).

Table 5.22: Firm Sustainable Recovery

No.	Category /Themes	Main Themes	Sub-themes	Interview Excerpts	Comments
1	Firm, Sustainable recovery	<p>Risk Management Integration</p> <p>Enhanced Relationship Internal</p> <p>Capability Building</p> <p>Contingency planning</p> <p>Sourcing and diversification</p> <p>Continuation of effective strategies</p>	<p>Embedding risk management in daily operations (C9, C11, C31).</p> <p>Developing internal capabilities in supply chain management and risk assessment (C10, C11).</p> <p>Continuing to source from a wider variety of suppliers (C10, C29, C32).</p> <p>Emphasising planning for various potential crises.</p> <p>Flexibility and adaptability.</p>	<p><i>"We've embedded risk management into our daily operations making it a core part of our strategy."</i>(C9, C19).</p> <p><i>"Developing our internal capabilities around supply chain management and risk assessment has been crucial."</i>(C9)</p> <p><i>"We probably toned down some of the strategies we've had to adopt."</i>(C29, C10)</p> <p><i>We probably source from a wider variety of suppliers for labour and other diversification."</i> (C10)</p> <p><i>"Maintaining an agile and quick-response team to handle any future disruptions is vital."</i> (C9, C16)</p> <p><i>During the COVID-19 times we were pretty well operating two shifts in isolation. We've probably relaxed some of those strategies but maintained others where needed."</i>(C10 C2, C11)</p>	<p>The analysis revealed that a lot of strategies implemented have been relaxed post-COVID-19 although some have been upheld for future implementation. Strategies such as diversification remain in place. Diversified sourcing has been sustained or adapted. Companies acknowledge that the concept of "normal" is fluid, requiring ongoing flexibility and strategic planning. Flexibility and adaptability remain crucial.</p>

The results shown in the table explain firm sustainable recovery, the outcome variable/construct in the modified framework. By embedding risk management into daily operations, companies ensured that risk mitigation became an integral part of their strategy, contributing significantly to their resilience. As one respondent noted,

"We've embedded risk management into our daily operations, making it a core part of our strategy" (C9).

This proactive approach allowed companies to stay ahead of potential disruptions and adapt quickly to changing circumstances. Developing internal capabilities, particularly in supply chain management and risk assessment, was also critical for sustainable recovery. This internal

strengthening ensured that firms were not solely reliant on external factors but could effectively leverage their resources. One participant emphasised,

“Developing our internal capabilities around supply chain management and risk assessment has been crucial” (C9).

In addition to internal strategies, maintaining and expanding supplier relationships played a key role in sustainable recovery. Firms that continued to source from a wider variety of suppliers were better equipped to handle supply chain disruptions. As another participant stated,

“We probably source from a wider variety of suppliers for labour and other requirements (C10).

This strategy provided immediate solutions during the pandemic and laid the groundwork for a more resilient supply chain in the future.

Flexibility and adaptability remained essential components of firm recovery. Even as some strategies were relaxed post-COVID-19, the core principles of flexibility and quick adaptation to new challenges were maintained. As one director commented,

“During the Covid times we were pretty well operating the two shifts in isolation. We’ve probably relaxed some of those strategies but maintain others where needed” (C10).

This approach ensured that companies could continue to operate efficiently while being prepared for future disruptions.

The strategies outlined in the Table 5.20 played a critical role in achieving firm sustainable recovery. The combination of proactive risk management, internal capability building, strong supplier relationships, and flexibility ensured that companies were not only able to recover from the immediate impacts of the pandemic but were also better prepared for future uncertainties. These findings reinforce the importance of a balanced approach that integrates both internal and external strategies for long-term resilience and success.

In summary, what emerged from the follow-up interviews is that companies have introduced new KPIs and at the same refining and maintaining some old KPIs. This dynamic nature of performance assessment indicates a shift towards a more adaptable and responsive business model. Companies’ resilience strategies during the pandemic have been primarily sustained

and evolved. Risk management has been embedded into daily operations, becoming a core part of the strategy. Companies have also focused on building internal capabilities in supply chain management and risk assessment, emphasising the importance of contingency planning for various potential crises. Lastly, there is a strong emphasis on continuous improvement and adaptation. Companies recognise that “normal” is fluid, and there is an ongoing need for flexibility and strategic planning. This is particularly evident in their commitment to sustainability and technology integration, which are seen as critical areas for future progress. The overall sentiment is that businesses must remain vigilant and prepared for a range of potential disruptions, be they related to pandemics, climate change, or other global challenges. This approach reflects a significant shift in how companies view and manage resilience, ensuring they are better equipped to navigate the evolving business landscape.

5.5 Modified Research Framework

The initial conceptual research framework was modified following the findings in section 5.3, which detailed hybrid strategies (proactive and reactive) and resource utilisation insights. The integration of findings of Phase 2 results, discussed in section 5.4, emphasised KPIs and mechanisms that helped recovering from the COVID-19 pandemic. This comprehensive framework combines insights from both research phases, providing a holistic understanding of the strategies necessary for effective supply chain disruption recovery and sustainable firm recovery.

The Phase 2 interviews were instrumental in identifying KPIs, including inventory turnover rates, lead time variability and customer satisfaction indices. These metrics are crucial for assessing both immediate recovery and long-term sustainability. Results of this study indicate that resilience strategies implemented by most retailers during the pandemic were more varied than those strategies before the pandemic. A range of dominant proactive and reactive strategies ranging from 59% to 100% of the interviewed retailers confirmed that they indeed implemented resilience strategies and used more than two strategies to survive. As a summary of this section so far, the results have shown that the proactive and reactive strategies (hybrid strategies), while being moderated by effective resource utilisation, have a significant influence in helping the firm to recover from a supply chain disruption to attain firm sustainable recovery. The modified framework is presented in Figure 5.16. The framework highlights the importance of hybrid strategies that integrate proactive measures, such as digitalisation and resource optimisation, with reactive measures like crisis management and contingency planning. This

dual approach ensures a resilient and adaptable supply chain capable of navigating future disruptions.

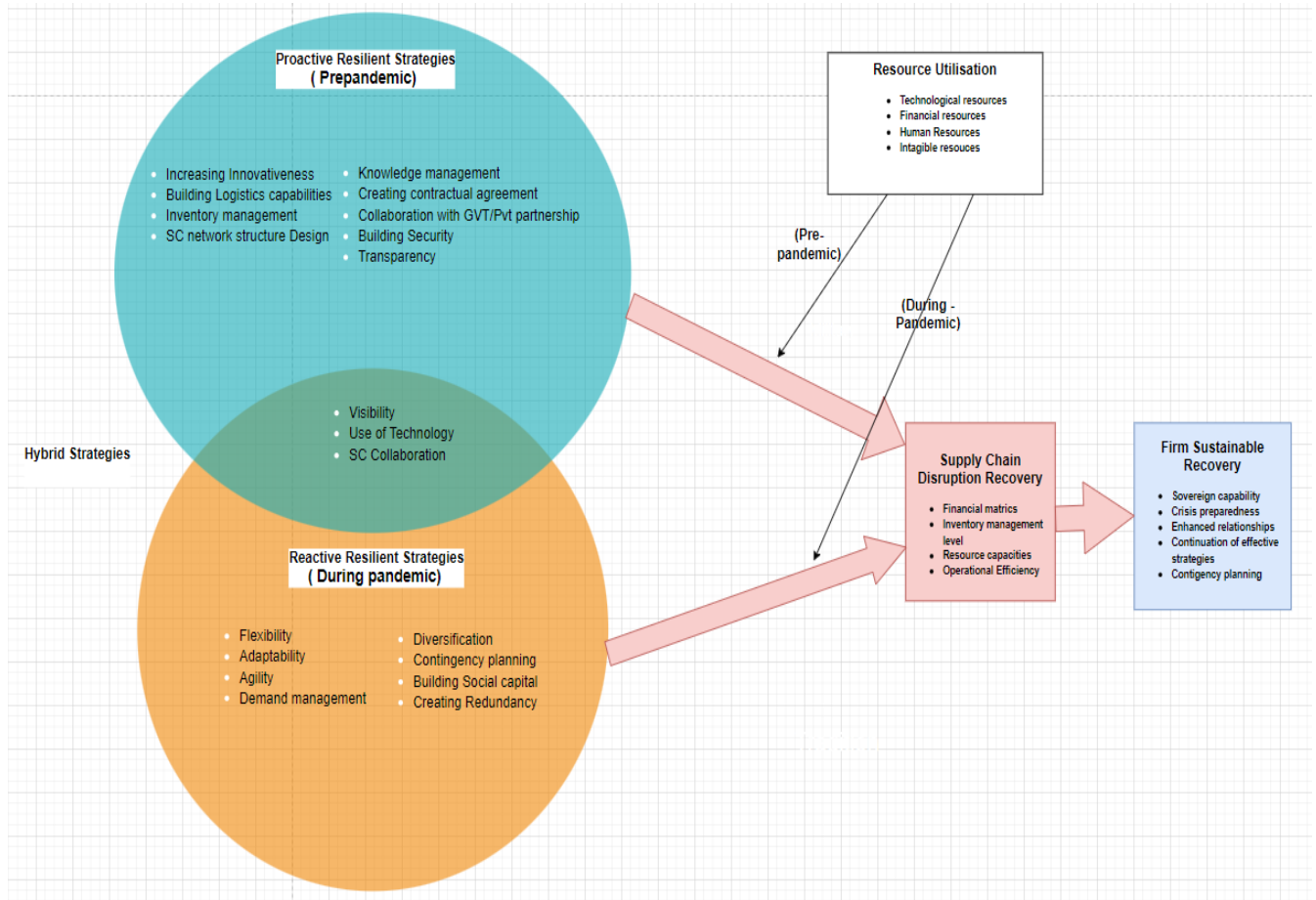


Figure 5.15 A hybrid resilience strategy during the pandemic.

5.5.2 Analysis and propositions based on findings.

Prior to the COVID-19 pandemic, organisations adopted proactive strategies to systematically enhance SCRE using existing resources. These strategies included maintaining optimal inventory levels, diversifying suppliers, and investing in technologies like AI and IoT for supply chain management. We propose the following:

Proposition 1 (P1): Proactive strategies combined with effective resource utilisation, contribute significantly to supply chain recovery.

Rationale: Proactive strategies, such as integrating digital technology and comprehensive inventory management, are crucial for enabling supply chains to withstand and recover from disruptions. Our analysis shows that these strategies improve visibility, coordination, and

overall preparedness, which are key to mitigating the impact of disruptions and ensuring swift recovery. Digital tools like AI and IoT enhance tracking and forecasting capabilities, facilitating efficient resource allocation.

Evidence suggests that proactive strategies significantly mitigate the effects of disruptions. Enhanced transparency through digitalisation and robust inventory buffers are vital for maintaining operational stability during crises, as indicated by improved inventory accuracy and service levels among participating companies. Proactive strategies involve anticipating potential adverse events—whether technical, natural, or human-made—and implementing measures to either prevent or minimise their impact (Cantwell, 2022). Based on the perceived threat level, managers should adjust operational processes accordingly. Therefore, proactive resilient strategies (pre-pandemic) that focus on digital technology, visibility and inventory management positively influence the recovery from supply chain disruptions.

Proposition 2 (P2): Reactive strategies, combined with effective resource utilisation, contribute significantly to supply chain recovery.

Rationale: Reactive strategies are critical for managing unexpected disruptions. Flexibility and adaptability allow supply chains to adjust quickly to new conditions, while contingency planning provides predefined responses to various types of disruptions, aiding in swift recovery. During the COVID-19 pandemic, Australian retailers successfully employed these strategies to manage sudden supply chain interruptions, maintaining business continuity and minimising adverse effects. Data indicate that reactive strategies enable companies to respond rapidly to changing circumstances, thereby mitigating the negative impacts of disruptions. This includes making swift adjustments in supplier relationships and operational processes, which are crucial for sustaining supply chain operations during crises.

