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

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# List of abbreviation

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JETRO: Japan external trade organization

LC: Logistics centres

LE: Large enterprises

SC: Supply chain

SME: Small and medium enterprises



# Outline of presentation

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## 1. Introduction

- Research background and purpose
- Research objectives and research questions
- Research framework

## 2. Literature review

## 3. Understanding the impacts of COVID-19 pandemic

- From web research
- From interviews

## 4. Summary

# Introduction



# Research background and purpose

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Logistics and SCs are an integral part of Japanese economy and society as a whole.

Any disruption happening inside or outside of Japan affects economic performance and life in general (as evidenced by several natural disasters in the past and COVID-19 pandemic in the recent time).

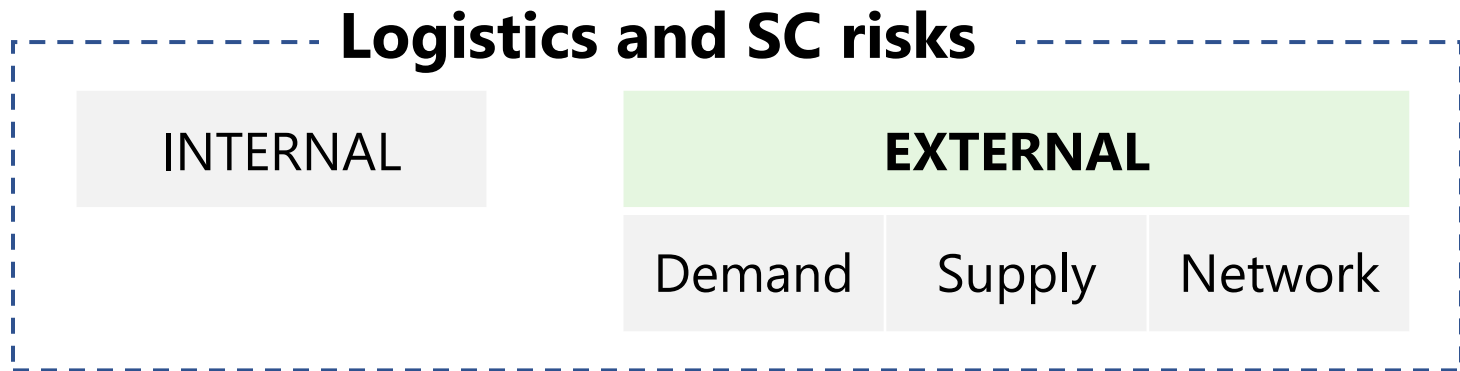


**Increasing emphasis on enhancing RESILIENCE of logistics and SCs in Japan and overseas.**



# What is supply chain resilience?

Supply chain resilience is the ability to be prepared for unexpected risks, responding and recovering quickly to potential disruptions to return to its original situation or grow by moving to a new, more desirable state in order to increase customer service, market share and financial performance (Hohenstein et al. 2015).



Logistics and SCs are subjected to more risks than ever, which are numerous and constantly evolving, and derive both from within and outside of the company. **Avoiding such risks or reducing their negative effects is one of the biggest challenge for today's management.**

- On average SC disruption destroy about 7% of a firm's shareholder value (World Economic Forum, 2013).
- Organizations are realizing the strategic importance of resilience investments.



# Example of a typical SC network

A SC consists of a network of suppliers, manufacturers, facilities (like warehouses, distribution centers, LCs) and customers which are connected by links.

