

Enhancing Resilience of Global Logistics and Supply Chains: Perspectives on Impacts of the COVID-19 Pandemic on Japanese Companies

Rajali MAHARJAN ^{a*}, Hironori KATO^b

^a *Japan Transport and Tourism Research Institute, Tokyo 105-0001, Japan; E-mail: maharjan-reu@jtrri.or.jp*

^b *Graduate School of Engineering, The University of Tokyo, Tokyo 113-8656, Japan; E-mail: kato@civil.t.u-tokyo.ac.jp*

Abstract: Enhancing resilience of global logistics and supply chains has been receiving growing attention in response to recent natural disasters and the COVID-19 pandemic. This paper presents findings from semi-structured interviews with five Japanese companies conducted from November 2020 to February 2021 to understand the impacts of the COVID-19 pandemic on different dimensions of logistics and supply chain activities and resilience strategies. The interviews focused on firms' financial performance and the status of resilience preparedness, response, and future plans. The interviews also investigated whether existing resilience measures helped them avoid, withstand, respond, or recover from pandemic impacts. The results showed that the interviewed companies experienced both positive and negative impacts from the pandemic on their logistics and supply chain activities and negative impacts mainly on their financial performance. The levels of resilience preparedness, response, and future plans varied across companies based on their attributes, such as industry type and organizational scale.

Keywords: Logistics and supply chain resilience, Global logistics and supply chains, COVID-19 pandemic, Japanese companies, Firm performance, Japan

1. INTRODUCTION

The coronavirus disease of 2019 (COVID-19) pandemic has placed unprecedented stress on logistics and supply chain activities and created many immediate challenges in industries worldwide. Bottlenecks in transportation and logistics have disrupted the movement of materials and products along the supply chain. International logistics for maritime, air, and terrestrial routes have experienced delays, postponements, cancellations, and obstructions due to large-scale travel restrictions and the closing of borders (Xu et al., 2020). The pipelines of global supply chains, from the supply of raw materials to the delivery of products, have been heavily affected by the COVID-19 pandemic, and disruptions have been observed in all phases of the global supply chain (Xu et al., 2020). Furthermore, pandemics directly cause disturbances in supply and demand at both global and local scales (Ivanov, 2020). According to a survey conducted by the Capgemini Research Institute with 1,000 companies in different parts of the world (11 countries) from August to September 2020, more than 80 percent of the organizations reported their supply chains as being negatively impacted by the COVID-19 pandemic, with a vast majority struggling across all aspects of their operations. The pandemic has forced organizations to prioritize supply chain resilience, with two-thirds stating that their supply chain strategy will need to change significantly to adapt to the new normal. As such,

* Corresponding author

many organizations realize the strategic importance of resilience investments.

Among the diverse impacts of the COVID-19 pandemic in the Japanese logistics sector, maritime, air, and land transportation has been affected mainly due to the impact of the measures to prevent the spread of the coronavirus. For instance, maritime transportation has been affected by the suspension of services in some ports, air transportation has been affected by the decline in the number of passenger air service operations, and land transportation has been affected by the blockade of roads and railway tracks (METI, 2020). These prevention measures can have a significant negative impact on economic activity, and can seriously damage the quality of life in Japan. It should be noted that maritime transportation accounts for 99.7% of Japan's international trade volume, air transportation accounts for 40% of the amount of money for trade, and land transportation and warehouses combined account for nearly 80% of Japan's overall logistics costs. However, due to the difference in features and functionality of each transportation mode, there is a limitation on the substitutability of each logistics route (METI, 2020).

With regard to the impacts of the COVID-19 pandemic on logistics facilities, the CBRE's Japan Logistics Occupier Survey asked respondents (firms using logistics facilities in Japan) a series of questions to gauge the short-, medium-, and long-term impacts of the COVID-19 pandemic on logistics demand in March 2020. They found some short-term impacts, such as a shortage of warehouses and delivery workers, while an increase in cargo and delivery volumes were reported by 405 respondents. Meanwhile, with regard to the medium- to long-term impacts of the pandemic on their businesses, 30% of the respondents from 361 companies mentioned additional inventory for unexpected situations, followed by accelerated automation of warehouse operations (17%). Additionally, a survey conducted by Japan's Chamber of Commerce and JETRO's overseas offices in China, Malaysia, Indonesia, India, and the US from April to July 2020 revealed that Japanese companies overseas observed operational decline mainly due to a decrease in domestic and overseas demand, operational regulations by the government, disruptions to domestic and overseas supply chains, logistical constraints, and high costs. They suggested that reactive resilience measures alone would not be sufficient to prevent or deal with the consequences of disruption within or outside Japan.