While a reactive approach is often necessary due to the unpredictable nature of business, it is important to balance this with proactive strategies to prevent potential issues. The use of reactive strategies, characterised by flexibility, adaptability, and the implementation of contingency plans, is vital for addressing unexpected disruptions and ensuring a resilient supply chain. Further, as per RDT perspective, resource availability and firms' ability to effectively use can lead to faster recovery.

Proposition 3 (P3): The adoption of both proactive and reactive strategies, along with appropriate resource utilisation, enhances supply chain disruption recovery.

Rationale: A hybrid strategy that integrates both proactive and reactive elements offer a comprehensive approach to enhancing supply chain resilience. Drawing on Resource Dependence Theory (RDT), this strategy emphasizes how organizational leaders can redesign their supply chains and mobilize resources to reduce uncertainties and build a resilient framework capable of resisting supply chain disruptions (SCDs), such as those caused by a pandemic like COVID-19. Proactive strategies prepare the supply chain for potential disruptions, while reactive strategies enable effective responses when disruptions occur. This dual approach ensures that companies are not only equipped to mitigate risks but can also manage crises effectively when they arise.

The integration of continuous visibility, technology use, and strong collaboration among supply chain partners further enhances overall resilience and recovery capacity. From an RDT perspective, resource availability—whether internally or through supply chain partners—supports faster recovery by enabling real-time monitoring, efficient decision-making, and coordinated responses. Empirical data from our study indicate that companies employing hybrid strategies, along with leveraging organizational resources, were better positioned to handle the challenges posed by the COVID-19 pandemic. Proactive measures such as digitalization and resource planning were effectively complemented by reactive crisis management, creating a robust response framework. This approach highlights the critical role of effective resource management in achieving resilience. Therefore, hybrid strategies that combine elements of visibility, technology, and collaboration significantly bolster both proactive and reactive resilience, leading to a more robust recovery from supply chain disruptions.

Proposition 4 (P4): Efficient resource utilisation is crucial for successfully implementing resilient strategies and recovering from supply chain disruptions before and during pandemics.

Rationale: Effective management of resources—including human, financial, and technological—is essential for supporting both proactive and reactive strategies in supply chain resilience. Adequate resource allocation, from RDT perspective, ensures that the necessary tools, processes, and capabilities are available to enhance the supply chain's ability to recover from disruptions. Efficient use of resources contributes to sustainable recovery and strengthens

resilience against future disruptions. RDT argues that recovery is dependent on the extent of resources reliance and its availability through partnership. The findings from the study emphasise that optimising the resource utilisation enables companies to maintain operational continuity and achieve recovery. By strategically managing resources, firms can ensure they possess the capabilities needed to withstand disruptions and support long-term sustainability. Efficient resource utilisation not only aids in immediate recovery but also builds a robust foundation for handling potential future crises.

Proposition 5 (P5): The strategic integration of proactive and reactive (hybrid) measures critically supports the supply chain disruption recovery.

Rationale: The findings from Phase 2 highlight the importance of combining proactive and reactive strategies to effectively manage and recover from supply chain disruptions. Proactive measures, such as risk assessment and technology investments, enable companies to prepare for potential disruptions. Reactive measures, including agile response and crisis management, allow for efficient handling of unexpected challenges as they arise.

This strategic combination ensures that companies can minimise operational downtime, reduce financial losses and maintain business continuity. The hybrid approach provides a comprehensive framework for managing disruptions, facilitating quicker recovery, and enhancing overall supply chain resilience. Effective coordination and communication within the supply chain network are key to implementing these strategies successfully, ensuring a robust response to any disruption.

Proposition 6 (P6): Disruption recovery strategies have significant effect on sustainable business continuity strengthening supply chain resilience.

Rationale: Sustainable recovery, defined as the ability to restore and enhance operations beyond pre-disruption levels, is vital for long-term supply chain resilience. The findings from Phase 2 interviews indicate that focusing on sustainable recovery strategies not only secures immediate operational stability but also builds overall resilience, offering a competitive advantage. These strategies include the continuous improvement of supply chain processes and the adoption of new technologies, which are essential for businesses to recover and grow post-disruption. The COVID-19 pandemic highlighted the critical need for companies to invest in sustainable recovery efforts that enable them to not just survive but thrive following

disruptions. By implementing sustainable recovery practices, companies can create more robust and adaptable supply chains, capable of withstanding future disruptions. This comprehensive approach integrates proactive, reactive and hybrid strategies, along with efficient resource utilisation, to enhance a firm's ability to recover from disruptions and ensure long-term sustainability. This framework provides a valuable guide for both academic research and practical applications in supply chain management, particularly in crisis recovery and resilience-building.

From the results of the interviews, the six propositions collectively emphasise the importance of integrating proactive, reactive (hybrid strategies), alongside efficient resource utilisation and sustainable recovery practices, to enhance SCRE and ensure effective disruption recovery. This comprehensive hybrid framework provides a robust approach for managing crises and maintaining long-term sustainability in supply chain operations.

5.5.3 Other findings on SCRE strategies

From the findings, a variety of equally important strategies were identified. These diverse strategies, while not discussed in depth, collectively highlight the multifaceted approaches that contributed to the resilience and recovery of retail businesses during the COVID-19 pandemic. This comprehensive understanding provides valuable insights into the practical aspects of supply chain management, enabling a deeper understanding of the importance of integrating various strategies to enhance resilience in times of disruption.

5.5.3.1 The Role of Leadership and Top Management Commitment

The commitment and leadership of top management were not only essential but also inspiring as companies navigated the challenges of the COVID-19 pandemic. Effective leaders fostered a culture of resilience, encouraging collaboration, sharing best practices, and making decisive strategic decisions. Their active involvement in crisis management served as a source of motivation, helping to maintain operational stability and boost employee morale. Leaders who demonstrated adaptability were particularly successful, striking a balance between providing clear direction and remaining flexible to respond to rapid changes, thereby enhancing the organization's ability to navigate the crisis. One CEO emphasized the critical role of leadership during the crisis, stating,

"Our CEO understands the importance of effective leadership in times of crisis. She invested in senior leadership within the supply chain, creating a structure with

experienced professionals in key supply chain roles. The presence of supply chain experts on the board and at the C-level was vital during the crisis." C15.

A logistics manager also highlighted the significance of leadership during the pandemic, saying,

"From a corporate perspective, the most important aspect during the COVID-19 outbreak has been leadership's role in sharing motivational information and corporate strategies. It was essential for leaders to communicate how the company was handling the lockdown, ensuring that motivation and confidence remained high across the organization." C10

During the pandemic, leaders who successfully managed the crisis demonstrated high stress tolerance by accepting the challenges, grounding themselves in a higher mission or values, and drawing on the support of their employees. This underscores that effective leadership is crucial for transformative, collective action in times of uncertainty, such as during a pandemic. To instil trust in their followers, leaders must take appropriate action through preparation and planning, seeking out relevant information, leading adaptation efforts, and ensuring a coordinated response.

5.5.3.2 A Strategic Shift to Omnichannel Retailing:

The interviews highlighted a pivotal strategy that retailers employed to recover from the disruptions caused by the COVID-19 pandemic: a shift to omnichannel retailing. This strategy exemplified the agility and adaptability required to navigate the unprecedented challenges. With in-store shopping heavily restricted and consumer preferences in constant flux, retailers quickly recognized the necessity of adopting an omnichannel approach. This involved seamlessly integrating various sales channels—such as physical stores, e-commerce platforms, mobile apps, and social media—to create a cohesive and enhanced shopping experience for customers. To effectively implement this strategy, retailers invested in key technologies like inventory management systems, customer relationship management (CRM) tools, and data analytics. These tools provided a comprehensive view of the customer across all channels, enabling retailers to better understand and respond to customer preferences. The shift to omnichannel retailing also allowed retailers to offer flexible purchasing options, such as buy online, pick up in-store (BOPIS), and to maintain sales continuity despite ongoing disruptions.

This strategic move aligns with findings by Patchett (2021) who reported that nearly two-thirds of retail and consumer products organizations were revising their supply chain strategies in response to the shift toward online shopping and the broader disruptions caused by the

pandemic. The COVID-19 pandemic dramatically disrupted the retail sector, with the impact varying significantly between brick-and-mortar and online stores, essential and non-essential retailers, and small versus large businesses. As Matt Darby, Head of Retail at KPMG, stated,

"There can be no doubt that the global retail sector has been impacted by hugely disruptive forces as consumers shift to digital and online as their preferred medium of engaging with brands. The simple truth is that Australian and New Zealand retailers are not immune to the changes affecting the entire world" (Australian Retail Outlook, 2020).

In conclusion, the shift to omnichannel retailing was not just a response to immediate challenges but a strategic evolution that positioned retailers to better meet the demands of the modern consumer and build resilience against future disruptions.

5.5.3.3 Creating a Risk Management Culture

Developing a risk management culture was a key strategy for building supply chain resilience. This involved proactive risk assessment, scenario planning and the establishment of contingency plans. The systematic collection and analysis of data, supported by technologies like big data analytics and blockchain, helped organisations learn from past disruptions. Strong leadership was essential in fostering a culture that prioritised risk management, enabling companies to anticipate and respond effectively to potential threats.

5.5.3.4 Effective Communication

Effective communication was another critical component of SCRE during the pandemic. Clear and timely communication with stakeholders, including customers, suppliers, and employees, helped manage expectations and maintain transparency. Retailers used various channels, including social media, emails, and internal communication platforms, to keep all parties informed about changes in operations, product availability, and safety protocols. This communication strategy was vital in managing uncertainties and ensuring smooth operations. Due to space limitations in this thesis, these strategies will not be discussed in depth. However, they collectively highlight the diverse approaches that contributed to the resilience and recovery of retail businesses during the COVID-19 pandemic. These findings provide valuable insights into the practical aspects of supply chain management and the importance of integrating various strategies to enhance resilience in times of disruption.

5.6 Summary of the Chapter

This chapter presents the primary findings of the study, detailing both the proactive and reactive strategies employed by retailers to navigate the challenges posed by the COVID-19 pandemic. Utilising the theoretical frameworks of Resource Theory (RT) and RDT, the research explored strategies that contributed to enhancing supply chain resilience. The interview results provided in-depth insights into these strategies, illustrating how retailers fortified their supply chains during a time of unprecedented disruption. These insights were combined to develop a table of hybrid strategies, which were pivotal in preparing for and mitigating disruptions, ensuring a responsive and efficient supply chain.

A key focus of the chapter is the development of a new conceptual framework, synthesising findings from both phases of the research. This framework highlights the significance of hybrid strategies, which combine proactive measures such as resource optimisation and technological integration with reactive measures like agile crisis response and contingency planning. These hybrid strategies were crucial for maintaining supply chain continuity and facilitating rapid recovery. The framework emphasises the importance of continuous visibility, active collaboration among supply chain partners, and the utilisation of digital tools to enhance overall resilience, making the audience feel engaged and involved in the process.

Additionally, the chapter highlights other critical strategies, such as leveraging social media for effective communication, the crucial role of leadership and top management commitment, strategic supplier selection and fostering a risk management culture. These strategies, particularly the leadership's commitment, were instrumental in ensuring operational stability and adaptability during the pandemic, providing reassurance and confidence in the face of uncertainty. The chapter concluded by presenting several propositions based on the study's findings. These propositions underscored the necessity of integrating proactive and reactive strategies, the importance of efficient resource utilisation and the focus on sustainable recovery as key components of a resilient supply chain. The propositions also highlighted the role of technological advancements and adaptive strategies in navigating future challenges.

