Towards Resilient and Sustainable Supply Chain Management in Face of Increasing Natural Disaster Disruptions

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Agenda

• Resilient and Sustainable SCM: A Concept
• The Relationship between SCM and Natural Disaster Disruptions
• National Experiences in Indonesia
  • SC Commercial Operations and Natural Disasters
  • SC Humanitarian Operations and Natural Disasters
• Additional Information of Japan and Philippines
• Conclusions
Resilient and Sustainable SCM: A Concept
Resilience & Sustainability
Resilient & Sustainable

• Refer to European Commission: Resilience is the ability to cope with, adapt and recover quickly from the impact of a disaster, violence, or conflict. Resilience covers all stages of disasters to adaptation and includes a positive transformation that strengthens the ability of current and “future generations to meet their needs and withstand crises” → sustainable concept

• Refer to UNICEF: Resilience is the ability to withstand threats or shocks, to adapt to new livelihood options. The resilience of a household is related to the available resources (e.g. financial, assets, human capital, social resources, etc.) and the household’s ability to use these resources (e.g. access to markets, access to public services, and social protection).

• Resilience is defined as “the ability of a system to return to its original state, or move to a new, more desirable state after being disturbed” (Christopher & Peck, 2004).

• Adaptability, agility, flexibility, and responsiveness are vital contributors in order for firms to achieve resilience in the face of Supply Chain Disruptions (Teece et al., 1997).

• Resilience “emphasizes important aspects of resilience such as adaptability, flexibility, maintenance, and recovery” (Kwak et al., 2018).

• The capacity to learn from disruptions to be better prepared for future events is a vital aspect of resilience (Ponomarov & Holcomb, 2009).

Resilience has a strong association with the ability or the capability of an individual or an organization or a community to the changes
Supply Chain Resilience (SCRES)

Source: Ali, et.al. 2017
Issues on SCRES Research

But, the issue of sustainability in the context of the resilience supply chain is still limited to the discussion.

Number of SCRES research tends to increase

Source: Ali, et.al. 2017
The Relationship Between SCM and Natural Disaster Disruptions
Types of Natural Disasters

Impacts of Natural Disasters on Supply Chain Performance, Mariana Bhurkhardt, 2020
The SCM in natural disaster disruption

The supply chain concept

The structure of relief supply chain

Hub-n-Spoke system

Donations
(In-kind donations)

Warehouses
(Pre-positioned supplies)

Suppliers
(Procured supplies)

Port of entry
(primary hub)

Central warehouse
(secondary hub)

Local distribution center (tertiary hub)

Modified from UNDP Disaster Management Training Program in Balcik (2008)
### Actors and The Goal of SC in Resilience

<table>
<thead>
<tr>
<th>Performance metric type</th>
<th>GOAL</th>
<th>Supply Chain</th>
<th>Relief Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources</td>
<td>High level of efficiency</td>
<td>Efficient resource management is critical to profitability</td>
<td>If an organization utilizes its resources poorly, donors may discontinue funding.</td>
</tr>
<tr>
<td>Output</td>
<td>High level of effectiveness</td>
<td>Without acceptable output, customers will turn to other supply chains</td>
<td>Poor output performance leads to increased deaths and suffering</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Ability to respond to a changing environment</td>
<td>In an uncertain environment, supply chains must be able to respond to change and have the ability to change</td>
<td>High variability and inherent uncertainties related to disaster characteristics and emergency relief environment require high levels of flexibility performance</td>
</tr>
</tbody>
</table>

National Experience in Indonesia:
SC Commercial Operations and Natural Disasters
Mapping the Logistics Service Industry in Indonesia affected by Covid-19 and able to survive

The classification of logistics services affected by Covid19 in Indonesia

<table>
<thead>
<tr>
<th>Type of logistics services</th>
<th>Type of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container operator</td>
<td>The decrease in the volume of export (30%) and import (40%)</td>
</tr>
<tr>
<td>Courrier services</td>
<td><strong>The increase in the volume of freight (depends on type of commodities)</strong></td>
</tr>
<tr>
<td>Freight forwarders</td>
<td>Depends on type of services and commodities</td>
</tr>
<tr>
<td>Railway freight services</td>
<td>The decrease in the volume of coal (1%), containers (13%), cement (13%),</td>
</tr>
<tr>
<td></td>
<td>fuel (6%), others (36%)</td>
</tr>
<tr>
<td>Trucking services</td>
<td>The decrease in the volume of freight (40%)</td>
</tr>
<tr>
<td>Sea freight services</td>
<td>The decrease in the volume of international cargo (14% - 18%), and domestic</td>
</tr>
<tr>
<td></td>
<td>cargo (5% - 10%)</td>
</tr>
<tr>
<td>Air Freight services</td>
<td>The decrease in the volume of international cargo (51%), and domestic cargo</td>
</tr>
<tr>
<td></td>
<td>(31%)</td>
</tr>
</tbody>
</table>
Strategic Alignment Model