Many studies have acknowledged that supply chain resilience is one of the most important issues and a way to combat disruptions in the supply chain (Klibi et al., 2010; Spiegler et al., 2012; Brandon-Jones et al., 2014; Dixit et al., 2016; Dehghani et al., 2018; Liu and Lee, 2018). Given the widespread impact of the COVID-19 pandemic, the adoption of logistics and supply resilience strategies is and will be highly detrimental in ensuring that the companies can prevent, respond, and recover from the impacts of disruptions moving forward. Xu et al. (2020) pointed out that enhancing supply chain resilience is the key driver for reducing vulnerability during disruptive times. Thus, there is a growing need for companies to build resilient supply chains (Zhu et al., 2020).

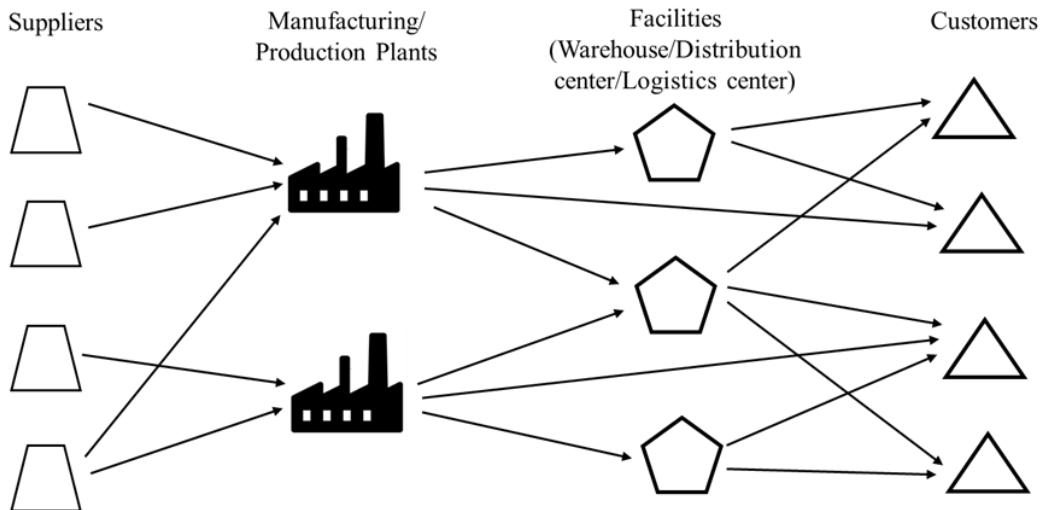


Figure 1: Typical structure of the supply chain network

Resilience can be built in logistics and supply chains by implementing different strategies that target both the nodes and links of the supply chain. Figure 1 illustrates the typical structure of a supply chain network to understand the different impacts of disruptions on the network. A supply chain consists of nodes (i.e., suppliers, manufacturing/production centers, facilities such as logistics centers, distribution centers, warehouses, and customers), connected with different links. From this perspective, small events that disrupt a node or link in the network can have major consequences for the entire network. A failure in a node or link can potentially stop the flow of materials across the network. Disruptions that could arise from natural disasters, manmade disasters, pandemics, epidemics, government regulations, etc., could affect either the nodes and/or links of the logistics and supply chain network, necessitating the incorporation of appropriate resilience measures.

Resilience strategies are adopted to avoid, withstand, and recover from the impacts of the disruption of supply chain networks. Supply chain resilience strategies are important as they enable efficient and effective responses (Carvalho et al., 2012). To build resilience in supply chains, several authors have suggested resilience strategies such as redundancy in inventory, additional production capacity, diversification of suppliers, and making supply chains shorter, more domestic, and more diversified (Miroudot, 2020; Xu et al., 2020; Zhu et al., 2020). However, Miroudot (2020) argued that before redesigning global supply chains, it is necessary to identify the concrete issues faced by firms during the crisis and the policies that can solve them. Miroudot (2020) also pointed out that many proposed solutions tend to be disconnected from the conclusions of supply chain literature (for instance, reshoring does not lead to resilience) and insisted that the insights of international business and global value chain scholars could contribute to finding better solutions.

With this background, this study aims to (1) investigate and analyze the impacts of the COVID-19 pandemic on logistics and supply chain activities and firms' financial performance through a case study of Japanese companies; (2) determine the current status of resilience preparedness, response, and future plans from the logistics and supply chain perspective in different Japanese companies; and (3) analyze whether the existing logistics and supply chain resilience measures (if) implemented by the interviewed companies helped to avoid, withstand, respond, or recover from the impacts of the COVID-19 pandemic. We would like to point out that there are very few empirical studies published on the topic of global logistics and supply

chain resilience and even fewer related to COVID-19 pandemic. Therefore, we believe this study is novel in this sense with an attempt to address the gaps in existing literature.