Chapter 6

Discussion and Implications

6.1 Introduction

This chapter presents an in-depth discussion of the research findings on resilience-enhancing strategies within the Australian retail sector during the COVID-19 pandemic. Utilizing Resilience Theory (RT) and Resource Dependency Theory (RDT), the study examines the strategies employed to strengthen SCRE amidst unprecedented disruptions. The discussion synthesizes insights from the conceptual framework developed through the research, emphasizing both its theoretical significance and practical implications for enhancing supply chain robustness in an evolving global landscape. Additionally, the chapter addresses the research questions, outlines key lessons learned, and explores future directions. It concludes with a thorough discussion of the study's practical, theoretical, and managerial contributions.

6.2 The COVID-19 Pandemic Phenomena

The sudden outbreak of COVID-19 led to severe and unprecedented supply chain disruptions globally. The pandemic created a perfect storm, with panic buying, raw material shortages, localization trends, and spikes in demand for essential products. These issues were further exacerbated by transportation and logistics problems, border closures, lockdowns, and political, social, and health crises. These factors, alongside logistics delays, stockpiling, hoarding, and panic buying, created a challenging environment that necessitated both proactive and reactive strategies for survival and resilience in the supply chain.

This study provides descriptive insights into the collaboration between retail companies and governments/regulatory bodies, emphasizing the need for closer collaboration to address current regulatory pitfalls and find solutions. The pandemic has exposed the fragility of supply chains, highlighting the need for a shift towards a more agile and resilient approach (CIPS REPORT, 2020a; Patchett, 2021). Organizations must develop a deeper understanding of their supply chains to identify potential pinch points and respond swiftly. Traditional long, lean supply chains that rely on just-in-time delivery may no longer be viable without accompanying localization strategies to spread supply risk. There is an ongoing need for businesses to invest in digitalization to improve responsiveness, data access, and supplier connectivity, emphasizing the importance of collaboration, trust, and transparency in building resilient supply chains.

6.3 The Impact of the COVID-19 Pandemic on Supply Chain Resilience

The COVID-19 pandemic brought unprecedented disruptions to global supply chains, significantly impacting the Australian retail sector. This study, grounded in RT and RDT, explored the strategies that enabled retail companies to navigate these challenges effectively. RT emphasises the capacity of a system to absorb disturbances and reorganise while maintaining essential functions, which is critical for supply chains facing disruptions like COVID-19 (Holling, 1973). Complementing this, RDT focuses on how organizations manage dependencies and secure essential resources from their environment (Davis & Cobb, 2010; Pfeffer & Salancik, 1978). By integrating these theories, the research offers a comprehensive understanding of how resource dependencies and adaptive capabilities influenced resilience during the pandemic.

The research identified a range of proactive and reactive strategies in literature. Most of these researchers and practitioners agree with division of these strategies along two main dimensions: proactive and reactive (Cheng & Lu, 2017; Dabhilkar et al., 2016; Deren & Skonieczny, 2021; Hohenstein et al., 2015; Tukamuhabwa et al., 2017). These strategies are crucial in mitigating the impact of supply chain disruptions. Proactive strategies, for example, enhancing digital technologies, increasing supply chain visibility, and fostering collaboration with supply chain partners, were essential in anticipating disruptions and preparing for unforeseen challenges. These strategies even echoed in recent literature emphasising the importance of digital transformation in building SCRE (Ekinci et al., 2024; Dmitry Ivanov, 2021; Ivanov, 2024; Paul, Chowdhury, et al., 2021; Zhang et al., 2023). Reactive strategies, including adaptive logistics, resource reallocation, and real-time data utilization, allowed companies to respond quickly to disruptions, supported by the availability of advanced technologies and strong partnerships (Fan et al., 2023; Ivanov & Dolgui, 2019; Jiang & Stylos, 2021; Khuan et al., 2023; Moosavi & Hosseini, 2021).

A significant contribution to this discussion is the transformation of SCRE research highlighted by Ivanov (2024) and Ekinci et al. (2024). Before the pandemic, resilience modelling primarily dealt with *known-known/random uncertainty*, where disruptions and their impacts were well-understood, and partially *known-unknown/epistemic uncertainty*, where disruptions were known but their impacts were uncertain (Ivanov & Dolgui, 2019). However, COVID-19 introduced a context where supply chains had to manage long-term crises characterized by volatile demand, capacity, and supply. Ivanov (2024) argues that traditional resilience models,

based on these known disruptions, were insufficient for the deep uncertainty presented by the pandemic. Instead, there was a shift toward adaptation and the acceptance of disruptions as part of the 'new normal' business operations, underscoring the need for a dynamic, continuously adaptive approach to resilience.

6.4 Hybrid Research Framework and Strategic Insights

The hybrid strategies emerged in this research form a central part of the SCRE enhancement framework. The integration of proactive and reactive strategies, thus named as hybrid strategies, allow organizations to anticipate and respond to disruptions while building long-term resilience through its continuous adaptation. Hybrid strategies include leveraging digital technologies, enhancing visibility and adaptability, fostering government support and public-private partnerships, and building robust ecosystem partnerships are few among 20 strategies identified in this study. This is supported by recent studies that emphasize flexibility and adaptability in managing complex and uncertain supply chain environments (Choi et al., 2023; Feizabadi et al., 2019; Gruchmann et al., 2024; Magableh, 2021a)

The proposed hybrid framework is particularly relevant amid ongoing global uncertainties, where traditional risk management strategies are inadequate. It offers a strategic roadmap for retail companies to build resilience against future disruptions (Hägele et al., 2023; Ivanov, 2023; Supply Chain Resilience Report, 2020). Grounded on RT and RDT perspective, the proposed framework emphasises on continuous adaptation and the integration of new technologies as well as support of various resources to ensure retailers better prepared for modern supply chain challenges for faster recovery. Equipped with various resilience-enhancing strategies, the retails are believed to operate in a sustainable way into the future.

Additionally, this study developed several propositions based on the framework where all hybrid strategies, as antecedent variables, have significant influence on the faster recovery from disruptions with the support of resources, that in turn leads to sustainable performance into post-COVID-19 period. These propositions are summarised listed below.

- 1. Proactive strategies combined with effective resource utilisation, contribute significantly to supply chain recovery.*
- 2. Reactive strategies, combined with effective resource utilisation, contribute significantly to supply chain recovery.*

3. *The adoption of both proactive and reactive strategies, along with appropriate resource utilisation, enhances supply chain disruption recovery.*
4. *Efficient resource utilisation is crucial for successfully implementing resilient strategies and recovering from supply chain disruptions before and during pandemics.*
5. *The strategic integration of proactive and reactive (hybrid) measures critically supports the supply chain disruption recovery.*
6. *Disruption recovery strategies have significant effect on sustainable business continuity strengthening supply chain resilience.*

These propositions are grounded in both empirical findings and broader literature, providing a strong foundation for future studies by using survey method. The SCRE framework not only addresses the immediate challenges posed by the COVID-19 pandemic but also provides a strategic foundation against future disruptions. This aligns with Ivanov's (2024) assertion that modern SCRE must be viewed through a lens of continuous adaptation rather than merely returning to a pre-disruption state. That is typically the “new normal” strategy which is not returning to pre-COVID-19 state, rather it is a whole new state of operations, that is restructured state.

The study also found the role of adaptive leadership in navigating crises. Leaders who could quickly pivot and adapt to changing circumstances were more successful in guiding their organizations through the pandemic. This finding aligns with recent research emphasizing leadership agility in crisis management (Fasth et al., 2022; Kurniawan et al., 2024; Min, 2023). The integration of RT and RDT in this study offers a nuanced understanding of how retail companies can navigate complex disruptions by leveraging their resources and capabilities. This study provides a comprehensive analysis of resilience-enhancing hybrid strategies employed by the Australian retail sector during the COVID-19 pandemic. The integration of proactive and reactive strategies, supported by robust organizational resources, enabled companies to recover swiftly and sustainably. The SCRE framework, enriched by recent research like Paul and Chowdhury (2020), Chen et al. (2019); Kiers et al. (2022) Grimmer (2022); Weber (2021), Manners-Bell (2023) offers a strategic guide for managing supply chain disruptions and building long-term resilience. The findings have significant implications for both academia and industry, providing a foundation for future research and practical guidance for enhancing in an increasingly uncertain global environment.

6.5 Proactive and Reactive Strategies in Supply Chain Management

The study identified various proactive and reactive strategies used in combination by retailers to navigate the challenges posed by COVID-19. These strategies were pivotal in managing immediate impacts and showcased unique applications that addressed the pandemic's specific conditions. The pandemic accelerated the pace of change in retail, creating an opportunity for businesses that could adapt faster and better than their peers. Managing and developing trust among stakeholders, alongside adopting necessary digital technologies, became key factors. Retailers, those who are slow in adapting and integrating COVID-19 disruption into their operations faced existential crises (Moosavi & Hosseini, 2021; Pantano et al., 2020; Patchett, 2021; Sopha et al., 2022; Weber, 2021).

To mitigate both current and future disruptions, it is crucial for retailers to identify, optimize, and reassess existing technologies and business models and redesign their supply chains (Cheng & Lu, 2017; Ekinici et al., 2024; Nah & Siau, 2020). This approach to building resilience addresses the immediate impacts of the pandemic and enhances preparedness for future disruptions. Retailers must understand stakeholder interactions to reduce response times and optimize communication channels. Proactive measures, such as revisiting business continuity plans (BCPs) to manage supply chain constraints and control panic buying, are essential for maintaining consumer trust and ensuring operational continuity.

The interview results highlighted that traditional models and theories were inadequate, compelling companies to innovate during these turbulent times. While collaboration and cooperation (known as co-opetition) are fundamental to Sustainable recovery operations (Limoubpratum et al., 2015). This crisis necessitated the transformation of theoretical concepts into practical strategies (Gregory, 2020; Grimmer, 2022; Ivanov, 2024). The pandemic has caused disruptions in supply and demand, severely impacting internal operations and profitability. The findings confirm that COVID-19 created significant disruptions, particularly for items sourced from international suppliers like China, Taiwan, and Europe, with stockouts and demand reductions observed across the sector (Sopha et al., 2022).

The pandemic has caused disruptions in both supply and demand and has severely impacted internal operations and bottom-line profit. The results of this study resonate well with Ekinici et al. (2024); Sopha et al. (2022); Weber (2021). Sopha revealed that COVID-19 pandemic resulted in supply disruption, particularly for some items acquired from international suppliers like China, Taiwan, and European suppliers, and 7% of other traditional retailers experienced

stockout. Ninety per cent of traditional retailers have also encountered demand reduction. This resonates well with the findings of this study.

Notably, the pandemic revealed a kind of polarisation among companies. Some thrived and even benefited from the new conditions, while others struggled to survive. This divergence was stark, with certain sectors—such as online entertainment, food delivery, online shopping, and remote work solutions—experiencing significant growth. These companies adapted swiftly to changing consumption patterns, with increased demand for takeout, snacks, alcohol, and cleaning products as people spent more time at home. This polarisation aligns with findings in the literature, where some businesses view the pandemic as an opportunity to innovate and grow, while others perceive it as a series of threats (Burgos & Ivanov, 2021; Chowdhury et al., 2020b).

6.7 Addressing the Research Questions

This study was driven by four pivotal research questions outlined in Chapter 1, which delved into the impact of the COVID-19 pandemic on the retail industry and the strategies employed to bolster supply chain resilience. These questions, which form the backbone of our research, are as follows:

RQ1: To what extent did the supply chain disruption caused by the COVID-19 pandemic impact the retail industry?

RQ2: What proactive resilience strategies helped improve resilience in the retail sector, and how did they contribute to sustainable recovery?

RQ3: What reactive resilience strategies were adopted by retail supply chains to overcome disruptions during the COVID-19 pandemic, and how did they contribute to sustainable recovery?

RQ4: To what extent did resources, such as technologies, labour, and materials, contribute to faster recovery from disruptions?