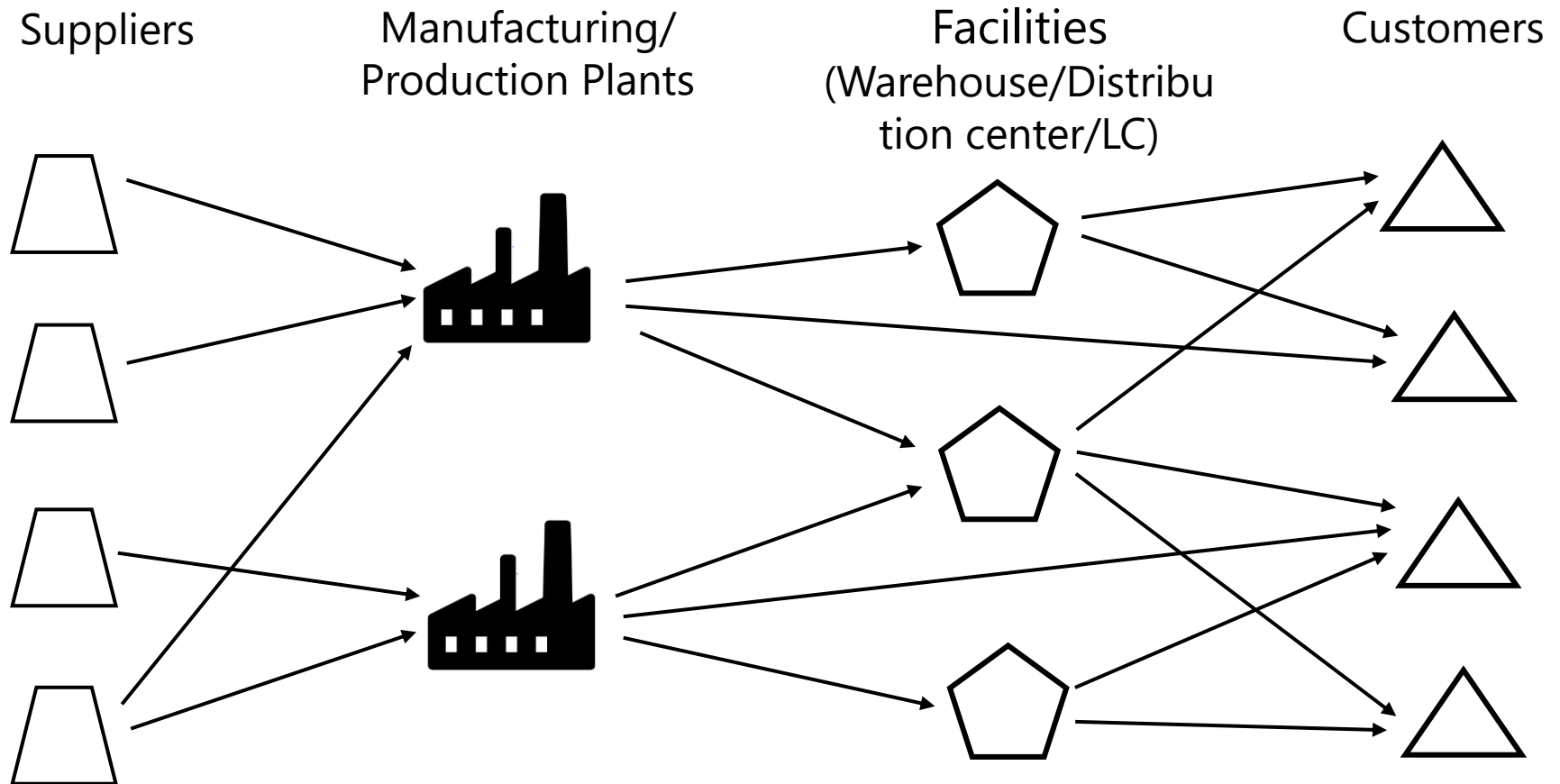


Figure 1: Typical structure of supply chain network



# Sources & impacts of logistics & SC disruptions

Nodes

Links

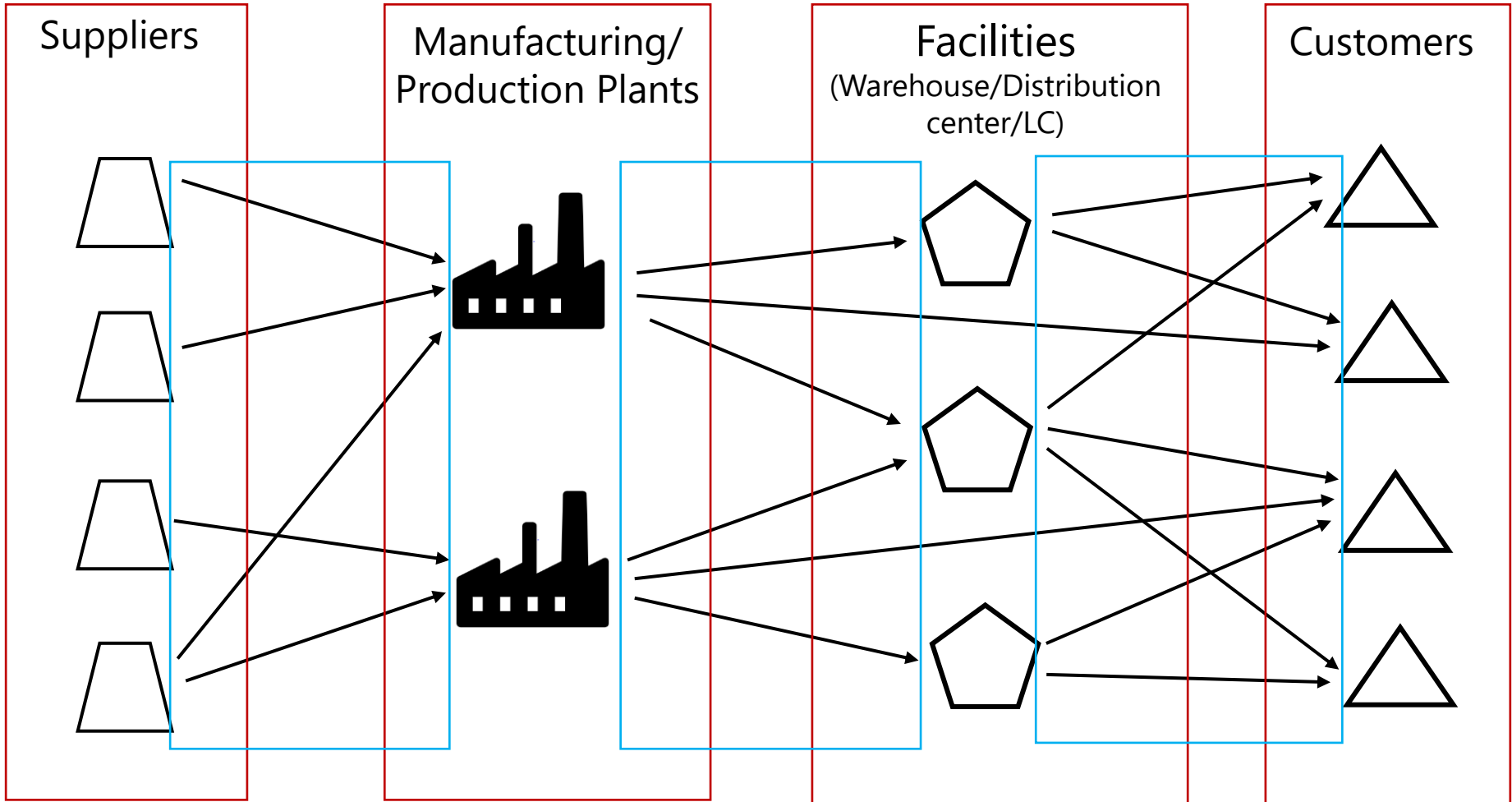


Figure 2: Sources & impacts of logistics & SC disruptions





# Research objectives

1. To investigate if the investment on logistics and SC resilience enhancement is worth it (using the case of COVID-19).
2. To identify logistics and SC resilience best practices (policies) to be recommended for other companies to enhance their resilience to future disruptions.

## Specific research questions

R1: What is the status of logistics and SC resilience?

R2: What is the impact of COVID-19 on logistics and SC activities?

R3: What are the impacts of COVID-19 on firm performance?

R4: Did existing logistics and SC resilience measures help to withstand or respond or recover from the impacts of COVID-19?

R5: Are the companies with logistics and SC resilience measures more resilient to disruptions?

R6: What are the logistics and SC resilience best practices (policies) that can be recommended for other companies to enhance their resilience to future disruptions?