The remainder of this paper is organized as follows: Section 2 summarizes the literature review. Section 3 presents the study's research methodology. The results are presented in section 4. Finally, section 5 concludes the paper with a summary of the findings and their implications.

2. LITERATURE REVIEW

The modern global economy has developed interconnected and complex supply chains, which is largely due to the benefits that companies have found in sophisticated trends and strategies such as global outsourcing, supply base rationalization, just-in-time deliveries, and lean practices (Rezapour et al., 2014; Hasani and Khosrojerdi, 2016). While these practices have led to lower costs, higher quality, and enhanced business agility for many supply chains, they are not without risk. As supply chains grow more complex, they become vulnerable to disruptions caused by various events such as natural disasters, political unrest, strikes, unexpected regulatory issues, port problems, and terrorist activities (Snyder et al., 2016; Scheibe and Blackhurst, 2017). Indeed, it can be argued that supply chain risk is currently greater than ever before. As a result, companies are now attempting to create and be part of more resilient supply chains, realizing the negative impacts of disruptions (Baghalian et al., 2013; Jabbarzadeh et al., 2016).

Resilience is identified as a way to combat disruptions in the supply chain. This indicates that companies with carefully designed supply chains are typically more resilient to disruption risks (Klibi et al., 2010; Dixit et al., 2016; Dehghani et al., 2018). Moreover, logistics and supply chain resilience are highly desirable because of the increasing intensity and impact of different types of disruptions. Several resilience strategies can be utilized to manage the risk associated with disruptions when supply chains are under uncertainty (Govindan et al., 2017). Although logistics and supply chain resilience strategies should be implemented to enhance the resilience of both nodes and links of the network, many studies have focused mainly on strategies to enhance the resilience of nodes while largely ignoring the resilience of the links. Furthermore, while implementing different resilience strategies is desirable and critical to withstand disruptions, a question often asked regarding resilience is, "Are the investments worth it?" Resilience enhancement often requires huge investment, making it difficult to monetize paybacks (Pettit et al., 2019).

The notion of supply chain resilience is a relatively new management concept; therefore, there is limited empirical research investigating the link between supply chain resilience and performance to date (Li et al., 2017). Wieland and Wallenburg (2013) revealed that improved supply chain resilience in terms of agility and robustness enhances a supply chain's customer value (i.e., customer satisfaction). Govindan et al. (2015) found that the resilient practice of flexible transportation is positively related to customer satisfaction. The findings of the empirical study conducted by Li et al. (2017) support the assertion that prepared supply chains enjoy better financial outcomes by linking supply chain preparedness directly to a firm's financial performance. Their findings also suggest that an organization's practices for supply chain preparedness tend to be financially more beneficial to a firm than reactive practices. The literature has also shown that prepared supply chains experience a less negative stock market reaction in the face of disruptions (Hendricks et al., 2009). However, there is no empirical evidence on whether companies' logistics and supply chain preparedness activities to enhance their resilience helped companies avoid, withstand, respond, or recover from the varying

impacts of disruptions.

Resource allocation (i.e., investment), and the implementation of appropriate resilience strategies to build resilience in supply chains, are required. It is particularly important to investigate the financial benefits of supply chain resilience to justify resource allocation (e.g., investments) (Hendricks and Singhal, 2005). Furthermore, in terms of resilience strategy, several authors have suggested making logistics and supply chain networks shorter, more domestic, and more diversified (Miroudot, 2020; Xu et al., 2020; Zhu et al., 2020). However, Miroudot (2020) argued that before redesigning global supply chains, it is necessary to identify the concrete issues faced by firms during the crisis and the policies that can help resolve them. Miroudot (2020) also pointed out that many proposed solutions tend to be disconnected from the conclusions of the supply chain literature.

Empirical studies are expected to reveal important supply chain issues and difficulties faced in different contexts because the pandemic has caused unique challenges for supply chains. However, Chowdhury et al. (2021), through their systematic literature review on COVID-19 pandemic related supply chain studies, concluded a lack of empirical studies. Only six of the 73 studies reviewed by Chowdhury et al. (2021) used empirical methods in their research. This study concentrates on establishing and examining the relationship between the status of logistics and supply chain resilience, the impact of the COVID-19 pandemic, and firms' financial performance in Japanese companies to address the gaps in the existing literature and practice and provide insights and recommendations to enhance logistics and supply chain resilience in Japanese companies. To the best of our knowledge, no empirical study has addressed all the topics in this study simultaneously. In doing so, this study hypothesizes that existing logistics and supply chain resilience strategies for supply chains adopted by Japanese companies mainly focus on enhancing the resilience of the nodes in the logistics and supply chain network. As a result, the links between the nodes are largely ignored, and resilience investment in the supply chain is positively related to a firm's ability to avoid, withstand, respond, or recover from the impacts of the pandemic.