In answering to the first research question (RQ1), the findings indicated that the COVID-19 pandemic significantly affected the retail sector, causing unparalleled disruptions to supply chains. The disruption was widespread, affecting the availability of essential goods, increasing lead times, and causing significant fluctuations in demand. Retail sectors, particularly grocery and pharmaceuticals, faced challenges in maintaining a steady supply due to restrictions, labour shortages, and transportation issues. Companies that were less prepared were more severely

impacted, whereas those with pre-existing resilience strategies were able to mitigate some of the adverse effects (Hunter, 2021; Nah & Siau, 2020). This disruption underscored the need for a robust supply chain capable of withstanding such shocks, emphasizing the critical role of proactive planning in reducing vulnerability to large-scale disruptions.

Addressing **RQ2**, the study identified proactive resilience strategies that were crucial in helping retail companies navigate the disruptions caused by the pandemic. Key strategies included digital transformation, increased supply chain visibility, and enhanced collaboration with supply chain partners as highlighted in the hybrid strategy framework Figure 5.16. These strategies allowed companies to anticipate potential disruptions and implement measures to mitigate their impact effectively. By embracing digital technologies, companies improved real-time monitoring and decision-making capabilities, which were vital in adjusting operations swiftly in response to changing conditions (Ardolino et al., 2018; Nah & Siau, 2020; Rozhkov et al., 2022; Seuring et al., 2022). These proactive measures not only helped manage the immediate challenges posed by the pandemic but also laid the groundwork for a sustainable recovery by enhancing the overall resilience of the supply chain.

In response to **RQ3**, the research revealed that reactive strategies were essential in addressing the immediate impacts of the pandemic. Strategies such as adaptive logistics, resource reallocation, and the utilization of real-time data were critical in overcoming disruptions as referenced to the RDT theory. Retailers who were able to reallocate resources efficiently and adapt their logistics networks to the new constraints were more successful in maintaining operations and reducing downtime (Bergami et al., 2022; Laksmana et al., 2020; Sarkis et al., 2020) as evidenced by the RDT theory that underpins this research. The use of real-time data allowed for more agile responses to supply chain issues, enabling companies to make informed decisions quickly. These reactive strategies were instrumental in achieving a swift recovery and contributed to building long-term resilience by reinforcing the ability to respond effectively to future disruptions.

Finally, in answering the **RQ4**, the study highlighted the pivotal role of resources in accelerating the recovery process. Advanced technologies such as AI, IoT, and data analytics were particularly beneficial in enhancing supply chain visibility and facilitating real-time decision-making. Companies that had invested in these technologies before the pandemic were better positioned to manage disruptions and maintain operational continuity which resonates

well with Ivanov (2024)s' findings. Moreover Paul, Chowdhury, et al. (2021) highlight that 80% of companies that failed to design recovery strategies for supply chain disruption during major outbreaks have closed down their operations within two years after the event. Additionally, the availability of skilled labour and essential materials played a significant role in the recovery process. The study showed that, as emphasised from the RT and RDT theories, companies with access to these resources could recover more rapidly and establish a more sustainable recovery. This highlights the importance of resource management in building resilience and ensuring long-term sustainability in the face of disruptions. What emerged is that retailers employed real-time adaptive measures to manage disruptions during the crisis, complementing both the proactive measures taken before and the reactive strategies used during and after the COVID-19 disruption.

6.8 Lessons Learned and Future Directions

The COVID-19 pandemic underscored the critical importance of resilience in supply chains. Key lessons include the value of proactive risk management, the transformative potential of digital technologies, and the necessity of maintaining operational flexibility. Future research should explore the long-term effects of these strategies on supply chain performance and investigate the evolving role of digital technologies in enhancing resilience. There is growing recognition of the need to mitigate disruption through greater visibility, better planning and data-driven decision. A McKinsey Report (2020) found that, for early adopters, AI-enabled supply chain management has improved logistics costs by 15%, inventory levels by 35% and service levels by 65%, compared to “slower-moving competitors”. By implementing AI in supply chain and logistics, supply chain managers can enhance their decision-making. They now can know, not just what happened, but what is going to happen. Table 6.1 describes the way forward regarding the retailers given the analysis and the findings from the study. These approaches may help the retailers build resilience going forward.

Table 6-1 The way forward for Australian retailers

No.	Strategy	Explanation
1	Optimise omnichannel for a seamless customer experience.	The first step to successfully implementing an omnichannel approach is to get a 360-degree view of the customer. This way, retailers can curate the best shopping experience for every single customer, whether they prefer to shop online, in store or across multiple online platforms.
2	Navigate a path to omnichannel excellence.	There are, however, set steps retailers can take to navigate a pathway to omnichannel success. This omnichannel success scale, developed in partnership with specialist e-commerce agency Convert Digital and Shopify Plus, lays out what it takes to be good, better, and best at omnichannel.
3	Establish your value in the eyes of your core consumer.	Understanding each consumer persona and what drives each consumer's purchasing decisions can give retailers the edge when it comes to investing in growth strategies and tactics most likely to appeal to their respective target audiences.
4	Build a brand set for future demand.	"It's long been known that while performance marketing drives revenue growth, it is brand marketing that drives profitability," a future brand realised.
5	Position products for maximum impact.	Australian consumers are rethinking how they shop and what they buy as they adjust to the evolving economic climate. Retailers have an opportunity to rejig, reposition or expand their product mix to appeal to consumers that might be stepping outside of their usual purchasing stomping grounds into uncharted territory.
6	Look beyond your immediate market.	As spending patterns shift, brands can attract consumers that may have previously not been among their core target audience. However, this is just one-way retailers can reach into new markets or market segments to find new customers, revenue, and growth. Retailers also have the chance to meet and serve new customers in non-traditional settings, while international expansion continues to be a top tool for retailers to find growth.
7	Embrace technology.	The emergence of COVID-19 in 2020 majorly impacted global supply chains, restricting the movement of goods, and forcing many staff to work from home to slow the spread of the virus. As a reaction to this, supply chain firms and retailers have had to adapt and find alternative ways of operating; this includes digitalising existing processes. As retailers' supply chains recover from the impact of COVID-19, we expect to see a sudden acceleration of interest in digitalisation and automating tasks and processes traditionally conducted by humans. It is evident that retailers such as pharmaceuticals and grocery firms will increasingly look to Industry 4.0 technologies as sources of innovation to increase their resilience in the wake of an extreme disruption.

Table 6.1 describes the way forward regarding the retailers given the analysis and the findings from the study. These approaches may help the retailers build resilience going forward.

6.9 Study Contributions

This exploratory timely study provides significant theoretical, practical, and managerial contributions to the field of SCRE and disruption management, particularly within the Australian retail sector during the COVID-19 pandemic. These contributions are outlined below.

6.9.1 Theoretical Contributions

1. The study extends the application of Resilience Theory (RT) and Resource Dependency Theory (RDT) into the SCRE framework within the retail sector, specifically for medium and large businesses during the COVID-19 pandemic. It introduces a new and novel perspective on the role of external dependencies and resource allocation in enhancing SCRE through the lens of RDT.
2. It contributes to existing literature by demonstrating and revealing that a hybrid approach—leveraging both internal capabilities and external resources—is essential for sustaining operations during crises. The research validates and extends theoretical frameworks by providing empirical evidence of their relevance during pandemic-induced disruptions. This integration offers a fresh perspective on building long-term resilience and adaptability in retail supply chains, addressing a critical gap in post-disruption recovery strategies.
3. The study also uniquely identifies critical resilience-enhancing hybrid strategies, enriching resilience literature with a robust approach to crisis management.
4. By addressing significant gaps in existing research, such as the lack of empirical analysis of SCRE strategies and the limited application of RDT in retail, the study responds to calls for further investigation by researchers such as Paul and Chowdhury (2020) and Kamalahmadi and Parast (2016). At the same time, it highlights the impact and importance of various resilience strategies in crisis contexts.

6.9.2 Practical and Managerial Contributions

This study provides actionable insights and frameworks for enhancing SCRE during disruptions like the COVID-19 pandemic. By integrating Resilience Theory (RT) and Resource Dependency Theory (RDT), the findings offer practical guidance for practitioners and decision-makers in managing and mitigating disruptions effectively. For practitioners, the study provides key insights. Investing in digital technologies is crucial for enhancing supply chain visibility and responsiveness, as suggested by Dolgui et al. (2018). Diversifying supply

chains to reduce dependency on single suppliers enhances resilience, as noted by Christopher (2011). Developing hybrid strategies that incorporate both proactive and reactive elements ensure firms are well-prepared for future disruptions. Managers should also strengthen their crisis management capabilities through robust frameworks and regular training (Blackhurst et al., 2005). Collaboration across the supply chain, as discussed by Scholten et al. (2014) is essential for coordinated and effective responses to disruptions.

Key Practical Contributions

1. The study equips supply chain managers with a roadmap to enhance resilience in the face of disruptions, prioritizing adaptive strategies such as digital technology adoption and optimized resource allocation.
2. The proposed framework offers a structured approach to managing supply chain disruptions, emphasizing the integration of risk management with recovery strategies. This tool is valuable for academics and practitioners alike, fostering better control and resilience against future disruptions.
3. While the research focuses on retail, the findings demonstrate the potential for extending hybrid strategies to manufacturing and service sectors impacted by similar crises.
4. The study provides actionable recommendations for retail managers, such as balancing global and local sourcing, adopting multiple sourcing strategies, and leveraging information and communication technologies for informed decision-making. These insights are crucial for adapting to the "new normal" and preparing for future disruptions.

Key Managerial Contributions

1. The research highlights strategies for retail sector managers to enhance resilience during crises like the COVID-19 pandemic. Adopting a hybrid approach—combining proactive measures (e.g., early warning systems and inventory diversification) with reactive strategies (e.g., agile resource reallocation and adaptive leadership)—can significantly accelerate recovery.
2. Managers are advised to implement digital technologies to enhance supply chain visibility, enabling real-time decision-making and faster response times. The study also emphasizes workforce flexibility, cross-training employees, and building strong partnerships with suppliers to mitigate disruption impacts.

3. Actionable recommendations include establishing redundancy in critical resources, fostering collaboration with government bodies for emergency support, and adopting predictive analytics tools for risk modelling. These strategies not only enhance resilience but also position organizations to achieve sustainable competitive advantage in uncertain environments.
4. The findings also provide insights for policymakers to develop supportive measures that encourage resilience-building initiatives in the retail sector, aiding economic recovery post-pandemic.

In summary this study integrates practical and managerial insights into a comprehensive framework for enhancing SCRE. RT underscores adaptability in dynamic environments, while RDT highlights the importance of managing resource interdependencies. Together, these theories provide actionable pathways for organizations to build sustainable resilience and recover effectively from future disruptions. By leveraging hybrid frameworks that incorporate proactive and reactive strategies, organizations can create robust networks and infrastructures, reducing vulnerabilities during crises and ensuring long-term stability.

6.10 Summary of Chapter

Chapter 6 summarises and discusses the multifaceted implications and lessons derived from the COVID-19 pandemic on SCRE within the Australian retail sector. It explores the application of hybrid resilience strategies—combining proactive and reactive approaches—and evaluates their efficacy in managing disruptions. By employing a research framework grounded in Resource Dependency Theory (RDT) and Resilience Theory (RT), the chapter addresses critical research questions and presents insights into strategic resilience-building efforts. Key strategies include leveraging digital technologies, fostering collaboration, and enhancing flexibility and visibility to ensure sustainable recovery. The findings emphasize the importance of integrating lessons learned to address future supply chain challenges effectively. Additionally, the chapter outlines contributions to academic literature and offers practical recommendations for policymakers and supply chain managers, aiming to enhance preparedness and adaptability for similar disruptions in the future.

