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# **International Journal of Retail & Distribution Management**

## **Understanding retail supply chain during COVID-19: A systematic review**

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## Understanding retail supply chain during COVID-19: A systematic review

**Purpose**– The aim of this paper is to identify the themes that emerged from retail supply chain (RSC) literature during the COVID-19 pandemic that inform future mitigation and recovery strategies.

**Design/methodology/approach**– This study analyses contributions in the RSC literature using four databases: Emerald, Elsevier (Science Direct), Wiley, and Taylor & Francis. The systematic review approach resulted in identifying 74 articles covering 2020 to 2022.

**Findings**– Four themes emerged from RSC literature on COVID-19. The first theme highlighted factors that exacerbated the effects of COVID-19 pandemic on the RSC. The second theme focused on the types of disruptions that occurred in the RSC during the pandemic. The third theme demonstrated the recovery strategies used to reduce the impact of COVID-19 on the RSC. The fourth theme identified proposed mitigation strategies for the RSC post COVID-19 outbreak.

**Practical implications**–The study provides a deeper understanding of how retail supply chain managers could successfully reduce the effects of the COVID-19 pandemic by dealing with interruptions. Based on the reviewed studies and the four themes that evolved from RSC literature on COVID-19 throughout 2020-2022, eleven key RSC strategies and lessons have been recommended to decision makers in the retail industry.

**Originality/value**– This is the first study to identify the themes that emerged from RSC literature during the COVID-19 pandemic to inform future mitigation and recovery strategies. The resulting themes add to the existing body of knowledge and established the need for further research into other sectors that might be affected by future pandemics.

**Keywords:** Retail Supply Chain, Supply Chain Disruptions, Mitigation Strategies, Recovery Strategies, Covid-19, Systematic Review.

## 1. Introduction

The retail industry is the fifth largest in the world (Sharma *et al.*, 2021). The COVID-19 pandemic exposed retailers to a number of unforeseen risks and disruptions, prompting a reconsideration of risk management practices (e.g. risk balance between suppliers and the retailer) in Supply Chain (SC) operations (Elnahla and Neilson, 2021; Schleper *et al.*, 2021; Cole and Shirgholami, 2022). Moreover, due to supply disruptions and changes in demand patterns, retailers were characterised mostly by erratic decisions and were forced to source from new suppliers for various products and services to satisfy changing needs for consumers (Schleper *et al.*, 2021; Towers *et al.*, 2020; Naeem, 2021; Park *et al.*, 2022).

Retailers improved their performance to offset financial losses and focus on post-pandemic preparedness (Adewopoa, *et al.*, 2021; Richards and Rickard, 2020; Pilawa *et al.*, 2022). This will be accomplished by collaboration among the RSC partners (Sharma *et al.*, 2021; Abushaikha, 2018). Disruption has affected both customers and the whole SC sourcing, procurement, manufacturing, and delivery systems (Butt, 2022). As a result, retailers deployed a variety of strategies to meet requirements and desires of customers during the pandemic, and to prepare them for post-pandemic situations (Sharma *et al.*, 2021; Salvietti *et al.*, 2022; Eymas and Bensebaa, 2021).

During the COVID-19 pandemic, the retailing sector has faced unexpected challenges in demand and supply, due to the applied restrictions on logistical activities, trade flows and production in the short term (Alikhani *et al.*, 2021; Towers *et al.*, 2020; Islam *et al.*, 2022). While significant research has recently been published on COVID-19 mitigation strategies, systematic review studies addressing the retailing sector are to a great extent quite scarce. Most existing literature has focused on risk mitigation strategies from the buyer, supplier, or distributor's perspective, disregarding the role of retailers in managing SC (Coopmans *et al.*, 2021; Grewal *et al.*, 2021; Priyadarshini and Abhilash, 2021; Mohamadi *et al.*, 2022). This study is set out to identify the themes that emerged from retail supply chain (RSC) literature during the COVID-19 pandemic to inform future mitigation and recovery strategies. This is the first scholarly work to provide a systematic review in this domain between 2020 and 2022. Table 1 shows that there have been some review studies related to supply chain management and COVID-19, but our study is different from other similar studies in that it reviews literature related to the response of retail supply chains to COVID-19.

*Table 1. Overview of similar previous review studies*

Author (s)	Title of the study	Focus of the study	Contribution from this study
Qrunfleh <i>et al.</i> (2022)	Mitigation themes in supply chain research during the COVID-19 pandemic: a systematic literature review	This review focused on extracting the themes and direction of supply chain mitigation and resilience research during COVID-19 by reviewing supply chain mitigation literature between 2020 and 2021.	- This study covers a wider time-span and captured retail supply chain studies covering three years i.e. 2020-2022.
Chowdhury <i>et al.</i> (2021)	COVID-19 pandemic related supply chain studies: A systematic review	This study reviews research on the COVID-19 pandemic in supply chain literature until 28 September 2020.	- This study investigates four emerging themes focusing on the specific retail supply chain characteristics that made it vulnerable to the pandemic, the resulting disruptions from the pandemic, the recovery strategies that are applied by retail supply chain managers, and the mitigation strategies related to the RSC.
Pujawan and Bah (2022)	Supply chains under COVID-19 disruptions: literature review and research agenda	this paper presents a review of literature that addresses supply chains under disruptions due to COVID-19 pandemic until March 2021.	- This study develops eleven themes related to recovery strategies in retail supply chain.
Spieske and Birkel (2021)	Improving supply chain resilience through industry 4.0: A systematic literature review under the impressions of the COVID-19 pandemic.	The paper conducts a review of the relevance of industry 4.0 in supply chain management to improve resiliency under covid-19 literature. It covers the period between 2011 and 2021	
Shi <i>et al.</i> (2021)	Present and future trends of supply chain management in the presence of COVID-19: a structured literature review.	This review focused on the major research topics in operations and SCM related to COVID-19, how the pandemic changed international cooperation amongst scholars, and what research opportunities related to the pandemic exist for scholars until August 2021.	

Thus, this study aims to identify the themes that emerged from retail supply chain (RSC) literature during the COVID-19 pandemic to inform future mitigation and recovery strategies by addressing the following research questions:

- RQ1. What are the factors that exacerbated the effect of COVID-19 pandemic on the RSC?
- RQ2. What are the disruptions occurred in the RSC due to COVID-19 pandemic?
- RQ3. What mitigation strategies are applied in the RSC to reduce the effect of COVID-19 pandemic?
- RQ4. What are the proposed recovery strategies by RSCs?

The structure of this paper is as follows. Section 2 presents the methodology used to conduct the systematic literature review (SLR). Section 3 analyses, interprets and discusses the research results. Finally, the conclusion is provided in Section 4.

## **2. Methodology**

This study provides a systematic review of research on SC issues faced by the retail sector during the COVID-19, published from 1/1/2020 to 31/12/2022. Our study will adopt the steps of SLR followed by Walker (2010), based on Tranfield *et al.* (2003).

### **2.1 Formulation of the research question**

The study has four research questions stated above. Formulating a well-defined research question reduces bias and achieves efficiency by reducing the time and cost of and obtaining relevant studies (Tranfield *et al.*, 2003).

### **2.2 Identification of the keywords and terms**

Four databases of Emerald, Elsevier (ScienceDirect), Wiley and Tylor & Francis were used for locating relevant studies. The academic sources of publications in the databases include leading journals in the field of SC which gives a foundation for identifying relevant literature. A set of keywords including COVID-19, SC, Corona virus, logistics and retail were identified from pervious literature. Moreover, the final sample of articles included the following keywords: distribution, supplier, and risk as well as the keywords used in the SLR.

### **2.3 Identification of studies and assessment of the quality of identified studies**

To determine the final number of the reviewed articles in the systematic review, the authors developed inclusion and exclusion criteria (see Table 2). Whereas COVID-19, SC and retail were used together in the first round of searching, COVID-19, logistics and retail emerged in the second round, Corona virus, SC and retail in the third round and Corona virus, Logistics and retail were used in the fourth round of searching. The number of articles resulted from searching keywords in all databases and published in 2020-2022 were 5878 in total. Only articles published in peer-reviewed journals, and Scopus-indexed – after excluding editorials - were considered in this analysis, which served as a quality check. These journals follow a strict quality-control procedure for published articles and as a result, we had 2137 articles. After removing studies that are not related to retailing sector, we had 854 articles. Each article's title and abstract were evaluated for inclusion and exclusion. Each article must have the study's main

keywords, and the journal's scope must be related to RSC during the COVID-19 pandemic. The final sample was 74 articles. Figure 1 illustrates the process of selecting the reviewed studies.