# Research framework

## Part I: Assess and understand

Impacts of COVID-19 on logistics and SC activities

Status of logistics and SC resilience (Past + Present + Future)

Impacts of COVID-19 on firm performance

**Tentative methodology**

Interview

Survey

Companies (LE+SME) with global SC

## Part II: Identify relationships, best practices, and caveats

Status of logistics and SC resilience (Past + Present + Future)

Impacts of COVID-19 on firm performance

Impacts of COVID-19 on logistics and SC activities

**Tentative methodology**

Econometric modelling + Statistical analysis

# Literature review



# Logistics and SC resilience measures in literature

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Logistics and SC resilience measures can be defined as the strategies or methods which enables organizations and companies to withstand the impacts of potential disruptions, respond and recover quickly from potential disruptions to return to its original situation or grow by moving to a new, more desirable state in order to increase firm performance.

- Till date different studies have used different measures/approaches to represent logistics and SC resilience in their studies (details in Table 1 and 2).
- As such there is no standard measure of logistics and SC resilience, rather it is case based.



# Logistics and SC resilience measures in literature

Table 1: List of logistics and SC resilience measures discussed in literature

S.N.	Resilience measure	Classification	
1	Multiple sourcing	Node	
2	Safety stock/Inventory prepositioning		
3	Facility fortification		
4	Segregation/dispersion (Suppliers/Facilities)		
5	Lateral transshipment		
6	Multiple allocation of facilities and customers		
7	Flexible capacity at the facilities		
8	Facility redundancy		
9	Backup supplier		
10	Rerouting		Link
11	Collaboration		Node + Link
12	Substitution		Node
13	Adding extra production capacity		



# Quantitative logistics and SC resilience measures in literature

Table 2: Quantitative logistics and SC resilience measures used in the literature

References	MS	SSt	F	NDCC	FR	LT	MA	FC	ABOM	DC	FD	RC	EFC
<a href="#">Haeri et al., (2020)</a>				o									
<a href="#">Tucker et al., (2020)</a>		o			o								
<a href="#">Rajesh (2020)</a>				o									
<a href="#">Taleizadeh et al., (2020)</a>		o											
<a href="#">Azad and Hassini (2019)</a>						o						o	
<a href="#">Ghomi-Avili et al., (2019)</a>						o	o						
<a href="#">Sabouhi and Jabalameli (2019)</a>	o			o									
<a href="#">Mikhail et al., (2019)</a>				o									
<a href="#">Elluru et al., (2019)</a>													o
<a href="#">Esfandiyari et al., (2019)</a>			o		o								
<a href="#">Zhao and You (2019)</a>								o					
<a href="#">Hamidieh et al., (2018)</a>		o											
<a href="#">Hamidieh et al., (2018)</a>	o							o					
<a href="#">Dehfhani et al., (2018)</a>	o		o						o				
<a href="#">Ghomi-Avili et al., (2017)</a>		o				o							
<a href="#">Yu et al., (2017)</a>							o						
<a href="#">Fattahi et al., (2017)</a>													
<a href="#">Jabbarzadeh et al., (2016)</a>			o										
<a href="#">Hasani and Khosrojerdi (2016)</a>	o	o	o						o		o		
<a href="#">Garcia-Herreros et al., (2014)</a>		o											
<a href="#">Klibi and Martel (2012)</a>	o				o					o			

MS: Multiple sourcing; SSt: Safety stock; F: Facility/supplier fortification; NDCC: Node density, complexity and criticality; FR: Facility redundancy; LT: Lateral transshipment; MA: Multiple allocation of customers and facilities; FCF: Flexible capacity at facilities; ABOM: Alternative bill of materials; DC: Demand coverage; FD: Facility dispersion; RC: Reassigning of customer



# Is logistics and SC resilience investment worth it?

While implementation of different resilience measures is desirable and indeed critical to withstand the disruptions, a question often asked regarding resilience is

**“Is the investment worth it?”**

Resilience enhancement often requires investment and it is difficult to monetize payback (Pettit et al. 2019).