Chapter 7

Conclusion, Limitations and Future Research Direction

7.1 Introduction

This chapter offers a comprehensive conclusion to the research, summarising key findings and their implications. Section 7.2 synthesises the research results, highlighting the critical role of proactive and reactive strategies in enhancing SCRE during the COVID-19 pandemic and addressing the research objectives. Section 7.3 discusses the study's limitations, including the scope of the research, data collection methods and focus on specific sectors, and suggests areas for future exploration, such as broader industry inclusion and more diverse data collection methods. Section 7.4 identifies opportunities for future research, including examining supply chain disruptions across different global catastrophes and conducting longitudinal studies to track the evolution of resilience strategies. Section 7.5 provides concluding remarks, reflecting on the fulfilment of the research objectives and the development of a new conceptual framework, while noting the use of NVivo 12 for data analysis. Finally, Section 7.6 summarises the chapter, reiterating the importance of the study's contributions and practical applications for enhancing supply chain resilience.

7.2 Conclusion of Research Findings

This research has identified and explored a comprehensive range of hybrid resilience strategies that emerged from the analysis of the Australian retail sector's response to the COVID-19 pandemic. These hybrid strategies, which combine proactive and reactive elements (hybrid), were crucial in facilitating a swift recovery and ensuring business continuity during one of the most disruptive global events in recent history. This timely study revealed that hybrid strategies such as digital technologies, increased visibility, adaptability, adaptive leadership, government support, and ecosystem partnerships were essential in navigating the complex challenges posed by the pandemic. These strategies did not function in isolation but were profoundly interconnected, leveraging both Resilience Theory (RT) and Resource Dependency Theory (RDT). The integration of these strategies into a cohesive framework allowed retail businesses to better prepare for, respond to, and recover from supply chain disruptions, ultimately contributing to sustainable performance.

It is important to note as a summary to my research the implementation of these revealed hybrid strategies was supported by the effective utilization of available resources, including technological advancements like digital platforms and analytics tools, as well as human resources skilled in adaptive leadership and crisis management. The deployment of these resources enabled businesses to maintain a high level of supply chain visibility and adaptability, critical factors that contributed to their resilience. The reliance on RT and RDT provided a robust foundation for understanding how these resources were mobilized. For instance, RT emphasized the adaptive capabilities required to withstand and recover from disruptions, while RDT highlighted the importance of managing external dependencies and resource limitations. Together, these theories informed the strategic use of resources, ensuring that the retail sector could not only survive the immediate impacts of the pandemic but also build long-term resilience.

In terms of the impact on recovery and Business Continuity, the hybrid strategies identified in this study were pivotal in accelerating the recovery process. By integrating proactive measures such as building logistics capabilities and enhancing supply chain visibility with reactive approaches like contingency planning and adaptive leadership, businesses were able to mitigate the effects of the pandemic more effectively. This dual approach led to a faster recovery, as businesses could quickly adapt to changing circumstances, minimize disruptions, and restore normal operations. Moreover, the emphasis on continuous improvement and learning from the crisis ensured that businesses were not merely returning to pre-pandemic conditions but were evolving to become more resilient in the face of future disruptions. This proactive stance, driven by a commitment to learning and growth, is critical for long-term business continuity, as it positions companies to better handle unforeseen challenges.

The research aimed to explore and validate the effectiveness of hybrid resilience strategies in enhancing SCRE and facilitating a sustainable recovery. The findings confirm that the research objectives have been successfully achieved. By examining the proactive and reactive strategies implemented by the retail sector, the study provides clear evidence of how these approaches contributed to resilience and recovery. Furthermore, the integration of RT and RDT into the analysis offered valuable insights into the underlying mechanisms that supported the successful implementation of these strategies. Recent studies, such as those by Sakurai and Chughtai (2020) Ivanov (2024) and Ramanathan et al. (2022) underscore the importance of hybrid resilience strategies in navigating global crises. These studies align with the findings of this

research, reinforcing the critical role of adaptive and integrated approaches in managing supply chain disruptions.

In conclusion, this research contributes to the understanding of hybrid resilience strategies in the Australian retail sector by demonstrating their effectiveness in achieving faster recovery and ensuring business continuity. The strategic application of available resources, guided by RT and RDT, has been instrumental in enhancing resilience. This study not only addresses the research questions but also offers practical recommendations for supply chain managers and policymakers on how to build more resilient supply chains in the face of future crises.

7.3 Study Limitations and Future Research Agenda

The study has limitations that warrant consideration for future exploration. This study focused on participants from the grocery and pharmaceutical retails, chosen for their critical role in retail supply chains and the distinct resilience challenges posed by the COVID-19 pandemic. By concentrating on grocery and pharmaceutical retails, the study provides insights specifically relevant to these sectors. Future research could expand on these findings by exploring other sectors independently, as different supply chains, for example, garments or construction materials, may face unique resilience challenges that warrant focused investigation. However, the sampling was not equitably distributed among the retails to get a balanced representation of participants and understand their coherent approach to hybrid strategies they used for recovery. As the time has passed by and businesses are operating in post-COVID-19 era, future research should expand the scope to include a larger, more diverse sample, encompassing retails in other states within Australia. This broader approach would help validate the hybrid research framework of this study.

Second, future research can be extended to East-Asia and other countries in the pacific region where the businesses were affected like Australia. The proposed research framework can further be validated using the qualitative data and findings to determine whether similar resilience strategies are applicable in these contexts (Chowdhury & Quaddus, 2016). Furthermore, existing literature suggests that incorporating mixed-method approaches—combining quantitative analysis with qualitative insights—can enrich understanding by uncovering deeper contextual factors.

Third, the data collection was constrained by COVID-19 restrictions, relying primarily on telephone, Zoom or Teams meetings interviews. This limitation restricted the depth of qualitative insights, as the absence of face-to-face interactions prevented the observation of non-verbal cues and more nuanced responses. Future studies should incorporate in-person interviews and focus groups, where feasible, to enhance the richness of data and provide a deeper understanding of the phenomena (Gligor et al., 2019).

Fourth, the study focussed on the retail sector, broadly grocery and pharmaceutical retails, limiting the number of interviews in food, garment, and construction material retails. While this provided valuable insights, it also limits the inclusion of insights of other sectors. Future research should explore resilience strategies across a broader range of industries, including services and other non-retail sectors, to provide a more comprehensive understanding of resilience across different economic contexts.

Fifth, the study is a snapshot in time during the COVID-19 pandemic, which may limit the relevance of the findings to other crises or time periods. The unique conditions of the pandemic influenced the strategies employed by firms, and these may not be directly transferable to future disruptions. Longitudinal studies are recommended to assess how resilience strategies evolve over time and during different phases of disruptions. Such research would provide insights into the long-term effectiveness and sustainability of these strategies.

Sixth, testing the hybrid strategy through a large-scale survey could yield quantifiable data, test the propositions, and offer a broader perspective on the prevalence and effectiveness of the proposed framework. Lastly, and seventh, the study predominantly focused on medium and large enterprises, potentially overlooking the unique challenges faced by SMEs. SMEs often operate with limited resources and face higher liquidity pressures, which can significantly influence their resilience strategies. Future research should specifically examine the resilience strategies of SMEs, considering their resource constraints and the role of external support, such as government interventions, in enhancing their resilience. Lastly given the rapid advancements in technology and external market changes, future research could explore how these evolving factors impact the core themes identified in this thesis, ensuring the research remains relevant in a rapidly shifting landscape.

7.4 Concluding Remarks

This study successfully fulfilled its research objectives, providing an in-depth analysis of the resilience strategies employed by the Australian retail sector during the COVID-19 pandemic. The primary research questions focused on identifying and evaluating proactive and reactive strategies used to mitigate the disruptions caused by the pandemic. The study utilised qualitative research methods, with data collected through interviews and analysed using NVivo 12 software. This methodological approach facilitated a comprehensive understanding of the strategic responses and adaptations made by firms, enabling a nuanced analysis of the factors contributing to supply chain resilience.

The major contributions of this study include the development of a new conceptual framework that integrates proactive, reactive and hybrid strategies for enhancing supply chain resilience. The research demonstrated that a combination of digital transformation, flexible inventory management, and robust supplier relationships are critical components of a resilient supply chain. This framework not only addresses the immediate challenges posed by the pandemic but also provides a roadmap for businesses to prepare for future disruptions.

In terms of theoretical contributions, the study advanced the understanding of Resilience Theory and RDT within the context of supply chain management. It highlighted the importance of balancing internal capabilities with external dependencies to maintain operational continuity during crises. The practical implications of the study are equally significant, offering actionable insights for managers and policymakers. By emphasising the importance of hybrid strategies, the research provides a clear framework for enhancing resilience and ensuring business continuity.

Overall, the study underscores the critical role of adaptability and flexibility in navigating complex and unpredictable global disruptions. It emphasises the need for continuous investment in digital technologies and the cultivation of strong, collaborative relationships with supply chain partners. By addressing both theoretical and practical aspects of supply chain resilience, the study offers a comprehensive contribution to the field, providing a foundation for future research and practical applications.

7.5 Summary of Chapter

This chapter concludes the research by synthesising key findings and their implications, particularly highlighting the importance of proactive and reactive strategies in enhancing SCRE

during the COVID-19 pandemic. It addresses how the study successfully met its research objectives and contributed valuable insights to both theoretical and practical knowledge. The discussion also critically evaluates the study's limitations, such as its focus on specific sectors and the scope of data collection and suggests areas for potential improvement. Furthermore, it outlines future research opportunities, emphasising the need for broader exploration across different global crises and the value of longitudinal studies to track the evolution of resilience strategies. The chapter concludes by reflecting on the development of a new conceptual framework and the methodological rigour provided by NVivo 12 for qualitative data analysis, reinforcing the significance of the study's contributions to enhancing SCORE and providing a foundation for future research.

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Appendices

Appendix A: Interview Questions

Phases 1 and 2

Resilience-Enhancing Strategies for Selected Australian retail sector industries.

Brian Chikwava [ID4604061]

Phase 1 Questions

Introduction:

Hello, my name is Brian Chikwava, and I am a Doctoral student at Victoria University Business School. Thank you very much for volunteering to participate in this study. The total time for this interview should be about 30-45 minutes.

Purpose of the study:

Unexpected externalities impacting supply chain activities have drawn attention of Supply Chain Disruptions (SCDs) and recovery mechanisms. Calamities and disasters have devastated businesses, especially during the recent outbreak of COVID-19 pandemic. Organizations, especially those in the retail sector, have adopted a variety of strategies for coping up with the disruptions. I'm curious about how your company managed the supply chain during the recent crisis. The aim of this research is to look at the resilience-enhancing strategies that helped the businesses improve their supply chain recovery from such disruptions. Supply Chain Resilience (SCR) is the ability to mitigate and rebound after disruptions and shocks.

Demographics:

- Your current job is and what responsibilities you have.
- Length of time in role in organization
- Brief background on organization / industry/any other office locations
- Male / Female
- Age and education

- Company size <19, 20- 200 ≤ 200
-

Interview Questions - General:

- 1 Briefly describe your supply chain ...
- 2 The worst crisis you can imagine for your organization is---?
- 3 Describe a recent severe disruption you / your organization has experienced.
What did your organization do, to stop / mitigate/minimise / reduce the disruption's effects?
What resources were needed to minimise this disruption?
- 4 Do you think your organisation managed the supply chain disruptions of COVID-19 pandemic in a timely manner?
 - a) How prepared was your organisation for the kind of SC disruption (Low Frequency High Impact) (LFHI)?
 - b) Please elaborate.

Supply chain Resilience and COVID 19

5. Please may you describe and elaborate on communication, and information sharing (technologies?) with your partners?
6. Flexibility is defined as “being able to bend easily without breaking or the ability to adapt to unforeseen changes- How flexible was your supply chain during/after COVID 19?
 - a) How did you innovate your supply chain to mitigate the effects?
 - b) Was there any restructuring of your supply chain?
7. Do you believe your partner organisations collaborated/cooperated regularly to resolve problems or communicates jointly during crisis?
8. How was the service level affected?
9. Explain to me your company Inventory policies (Redundancy)
 - a) Did you maintain safety stock/excess resources before the disruption?
 - b) If yes, how did this help in the recovery from the disruption
 - c) Maintaining continuity of supply to your customers

- d) Does your company hold buffer stock to mitigate the risk of stock-out/to mitigate supply risks in times of disruptions?