**Strategy of business:**
- Collaboration of intermodal transport
- Multi-commodities
- Identification of demand pattern
- Optimization of potential cooperation (Governments-SOE/Privates → PPP)
- Integration of business process amongst logistics service providers
- Service system transformation
- Tariff discount/promotion and loyalty program
- Sharing risk business model

**Strategy of IT:**
- Digitalisation in the business process (*digital push*)
- ICT System development
- Automatisation

**Organisation infrastructure and Process:**
- Human resources competency development/improvement
- Cost effectiveness and efficiency, and responsiveness
- Market share development through market penetration
- Company refinancing
- Tax relaxation

**IT infrastructure dan Process:**
- Integration commodities information system and supply chain integration
- Integrated transport information system
- Logistics System Platforms development to meet the consumer’s needs
The hazard zone is a consideration in the selection of logistics transportation modes during the disaster response.
National Experience in Indonesia:
SC Humanitarian Operations and Natural Disasters
Disaster Management during Covid-19 in Indonesia (case: railway utilization for distributing humanitarian commodities in Java Island - Indonesia)

- The pandemic Covid-19 gives an impact directly on the logistics service industry due to restrictions on people mobilization which reduces goods flow using transportation modes (inland, ocean, air).
- Rail transportation utilization to support the distribution of humanitarian logistics during the COVID-19 Pandemic considering its advantages, such as being suitable for long-distance, large-volume cargo capacity, and more efficient.
- However, the railway is not as flexible as highway transportation such as trucking which provides door-to-door service.

2 OPTIONS for utilizing railway transportation to support the humanitarian logistics implementation

**SHIFTING** is defined as a passenger train operational strategy to support humanitarian logistics distribution during the COVID-19 pandemic by filling unused/idle train passenger seats with humanitarian goods or commodities (medicines and medical equipment).

**EXTENDING** is an operational strategy for freight train transportation to support humanitarian logistics distribution by increasing cargo capacity or adding freight train cars to transport health commodities.
Indonesia: earthquake prone area

Major earthquakes in 1900-2009 (magnitude more than 5), more than 52,000 events
Other disasters
What happened?

- High percentage of disaster prone villages in Sumatera dan Java, which have 80% of population but also have better infrastructures and capacity.

- The impacted villages by ‘large disaster’ event only small number:
  - earthquake (4.7%), tsunami (0.02%) and volcano eruption (0.5%)

- Landslide, flood and drought have more percentage and more frequent.

- Level of disaster management depend on scale of disaster:
  - some institutions have to help themselves
  - can be assisted by nearest agencies
  - private opportunities to help

(\textit{BNPB Reg, 4/2009})
From Concept to Implementation: in the Context of Indonesia

There is potential for private involvement to optimize the SC process in logistics disasters.
The principles of the model:
- Performance System Response Capability → the functions of distance & distributed volume of goods/commodities
- Response speed → equally correlated with mileage & freight volume
- Point of demand as the center of freight distribution.
- The model remains considering the balancing of supply and demand.

Information:
- Location, supplier capacity & distance to railway station
- Location, consumer capacity & distance to railway station
- Location & number of demands

Outputs:
- Performance of response: distance × flow of goods
- Optimization: flow of goods & the selected railway station

Maximum distance from railway station to consumer point
Data Input

The location of 105 suppliers in Java island

The location of 113 demand/consumers in Java island

The location of 8 railway stations as the potential hub in Java island
The result of the optimization model

- Distribution routes from the railway station of Jakarta to demand/consumer locations.
- The routes from suppliers to the railway station of Jakarta.
- The supplier that distributes the goods to the railway station of Jakarta.
- Consumer points that get supply from the railway station of Jakarta.

- Distribution routes from the railway station of Cirebon to demand/consumer locations.
- The routes from suppliers to the railway station of Cirebon.
- The supplier that distributes the goods to the railway station of Cirebon.
- Consumer points that get supply from the railway station of Cirebon.

- Distribution routes from the railway station of Semarang to demand/consumer locations.
- The routes from suppliers to the railway station of Semarang.
- The supplier that distributes the goods to the railway station of Semarang.
- Consumer points that get supply from the railway station of Semarang.

- Distribution routes from the railway station of Surabaya to demand/consumer locations.
- The routes from suppliers to the railway station of Surabaya.
- The supplier that distributes the goods to the railway station of Surabaya.
- Consumer points that get supply from the railway station of Surabaya.

- Distribution routes from the railway station of Banyuwangi to demand/consumer locations.
- Consumer points that get supply from the railway station of Banyuwangi.