Analysis of the literature shows that the benefits of incorporating resilience measures are illustrated quantitatively mainly in terms of monetary value. While some studies have found that incorporation of resilience measures lead to

1. reduced total cost (Rajesh, 2020; Azad and Hassini 2019; Ghomi-Avili et al., 2019; Esfandiyari et al., 2019; Dehfhani et al., 2018; and Ghomi-Avili et al., 2017),
2. other studies found that it leads to increased total cost (Fattahi et al., 2020; Sabouhi and Jabalameli 2019; Zhao and You, 2019; Margolis et al., (2018; Fattahi et al., 2017; Jabbarzadeh et al., 2016; Garcia-Herreros et al., 2014).

**As such there is no unanimity.** Similar results were obtained when measured in terms of total profit.



# Research need

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- Although studies have shown the impacts of incorporating logistics and SC resilience measures using numerical illustrations, **there is a lack of empirical studies**
  - clarifying whether the resilience investments are worth it and
  - demonstrating the impacts of pre-adopted logistics and SC resilience measures using a real life disruption situation.
- From the practical point of view significant proportion (>50%) of SMEs are still not prepared for natural disasters in Japan. When asked about reason "**Don't know where to start**" and "**Importance and effects of effort is unclear**" were found to be main reasons (METI, 2019) such that research on addressing these issues is needed.

Therefore, using the case of COVID-19's widespread impact on companies in different sectors this study aims to address the gaps in the literature and practice.



# **Understanding impacts of COVID-19 pandemic – From web research**



# Impacts of COVID-19 on logistics in Japan

	Maritime Transportation	Air Transportation	Land Transportation
Influence of the measures to prevent the spread of COVID-19	Blockade of some ports	Decline in the number of operation of passenger aircraft	Blockade of some roads and railway tracks
Impact of each logistics route	In terms of <b>trade volume</b> , sea transportation accounts for <b>99.7%</b> of Japan's international trade	In terms of <b>trade amount of money</b> , air transportation accounts for <b>40%</b> of Japan's international trade.	Land transportation and warehouses account for <b>nearly 80%</b> of <b>Japan's overall logistics costs</b> .
Limitation on substitutability of each logistics route	In the case of transportation between long distances, maritime transportation with a lengthy transit time is not suitable as an emergency alternative means of transportation.	For heavy goods and mass transportation, it is difficult to replace sea transportation with air transportation.	It is essential to connect before and after sea and air transportation. In international trade, it is impossible to replace sea and air transportation with land transport.

Due to the limitation on the substitutability of each logistics routes, reactive resilience measures alone will not be sufficient to prevent/deal with the consequences of disruptions.



# Impacts of COVID-19 on logistics facilities

According to CBRE's Japan Logistics Occupier Survey (4<sup>th</sup> – 9<sup>th</sup> March, 2020) – which asked respondents (companies in Japan that use logistics facilities) a series of questions to gauge the **short-, medium- and long-term impacts of COVID-19 on logistics demand** – has found

Short-term impacts like (405 companies),

- shortage of warehouse workers,
- increasing cargo and delivery volume and
- shortage of delivery workers.

Regarding the medium- to long-term impact (361 companies), the most selected response was

- additional inventory for unexpected situations (30% respondents),
- automation of warehouse operations will be accelerated (17% respondents)



# Impact of COVID-19 on Japanese companies overseas

Based on a survey conducted by Japan's Chamber of Commerce and JETRO's overseas office in China, Malaysia, Indonesia, India and US, Japanese companies overseas observed operational decline caused mainly due to,

- Decrease in [Domestic + Overseas] demand
- Operational regulations by the government
- Disruptions to [Domestic + Overseas] supply chain
- Logistics constraints and high cost

## **Understanding impacts of COVID-19 pandemic:** Conclusion based on web research

Research on identifying logistics and SC resilience best practices is needed to facilitate adoption of appropriate resilience measures in future.

# **Understanding impacts of COVID-19 pandemic – From interviews**



# Purpose of interview and Interview methodology

R1: What is the status of logistics and SC resilience?

R2: What is the impact of COVID-19 on logistics and SC activities?

R3: What is the impacts of COVID-19 on firm performance?

R4: Did existing logistics and SC resilience measures help to withstand or respond or recover from the impacts of COVID-19?