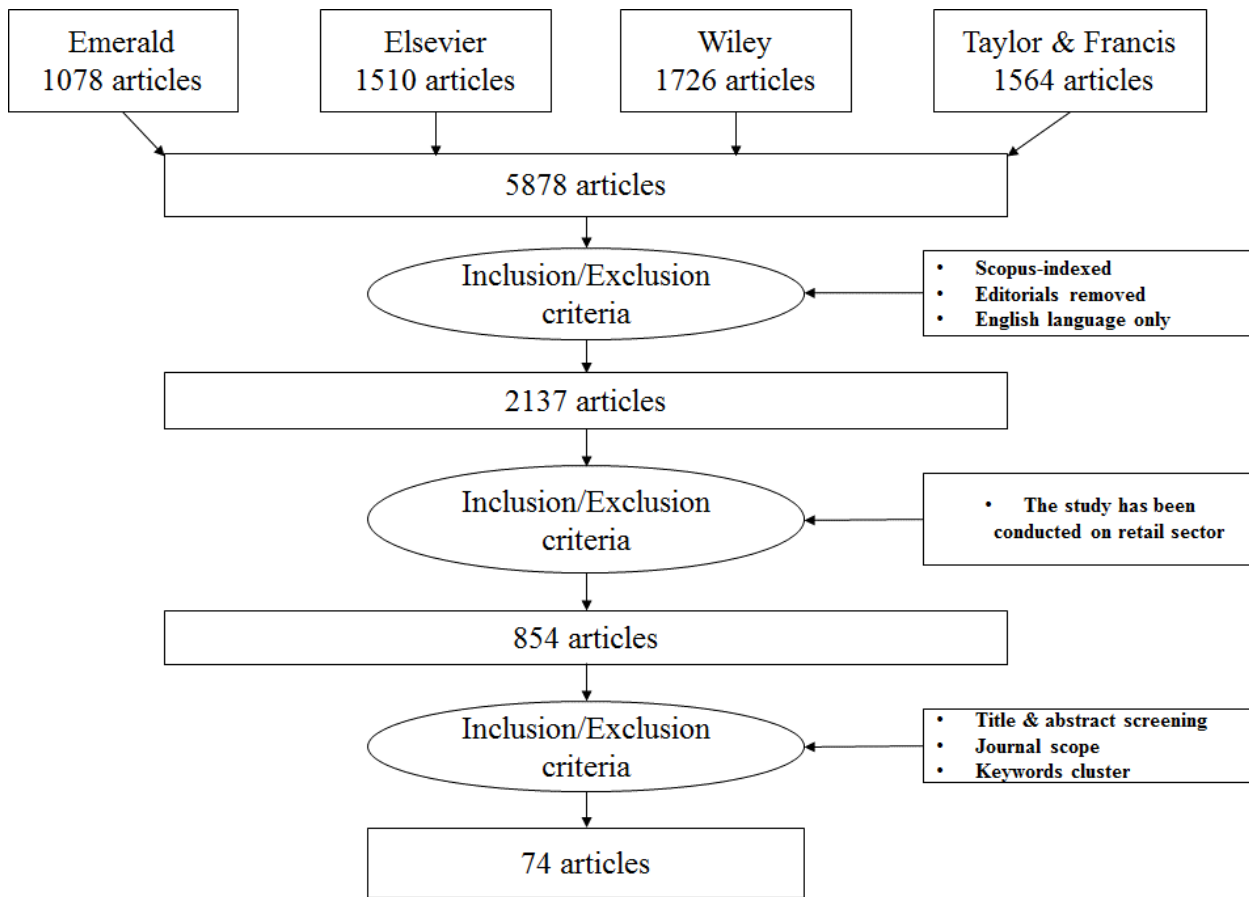


Figure 1. Selection process for articles published between 2020 and 2022

To increase the validity of the results, another search was conducted using the snowballing technique (Abidi *et al.*, 2014). Each selected article's references were reviewed, selected, evaluated, and analysed. No new articles resulted from this process, confirming its validity. Some keywords used in the evaluation process were considered even if not written exactly since they had the desired meaning.

#### 2.4 Extraction of data from studies selected after the assessment

We used structured data extraction on all articles to reduce subjectivity. We analysed the data to answer our questions. For recording, coding, and synthesizing, we created an excel document with each article's title, author(s), journal name, publication year, country of study, and type of respondents. Table 2 shows a summary of the inclusion/exclusion criteria used in our study.

Table 2. The applied inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> <li>• Source of the article (Database and journal)</li> <li>• Availability of the keywords (COVID-19, supply chain, logistics, retail, coronavirus)</li> <li>• Must contain the keywords cluster (COVID-19, supply chain/ logistics and retail) in the study.</li> <li>• Availability of the keywords in the study abstract and body text of the article.</li> <li>• The article must be in written in English.</li> </ul>	<ul style="list-style-type: none"> <li>• Editorials, conferences and book chapters</li> <li>• Not found in Scopus database</li> <li>• Don't have all of the keywords together (COVID-19, supply chain/ logistics, retail) in the study</li> <li>• Availability of any keyword in the body text, reference or in the about the authors part only</li> </ul>

## 2.5 The synthesis of extracted data

By reviewing each study and identifying significant information about RSC during COVID-19 period, data analysis attempted to answer the study research questions. On the other hand, synthesis seeks to organize the results of individual studies in a unique way to provide information that cannot be deduced from reading individual studies (Tranfield *et al.*, 2003). The significant findings and contributions of this study are presented in the following sections.

## 3. Analysis and discussion

### 3.1 Descriptive analysis

This study is built based on a number of published articles in scholarly journals. Each journal has a number of studies that were revised in detail. Table 3 shows the name of the peer-reviewed journals and the number of studies per journal.

Table 3. Publication journals and the number of studies per journal

Name of Journal	Number of studies	Name of Journal	Number of studies
Canadian journal of agricultural economics	5	International Journal of Physical Distribution & Logistics Management	1
International Journal of Logistics Research and Applications	4	Internet of Things and Cyber-Physical Systems	1
Supply Chain Management: An International Journal	4	Journal of Operations Management	1
International Journal of Operations & Production Management	4	Industrial Relations Journal	1
International Journal of Production Research	3	American Journal of Agricultural Economics	1



Journal of Supply Chain Management	3	Decision Sciences	1
Applied Economic Perspectives and Policy	3	Qualitative Market Research: An International Journal	1
Agribusiness	3	Transportation Research Part D: Transport and Environment	1
China Agricultural Economic Review	2	Journal of Business Research	1
Journal of Chinese Economic and Business Studies	2	Heliyon	1
International Journal of Retail & Distribution Management	2	Transportation Research Interdisciplinary Perspectives	1
International journal of production Economics	2	Journal of Enterprise Information Management	1
Global food security	2	Food policy	1
Journal of Global Operations and Strategic Sourcing	2	Agricultural systems	1
Socio-Economic Planning Sciences	2	Journal of retailing	1
Production and Operations Management	2	Transportation Research Part E	1
Benchmarking: An International Journal	2	The International Journal of Logistics Management	1
Technology in Society	2	Continuity & Resilience Review	1
Journal of Strategic Marketing	1	Journal of Cleaner Production	1
Journal of Integrative Agriculture	1	The International Review of Retail, Distribution and Consumer Research	1
Journal of International Logistics and Trade	1	British Journal of Management	1
Journal of Service Management	1	<b>Total</b>	<b>74</b>

### 3.2 Graphical analytics

Each study's publication date was identified to determine the year and month of most COVID-19 and RSC publications as shown in Figure 2. The diagram shows that there was an ongoing scholarly interest in the RSC topics in the three years following the pandemic.