10: Besides these strategies that we talked about, what are some of the strategies that help to enhance SCR?

Technologies & Resilient supply chain recovery capability/ mechanism:

11: What are some of additional technologies you implemented? Or was the legacy/existing tech enough to manage the crisis?

12. What sources of data did you refer during time?

- a) With this multi-sourcing of data how did you use/analyse them, report them, and communicated them?

13 How long did it take you to get the organization back to normal and why?

- a) Does your organisation implement (contingency/risk mgmt. strategies) proper recovery plans/measures to recover from supply chain disruptions?
- b) What insights can be gleaned from COVID 19 experiences to help current enterprises prepare for future disruptions?

14. What other information (if any) would you like to share concerning how you mitigate SCD and build stronger SCR

Thank you for taking the time to participate in this Interview. We appreciate your time and insight. The information you provided will make a valuable contribution to uncover the impact of successful resilient supply chain practices particularly under this COVID 19 pandemic. If you want to have a copy of the results of this research, please fill in your name, address, phone number, and email address below (optional).

Name:

Address:

Phone number:

Email address:

Phase 2 Questions

Dear participant

I hope this message finds you well. As discussed over the phone, let me start with a brief introduction. My name is Brian Kaunda Chikwava, and I am a PhD candidate at Victoria University. You kindly volunteered your time for an interview in 2021, focusing on supply chain disruptions caused by the COVID-19 pandemic, and your insights were invaluable. I am reaching out to request a brief follow-up conversation to conclude my research. Your feedback is crucial in shaping the final outcomes of my study. This follow-up consists of three questions and should take no more than 15 minutes of your time. Please note the information shared will highly be confidential, purely academic, non-identification of interviewees. We can do this over the phone at a time that is convenient for you.

Here are the three follow-up questions I would like your feedback on:

1. What performance indicators demonstrated your company's recovery from pandemic disruptions?
2. How confident are you that the current performance indicators demonstrate your company's progression into the future?
3. Do you still uphold the resilience strategies that helped you recovered from the pandemic disruptions, or have they been changed since then?

Thank you for your time and participation.

Best regards,

Appendix B: Consent Form for Participants Involved in Research

INFORMATION TO PARTICIPANTS:

We would like to invite you to participate in a research study entitled: *Resilience-Enhancing Strategies for Australian Retail Sector Supply Chains*. The aim is to explore a pool of suitable resilience-enhancing strategies and identify the extent to which each of them helps build resilience against supply chain disruptions (SCDs) and pave the way for recovery. Also, it uncovers how digital technologies and resources moderate the resilience building capability to sustain disruptions.

This study involves obtaining information from company owners, logistics managers, and procurement managers in Victoria state. The participants will be either face-to-face (Post COVID -19) or online interviewed using Zoom. The interview will be recorded using a digital recorder. The interviews will be themed around your views about the company's suitable resilience-enhancing strategies that help build resilience against SCDs for quicker recovery. It also seeks your ideas on how and why some firms adapt well, while others quickly succumb to the devastating effects of disruption. The semi-structured interviews are anticipated to last between 45 to 60 minutes. The participants have the option to withdraw at any time without being disadvantaged.

The company will be provided with a summary of the findings. This summary will **not** identify any names, persons, organisations, or business. The collected information will be analysed and may be included in a thesis, and subsequently be presented at conferences and published in journals. The participants or the organisations will not be identified in any of the publications. Any identifying information collected during the interview will be de-identified. All electronically collected data will be secured with research team and stored in password protected computer. Later, the data will be transferred to R-drive within Victoria University after completion of the project.

CERTIFICATION BY PARTICIPANT

I, "[Click here & type participant's name]"

of "[Click here & type participant's suburb]"

certify that I am at least 18 years old* and that I am voluntarily giving my consent to participate in the study: **Resilience-Enhancing Strategies for Australian Retail Sector Supply Chains**, being conducted at Victoria University by a researcher Brian Kaunda Chikwava under the supervision of Associate Professor Himanshu Shee and Dr Kolawole Ewedairo. I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by:

Brian Kaunda Chikwava and that I freely consent to participation involving the below mentioned procedures:

- Interview will occur over Skype/WhatsApp/phone as suits to both parties.
- Supervisor Associate Professor Himanshu Shee will also join the interviews. He may seek extra clarification if some part of the interviews is not clear or incomplete.
- In case the participants disclose some sensitive information about the company or talk adversely it will be kept confidential within the research team. Neither it will be included in the report, nor will be communicated to the company.
- The online interview is anticipated to take between 45 and 60 minutes.

☐ I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

☐ I have been informed that the information I provide will be kept confidential.

☐ I agree that the interview and focus group session to be audio and video recorded.

Signed:

Date:

Any queries about your participation in this project may be directed to the student researcher.

Brian Kaunda Chikwava kaunda.chikwava@live.vu.edu.au Mobile: +61 434808453

Or Chief Investigator: Dr Himanshu Shee, +61 3 9919 4077, himanshu.shee@vu.edu.au .

If you have any queries or complaints about the way, you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001, email Researchethics@vu.edu.au or phone (03) 9919 4781 or 4461.

8.

Appendix C: Information to participants Involved in Research



You are invited to participate.

You are invited to participate in a research project entitled: Resilience-Enhancing Strategies for Selected Australian retail sector industries.

This project is being conducted by a student researcher Brian Kaunda Chikwava (ID 4604061) as part of a Doctor of Philosophy (PhD) study at Victoria University (VU) under the supervision of Associate Professor Himanshu Shee and Dr. Tharaka DeVass from Institute for Sustainable Industries & Liveable Cities'

Project explanation

- The research aims to explore both the proactive and reactive resilience-enhancing strategies that helped the businesses improve and recover from their supply chain recovery from such disruptions such as COVID 19 pandemic.

- NVivo, a qualitative software, will be used to analyse the interviews for theme supporting these factors as well as any new themes that may add and contribution to the recovery mechanisms to these factors.
- The study provides practical insights for supply chain managers, offering a roadmap for enhancing resilience in the face of disruptions. It equips managers with tools to prioritise and implement adaptive strategies, such as leveraging digital technologies and optimising resource allocation.
- Additionally, the findings emphasise the critical role of leadership in fostering a culture of resilience and the importance of collaboration with supply chain partners. Managers are encouraged to build strong, long-term relationships with suppliers and other stakeholders to enhance resilience.

What will I be asked to do?

- The participation is voluntarily. Participants will be interviewed either through face-to-face (Post COVID -19) or online using Zoom as convenient.
- The participants will be approached for their consent to participate by signing a consent form.
- Verbal consent will be collected prior to the start of the online interviews.
- A set of semi-structured interview questions for both Phase 1 and phase 2 will be provided early to let the participants know about the interview content. They will be given time to consult and prepare for the interviews.
- The information collected through interviews will be used for academic purpose only and strictly adhere to non-identification of the participants' details.

What will I gain from participating?

Participants will benefit from the findings of the study. Thematic analysis will extend the understanding of resilience-enhancing strategies by selective factors that most suited in low-frequency-high impact disruption context, for instance, COVID-19 pandemic. Summary of

findings from this study will be shared with the participants of the retail sectors provides the following.

- It provides empirical evidence on traditional retail resilience regarding the COVID-19 pandemic, which is explored in more detail in this study and to presenting critical levers for traditional retailers to cope with the disruptions, particularly in Australia.
- This timely research offers insights into resilience capability building: The research underscores the importance of building resilience capabilities at different stages, particularly through effective utilisation of digital responses. It offers comparative insights across sectors, such as manufacturing and tourism, demonstrating the versatility of proactive and reactive strategies.
- It will also provide actionable recommendations for retail managers, such as balancing global and local sourcing, adopting multiple sourcing strategies, and leveraging information technology for better information availability. These insights are crucial for adapting to the “new normal” and preparing for future disruptions.
- The study’s findings can help supply chain decision-makers develop crucial recovery and resilience strategies and assist practitioners paying attention to resilience and sustainability practices for managing the impacts of future large-scale disruptions, because this study is the first to analyse critical supply chain recovery and establish SCRE solutions for the post-COVID-19 environment and augmenting existing knowledge related to SCRE.

How will the information I give be used?

The data gathered through interviews will be:

1. Analysed by NVivo Software for its content and theme.
2. The conceptual framework and research questions proposed by current literature will be assessed and modified according to thematic analysis.
3. The report summarising the interview will be provided to the company for verification.
4. Once agreed then it will be included in the thesis.

The summary will not identify any names, persons, organisations, or business. The information will be analysed and presented in a PhD thesis, a conference paper and journal articles. The participants will not be identified in any of these publications. The company will be provided with a summary of the thesis.

What are the potential risks of participating in this project?

This is low-risk research as it involves interviews with human. Involvement of senior management and their approval for others to participate will help reducing the risk. The student researcher being a Citizen of Australia will be able to explain any issue/confusion arises during interviews. Supervisor will also monitor the situation to make sure interviews goes a smooth and friendly way.

In case the participants disclose some sensitive information about the company, or talk adversely, it will be kept confidential within the research team. Neither, it will be included in the report, nor will be communicated to the company.

How will this project be conducted?

1 The researcher and supervisor will take the interviews online from Melbourne (Victoria) and Perth (Western Australia). After email consultation with the participant the interview date and time will be scheduled. Considering the time zone difference between Melbourne and Perth, Both research

team and the participants can use either Skype, face time, WhatsApp etc. So, there will be No travel unless a face-to-face interview has been secured.

2. The interviews will include 30-40 Individual /dual of participants comprising Supply chain experts risk managers, Logistics experts and senior members of the selected organisations in retail units. The interviews will occur in 2 Phases. The first phase will occur in July to October 2021 and Phase two the second phase will occur in July 2024 as follow up interviews.

3. For the first Phase each semi-structured interview will take about 45 minutes and second phase will take about 15 minutes. The consent form will be sent. for their signature via email

prior to the interview date with a request to send the signed. copy back in a reply email. Those who fail to provide on time, a verbal consent will be collected prior to start of the interviews.

4. A semi-structured interview questions will explore the resilience-enhancing strategies that helped the businesses improve and recover from their supply chain recovery from such disruptions such as COVID 19 pandemic The interview questions will be structured around These proactive and reactive strategies where second phase the interview question revolves around KPI to demonstrate recovery leading to firm Sustainable recovery.

5. The interviews will be recorded using an external digital recorder.

6. The interviews will be content analysed by NVivo software.

Who is conducting the study?

Student Researcher:	Brian Kaunda Chikwava (ID s4604061)	Victoria University Business School
Email	kaunda.chikwava@live.vu.edu.au	
Course:	Doctor of Philosophy (Ph.D.)	
Chief Investigator:	Dr Himanshu Shee himanshu.shee@vu.edu.au	
Co-Supervisor:	Dr Tharaka De Vass - Tharaka.DeVass@vu.edu.au Kola Ewedairo Kola.Ewedairo@vu.edu.au	

Any queries about your participation in this project may be directed to the Chief Investigator listed above. If you have any queries or complaints about the way, you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001, email researchethics@vu.edu.au or phone (03) 9919 4781 or 4461.

Appendix D: Ethics Approval

Dear DR HIMANSHU, SHEE

Your ethics application has been formally reviewed and finalised.

»Application ID: HRE20-227

»Chief Investigator: DR HIMANSHU SHEE

» Other Investigators:

» Application Title: Resilience-Enhancing Strategies for Selected Australian retail sector industries.