3. METHOD

This study applied a qualitative approach to elicit necessary information. We used an exploratory research design and performed no statistical analyses. An interview-based approach, which is the most common format of data collection in qualitative research, was chosen because it is an excellent way to gather detailed information and because the respondents' opinions are representative of the scope of the issue under study (Cooper and Schindler, 2011). This study employed a combination of purposive and snowball sampling techniques to interview key informants from companies with global logistics and supply chain networks. This method allows for maximum variation, following the principles of appropriateness and adequacy (Gaskell, 2000; Seawright and Gerring, 2008). The main criterion for selecting respondent companies was whether or not they had global logistics and supply chain activities.

This study employed semi-structured questionnaires for the interviews, as the primary purpose was to identify as many important issues relevant to the research field as possible (Sekaran, 2003). The interview questions were designed using the funneling technique (Sekaran, 2003; Cooper and Schindler, 2011). The questions were structured from broad topics related to the company's strategy on logistics and supply chain activities to specific topics. These include questions on the pandemic's impact on logistics and supply chain activities, firms' financial performance, the status of logistics and supply chain resilience, the relationship

between the logistics and supply chain resilience activities, and ability to avoid, withstand, respond, or recover from the impacts of the COVID-19 pandemic. Specifically, the interview questions were broadly classified as follows:

1. What is the impact of the COVID-19 pandemic on logistics and supply chain activities?
2. What is the impact of the COVID-19 pandemic on the firm's financial performance?
3. What is the status (past, present, and future) of logistics and supply chain resilience?
4. Did existing logistics and supply chain resilience measures help to withstand, respond, or recover from the impacts of the COVID-19 pandemic?

The interviews were conducted in the Japanese language using online platforms Zoom and Microsoft Teams from October 2020 to February 2021. The respondents were at the decision-making level and included directors and general department managers. In total, five in-depth interviews were conducted with six interviewees, and each interview lasted approximately one hour on average. All conversations were recorded with permission from the respondents to ensure that the correct information was gathered from the interviews. A brief profile of the companies interviewed is presented in Table 1.

Table 1. Respondents' company profile

Company	Industry type	Characteristic	Customer base	Interview date	Interviewees
Company 1	Cosmetic	Large enterprise	Supermarkets Wholesalers Retailers	October 22, 2020	Director of logistics center
Company 2	Trading	Small and medium enterprise	Manufacturing companies Assembly companies Maintenance companies	November 1, 2020	Sales head
Company 3	Logistics and supply chain solutions	Large enterprise	Manufacturing companies Assembly companies Production companies Trading companies	November 10, 2020	General managers
Company 4	Freight-forwarding	Small and medium enterprise	Manufacturing companies Agricultural machinery parts Pharmaceutical companies Apparel Convenience goods	December 22, 2020	Executive director

Company 5	Freight-forwarding	Small and medium enterprise	Apparel business companies Trading companies	February 17, 2021	Director
-----------	--------------------	-----------------------------	---	-------------------	----------

4. RESULTS

4.1 Status of Logistics and Supply Chain Resilience

The interviewed companies' logistics and supply chain resilience were evaluated based on their preparedness, response, and future intended initiatives. Table 2 presents the details of logistics and supply chain resilience preparedness, response, and future intended initiatives of the interviewed companies. Regarding logistics and supply chain preparedness, we specifically asked about the initiatives undertaken for natural disasters and pandemics, focusing on the COVID-19 pandemic and future intended initiatives for both natural disasters and pandemics.

First, in terms of logistics and supply chain resilience preparedness strategies, Company 1 had strategies such as business continuity planning, lateral transshipment between logistics centers, and moving electrical lines away from tsunami-prone areas as part of resilience preparedness. Company 1 pointed out that all resilience strategies were implemented after the 2011 Great East Japan earthquake. Companies 2 and 4 did not have any form of preparedness. Company 3 had facility fortification and dispersion as part of their resilience preparedness. Company 5 had prearrangements to use multiple ports (both sea and air) to handle incoming and outgoing cargo. This strategy protects company 5 in times of risks arising from the unavailability of one port by using an alternative port. The interviews showed that none of the companies had strategies in place, should a pandemic break out. It can be observed that companies 1, 3, and 5, had some form of logistics and supply chain resilience preparedness for natural disasters, while companies 2 and 4 did not have any form of logistics and supply chain resilience preparedness. From this result, we can conclude that larger firms have more preparatory initiatives, which aligns with the results of studies conducted by Chowdhury and Quaddus (2017) and El Baz and Ruel (2021).