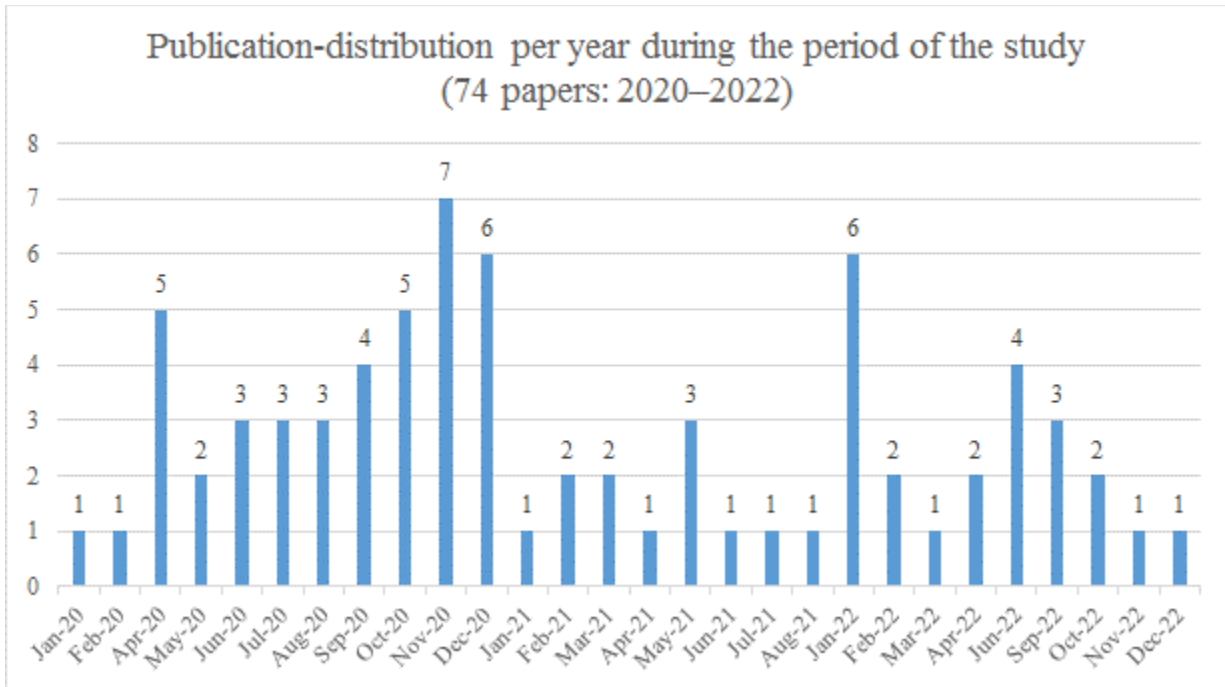


Figure 2. Publication-distribution per year during the period of the study (74 papers: 2020–2022)

In addition, Figure 3 shows the resulted peer-to-peer journals and number of studies in each journal selected and analysed in this study. A large number of studies on RSC were published in leading journals such as International Journal of Retail & Distribution Management, Canadian Journal of Agricultural Economics, and Supply Chain Management: An International Journal.

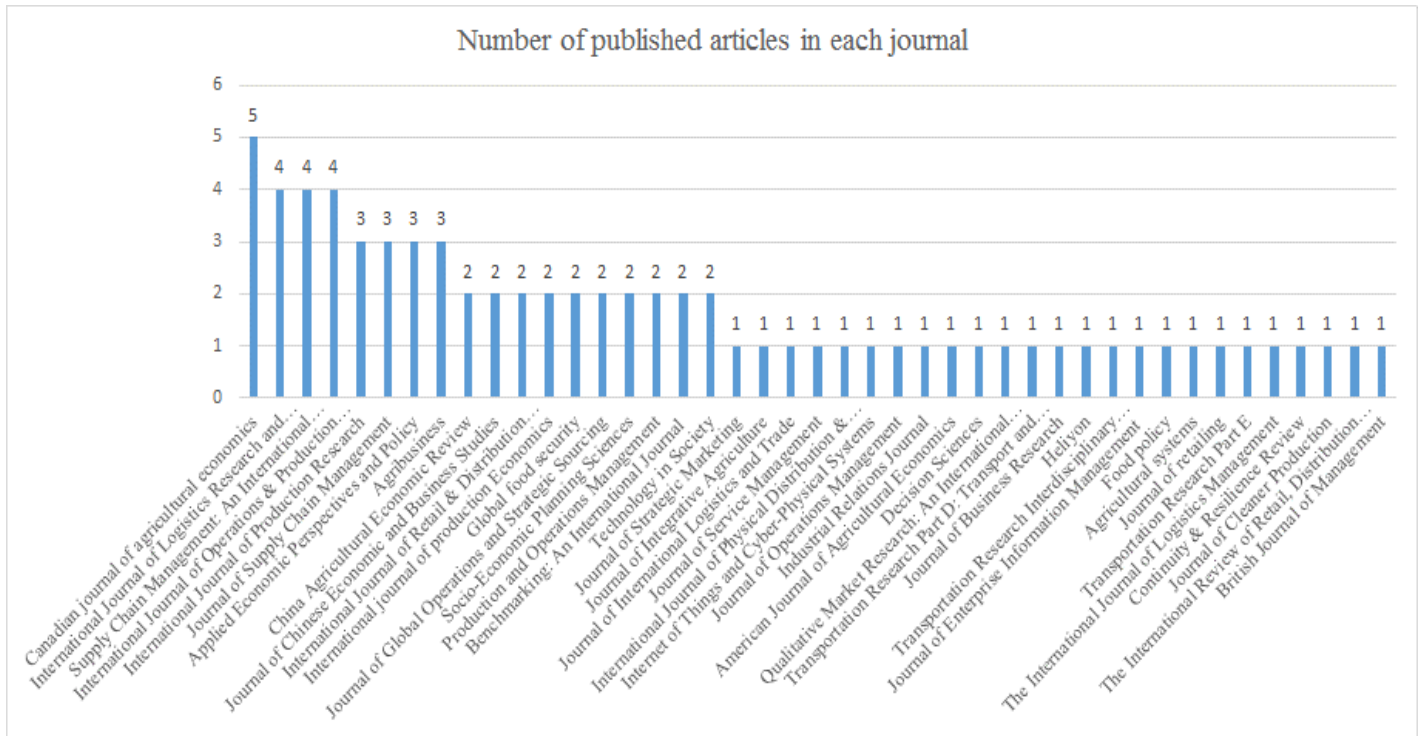


Figure 3. Number of published articles in each journal

Figure 4 represents a percentage of publications in each database. Most of the studies appeared in journals published by Emerald database, followed by Wiley, Elsevier, and Taylor & Francis respectively.

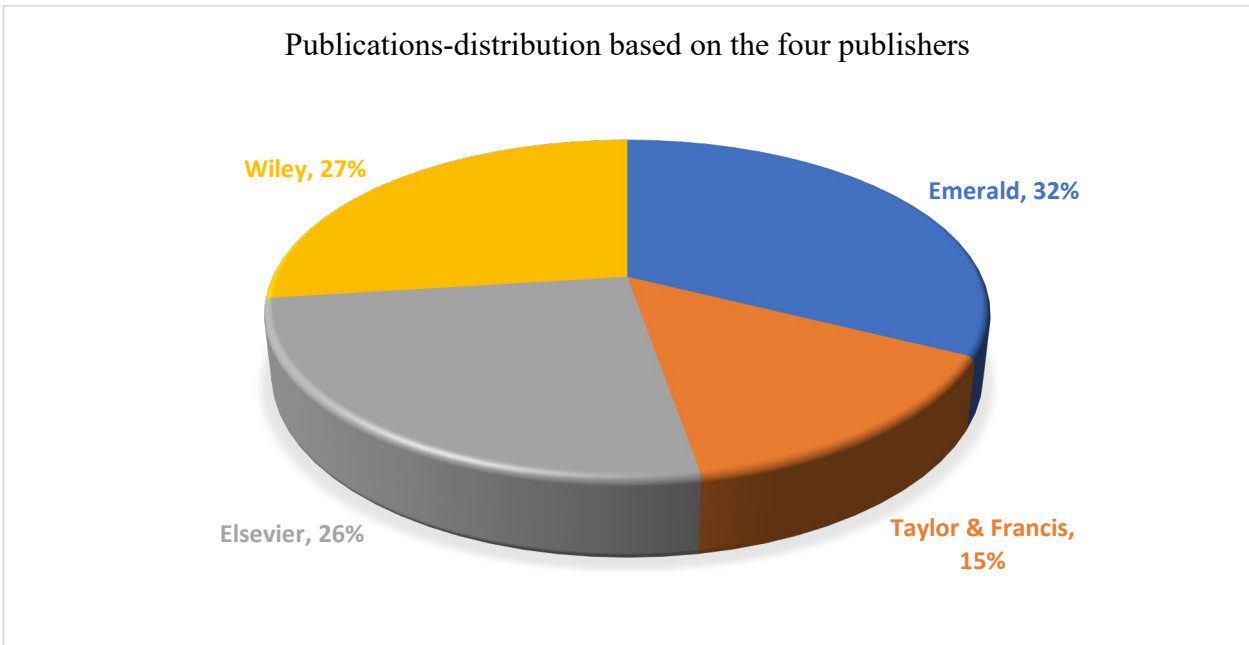


Figure 4. Publications-distribution based on the four publishers

Different retailing sectors and contexts were considered in the 74 studies, as shown in Figure 5. Food supply chain is the most studied sector followed by agricultural SC, mixed retail sectors and meat SC.