## Interview methodology

### Sample selection

Employed a combination of purposive sampling technique and snowball sampling, interviewing key informants. This approach allows for maximum variation, following the principles of appropriateness and adequacy (Gaskell, 2000; Seawright and Gerring, 2008).

### Data collection

Semi-structured interview with the respondents from different Japanese companies (LE+SME) with global SC.



# Characteristics of interview sample

Table 3: Characteristics of interview sample

	<b>Sample 1</b>	<b>Sample 2</b>	<b>Sample 3</b>
Industry type	Cosmetic	Trading	Logistics and SC solutions
Company category	Large enterprise	Small and medium enterprise	Large enterprise
Customer base	<ul style="list-style-type: none"><li>- Supermarkets</li><li>- Wholesalers</li><li>- Retailers</li></ul>	<ul style="list-style-type: none"><li>- Manufacturing companies</li><li>- Assembly companies</li><li>- Maintenance companies</li></ul>	<ul style="list-style-type: none"><li>- Manufacturing companies</li><li>- Assembly companies</li><li>- Production companies</li><li>- Trading companies</li></ul>





# Details of the interview

Table 4: Details of the interview

	<b>Sample 1</b>	<b>Sample 2</b>	<b>Sample 3</b>
No. of interviewee	1	1	2
Designation	Director of LC	Sales	General Manager, Dept 1 General Manager, Dept 2
Date of interview	October 22, 2020 Thursday	November 1, 2020 Sunday	November 10, 2020 Tuesday
Duration of interview	16:00-17:30 (90 minutes)	14:00-16:00 (2 hour )	15:00 – 15:50 (50 minutes)
Data collection method	Semi-structured interview	Semi-structured interview	Semi-structured interview
Sample selection	Purposive sampling technique	Snowball sampling technique	Snowball sampling technique
Means of communication	Microsoft Teams	In-person	Zoom



# Interview summary (1) → [R1]

Table 5: Current state of logistics and SC resilience **Preparedness**

S.N.	Sample 1	Sample 2	Sample 3
Natural disaster	1 Business continuity plan	None	Facility fortification
	2 Provision of lateral transshipment between LCs		Facility dispersion
	3 Moving electrical lines away from tsunami prone areas		
Pandemic	4 None	None	None

Table 1: List of logistics and SC resilience measures discussed in literature

S.N.	Resilience measure	Classification
1	Multiple sourcing	
2	Safety stock/Inventory prepositioning	
3	Facility fortification	
4	Segregation/dispersion (Suppliers/Facilities)	
5	Lateral transshipment	Node
6	Multiple allocation of facilities and customers	
7	Flexible capacity at the facilities	
8	Facility redundancy	
9	Backup supplier	
10	Rerouting	Link
11	Collaboration	Node + Link
12	Substitution	
13	Adding extra production capacity	Node



# Interview summary (2) → [R1]

Table 6: Current state of logistics and SC resilience **Response**

S.N.	Sample 1	Sample 2	Sample 3	
For pandemic	1	Change of transportation mode	Seeking alternative suppliers for products with single supplier	Using warehouses of other companies
	2	Lateral transshipment of goods from low demand LCs to high demand LCs		Moving stocks to overseas warehouses
	3			

Table 1: List of logistics and SC resilience measures discussed in literature

S.N.	Resilience measure	Classification
1	Multiple sourcing	
2	Safety stock/Inventory prepositioning	
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4	Segregation/dispersion (Suppliers/Facilities)	
5	Lateral transshipment	Node
6	Multiple allocation of facilities and customers	
7	Flexible capacity at the facilities	
8	Facility redundancy	
9	Backup supplier	
10	Rerouting	Link
11	Collaboration	Node + Link
12	Substitution	
13	Adding extra production capacity	Node

Table 7: Current state of lo

S.N.	Sample 1
1	Research on how to accurately predict demand
2	Increase capacity of LCs
3	Increase inventory of raw materials in Japan



# Interview summary (3) → [R3]

Table 8: Impacts of COVID-19 on **Logistics and SC activities**

S.N.	Sample 1	Sample 2	Sample 3
1	Increase in demand for sanitary products	Decrease in demand from customers	Increase in demand for warehouse storage
2		No access to suppliers from March – August	High air transport cost
3			High sea transport cost