Next, in terms of logistics and supply chain resilience response strategies, our interviews revealed that company 1 employed measures such as changes in transportation mode and lateral transshipment of goods from low- to high-demand logistics centers. Company 2 implemented measures such as seeking alternative suppliers for products with a single supplier. Company 3 employed measures such as using other companies' warehouses in remote areas, moving stock to overseas warehouses, and operating a temporary warehouse overseas. Company 4 chose an alternative mode of transportation to respond to the impacts of the COVID-19 pandemic, whereas company 5's response strategy was to wait for the situation to return to normal.

Table 2: Status of logistics and supply chain resilience

Company	Preparedness		Response	Future plan
	Natural disaster	Pandemic		
Company 1	Business continuity plan Provision of lateral transshipment between logistics centers Moving electrical lines away from tsunami-prone areas	None	Change of transportation mode Lateral transshipment of goods from low-demand logistics centers to high-demand logistics centers	Research on how to accurately predict demand Increase capacity of logistics centers Increase inventory of raw materials in Japan
Company 2	None	None	Seeking alternative suppliers for products with business a single supplier	Diversification of
Company 3	Facility fortification Facility dispersion	None	Using warehouses of other companies Moving stock to overseas warehouses Operating a temporary warehouse overseas	No actions have been planned yet.
Company 4	None	None	Seeking alternative mode of transportation	No actions have been planned yet.
Company 5	Using multiple ports	None	Wait for the situation to get better	Enhance business relationship

The response strategy chosen by each company suggests that the selection of appropriate strategies is mainly affected by the nature of the impacts they experience and their industry type. For example, company 1, a cosmetic company that has experienced a surge in demand for sanitary products, chose to change the mode of transportation from maritime to air transportation to import the necessary goods to minimize transportation time and meet the demands on time. Meanwhile, company 3, a logistics and supply chain service provider, has also observed a surge in demand for their warehousing space, flexibly adopted strategies such as collaboration with other companies to obtain more warehouse space, and moved finished goods to overseas warehouses to meet the incoming demand. It should be noted that they have also faced several challenges implementing their response strategies due to labor shortages, sealed borders, trade control, and the shutdown of commercial aviation. By contrast, company 5, involved in the freight-forwarding business, chose to wait and watch for the situation to get better as their response strategy.

When asked about their company's future plans to enhance resilience, the answers differed between the respondents. For example, an interviewee from company 1 mentioned that they would reduce uncertainties in the future demand by introducing strategies such as increasing the logistics center's capacity and enhancing the inventory of raw materials in Japan to prevent potential shortages. A respondent from company 2 mentioned the diversification of business. Interviewees from companies 3 and 4 did not have any current plans regarding their actions in the future. Company 5, however, mentioned that for small companies like theirs, it is crucial to have good business relations with other companies; therefore, they will focus more on enhancing business relationships with other companies as their future plan. These findings imply that there is no coherence in future plans for enhancing the resilience of logistics and supply chain activities among the interviewed companies. This could largely be because the uncertainties associated with the timing and scale of impacts vary among different types of disruptions and industrial characteristics.

4.2 Impact of the COVID-19 pandemic on logistics and supply chain activities

The COVID-19 pandemic has caused considerable damage to different industry sectors with varying impacts on different dimensions. In this study, we identified the impacts of the pandemic on the logistics and supply chain activities of five Japanese companies, as summarized in Table 3. Based on the responses from the interviewees, these impacts are presented in relation to the structure of logistics and supply chain networks. We observe that different companies face different types of impact. Company 1 experienced an increase in demand for their products, signaling a positive impact. Company 2 experienced a decrease in demand for their products and/or services and difficulty accessing their suppliers, signaling a negative impact. In contrast, companies 3 and 4 observed both positive and negative impacts, as they saw an increase in demand for their products and/or services (signaling a positive impact) and a subsequent increase in both sea and air transportation costs (signaling a negative impact). Company 5 observed mainly negative impacts due to high transportation costs, decreased shipping volumes, and irregular shipping schedules. We can also note that Company 1 mainly experienced impacts on the nodes, while companies 2, 3, 4, and 5 experienced impacts on both, nodes and links of the supply chain network.