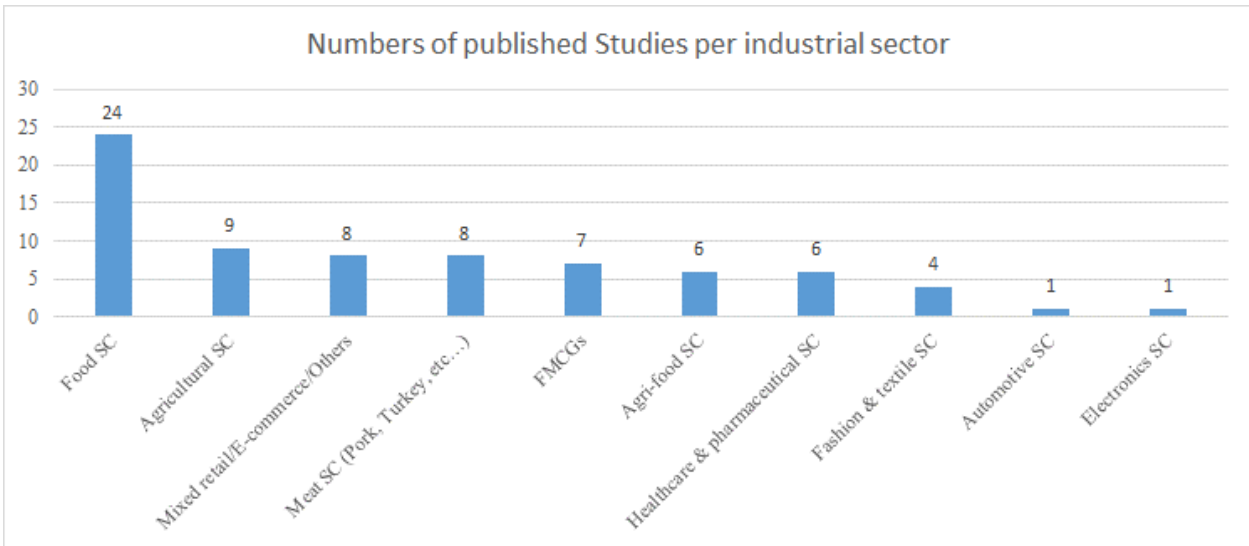


Figure 5. Distribution of publications based on the industrial sector

### 3.3 Characteristics that increased the impact of COVID-19 pandemic on RSCs

The reviewed articles revealed why the COVID-19 pandemic had such a detrimental influence on the RSC. For instance, The SC's vertical integration, product packaging size, and labelling difficulties are the main drivers of the COVID-19 pandemic negative impact on RSC (Hayes *et al.*, 2021; Do *et al.*, 2021). Many retailers encountered significant interruptions within their supply chains within the COVID-19 pandemic, resulting in severe impacts on the accessibility of packing materials and labelling supplies. Retailers were compelled to modify their packaging and labelling practices in order to conform to the distinct demands of e-commerce, including the incorporation of protective packaging measures. The pandemic induced a shift in consumer preferences pertaining to specific package formats. One notable preference seen was the inclination towards individually wrapped or sealed products as a means of ensuring optimal cleanliness. Retailers had difficulties in adapting product labels to accurately represent alterations in product availability, expiration dates, or pricing. COVID-19 business risk perception was highly asymmetric across geographical regions, and the main reasons for the low resiliency levels to risks are the dependency on JIT approach and the absence of proactive risk management practices (Abu Hatab *et al.*, 2020; Dung, 2020). Retailers frequently rely on a global

network of suppliers, but the pandemic affected different locations differently with some regions instituting tight lockdowns and others implementing fewer restrictions. Due to lockdowns or low-foot traffic, many retailers were forced to temporarily close their stores, and reduce their reliance on overseas suppliers reverting to more localised supply chains. Table 4 summarises the characteristics that increased the impact of COVID-19 pandemic on RSC.

*Table 4. Characteristics that increased the impact of COVID-19 pandemic on RSC*

<b>Studies</b>	<b>First-order theme</b>	<b>Second-order themes</b>
<ul style="list-style-type: none"> <li>✓ Hayes <i>et al.</i> (2021)</li> <li>✓ Do <i>et al.</i> (2021)</li> <li>✓ Abu Hatab <i>et al.</i> (2020)</li> <li>✓ Dung <i>et al.</i> (2020)</li> <li>✓ Riglietti <i>et al.</i> (2022)</li> <li>✓ Kumar (2022)</li> <li>✓ Wulff (2022)</li> </ul>	Triggers allow COVID-19 pandemic to impact the RSC.	<ul style="list-style-type: none"> <li>- Supply chains’ vertical integration &amp; high dependency on SC members (disruption in supply from any memeber in the SC)</li> <li>- Packaging and labelling challenges (availability, online orders, consumer preferences, changing information )</li> <li>- Connection with manufacturing industry in terms of products (lack of inventory)</li> <li>- Geographical spread challenges (suppliers’ network, consumer traffic, level of restriction by region)</li> <li>- Dependency on JIT approach</li> <li>- Lack of proactive risk management practices</li> </ul>

### **3.4 The impact of COVID-19 pandemic on the RSC**

Within the complex domain of transportation, the RSC encountered an extensive number of challenges, resulting in a cascading impact on the industry. Significantly, the implementation of rigorous traffic regulations in crucial logistical centres exacerbated the challenges faced by the RSC, necessitating their navigation through a complex network of delays and operational obstacles (Gray, 2020; Scala and Lindsay, 2021). Simultaneously, the retailers were obligated to execute substantial workforce cutbacks as a means of cost reduction, with the consequence impact of operational complexities. In addition, the shortage of vacant containers, which are a vital asset in the transportation sector further intensified the challenges encountered by the RSC (Gray, 2020; Scala and Lindsay, 2021).

These unfavourable conditions led to a fragile market environment represented by significant imbalances in the RSC network. The constraints imposed on the supply chain due to limitations on traffic, reductions

in labour, and shortages of containers had a widespread impact across the sector, leading to disruptions that affected not only the RSC but also its partners and competitors (Naeem, 2021; Cariappa et al., 2022a). As a result, consumers were impacted by these issues, as members of the RSC were obligated to forward the increasing operational expenses to end-users, with an increase in product prices.

The complex network of interrelated elements and consequences highlighted the necessity for inventive approaches and holistic tactics to navigate the continuously changing environment of transportation and logistics (Naeem, 2021; Cariappa et al., 2022a). Producers and businesses predominantly used e-commerce platforms to market and sell during the COVID-19 pandemic (Thilmany et al., 2020; Kazancoglu and Demir, 2021), but the COVID-19 pandemic negatively affected sales and revenue performance (Abu Hatab et al., 2020). RSCs faced rising production and distribution costs, supply and distribution instability, import disruptions, and trade mistrust.

Besides transportation constraints, RSCs faced food security, quality, health and safety challenges, price volatility, inventory shortages, logistical backlogs, and consumer behaviour changes (Untaru and Han, 2021; Cariappa et al., 2022b). Table 5 shows the impact of the pandemic on RSC.