The simulation results form a complex network. Results are highly dependent on the completeness and quality of the data.
Trends in disaster response

• Partnering between government and humanitarian organisations
• Increased private sector engagement
• Current public-private collaborations typically are
  • short term engagements
  • mainly focused on the response phase
  • hands-on and/or cash donation in nature

WHAT private HAVE?

• Money
• Logistics networks
• Efficient operation
• Expertises
• Experience in logistics operation
## Expected public-private cooperation at Disaster Response Phases

<table>
<thead>
<tr>
<th>MITIGATION PHASE</th>
<th>PREPAREDNESS PHASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Capacity building</td>
<td>• Capacity assessment, to include the private capacity at observed location that disaster may occur. The private capacity including: commodity, people and tools/equipment available</td>
</tr>
<tr>
<td></td>
<td>• To include the private at the emergency response team</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RESPONSE PHASE</th>
<th>RECOVERY PHASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Involve in emergency response team</td>
<td>• Knowledge transfer</td>
</tr>
</tbody>
</table>
| • Emergency operation:  
  • Delivering relief |
THE opportunities IN INDONESIA

1. The population in disaster vulnerable area is high
   • more than 85% of Indonesia population

2. The infrastructure relatively better
   • Potential for private to built network

3. Corporate Social Responsibility (CSR) in Indonesia
   • Compulsory by Law No 40 Year 2007 about the Limited Company and Government Regulation No 47 Year 2012.
     • compulsory for a company that exploit nature resources as their main activity or create impact on nature in their activities.
     • The potency of CSR is big, as it is compulsory for almost any business activity in Indonesia.
     • Estimated range between USD 900 – 1,300 million (IDR 12 – 17 trillion) per year, could be direct fund or inkind/activities.
     • The challenge is that how to maximize the use of CSR in disaster and to make it long term benefit for disaster operation.

4. Good business networks
   • Indonesia, mainly Java and Sumatera have good business networks including at disaster prone area
     • Retail,
     • warehouses,
     • transports,
     • factories, etc
   • Opportunity to include/involve them in the humanitarian logistics systems
Additional Information of Japan and Philippines
Top 10 Countries in Asia related to Disaster Occurrence

According to data (as of Sept 2022):

- Japan and the Philippines are 2 out of the top 10 countries in Asia with a significant number of disaster occurrences in 2021.
- Japan and the Philippines are 2 countries with more than 100 million inhabitants amongst 10 other countries in the world.

Source: Natural Disaster Databook 2021, An Analytical Overview (https://www.adrc.asia)
Japan

AN OVERVIEW

• Japan is an island country located in the western Pacific Ocean.
• Total population is about 123.72 million (in 2022).
• Total land area is about 378,000 square kilometers, more than 70% of the land surface is mountainous.
• Japan has several volcanic regions and is frequently affected by earthquakes and tsunamis.
• Japan is affected by typhoons mostly every year and Volcanic disasters triggered by eruptions and volcanic earthquakes.
• Japan is an earthquake-prone area due to the geological formation with plate boundaries of the Pacific plate, the Philippine Sea plate, the Eurasian plate, and the North American plate.

RECENT MAJOR DISASTERS:
1. Great Hanshin-Awaji Earthquake (January 1995)
3. The Great East Japan Earthquake (March 2011)

Source: https://www.adrc.asia
The Philippines

AN OVERVIEW

• Located in Southeast Asia, bordered by the Pacific Ocean to the east, the West Philippine Sea to the west, and the Celebes Sea to the south.
• Total population is about 115.97 million (in 2022).
• The Philippines constitutes an archipelago of 7,109 islands with a total land area of approximately 299,764 square kilometers.
• The Philippines has a tropical and maritime climate. It has two major seasons: the rainy season and the dry season.
• Located along the typhoon belt in the Pacific, visited by an average of 20 typhoons every year.
• Being situated in the “Pacific Ring of Fire” makes it vulnerable to frequent earthquakes and volcanic eruptions.
• Its geographical location and physical environment also contribute to its high susceptibility to tsunamis, sea level rise, storm surges, landslides, flood/flashflood/flooding, and drought.

RECENT MAJOR DISASTERS:
1. Volcanic Eruption of Mt. Pinatubo (June 1991)
2. Super Typhoon Haiyan (November 2013)
3. Luzon Earthquake (July 1990)

Source: https://www.adrc.asia
Conclusions
Adaptability, agility, flexibility, and responsiveness are vital contributors for firms to achieve resilience.

The capacity to learn from disruptions to be better prepared for future events is a vital aspect of resilience.

Resilience has a strong association with the ability or the capability of an individual or an organization or a community to the changes.
References:

- UNICEF: Resilience, humanitarian assistance, and social protection for children in Europe and Central Asia
- https://www.adrc.asia
- https://worldpopulationreview.com/
Terima kasih
Thank You
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