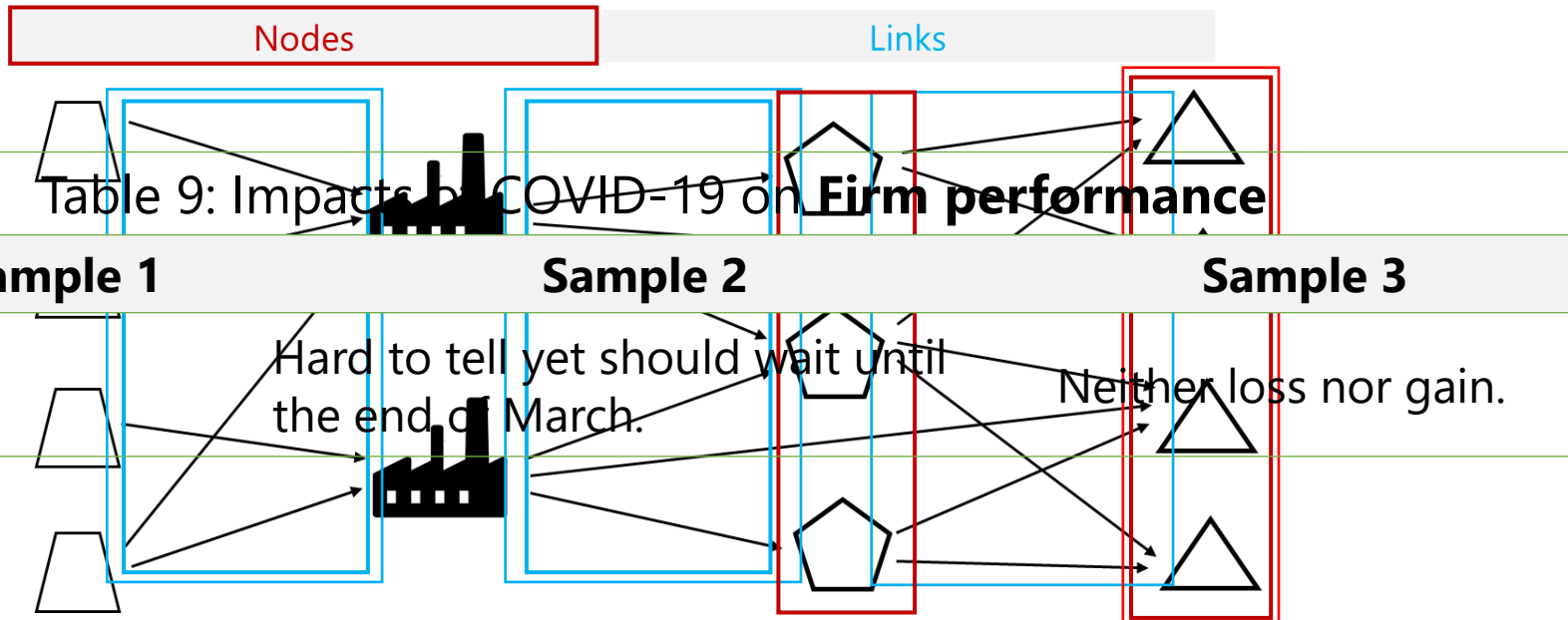


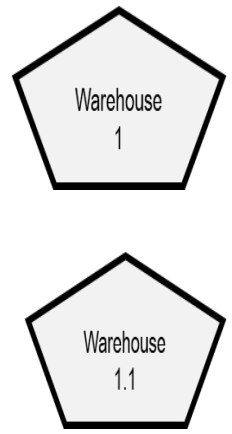
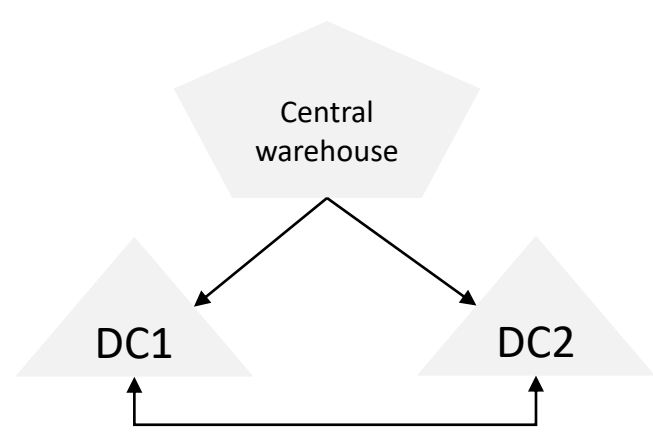
Figure 2: Sources & impacts of logistics & SC disruptions