*Table 5. The impact of COVID-19 pandemic on the RSC*

<b>Study</b>	<b>First-order Theme</b>	<b>Second-order Themes</b>	<b>Third-order Themes</b>
<ul style="list-style-type: none"> <li>✓ Sarkis (2020)</li> <li>✓ Min <i>et al.</i> (2020)</li> <li>✓ Mahajan and Tomar (2020)</li> <li>✓ Gray (2020)</li> <li>✓ Adewopoa, <i>et al.</i> (2021)</li> <li>✓ Richards and Rickard (2020)</li> <li>✓ Brewin (2020)</li> <li>✓ Do <i>et al.</i> (2021)</li> <li>✓ Naeem (2020)</li> <li>✓ Thilmany <i>et al.</i> (2020)</li> <li>✓ Hayes <i>et al.</i> (2021)</li> <li>✓ Rude (2020)</li> <li>✓ Sodhi and Tang (2020)</li> </ul>	The impact of COVID-19 pandemic on the RSC	<ul style="list-style-type: none"> <li>-Lack of workforce</li> <li>- Shifts in demand patterns towards products</li> <li>- Logistical restrictions &amp; shifts in marketing channels</li> <li>- Disequilibrium in businesses (decrease in supply and demand)</li> <li>- Increases in operating costs</li> </ul>	<ul style="list-style-type: none"> <li>- Transportation disruptions (Cost increase, long lead time, available modes)</li> <li>- Sourcing disruptions (Suppliers/supply availability, current contracts, dealing with new suppliers/supply sources, Increases in logistical backlogs)</li> <li>- Workforce disruptions (Availability, new working rules, staff reduction)</li> <li>- Distribution disruptions(shift to online distribution channels, long</li> </ul>

<ul style="list-style-type: none"> <li>✓ Koppenberg <i>et al.</i> (2020)</li> <li>✓ Abu Hatab <i>et al.</i> (2020)</li> <li>✓ Scala and Lindsay (2021)</li> <li>✓ Liverpool-Tasie <i>et al.</i> (2020)</li> <li>✓ Norwood and Peel (2020)</li> <li>✓ Sharma, <i>et al.</i> (2020a)</li> <li>✓ Pani, <i>et al.</i> (2020)</li> <li>✓ Wang <i>et al.</i> (2020)</li> <li>✓ Gu and Wang (2020)</li> <li>✓ Cavallo <i>et al.</i> (2020)</li> <li>✓ Ghadge <i>et al.</i> (2020)</li> <li>✓ Loske (2020)</li> <li>✓ Kumar and Kumar Singh (2022)</li> <li>✓ Singh <i>et al.</i> (2020)</li> <li>✓ Shen <i>et al.</i> (2021)</li> <li>✓ Burgos and Ivanov (2021)</li> <li>✓ Malone <i>et al.</i> (2021)</li> <li>✓ Coopmans <i>et al.</i> (2021)</li> <li>✓ Ghadge <i>et al.</i> (2022)</li> <li>✓ Cole and Shirgholami (2022)</li> <li>✓ Islam <i>et al.</i> (2022)</li> <li>✓ Cariappa <i>et al.</i> (2022a)</li> <li>✓ Cariappa <i>et al.</i> (2022b)</li> <li>✓ Wulff (2022)</li> <li>✓ Mohamadi <i>et al.</i> (2022)</li> <li>✓ Cai <i>et al.</i> (2022)</li> </ul>		<ul style="list-style-type: none"> <li>- Prices vulnerability (gap between the actual price and the market price)</li> <li>- Emergence of health &amp; safety regulations</li> </ul>	<ul style="list-style-type: none"> <li>lead times, customers accessibility limitations, inventory availability/capacities)</li> <li>- Consumer demand patterns disruptions (demand increase for personal protection products, shifts toward food-at-home, increase for non-perishable products)</li> <li>- Cost disruptions (increase in operating costs, increase in product prices)</li> </ul>
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**3.5 Applied recovery strategies in RSC during COVID-19 pandemic**

Recovery strategies represent risk management techniques that are utilized to eliminate or reduce the likelihood and/or consequence of a risk such as COVID-19.

During the pandemic, numerous recovery strategies were adopted by retailers, including accelerating innovation and digital transformation, partnering with international economic and innovation experts, and adopting regional economic recovery strategies through the help of local and national officials (Fu

*et al.*, 2020; Do *et al.*, 2020). RSCs responded to the pandemic by establishing inventory reserves, pooling to dampen demand fluctuations, sharing e-commerce delivery and storage resources between competitors, deploying omni-channels, gaining financial support from governments, creating online platforms, and applying just-in-time financing (Scala and Lindsay, 2021; Hänninen *et al.*, 2021).

Furthermore, AI, big data analytics, automation, AR, and robotics were used mainly in delivery and distribution to boost revenue and customer satisfaction in responsive retailing strategies (Guha *et al.*, 2021; Njomane and Telukdarie, 2022). Retailers adopted several inventory strategies by improving communication and collaboration of inventory levels across the SC, creating buffer stocks, redefining inventory strategies, restructuring retailing operations and retailing digitalization (Burgos and Ivanov, 2021; Kumar, 2022). Table 6 summarizes the applied recovery strategies.

*Table 6. Applied recovery strategies in RSC during COVID-19 pandemic*

Studies	First-order theme	Second-order themes	Third-order themes
<ul style="list-style-type: none"> <li>✓ Fu <i>et al.</i> (2020)</li> <li>✓ Thilmany <i>et al.</i> (2020)</li> <li>✓ Dung <i>et al.</i> (2020)</li> <li>✓ Scala and Lindsay (2021)</li> <li>✓ Do <i>et al.</i> (2021)</li> <li>✓ Ghadge <i>et al.</i> (2020)</li> <li>✓ Hayes <i>et al.</i> (2021)</li> <li>✓ Halan (2021)</li> <li>✓ Craighead and Darby (2020)</li> <li>✓ Sodhi and Tang (2020)</li> <li>✓ Azadegan and Dooley (2020)</li> <li>✓ Gu and Wang (2020)</li> <li>✓ Coopmans, <i>et al.</i> (2021)</li> <li>✓ Grewal <i>et al.</i> (2021)</li> </ul>	<p>Applied recovery strategies in RSC during COVID-19 pandemic</p>	<ul style="list-style-type: none"> <li>- Accelerating innovations and digital transformation</li> <li>- Dealing with changing consumer demand patterns</li> <li>- SCs resiliency and flexibility by sharing learning experience through discussions at local and national levels</li> <li>- Sharing e-commerce delivery and storage resources between competitors</li> <li>- Redefining inventory strategies such as having buffer stocks</li> <li>- Transform in work environment to allow personnel to work remotely</li> <li>- Restructuring retailing operations in terms of inventory strategies and online distribution channel</li> </ul>	<ul style="list-style-type: none"> <li>- Use truck-drones synchronized delivery systems</li> <li>- Simulating consumption (forecast future demand patterns)</li> <li>- Promoting demand for some items (making discounts on prices)</li> <li>- Discussions between policy makers</li> <li>- Sharing delivery and storage resources</li> <li>- Digital transformation to e-commerce</li> <li>- New sources of supplies</li> <li>- Opening e-commerce platforms and channels</li> <li>- Governmentally financial support</li> <li>- Distance working</li> <li>- Integrating warehouses</li> <li>- Improving retailing strategies</li> <li>- Conducting complementary research</li> <li>- Adopting 3D-printing technologies</li> <li>- Providing consumer subsidies</li> <li>- Promoting social mask business</li> </ul>



<ul style="list-style-type: none"> <li>✓ Priyadarshini and Abhilash (2021)</li> <li>✓ Singh, <i>et al.</i> (2020)</li> <li>✓ Shen <i>et al.</i> (2021)</li> <li>✓ Burgos and Ivanov (2021)</li> <li>✓ Malone <i>et al.</i> (2021)</li> <li>✓ Shen and Sun (2021)</li> <li>✓ Sharma <i>et al.</i> (2021).</li> <li>✓ Chatterjee <i>et al.</i> (2021)</li> <li>✓ Grant <i>et al.</i> (2021)</li> <li>✓ Ghadge <i>et al.</i>, (2022)</li> <li>✓ Timotius <i>et al.</i> (2022)</li> <li>✓ Munir <i>et al.</i> (2022)</li> <li>✓ Mariappan <i>et al.</i> (2022)</li> <li>✓ Fares and Lloret (2022)</li> <li>✓ Sarkar <i>et al.</i> (2022)</li> <li>✓ Ramanathan <i>et al.</i> (2022)</li> <li>✓ Njomane and Telukdarie (2022)</li> <li>✓ Ozdemir <i>et al.</i> (2022)</li> <li>✓ Cai <i>et al.</i> (2022)</li> <li>✓ Wulandhari <i>et al.</i> (2022)</li> </ul>		<ul style="list-style-type: none"> <li>- Seeking financial supports from government and banks</li> <li>- Deal with new alternative suppliers</li> </ul>	<ul style="list-style-type: none"> <li>- Assessing COVID-19 impacts</li> <li>- Safety stock</li> <li>- Redefining inventory strategies</li> <li>- New food distribution methods</li> </ul>
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### 3.6 Applied strategies to mitigate the impact of COVID-19 in RSC