» Form Version: 13-07

The application has been accepted and deemed to meet the requirements of the National Health and Medical Research Council (NHMRC) 'National Statement on Ethical Conduct in Human Research (2007)' by the Victoria University Human Research Ethics Committee. Approval has been granted for two (2) years from the approval date; 19/04/2021.

Continued approval of this research project by the Victoria University Human Research Ethics Committee (VUHREC) is conditional upon the provision of a report within 12 months of the above approval date or upon the completion of the project (if earlier). A report proforma may be downloaded from the Office for Research website at: <http://research.vu.edu.au/hrec.php>.

On behalf of the Committee, I wish you all the best for the conduct of the project.

Secretary, Human Research Ethics Committee

Phone: 9919 4781 or 9919 4461

Email: researchethics@vu.edu.au

Appendix E: Table 3-10 Proactive Resilience strategies identified in the literature as being applied in response to the Pandemic.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources
Proactive strategi	1	Appropriate supplier selection/procurement	Taqi et al (2020), Zhu et al. (2020), Scala and Lindsay (2021), Ivanov (2020), Sharma et al (2020), Remko (2020), Mahajan & Tomar (2021), Taqi et al. (2020), Van Hoek (2020).	Only local suppliers were used by switching on to activate secondary supplier. Changing the criteria for selecting suppliers. Building relationships instead of focusing on tier one suppliers. Diversifying suppliers and other SC tiers nearshoring, localising, multi-sourcing of suppliers ensures continuous material supply.	IT integration, financial resources.
	2	Building logistics capabilities	Blom T (2022)	Capabilities for managing supply and information flows necessary for minimising vulnerabilities, e.g., risk hedging capabilities, information technology upgrades, and information sharing.	IT integration: ensuring they had scalable resources in place, such as adequate inventory levels, transportation capacity, and warehouses.
	3	Building security	Aslam et al. (2020)	<ul style="list-style-type: none"> •Protection of the SC (e.g., cyber security) •Reduction of theft or infiltration security gadgets, data Integration capability, insure against various risks because of uncertainties. Building security was also dominant as a proactive strategy to protect against any disruption as most companies were relying on technology for survival. 	Resources such as money were used to build security. Assets such as computers, IT experts.
	4	Building social capital and relational competences	O Kuivalainen (2020), Gölgeci et al (2020).	Social capital affects the resource exchange in network relationships. Provision of access to tangible and intangible resources provides opportunities and facilitates learning. Providing each other with emotional support, creating solidarity and helping each other during the crisis. Facilitation and the sharing of critical information between retailers and suppliers.	Exchange of resources such as equipment and sharing assets. Learning and training materials, information sharing, social media, human resources.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources
	5	Co-opetition	Mirzabeiki, He and Sarpong (2021), de Sousa Jabbour et al. (2020), Crick and Crick (2020), Deren and Skonieczny (2021).	This involved successful collaborative relationships in SCs that enabled resource sharing (e.g., warehouse and hardware) between operations of partners. Collaborative planning and forecasting allowed for more efficient resource sharing among competitors, ensuring a more stable supply chain. Majority of supplier entered co-opetition to improve procurement and supplier relationship management efficiency. Business acumen, arm's length relationship, transparency/ honesty, collaborative planning and forecasting which enabled business continuity. Very few mentioned this as a strategy. Creating and maintaining collaboration between competitors to gain from synergies, e.g., sharing resources for building security & resilience.	Warehouse and hardware, financial resources, capital, IT Integration, collaboration between competitors, sharing the expertise.
	6	Creating appropriate contractual agreements	Chowdhury et al (2020), Remko VankHoek (2020)	Suspension and recalculation of contracts ready to be signed, trade-off between cash and credit lines becomes more important establishing shared resources with their secondary suppliers to manage raw materials inventory. Seeking inventory and improved terms with suppliers as part of coping with financial pressure. Development of synergies among business facilitating combined planning and ensuring real-time information sharing.	Financial resources, legislative documents, and policies. Local sourcing and multisource as an alternative. Dual sourcing to mitigate single sourcing issues.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources
	7	Collaboration with the government/creating public-private partnerships	Moosavi et al. (2021), Haring et al (2021), Alhawari et al (2021), Cohen and Kupferschmidt, (2020), Hale et al. (2020) Lu et al. (2020) Sopha et al. (2021), Sumarliah et al. (2021).	Government implementation and declaration of business-friendly policies taking into consideration organisations of all type, sizes, and ownerships. Government further relaxation of taxes and obligations. Government provided financial support. Government supported the enterprises through financial means and provide the usage of state facilities. Government to allow temporary visas for other nationalities' drivers to help fill driver gaps. Trust among citizens with the government policies helped to improve the recovery process. Reciprocal trust between the government and its citizens determined the speed of recovery. Those who followed government authorities' recommendations did better than those who did not.	Financial resources, government legislative resources, policies and procedures, provision of visas, government directives, social media. Collaboration with freight carriers and government agencies to mitigate freight disruption.
	8	Creating a risk management culture	De Sousa Jabbour et al. (2020), Sanjoy Kumar Paul et al (2021), El Baz et al. (2021), Golan et al. (2020).	Ensuring that all organisational members embrace supply chain risk management, and this involves e.g., top management support and firm integration/teamwork.	Training programs, operation among staff, allocation of resources.
	9	Increasing innovativeness	Feng et al. (2020), Pilawa (2022), Choi (2020), Roggeveen and Sethuraman (2020), Pilawa (2022), Berry et al. (2020), Bove and Benoit (2020), Heinonen and Strandvik (2020), Pantano et al. (2020), Heinonen and Strandvik (2020), Bolton et al. (2021), Beckers et al. (2021), Maemunah (2021), Wang et al., (2020), Beckers et al. (2021).	Communicating new strategies with relevant stakeholders such as customers, suppliers, and distributors. Increasing service innovations through small operational changes. Introduction of an online channel and changing the offering. Increasing professionalism online and developing relationships with customers using online platforms. Adopting adaptive business strategies, starting e-business.	Innovativeness including diversifying portfolio.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources
	10	Increasing visibility	Aslam et al. (2020) Chowdhury et al. (2020) Lohmer (2020).	<ul style="list-style-type: none"> •Visibility helps retailers establish better communication and collaboration with their suppliers. •Introduced a transport management system (TMS) to keep a grip on logistics supply chain. •TMS software provides insight into transport flows, expected arrival times, transport performance and logistics costs •Big data analytics enhanced flexibility from increased visibility, retailers identify areas that need improvement continually. •Data-driven decision-making was improved through visibility of SC •Transparency for customers •Cost optimisation: improved visibility enables retailers to identify inefficiencies and bottlenecks in the supply chain. 	IT Integration, utilising social media.
	11	Inventory management	Shekar Ian and Mellat Parast (2021)	Modification, reviewing in inventory policies and planning parameters other firms started executing reduced inventory levels. Reserving safety stock to meet normal demand and further support the variability. Artificially inflate the positions of inventory. Food retailers experienced a sharp reduction in inventory, increased product backlog.	IT integration, using IT for forecasting tool, social media.
	12	Knowledge management	Shashi et al. (2020) Sabahi and Parast et al. (2020).	<p>Gathering data by means of both formal group discussion and brainstorming with key members of a supply chain</p> <ul style="list-style-type: none"> •Knowledge management identify errors, bottlenecks, opportunities to innovate and solutions that work is critical to managing continuity. 	After dealing with disruptions such as COVID-19 pandemic in SC firms need to ensure that the three T for successful implementation of SC have been used (Time, Transparency and Trust). Time means focusing adding value processes with transparency relating to understanding the required level of inventory and costs of production which

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources
					are reliable and fair and trust relating to consequences of collaborative working practices.
	13	Portfolio diversification	Sharma et al. (2020) Zhu, et al. (2020), Magableh (2021).	Some firm diversified their portfolio as Risk-Adjusted Returns strategy. Adopted by other firms as Risk Reduction strategy, introducing new product categories to the commercial production assortment.	Those who were successful embarked implementing various countermeasures of local sourcing to secure material supply. This was applied through diversifying the geographic locations of suppliers, placing more emphasis on suppliers that are physically closer to production and distribution centres, and strengthening relationships with current partners., equipment reuse, diversification of the supply, diversification of the demand, and deployment of distributed manufacturing system.
	14	Supply chain collaboration	Shekarian and Mellat Parast (2021), Duong and Chong (2020), Niemann and Meyer (2020), de Sousa Jabbour et al. (2020), Linton and Vakil, (2020).	Collaborate with suppliers to increase material in shortage/production and raw material supply. Increase their focus on supplier relationships and contract management. Built strategic relationships and collaborate with all key partners at different tiers. Collaboration between manufacturers and suppliers to overcome the challenges of the HGV driver shortage.	Collaborate with suppliers to improve resource dependence on the material in shortage. ERP-integrated EDI. Utilise ICT to improve resource dependence on data, financial resources.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources
				<p>Sharing trucks and resources, sharing information, decision synchronisation. Collaborative communication and goal alignment</p> <p>•Contract agreements Collaborate with freight carriers and government agencies to mitigate freight disruption.</p>	
	15	Supply chain network structure/design	Govindan et al (2020), de Sousa Jabbour et al. (2020).	Reconstructing the supply chain network for resilience, e.g., balancing redundancy, efficiency, vulnerabilities, etc. Investing in the capabilities and assets of network partners. Joint knowledge creation. Reconfigure the supply chain structure.	Reconfigure the supply chain structure, including reconfiguring of purchasing processes.
	16	Supplier development	Mukucha and Chari (2022)	Facilitating suppliers with incentives, e.g., financial, training, and technical knowledge to improve efficiency, commitment, and reliability. Investing in the capabilities and assets of network partners. Joint knowledge creation. Alignment of incentives. Developing trust including developing relationships with customers using online platforms, supplier relocation. Supplier-based mapping.	IT integration, social media platforms, sharing resources.
	17	Sustainability compliance		Compliance with economic, social, and environmental requirements to mitigate associated supply chain risks, e.g., reputational risks. Business acumen, knowledge of circular economy principles.	Resources such IT integration, Communicating with relevant government departments
	18	Use of information technology	Sarkis (2020). Frederico et al. (2023), Burgos and Ivanov (2021), blockchain: Moosavi et al. (2021), Nguyen et al., (2021), Khuan et al. (2023),	•Information technology helped in improving information sharing efficiently and effectively across supply chain partners. Promoted transparency in building trust and commitment between the aforesaid partners	RFID and bar codes, AI, IoT, big data analytics, using of modern technologies in business process management, MS.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources
			Salehi-Amiri et al. (2021), Grimmer (2022), Ivanov (2021), Taqi et al. (2020), Burgos and Ivanov, (2021), Moosavi et al. (2021), Nguyen et al. (2021), Khuan et al. (2023), Salehi-Amiri et al. (2021), Grimmer (2022), Shee, Miah and De Vass (2021).	<ul style="list-style-type: none"> • Digital technologies increased visibility across the SC gaining efficiency and de-risking SC • Digital technologies changed functionality of existing retailers .Introduced TMS on to keep track of logistics • IoT technology helped supplier's full retailers inventory stock requirements using critical information • Retailers are looking to manage the evolution from multi-channel, through omnichannel, towards unified commerce • Used to technology through sharing medical resources and information related to COVID-19 • Technology has enabled the digitalisation of service offerings and product delivery • Enabled integration among stakeholders facilitated high connectivity, accuracy and transparency. <p>-Establishing contacts using online platforms.</p>	
	19	Geographic location	Shishodia et al. (2019), Ivanov, (2021).	The technical capability of suppliers, flexibility, variability in the cost of supplies, quality parameters and lead time. Avoiding vulnerable locations and threats, supplier relocation.	Government legislative policies, social media platform.
	20	Business Certification	N/A	Business certifications ensure that a business meets the requirements of the governing industry standards. Pursuit of these certifications reinforce the commitment to continuous improvement, thus reducing risks.	Government legislative policies, social media platform. Financial resources.
	21	Knowing supply chain vulnerabilities	Adobor (2020), Ali and Gurd (2020), Wong et al. (2020).	Health and Safety Certifications: demonstrate their commitment to maintaining a safe environment for their employees and customers' ISO 45001 for occupational health and safety.	Financial resources, social media platform, HR, IT integration.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources
				<ul style="list-style-type: none"> •Compliance Certifications to continue operating Digital Transformation Certifications e.g., online payment systems • adopting new technologies •Collaboration and communication with partners •Retailers can work closely with Sustainability and Green Certifications Risk Identification: retailers can identify potential weak points in their supply chain: e.g., single source suppliers. •Contingency planning: Armed with knowledge about vulnerabilities, retailers can create contingency plans to address potential disruptions •Diversification •Technology Integration: identifying supply chain vulnerabilities often necessitates suppliers, manufacturers, and logistics providers to share information, coordinate efforts, and jointly develop recovery strategies. •Resilience testing •Continuous improvement. 	
	22	Globalisation	Gölgeci et al (2020).	Through well-managed and diversified global approach to business operations. Although globalisation increases complexity, it offers opportunities for business growth. A positive impact of globalisation on firms' growth and adaptation is resilience. Global sourcing.	IT integration, financial resources.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources
	23	SC sustainability	DeSousa and Jabour (2020), Rowan and Laffey (2020), Zhang and Alipour (2021), T. Ibn-Mohammed et al (2020), Queiroz, (2020).	The efficient usage of available resources. Proactive resource reservations. The pandemic changed purchasing behaviour, waste composition and quantity. Exchange data easily with chain partners through digital means. People bought non-perishable items during lockdowns. Pandemic decreased CO ₂ emissions, improved air quality, and reduced noise pollution due to lockdowns. Development of SC agility, replenishment and incentivising online delivery.	IT integration, financial resources.
	24	Circular economy principles	Aranda-Usón et al. (2020), Chikwava, Shee, Millcock, and Chapman (2022), Nandi et al. (2020), Ivanov (2021).	Contribute to an equilibrium between the economy, environment, and society, balancing the economic, environmental, and societal impacts of products and processes remanufacturing, repurposing, and recycling. Keep the material within the supply chain. Increase in resource use efficiency. Circular economy principles can reinforce localisation capabilities to increase resilience. Keep the material within the supply chain. Increase in resource use efficiency. Circular economy principles can reinforce localisation capabilities to increase resilience.	Adoption of green policies, green sourcing and flexible capacities, trust development, collaboration, and coordination. Introduction of economic incentives.