# Analysis of interview responses (1) → [R4]

	Sample 1	Sample 2	Sample 3
1. Company's actions to build logistics and SC resilience to natural disasters.	<ul style="list-style-type: none"> <li>- Business continuity plan</li> <li>- <b>Lateral transshipment</b></li> <li>- Moving electrical lines away from tsunami prone areas</li> </ul>	N/A	<ul style="list-style-type: none"> <li>- <b>Facility fortification</b></li> <li>- <b>Facility dispersion</b></li> </ul>
2. Did the resilience preparedness for natural disaster help to prevent or respond or recover from the impacts of COVID-19?	<b>Yes</b>	N/A	<b>No</b>

## Resilience strategy





# Analysis of interview responses (2) → [R4]

	Sample 1	Sample 3
1. Company's actions to build logistics and SC resilience to natural disasters.	<ul style="list-style-type: none"> <li>- Business continuity plan</li> <li>- <b>Lateral transshipment</b></li> <li>- Moving electrical lines away from tsunami prone areas</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Facility fortification</b></li> <li>- <b>Facility dispersion</b></li> </ul>
2. Did the resilience preparedness for natural disaster help to prevent or respond or recover from the impacts of COVID-19?	<b>Yes</b>	<b>No</b>

## Industry type

Cosmetic products

Logistics and SC solutions

## Impacts of COVID-19

Increase in demand for sanitary products

Increase in demand for warehouse storage

High air transport cost

High sea transport cost

# Summary



# Analysis and Summary (1)

## Status of logistics and SC resilience

- It was found that two out of three **companies have some sort of logistics and SC resilience preparedness** in place specifically in anticipation of natural disasters.
- As a part of preparedness for disruptions companies had in place **resilience measures such as**
  - Business continuity plan
  - Lateral transshipment
  - Facility fortification
  - Facility dispersion
- There was **no logistics and SC resilience preparedness for pandemics.**
- The **logistics and SC resilience preparedness strategies were mainly targeted for enhancing resilience of nodes** of the SC.
  - **Resilience of links of the network were overlooked.**
  - However, the actual impacts were seen both on nodes and links.





# Analysis and Summary (2)

## Impacts of COVID-19 pandemic

- Companies in different sectors in Japan have already faced significant impacts due to COVID-19 pandemic.
  - The **impacts of COVID-19 were different** for different Japanese companies.
- Apart from fluctuation in demand, **disruption to [domestic and overseas] SC and logistics constraint & high cost** were found to be the major factors behind operational decline of Japanese companies overseas.
- While two of the interviewed companies observed **increase in demand** for their product/service one company observed **decrease in demand** (Sample 1 and 3 Vs Sample 2).
- In terms of **firm performance**, Sample 1 observed improved firm performance, Sample 2 has yet to find out the impacts and Sample 3 did not observe any change in firm performance yet.



# Analysis and Summary (3)

## Resilience preparedness and its benefits

- Logistics and SC resilience preparedness strategies,
  - Facilitated Sample 1 to streamline their response strategies,
  - Did not facilitate Sample 3 to streamline their response and/or recovery activities.

Sample 1 observed benefits from preparedness for natural disasters but Sample 3 did not.



# Limitations and future work

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## Limitations

- This study is a work-in-progress. Consequently, there are only limited number of samples. As a results, conclusions and practical implications cannot be generated at this moment.

## Future work

- Conduct interviews with other companies.
- Conduct survey.



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Thank you.