Recovery strategies are alternative methods for restoring business operations to a minimally acceptable level after the pandemic. Consumers changing to online shopping, regular sanitization and social distancing were new strategies that retailers needed to implement during the pandemic (Sharma *et al.*, 2020a; Fuentes *et al.*, 2022). Furthermore, adopting real-time information systems, applying just-in-time order fulfilment, changing distribution methods, restructuring internal supply systems, investing in autonomous technologies, and ensuring staff communication were effective SC mitigation strategies (Sharma, *et al.*, 2020c; Fares and Lloret, 2022). In addition, RSCs had learned lessons from adopting quick strategic decision-making, standardizing technical specifications, using new technologies, cross-sector collaborations, conducting vulnerability analysis, segmenting suppliers based on disruption,

adopting local/multiple sourcing, and localising SC activities, as key strategies for pandemics (Hultman and Egan-Wyer, 2022; Ramanathan *et al.*, 2022; Kumar and Kumar Singh, 2022).

The upstream initiatives during the pandemic focused on supplier liquidity, SC finance, member collaborations, contracting with new suppliers, developing transformative leadership, adjusting store layout, and applying a safety stock strategy (Schleper *et al.*, 2021; Alikhani *et al.*, 2021). Table 7 demonstrates the applied mitigation strategies during and post the COVID-19 pandemic.

*Table 7. Applied strategies to mitigate the impact of COVID-19 on RSC*

<b>Studies</b>	<b>First-order theme</b>	<b>Second-order theme</b>	<b>Third-order theme</b>
<ul style="list-style-type: none"> <li>✓ van Hoek (2020)</li> <li>✓ Sharma <i>et al.</i> (2020a)</li> <li>✓ Sharma <i>et al.</i> (2020b)</li> <li>✓ Singh <i>et al.</i> (2020)</li> <li>✓ Dung <i>et al.</i> (2020)</li> <li>✓ Scala and Lindsay (2021)</li> <li>✓ Do <i>et al.</i> (2021)</li> <li>✓ Ghadge <i>et al.</i> (2020)</li> <li>✓ Hobbs (2020)</li> <li>✓ Mollenkopf <i>et al.</i> (2020)</li> <li>✓ Azadegan and Dooley (2020)</li> <li>✓ Zhang <i>et al.</i> (2020)</li> </ul>	<p>Applied strategies to mitigate the impact of COVID-19 in RSC</p>	<ul style="list-style-type: none"> <li>- Improving SC sustainability by rapid change to hygiene requirements and social distancing</li> <li>- Shifting to online shopping</li> <li>-Applying SC entrepreneurial embeddedness</li> <li>- Less dependency on global suppliers</li> <li>- Strategic stock management</li> <li>- Using new technologies for delivery/distribution</li> <li>- Plan for cross-sector collaboration and partnerships</li> <li>- Conducting vulnerability analysis for SC suppliers</li> <li>- Using online platforms for coordination between suppliers and retailers</li> <li>- Diversifications of sourcing and restructuring global value chains</li> <li>- Multiple sourcing through finding new available suppliers and localization of SC</li> <li>- SC collaborations and coordination between stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>- Rapid changes to hygiene requirements and social distancing in terms of retail shop layout and ensuring the availability of hygiene’s kits and machines</li> <li>- Rapid changes of adopted technologies</li> <li>- SC entrepreneurial embeddedness would enable retailers to navigate concurrent changes in the SC effectively.</li> <li>- Preparing stock across SCs in strategic locations</li> <li>- High speed in making right decisions about stock when responding to changes</li> <li>- Standardizing the technical specifications of items</li> <li>- Innovate in using new technologies (drones, ziplines, additive manufacturing and blockchain)</li> <li>- Define the disruptive suppliers</li> </ul>

<ul style="list-style-type: none"> <li>✓ Ketchen and Craighead (2021)</li> <li>✓ Norwood and Peel (2020)</li> <li>✓ Sharma <i>et al.</i> (2020c)</li> <li>✓ Javorcik (2020)</li> <li>✓ Gray (2020)</li> <li>✓ Kumar and Kumar Singh (2022)</li> <li>✓ Schleper <i>et al.</i> (2021)</li> <li>✓ Alikhani <i>et al.</i> (2021)</li> <li>✓ Nigro <i>et al.</i> (2021)</li> <li>✓ Sharma <i>et al.</i> (2022)</li> <li>✓ Butt (2022)</li> <li>✓ Riglietti <i>et al.</i> (2022)</li> <li>✓ Fares and Lloret (2022)</li> <li>✓ Njomane and Telukdarie (2022)</li> <li>✓ Kumar (2022)</li> <li>✓ Wulandhari <i>et al.</i> (2022)</li> </ul>	<ul style="list-style-type: none"> <li>- Collaborating on SC finance and supplier liquidity issues</li> <li>- Applying safety stock strategy</li> <li>- RSC network design/redesign to provide flexibility for demand fulfillment</li> </ul>	<ul style="list-style-type: none"> <li>- Segmenting suppliers into categories according to disruption risk</li> <li>- The online platform helps in using available resources for suppliers and retailers</li> <li>- Finding product alternatives and contracting with available new/local suppliers</li> <li>- Increase collaborations through information sharing, digitalization of the process, resource sharing, stockholders commitment, sharing risk and rewards between SC partners and joint planning</li> <li>- Conduct suppliers credit rating to allocate retailer budget properly</li> <li>- Analyze the design of RSC network in order to find/develop different scenarios for order fulfillment</li> </ul>
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#### 4. Conclusion

The disruptive nature of the COVID-19 pandemic forced retailers to embrace new strategies and tactics. An extensive review of 74 publications yielded four themes. Many research articles on RSC during COVID-19 were published between 2020 and 2022. A significant contribution from this study has been to identify how the RSC has been impacted by the pandemic, the different types of disruptions that faced

retailers during the pandemic, different mitigation strategies to deal with SC disruptions, and finally recovery strategies used by retailers to deal with SC disruptions. The study identified four major themes in retail sector during COVID-19, which are:

1. Characteristics of retail supply chain resulting from the impact of COVID-19 pandemic.
2. The disruptions resulted from COVID-19 pandemic on the RSC.
3. Applied recovery strategies in the RSC during COVID-19 pandemic.
4. Applied strategies to mitigate the impact of COVID-19 in RSC

Each theme was identified, categorised, and tabulated as shown in Tables 4, 5, 6 and 7. An overview of the analysed studies was presented in the appendix A.

#### **4.1 Theoretical contribution**

The first theme explored why COVID-19 affected RSC in particular. One of the primary issues appears to be SC vertical integration and excessive dependence on SC members. Additionally, the relationship with the manufacturing industry affected some products more than others.

When confronted with the COVID-19 pandemic, retailers experienced severe disruptions due to the nature of this sector, which addressed the second theme of this study. Moreover, price vulnerability was an addressing issue that retailers would face; there will be a difference between the actual price and the market price, thus market prices should be adjusted accordingly.

The systematic review provided a third theme regarding the recommended applied recovery strategies in RSC during the pandemic. Retailers who demonstrated a quick pace of digital transformation were less affected by the pandemic. In the situation of a pandemic, retailers may adopt a strategy of sharing e-commerce delivery and storage facilities among rivals, which is a win-win situation that will result in cost savings.

The fourth theme resulted from this study relates to mitigation strategies. Retailers are advised to implement the SC entrepreneurial embeddedness strategy, which indicates small entrepreneurial business capabilities (e.g., innovation, creativity, resourcefulness, fast decision-making, and swift execution) within its SC. Besides, retailers should proactively plan for cross-sector collaboration and partnerships in the case of emergency, strategies for SC collaborations and coordination among

stakeholders in their SC, and strategies for collaborating on SC finance and supplier liquidity issues. The findings suggested that retailers become less reliant on global suppliers, diversifying sourcing, and reorganizing global value chains, adopting multiple sourcing by locating new accessible suppliers and localising suppliers in the SC.