Table 3: Impacts of the COVID-19 pandemic on logistics and supply chain activities and firms' financial performance

Company	Impacts on Logistics and supply chain activities	Firm's financial performance
Company 1	Increase in demand for sanitary products	N/A
Company 2	Decrease in demand from customers No access to suppliers from March to August	Hard to tell yet, should wait until the end of March
Company 3	Increase in demand for warehouse storage High air transportation cost High sea transportation cost	Neither loss nor gain
Company 4	Increase in demand for warehouse storage High air transportation cost High sea transportation cost	Negative impact; exact details will be known at the end of the fiscal year
Company 5	High air transportation cost High sea transportation cost Decrease in shipping volume Irregular shipping schedule	Negative impact; sales volume decreased by (20-30)%

4.3 Impact of the COVID-19 pandemic on firms' financial performance

As shown in Table 3, company 1 did not comment on the impacts on the firm's financial performance. For company 2, given that its financial performance is generally evaluated once a year, the interviewee commented that it was difficult to tell yet. Company 3 did not observe any significant increase or decrease in its financial performance. Company 4 experienced a negative impact; however, the exact details will be known at the end of the fiscal year, March 2021. Company 5 already had a negative impact on its firms' financial performance, mainly due to decreased sales volume. This is an important observation in terms of the impact of the COVID-19 pandemic on the financial performance of Japanese companies, which highlights the importance of the timing of the interview to obtain the necessary information.

4.4 Benefits of logistics and supply chain resilience preparedness

To gather information on whether the companies with resilience preparedness thought they benefited from their preparedness initiatives for natural disasters in responding to the impacts of the COVID-19 pandemic, respondents' opinions were asked on whether or not they thought resilience preparedness helped avoid, withstand, respond, or recover from the impacts of the pandemic. While Company 1 thought that it was helpful, companies 3 and 5 thought it was not helpful. This question did not apply to companies 2 and 4 because they did not have resilience preparedness strategies in place.

To understand why the responses for companies 1, 3, and 5 were different, we compared their resilience strategies to the impacts observed. The concept of lateral transshipment was implemented by company 1, which means that there is a prior agreement and mechanism in place to move goods between logistics centers in the same echelon when needed. Company 1, whose main products are cosmetics, viewed the huge surge in demand for sanitary products as an impact of the COVID-19 pandemic. Using their lateral transshipment strategy, company 1 could move goods from low-demand logistics centers to high-demand logistics centers to meet the increased demand, thereby preventing loss of sales. By contrast, company 3 had facility fortification, which refers to the retrofitting of facility structure and facility dispersion, which refers to having facilities in more than one location as their resilience strategy.

Company 3, whose main business is providing logistics and supply chain solutions, viewed the huge increase in demand for their warehouse space and high transportation costs as an impact of the COVID-19 pandemic. Neither of the resilience strategies implemented by company 3 provided additional space at the scale that the company needed to make the existing preparedness strategy quite useful. Company 5, which implemented the strategy of using multiple ports within Japan, did not find their preparedness strategy useful because of the global and large-scale impact of the COVID-19 pandemic.

5. SUMMARY AND CONCLUSION

Our survey found that three out of five companies have some logistics and supply chain resilience preparedness in place, specifically in anticipation of natural disasters. As part of preparedness for disruptions, the companies had resilience measures such as a business continuity plan, lateral transshipment, facility fortification, facility dispersion, and the use of multiple ports. Two large enterprises and one small and medium enterprise had resilience preparedness for natural disasters. There was no logistics or supply chain resilience preparedness for pandemics in any of the interviewed companies. As we hypothesized, the logistics and supply chain resilience preparedness strategies adopted by the three companies were mainly targeted at enhancing the resilience of the supply chain nodes. The resilience of network links was overlooked. However, the actual impacts of the COVID-19 pandemic were seen both on the nodes and links.

Companies in different sectors in Japan have already faced significant impacts due to the pandemics, which were different for different Japanese companies. Apart from fluctuations in demand and supply, disruption to the domestic and overseas supply chain, logistical constraints, high cost, and irregular shipping schedules were the major factors behind the operational decline of Japanese companies. While three of the interviewed companies experienced an increase in demand for their products/services, two companies experienced a decrease in demand. In terms of firms' financial performance, company 1 experienced improved performance, company 2 had not yet established its impacts, company 3 did not observe any

change in its financial performance, and company 4 and 5 observed negative impacts on its financial performance. Resilience preparedness strategies facilitated Company 1 to streamline their response strategies; however, it did not facilitate companies 3 and 5 to streamline their response and/or recovery activities. Company 1 observed the benefits of preparedness for natural disasters, but companies 3 and 5 did not.