Appendix F: Table 3.11 Reactive Resilience strategies identified in the literature as being applied in response to the Pandemic.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources to implement the strategy
Reactive strategies	1	Building logistics capabilities	Ivanov (2021).	Capabilities for supply and information flows, e.g., to reduce cycle times, increase delivery competence, knowledge management and customer service to quickly recover from a disruption. •Provision of scalable resources in place such as inventory levels, transportation capacity, and warehouses. •Customers modified their shopping behaviour and increased their home consumption, introducing domestic production. Decentralisation of distribution centres.	Data integration to facilitate information sharing. Resources such as knowledge management from HR experts, financial resources.
	2	Building social capital and relational competences	Polyviou et al. (2020), Zhu, et al. (2020), Kuivalainen (2020), Ismail Gölgeci et al. (2020), Remko Van Hoek (2020).	•Social capital affects the resource exchange in network relationships. •Provision of access to tangible and intangible resources, social capital facilitated the sharing of critical information between retailers and suppliers. Providing opportunities and facilitating learning, collaborative decision-making and innovative solutions Providing each other with emotional support, creating solidarity and helping each other during the crisis. •Building strong relationships fostered risk mitigations.	Resource sharing, collaborative communication, and decision synchronisation. Trust and commitment.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources to implement the strategy
	3	Contingency planning	Bastas (2022), Ivanov (2020), Palmatier, Sivadas, Stern and El-Ansari (2020).	<p>Anticipating potential events and specifying the measures to deal with supply chain risks and disruptions before they occur, e.g., by forecasting and monitoring early warning signals. Contingency planning is key to achieving flexibility in that it is impossible to predict any disruptive event with 100% accuracy.</p> <ul style="list-style-type: none"> •Advanced ordering to guarantee supply. •Shorten the supply chain through centralised synchronous distributors. •Producing emerging product to meet current customers' needs. •Firm developing relationships with alternative suppliers from non-impacted regions. Execute novel business continuity strategies. •Use digitalised marketing through mobile applications and social media, such as Facebook and WhatsApp. •Supply chain positioning, administration and cooperations. Employ 'collect on delivery' or 'cash on demand' transaction for the sale of goods. •Receive payment via bank transfer or e-wallet. •Operation of business from home. 	Technology integration and resources to training the employees. Decision synchronisation. Sustainable resource utilisation, reduce supply chain vulnerabilities. New supplier's utilisation.
	4	Contingency re-routing	Goldbeck, Angeloudis and Ochieng (2020), Chowdhury et al. (2020).	Consolidate deliveries from multiple suppliers. Decentralisation of distribution centres, developing multi-channel distribution. Developing e-commerce distribution.	TMS, IT integration, social media platforms for communication, financial resources.
	5	Creating redundancy/diversification	Shekarian and Mellat Parast (2021), Chowdhury et al (2020)	Maintaining the continuity of production processes, checking level of inventory in SC intermediary links, increasing inventory of finished products on SC demand side. Changes in inventory management.	Social media platforms, IT integration.
	6	Demand management	Hobbs (2020), Naghshineh, and Carvalho (2021).	Retailers made substantial efforts including utilisation investments in these technologies to gain insights into evolving consumer behaviours and demand patterns. This data-driven approach empowered them to make more informed decisions regarding inventory management,	IT integration, consolidating deliveries from multiple vendors.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources to implement the strategy
				product assortments, and pricing strategies. Increasing inventory levels in supplier locations.	
	7	Ensuring supply chain agility	Shekarian and Mellat Parast (2021), Scholten et al. (2020), Mutebi et al. (2021), Ivanov (2020).	Retailers swiftly adjust product offerings, diversify supply sources, employ advanced technologies, and reconfigure distribution networks which allowed retailers to respond effectively to the unique challenges presented by the pandemic. Consolidate deliveries from multiple vendors.	Financial resources, IT integration, sharing trucks, equipment such as forklifts and warehouses.
	8	Increasing flexibility	Shekarian and Mellat Parast (2021), Rajesh (2020), Magableh et al. (2021), Kiers et al (2022).	Flexibility allowed Australian retailers to react swiftly to the rapidly changing dynamics of the pandemic. They quickly adjusted their supply chain operations in response to lockdowns, surges in demand for specific products, and disruptions in the global supply chain for them to survive. This flexibility and agility enabled them to continue serving customers and minimise disruptions. Others were flexible through diversification of suppliers and sourcing: flexible supply chain strategies involved diversifying suppliers and sourcing options, decentralisation of distribution centres and extending order fulfilment dates.	Increasing the frequency of deliveries. IT integration financial resources such as capital and developing arm's length relationships with another supplier.
	9	Increasing velocity/adaptability	Aslam et al. (2020); Vanpoucke and Ellis (2020).	Adaptability was highlighted through flexibility in procurement and logistics, capacity to handle surges in demand and ability to recover from pandemic, including adjusting their expectations, demand and purchasing behaviours. Rapid product innovation promoted adaptability. Retailers have had to pivot swiftly to address disruptions in the sourcing of goods, transportation bottlenecks, and fluctuations in demand.	HR transition of employees to remote work model, social capital, financial resources, setting priorities in managing business process in SC.
	10	Increasing visibility	Aslam et al. (2020), Kiers (2022), Pettit et al. (2019), Van Hoek (2019), Aslam et al. (2020), Chowdhury et al. (2020), Lohmer (2020).	Visibility helps retailers establish better communication and collaboration with their suppliers. Introduced transport management system (TMS) to keep a grip on logistics supply chain. •TMS software provides insight into transport flows, expected arrival times, transport performance and logistics costs.	TMS, IT Integration, financial resources, use of social media to communicate with suppliers.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources to implement the strategy
				<ul style="list-style-type: none"> •Big data analytics enhanced flexibility from increased visibility, retailers identify areas that need continuous improvement. •Data-driven decision-making was improved through visibility of SC. •Transparency for customers. •Cost optimisation: improved visibility enables retailers to identify inefficiencies and bottlenecks in the supply chain. 	
	11	Supply chain collaboration	Shekarian and Mellat Parast (2021), Duong and Chong, (. (2020) Sanjoy Kumar Paul et al. (2021), Ivanov, (2020), Ozdemir et al. (2022) Ramanathan U et al. (2021) McKinsey & Company Report (2020),	Collaboration allowed for the pooling of resources among network partners, resulting in a more efficient and responsive supply chain recovery. This collaborative effort led to the formation of interconnected networks and development of ecosystems partnership, where the constant exchange of information ensured business continuity. Strategy extended beyond mere cooperation; it involved the purposeful integration of supply chain processes.	IT integration, social media platforms, financial resources, staff employees, contractual agreement policies.
	12	Use of information technology	Jiang and Stylos (2021), Burgos and Ivanov (2021), blockchain: Moosavi et al. (2021), Khuan et al. (2023), Salehi-Amiri et al. (2021), Grimmer (2022), Ivanov (2021), Khuan et al. (2023), Katsaliaki et al. (2021), Sharma et al. (2020).	The use of technology improved demand forecasting, adapted product offerings to rapidly shifting market dynamics, streamlined fulfilment processes by digitalising operations, enhanced supply chain visibility, and boosted adaptability to disruptions. It also facilitated the identification of distribution capacity and enabled cost-effective last mile deliveries. Though embracing omnichannel retailing, with technology facilitating seamless integration between online and physical stores increased information sharing and communication, swiftly pivoting and building resilience in response to the unique challenges posed by the pandemic.	AI, IoT, social medial platforms, financial resources, sharing assets, IT integrations, digitisation, and automatization of purchasing processes. Using new technologies in business process management.
	13	Suspension of operations and rationalisation	Parsons (2020), Naghshineh and Carvalho (2021).	Production shutdown. This involves shutting down or suspending operations due to reduced demand, lack of raw materials, willingness to limit inventory of finished products. Others abandoned operations. Other companies focused on maintaining the production continuity in cooperation with purchasing departments, to guarantee the necessary resources for production lines. During a	Abandoning other warehouses, IT integration with other suppliers. Assortment rationalisation.

	No	Strategy	References (from 2019 to 2024)	How the strategy is applied	Use of resources to implement the strategy
				disruption, manufacturers, and maybe even retailers, suspend their operations for weeks, due to delays or unavailability of required key input supplies. This can be applied through suspending operations to conserve resources and avoid accumulating further losses until economic conditions improve. Decision synchronisation. Improve responsiveness, social media.	
	14	Diversification	Sellam (2023), Taqi et al., (2020), Kiers et al. (2022), Grimmer (2022), Sharma et al. (2022), Deloitte (2020), Sharma et al. (2020), Van Hoek (2020).	Many retailers embarked on diversification and localisation of suppliers as strategies although it required agility to shift from single sourcing to multiple sourcing. As the demand for materials shot through the roof with shortage of essentials, retailers had to adopt a flexible adaptive and agile way of dealing with the peak demand. Those who were successful embarked on implementing various countermeasures of local sourcing to secure material supply.	Resource sharing. Financial resources, IT integration, multiple sourcing.
	15	The role of leadership /Top Management Commitment/ Adaptable leaders	Giustiniano et al. (2018), Lombardi et al. (2021).	Increasing and lowering employee salaries. Reconfiguration of customers order fulfilment process, starting business, reformulating goals in SCM.	The role of TMC in SC operations is to aid while acquiring resources and developing capabilities and enhance the supply chain practices that help develop and sustain competitive advantages.