## **4.2 Managerial implications and impact**

Our study has contributed to significant impact through developing managerial insights for retailers, as they attempt to implement effective mitigation and recovery strategies in their RSCs. Based on the reviewed studies and the four themes that evolved from RSC literature on COVID-19 throughout 2020-2022, there are eleven key RSC strategies and lessons that may be learnt from COVID-19.

### **1. Investing in digital platforms**

Retailers should make investments in digital channels to reach customers and offer a smooth purchasing experience, such as social media, smartphone apps, and e-commerce websites (Kazancoglu and Demir, 2021). Additionally, retailers can use cutting-edge tools like chatbots, machine learning, and artificial intelligence (AI) to streamline operations, enhance customer support, and enhance the shopping experience (Njomane and Telukdarie, 2022). Moreover, retailers should use omnichannel tactics which combine online and offline channels to give customers a seamless, uniform experience across all channels. AI is transforming the RSC by offering individualised shopping experiences, optimising inventory management, and improving customer service. AI-powered chatbots and virtual assistants offer real-time customer service, while AI-powered recommendation engines evaluate user data to recommend related products, increasing sales and client retention. Retailers can use augmented reality (AR) technology to bridge the gap between online and offline purchasing experiences. Customers can see items in their natural surroundings before purchasing, increasing their confidence and decreasing the risk of returns. In-store AR experiences such as virtual try-ons and product demos are also possible. A fluid and user-friendly purchasing experience is essential for user experience (UX.) Retailers engage in UX design to ensure that their websites and mobile apps are simple to use, load quickly, and have an appealing user interface. User-centric design raises conversion rates by increasing customer happiness, encouraging longer interaction, and encouraging longer engagement. Finally, omnichannel retailing combines many channels (physical stores, internet platforms, mobile apps, social media for example) to produce a cohesive and consistent buying experience. Customers may seamlessly explore, purchase, and

return products across several touchpoints. This method not only improves convenience but also enables shops to collect crucial data for better consumer understanding and targeted marketing.

## 2. Leverage e-commerce capabilities

Retailers are advised to use a shared e-commerce platform with other companies to pool resources for storage and delivery during the pandemic (Wulff, 2022). Retailers can pool resources and cut expenses while still maintaining their own distinctive branding and consumer experience by utilizing a shared platform (Sodhi and Tang, 2020). Additionally, retailers can take part in sharing economy model/system that allows them to collaborate with other companies to share shipping and storage capabilities (Cole and Shirgholami, 2022). Platforms for the sharing economy can give retailers access to a network of other companies eager to share resources, enabling them to cut costs and strengthen the resilience of their supply chains (Scala and Lindsay, 2021). Furthermore, if the capabilities of retailers are limited during the pandemic, they can pool delivery resources by using crowdsourced delivery services. Deliveries are made through a network of independent contractors by crowdsourced delivery firms, which can be less expensive than standard delivery services.

## 3. Handling the shifting consumer demand trends

To understand changing consumer demand patterns, preferences, and behaviour retailers should perform market research during the pandemic (Gheibi and Fay, 2021) and use it to modify their product line-up and also marketing tactics to match changing customer demands. For instance, many stores changed their product offerings to concentrate on home office equipment, loungewear, and wellness products during the pandemic because these items were in high demand (Untaru and Han, 2021). In order to adapt to rapidly evolving consumer demands for convenience and security, retailers can offer flexible fulfilment alternatives including curbside pickup, home delivery, buy online, and pick-up instore (Cavallo *et al.*, 2020).

## 4. Promoting collaboration, communication and partnerships

Retailers can create channels of communication to help in debates and information exchange at the local and national levels during the pandemic (Sharma *et al.*, 2022). Online discussion boards, social media groups, webinars, and in-person gatherings are some examples of these channels (Naeem, 2021). Additionally, retailers' shops can be a part of networks and groups that give its members the chance to exchange information, best practices, and experiences. Access to industry experts and leaders in the retail fields who can offer advice and insights is another benefit of these groups and networks (Fares and Lloret, 2022). Moreover, members of the SC should collaborate, share resources, and work to increase

overall supply chain flexibility and resilience. Retailers ought to take note of best practices and success stories of other businesses that have effectively handled supply chain interruptions, which can provide ideas and directions for enhancing the adaptability and resilience of their own supply chains (Sarkar *et al.*, 2022).

#### 5. Rethinking distribution and inventory strategies

By keeping buffer stockpiles of important products, retailers can rethink their inventory and replenishment strategy, and guarantee supply continuity in the event of supply chain disruptions. Several inventory management strategies, including safety stock, can be used to manage buffer supplies during the pandemic (Cai *et al.*, 2022). Retailers can predict future demand trends using demand forecasting tools and modify their inventory levels accordingly. They can predict changes in consumer demand and match their inventory levels to satisfy changing client needs by studying past sales data especially in the event of disruptions (Park *et al.*, 2022). To accommodate the rising demand for online shopping, retailers can also reconfigure their retail operations by increasing their online distribution channels by adopting a multi-channel distribution approach.

#### 6. Getting retailers' staff members ready for remote work/management

Retailers should also set precise policies and guidelines for remote working that clearly explain the requirements, obligations, and communication procedures involved (Hultman and Egan-Wyer, 2022). This includes providing staff with the capability to work remotely, including computers, mobile devices, and internet connectivity and receive training and support required for remote home working. This includes instruction on cybersecurity best practices and the use of remote communication technologies such as Zoom and Microsoft TEAMS platforms. To encourage distant contact and teamwork among employees, retailers should set up virtual communication channels including video conferencing, instant messaging, and collaboration tools (van Hoek, 2020). Finally, by establishing clear goals, giving frequent feedback, and praising and rewarding success, retailers can help remote employees develop a culture of trust and accountability (Shen and Sun, 2021).

#### 7. Seeking banks, governments, or any other organization for financial assistance

Governments and banks have started assistance initiatives to aid businesses impacted by the pandemic. Retailers can assess these programs to understand those that are relevant and apply for financial aid (Wulff, 2022). Therefore, retailers should prepare detailed financial statements that are a true reflection of their actual financial position (Hänninen *et al.*, 2021). This information is crucial when requesting financial assistance, since it enables lenders and government officials to evaluate the retailer's financial

situation and determine the level of support required. They must show how the pandemic has affected their business, what efforts they have taken to lessen the impact, and what will happen if they do not receive financial assistance. This could include extending the loan's payback time, lowering the interest rate, or gaining access to new credit lines (Nigro *et al.*, 2021). Finally, to get additional finance during the pandemic, retailers can investigate alternative financing methods like venture capital and crowdfunding (Kumar and Kumar Singh, 2022). These possibilities could be especially beneficial for retailers who struggle to find capital from conventional sources.

#### 8. Sales strategies used by retailers during COVID-19

Retailers should employ a variety of sales strategies throughout the pandemic. First, to drive sales from a lower point during the pandemic, many retailers have changed their product discounts across essential and non-essential items. This was found to be especially relevant for non-essential commodities like apparel and cosmetics since people have been less willing to spend money on these categories during the pandemic's economic unpredictability (Wulandhari *et al.*, 2022). Second, as many high street stores closed during the pandemic or operated at reduced capacity because of staff shortages, retailers switched to internet sales. A different approach of product discounts was observed including free delivery and price promotions on purchases. Third, some retailers have promoted their goods by using pandemic-related materials like face masks and hand sanitizer. For instance, they might provide a discount on apparel when a face mask is purchased. On the other hand, some necessities like food and cleaning products have seen price hikes during the pandemic because of supply chain restrictions and increased demand (Do *et al.*, 2021). As a result of increased financial strain on consumers, retailers have been more selective in who they target with their promotions. They provided discounts and special offers to targeted customer groups, such as members of loyalty programs or those who have not made a purchase for some time.