Enhancing the resilience of global logistics and supply chains has received significant attention in recent years. The global and widespread impacts of the COVID-19 pandemic have once again highlighted the importance of enhancing the resilience of global and complex logistics and supply chains. In this study, we investigated and analyzed the impacts of the COVID-19 pandemic on logistics and supply chain activities and the financial performance of Japanese companies, identified the current status of resilience preparedness, response, and future plans from a logistics and supply chain perspective in different Japanese companies. Finally, we analyzed whether the existing logistics and supply chain resilience measures (if) implemented by the interviewed companies helped to withstand, respond to, or recover from the impacts of the COVID-19 pandemic.

The results of the interviews highlighted that not all companies have invested in enhancing logistics and supply chain resilience, and it largely varies by the size of the companies and the nature of their business. Only around half of the interviewed companies have future plans for enhancing logistics and supply chain resilience, which makes sense because companies are not legally bound to compensate for damages and delays caused due to natural disasters and pandemics. However, we argue that companies could benefit from implementing strategic logistics and supply chain resilience strategies to avoid, withstand, respond, or recover from the impacts of future disruption and minimizing financial losses. Employing qualitative interviews enabled us to capture respondents' subjective experiences during the pandemic closely. The interviews added vividness, concreteness, and richness to this study.

It is difficult to conclude whether popular logistics and supply chain resilience strategies, such as redundancy in inventory or production capacity, diversification of suppliers, reshoring, and nearshoring, meet the individual needs of the companies discussed in this study. In general, the cost of holding a large inventory or maintaining spare production capacity often outweighs the gains from mitigating risks, particularly in the case of low-probability events. Therefore, further research on this topic is required. As this study is work-in-progress, there are only a limited number of samples. Consequently, it is difficult to generate practical implications. Future research will focus on conducting more interviews and surveys with different companies to achieve the research objectives.

REFERENCES

- Baghalian, A., Rezapour, S., & Farahani, R. Z. (2013) Robust supply chain network design with service level against disruptions and demand uncertainties: A real-life case. *European Journal of Operational Research*, 227(1), 199-215.
- Brandon-Jones, E., Squire, B., Autry, C. W., & Petersen, K. J. (2014) A contingent resource-based perspective of supply chain resilience and robustness. *Journal of Supply Chain Management*, 50(3), 55-73.
- Capgemini Research Institute (2020) Fast forward: Rethinking supply chain resilience for a post-COVID-19 world.
https://www.capgemini.com/wp-content/uploads/2020/11/Fast-forward_Report.pdf.

- Carvalho, H., Maleki, M., and Cruz-Machado, V. (2012) The Links between Supply Chain Disturbances and Resilience Strategies. *International Journal of Agile Systems and Management* 5 (3), 203–234.
- CBRE, Japan Market Flash, (2020) Outbreak to drive structural change in logistics industry and accelerate occupier demand. <https://www.cbrekorea.com/en/research-reports/Jpan-MarketFlash-1-April-2020-outbreak-to-drive-structural-change-in-logistics-industry>.
- Chowdhury, M.M.H. and Quaddus, M (2017) Supply chain resilience: Conceptualization and scale development using dynamic capability theory. *International Journal of Production Economics*, 188, 185-204.
- Chowdhury, P., Paul, S. K., Kaisar, S., and Moktadir, M. A. (2021) COVID-19 pandemic related supply chain studies: A systematic review. *Transportation Research Part E: Logistics and Transportation Review*, Volume 148, 102271,ISSN 1366-5545.
- Cooper, D. R., & Schindler, P. S. (2011) Business Research Methods, McGraw-Hill, Singapore.
- Dehghani, E., Jabalameli, M. S., Jabbarzadeh, A., & Pishvaee, M. S. (2018) Resilient solar photovoltaic supply chain network design under business-as-usual and hazard uncertainties. *Computers & Chemical Engineering*, 111, 288-310.
- Dixit, V., Seshadrinath, N., & Tiwari, M. K. (2016) Performance measures based optimization of supply chain network resilience: A NSGA-II + Co-Kriging approach. *Computers & Industrial Engineering*, 93, 205-214.
- El Baz, J., Ruel, S. (2021) Can supply chain risk management practices mitigate the disruption impacts on supply chains' resilience and robustness? Evidence from an empirical survey in a COVID-19 outbreak era, *International Journal of Production Economics* 233.
- Gaskell, G. (2000) Individual and Group Interviewing. Qualitative Researching with Text, Image and Sound: A Practical Handbook, Sage Publications.
- Govindan, K., Azevedo, S. G., Carvalho, H., & Cruz-Machado, V. (2015) Lean, green and resilient practices influence on supply chain performance: Interpretive structural modeling approach. *International Journal of Environmental Science and Technology*, 12(1), 15-34.
- Govindan, K., Fattah, M., & Keyvanshokooh, E. (2017) Supply chain network design under uncertainty: A comprehensive review and future research directions. *European Journal of Operational Research*, 263(1), 108-141.
- Hasani, A., & Khosrojerdi, A. (2016) Robust global supply chain network design under disruption and uncertainty considering resilience strategies: A parallel memetic algorithm for a real-life case study. *Transportation Research Part E: Logistics and Transportation Review*, 87, 20-52.
- Hendricks, K. B., & Singhal, V. R. (2005) An empirical analysis of the effect of supply chain disruptions on long-run stock price performance and equity risk of the firm. *Production and Operations Management*, 14(1), 35-52.
- Hendricks, K. B., Singhal, V. R., & Zhang, R. (2009) The effect of operational slack, diversification, and vertical relatedness on the stock market reaction to supply chain disruptions. *Journal of Operations Management*, 27(3), 233-246.
- Ivanov, D. (2020) ‘A blessing in disguise’ or ‘as if it was not hard enough already’: Reciprocal and aggravate vulnerabilities in the supply chain. *International Journal of Production Research*, 58(11), 3252-3262.
- Jabbarzadeh, A., Fahimnia, B., Sheu, J.-B., & Moghadam, H. S. (2016) Designing a supply chain resilient to major disruptions and supply/demand interruptions. *Transportation Research Part B: Methodological*, 94, 121-149.