#### 9. Hygiene guidelines and procedures

During the pandemic, retailers should increase how often and thoroughly they clean and sanitize their buildings, including their distribution centres (Sharma, *et al.*, 2020b). Door handles, handrails, and other items that are often touched should be cleaned and sanitized more often. Additionally, to limit the number workers in a specific location, distribution facilities have implemented social distancing techniques including staggered shifts and break times. Additionally, when working in the retail shop, staff are expected to wear PPE, such as gloves and masks. Moreover, health examinations and temperature checks must be taken to make sure that personnel are not showing signs of COVID-19



symptoms. Some distribution facilities have also introduced employee temperature checks and health inspections at their workplace (Fuentes *et al.*, 2022). Lastly, having contactless transmission and reception areas are essential where distribution facilities use contactless delivery and reception practices to lower the risk of transmission. For instance, delivery drivers might be instructed to place packages at predetermined areas rather than speaking with staff members directly.

#### 10. Proactive risk assessment

Retailers should carry out a thorough examination of potential risks and resilience concerns that might affect their business resulting from a pandemic. This includes consideration of supply chain interruptions, changes in customer behaviour, revisions to regulations, staff health and safety, and financial threats. Retailers will rank risks according to their potential significance and probability of occurrence. This aids in directing attention and resources toward the risks that require the most urgent care (Dung *et al.*, 2020).

In addition, retailers must set up monitoring systems for key metrics and variables that could indicate changes in risk levels. This includes assessing market trends, governmental guidelines, consumer attitudes, and other pertinent influences. Retailers should participate in scenario planning exercises to model different risk scenarios and evaluate their possible effects.

#### 11. Supplier management

In the context of supplier management, four recommendations are provided to RSC decision makers to deal with the pandemic.

##### A. Flexibility to deal with new suppliers

Retailers must explain their expectations to new supplier, including quality requirements, deadlines for deliveries, costs, and terms of payment. Before beginning a commercial partnership in a pandemic, it is particularly important to make sure the supplier is fully aware of these expectations. The ability of suppliers to respond and deliver to retail shops in very uncertain times will be an important capability requirement (Park *et al.*, 2022).

##### B. Diversification of suppliers

Retailers should attempt to diversify their supplier base, as a strategy to address supply sourcing risk and resilience considerations. It would lessen retailers' reliance on specific regions or countries that may experience significant disruptions, with local sourcing from alternative suppliers with minimal

disruption to supply. This can be achieved through prioritizing collaborations with local suppliers, as well as searching for suppliers in close and neighbouring countries as an alternative approach (Ghadge *et al.*, 2020).

#### C. Flexible contracts and payment terms

Retailers should ensure that supplier contracts outline the revised relationship arrangements with the current/new supplier during the pandemic. Timelines for delivery, payment requirements, quality requirements, and any other significant terms or conditions should all be covered in this contract. This could include adjusted contract terms, revised payment timelines, and flexible order volumes. In uncertain times such as the COVID-19 pandemic, retaining positive relationships with suppliers will help with greater financial security.

#### D. Supplier risk assessment

Retailers must evaluate the financial position and risk and resilience profiles of their suppliers, conducting regular supplier assessments to identify potential weaknesses and develop backup strategies in the event of supplier interruptions or closures during a pandemic.

### **4.3 Limitations and future research**

This paper synthesised the existing literature to identify the themes that emerged from RSC literature on COVID-19 pandemic to inform future mitigation and recovery strategies. However, there are some limitations that should be considered: first, this study did not include previous literature which dealt partially with the retail industry. However, the narrow scope of this SLR enabled us to provide an in-depth discussions of RSC mitigation and recovery strategies during COVID-19. Second, there are several sources of information that were excluded in the study such as book chapters, theses, unpublished articles, short notes, and editorials. Nevertheless, we excluded all studies that are not Scopus-indexed to meet certain quality standards. Finally, the studies included in this SLR were limited to English language studies published during the period of 2020-2022. Future studies would possibly focus on e-commerce, omni-channel integration, and the integration of offline and online channels inside the RSC. Moreover, future studies may examine how RSC operations, such as warehouse management, inventory optimization, demand forecasting, and delivery are impacted. In addition, future studies can investigate ways to promote cooperation, increase information sharing and visibility, and improve coordination across SC members, including retailers, suppliers, logistics providers, and other stakeholders. Finally,

we suggest that future studies focus on conducting SLRs on specific retail sectors such as pharmaceutical and food supply chains.

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## Appendix A: 74 reviewed studies by theme

NO.	STUDIES	THEMES			
		Theme 1	Theme 2	Theme 3	Theme 4
1	Abu Hatab <i>et al.</i> (2020)	X	X		
2	Adewopoa <i>et al.</i> (2021)		X		
3	Alikhani <i>et al.</i> (2021)				X
4	Azadegan and Dooley (2020)			X	X
5	Brewin (2020)		X		
6	Burgos and Ivanov (2021)		X	X	
7	Butt (2022)				X
8	Cai <i>et al.</i> (2022)		X	X	
9	Cariappa <i>et al.</i> (2022a)		X		
10	Cariappa <i>et al.</i> (2022b)		X		
11	Cavallo <i>et al.</i> (2020)		X		
12	Chatterjee <i>et al.</i> (2021)			X	
13	Cole and Shirgholami (2022)		X		
14	Coopmans <i>et al.</i> (2021)		X	X	
15	Craighead and Darby (2020)			X	
16	Do <i>et al.</i> (2021)	X	X	X	
17	Dung <i>et al.</i> (2020)	X		X	
18	Fares and Lloret (2022)			X	X
19	Fu <i>et al.</i> (2020)			X	
20	Ghadge <i>et al.</i> (2020)		X	X	
21	Ghadge <i>et al.</i> (2022)		X	X	
22	Grant <i>et al.</i> (2021)			X	
23	Gray (2020)		X		X
24	Grewal <i>et al.</i> (2021)			X	
25	Gu and Wang (2020)		X	X	
26	Halan (2021)		X	X	
27	Hayes <i>et al.</i> (2021)	X	X	X	
28	Hobbs (2020)				X
29	Islam <i>et al.</i> (2022)		X		
30	Javorcik (2020)			X	X
31	Ketchen and Craighead (2021)				X
32	Koppenberg <i>et al.</i> (2020)		X		
33	Kumar (2022)	X			X
34	Kumar and Kumar Singh (2022)		X		X
35	Liverpool-Tasie <i>et al.</i> (2020)		X		
36	Loske (2020)		X		
37	Mahajan and Tomar (2020)		X		
38	Malone <i>et al.</i> (2021)		X	X	
39	Mariappan <i>et al.</i> (2022)			X	
40	Min <i>et al.</i> (2020)		X		
41	Mohamadi <i>et al.</i> (2022)		X		
42	Mollenkopf <i>et al.</i> (2020)				X
43	Munir <i>et al.</i> (2022)			X	
44	Nacem (2020)		X		
45	Nigro <i>et al.</i> (2021)				X
46	Njomane and Telukdarie (2022)			X	X
47	Norwood and Peel (2020)		X		X
48	Ozdemir <i>et al.</i> (2022)			X	
49	Pani <i>et al.</i> (2020)		X		
50	Priyadarshini and Abhilash (2021)			X	
51	Ramanathan <i>et al.</i> (2022)			X	
52	Richards and Rickard (2020)		X		
53	Riglietti <i>et al.</i> (2022)	X			X
54	Rude (2020)		X		
55	Sarkar <i>et al.</i> (2022)			X	

56	Sarkis (2020)		X		
57	Scala and Lindsay (2021)		X	X	
58	Schleper <i>et al.</i> (2021)				X
59	Sharma <i>et al.</i> (2020a)				X
60	Sharma <i>et al.</i> (2020b)		X		X
61	Sharma <i>et al.</i> (2020c)		X		X
62	Sharma <i>et al.</i> (2021)			X	
63	Sharma <i>et al.</i> (2022)				X
64	Shen and Sun (2021)			X	
65	Shen <i>et al.</i> (2021)		X	X	
66	Singh <i>et al.</i> (2020)		X	X	X
67	Sodhi and Tang (2020)		X	X	
68	Thilmany <i>et al.</i> (2020)		X	X	
69	Timotius <i>et al.</i> (2022)			X	
70	van Hoek (2020)				X
71	Wang <i>et al.</i> (2020)		X		
72	Wulandhari <i>et al.</i> (2022)			X	X
73	Wulff (2022)		X		
74	Zhang <i>et al.</i> (2020)				X