- Klibi, W., Martel, A., & Guitouni, A. (2010) The design of robust value-creating SC networks: A critical review. *European Journal of Operational Research*, 203(2), 282-293.
- Li, X., Wu, Q., Holsapple, C. W., & Goldsby, T. (2017) An empirical examination of firm financial performance along dimensions of supply chain resilience. *Management Research Review*, 40(3), 254-269.
- Liu, C.-L., & Lee, M.-Y. (2018) Integration, supply chain resilience, and service performance in third-party logistics providers. *International Journal of Logistics Management*, 29(1), 5-21.
- Ministry of Economy Trade and Industry (METI), (2020) White paper on international economy and trade 2020 (outline), Trade Policy Bureau METI. https://www.meti.go.jp/english/press/2020/pdf/0707_001a.pdf.
- Miroudot, S. (2020) Reshaping the policy debate on the implications of COVID-19 for global supply chains. *Journal of International Business Policy*, 3(4), 430-442.
- Pettit, T. J., Croxton, K. L., and Fiksel, J. (2019) The evolution of resilience in supply chain management: A retrospective on ensuring supply chain resilience. *Journal of Business Logistics*, 40(1), 56-65.
- Rezapour, S., Farahani, R. Z., Dullaert, W., & De Borger, B. (2014) Designing a new supply chain for competition against an existing supply chain. *Transportation Research Part E: Logistics and Transportation Review*, 67, 124-140.
- Scheibe, K. P., & Blackhurst, J. (2017) SC disruption propagation: A systemic risk and normal accident theory perspective. *International Journal of Production Research*, 56(1-2), 43-59.
- Seawright, J., & Gerring, J. (2008) Case selection techniques in case study research: A menu of qualitative and quantitative options. *Political Research Quarterly*, 61(2), 294-308.
- Sekaran, U. (2003) Research Method for Business, Wiley, Singapore.
- Snyder, L. V., Atan, Z., Peng, P., Rong, Y., Schmitt, A. J., & Sinsoysal, B. (2016) OR/MS models for supply chain disruptions: A review. *IIE Transactions*, 48(2), 89-109.
- Spiegler, V. L. M., Naim, M. M., & Wikner, J. (2012) A control engineering approach to the assessment of supply chain resilience. *International Journal of Production Research*, 50(21), 6162-6187.
- Survey on the impact of COVID-19 conducted by Japan's Chamber of Commerce and JETRO's overseas offices in each country (2020). https://www.jetro.go.jp/ext_images/_News/en/2020/b79a1ae9c1af7f8d/1-keypoints_en.pdf. Region.
- Wieland, A., & Wallenburg, C. M. (2013) The influence of relational competencies on supply chain resilience: A relational view. *International Journal of Physical Distribution and Logistics Management*, 43(4), 300-320.
- Xu, Z., Elomri, A., Kerbache, L., & El Omri, A. (2020) Impacts of COVID-19 on global supply chains: Facts and perspectives. *IEEE Engineering Management Review*, 48(3), 153-166.
- Zhu, G., Chou, M. C., & Tsai, C. W. (2020) Lessons learned from the COVID-19 pandemic exposing the shortcomings of current supply chain operations: A long-term prescriptive offering. *Sustainability*, 12(14), 5858.