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**Supply Chain Resilience: The Indirect
Economic Implication of Sunda Strait
(Krakatoa) Tsunami and COVID-19 Outbreak
to the Tourism Hospitality Supply Chain
in Pandeglang, Indonesia**

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Supply chain resilience: the indirect economic implication of Sunda Strait (Krakatoa) Tsunami and COVID-19 outbreak to the tourism hospitality supply chain in Pandeglang, Indonesia

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Abstract

The coastal tourism sector in Pandeglang Regency (Banten Province) is a significant contributor to regional income and one of its coastal areas is designated as a Special Economic Zone in 2018. Tourism sector in Pandeglang Regency is supported by many components, one of them is the hotel industry which has a wider economic impact because of its links to other industries, creating a supply chain. Unfortunately, most of those accommodation facilities are located in area prone to tsunamis. This resulted in the large impact that the tsunami had on Pandeglang's tourism hospitality supply chain. One year after the disaster, tourism was still unable to recover, then two years after the tsunami, the COVID-19 outbreak appears, making the recovery measures more difficult. Based on that, this study aims to understand the indirect impacts of Sunda Strait Tsunami and COVID-19 pandemic and how it affects the resilience of tourism hospitality supply chain in Pandeglang. In order to quantify the indirect losses, this research adopts the Support Analysis Framework (SAF) with several relevant modifications. There are three indicators included in SAF analysis: (1) Losses of Financial Function; (2) Business Disruption Between Tourism Business Actors; (3) Operational Changes. Based on the SAF calculation, the index of indirect losses from the Sunda Strait Tsunami and COVID-19 is in the third class which is high losses. The two incidents had caused huge losses on the Pandeglang tourism sector, affected suppliers, distributors, and customers, also forced the tourism businesses to stop operating for several months. The analysis of these indirect impacts can be useful for governments and private sectors to develop strategies and interventions in tourism sector to increase disaster preparedness and the resilience of tourism and hospitality supply chains in Pandeglang based on resilient supply chain determinants.

Keywords: Supply chain resilience; indirect economic implication; Sunda Strait.

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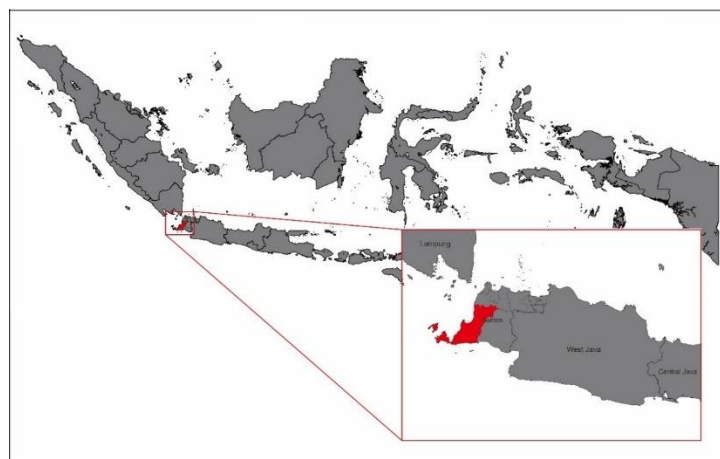
Introduction

Coastal areas have attractive and unique landscapes for community livings, tourism activities and many types of economic developments. Coastal tourism has been important attractions in the world since years ago (Honey & Krantz, 2007). Indonesia has about 81,000 kilometers of coastline area and has interesting coastal tourism attractions. Nonetheless, coastal areas in Indonesia are also vulnerable to disaster and climate change. In addition to that, Indonesia is also located within the Pacific Ring of fire where coastal tourism can be affected. In general, Indonesia ranks the 27th highest economic risk from disasters out of 196 countries (Shi & Kaspersen, 2015).

One of important coastal tourism attractions in Indonesia is located in Pandeglang Regency, Banten Province (Figure 1). It is neighboring province to Jakarta (the capital of Indonesia) and about 2 hrs drive by road. Due to close distance to Jakarta and other provinces (Lampung and West Java), many tourists visit Pandeglang during weekend and national holidays. However, Pandeglang Regency is also classified as high disaster risk and the Pandeglang coastal areas are highly prone to tsunamis, earthquakes, and floods (National Disaster Management Agency (BNPB), 2018).

On the Saturday night of 22 December 2018, a tsunami hit some areas Banten Province, and particularly the coastal areas of Pandeglang. The tsunami claimed at least 426 people with 14,059 injured in which many of them are tourists. The tsunami was considered unique because there was no tsunami warning since the trigger of the tsunami was undersea landslide of the Anak Krakatoa Volcano. Losses and devastation caused by the tsunami have affected the hospitality industry as a core aspect of tourism in Pandeglang. A variety of tourism attractions were also seriously affected by the tsunami, according to the Pandeglang Regional Disaster Management Agency (Badan Penanggulangan Bencana/BPBD). Moreover, the death toll reached 296 people who died and one of the highest numbers of deaths were tourists (BNPB, 2018; Humanity Road/Animals in Disaster, 2018). Besides, the tourism hospitality industry has a wider economic impact because of its links to other industries, such as food industry, souvenirs, restaurants, travel agents, transportation etc, creating a tourism hospitality supply chain. The tsunami clearly had a significant impact on the tourism hospitality industry in Pandeglang.

Figure 1. Pandeglang Regency Map



Source: Made by authors based on Regional Development Planning Agency of Pandeglang (Bappeda) data.

Banten Province has a significant contributor to regional income. In 2019, it was reported that Banten contributed 7,01% to Java's Gross Regional Domestic Product (GDP) (Statistics Indonesia, 2019). Moreover, one of the coastal areas is designated as a Special Economic Zone in 2009 mandated by Government Regulation No.22/2012 concerning the Tanjung Lesung Special Economic Zone.

The global outbreak of COVID-19 at the beginning of 2020 also affecting the ability to rebound from tsunami 2018 in Pandeglang. Along with the increasing COVID-19 cases in Indonesia, Pandeglang's COVID-19 cases have also been increasing. As of February 5th 2021, COVID-19 Cases in Pandeglang reached approximately 1,377 cases with 0,01 proportion of deaths toll (Pandeglang Regency Government, 2021). The spike in COVID-19 cases could trigger panic and concerns for the public and tourists to visit destinations, thus, reducing the demand for the tourism industry (Bakar & Rosbi, 2020). Hence, both the COVID-19 outbreak in 2020 and the tsunami in 2018 have severely affected the Pandeglang tourism hospitality industry. This would potentially impact the regional economy, including its GDP and economic growth, in addition to affecting the different sectors related to tourism hospitality, because the tourism sector is one of the major contributors to regional income in Pandeglang.

In this context, disruption in the tourism hospitality supply chains pose more threats than ever before, which are various and continuously changing, and originated from both within and outside of hospitality business. Hence, one of the strategies that can be carried out in the tourism hospitality industry to increase the capacity to bounce back from the impact of Tsunami 2018 and COVID-19 Outbreak is building the tourism hospitality industry resilient supply chain management. Resilient supply chain is defined as the adaptive capacity of the supply chain to adapt for, respond to, and recover from unpredictable events by preserving the continuity of operations at the optimal level of communication and control over structure and function within the supply chain (Ponomarov & Holcomb, 2009).

The significant economic impact of the tsunami and COVID-19 needs measures to be taken by the tourism sector to increase disaster preparedness. A resilient tourism hospitality supply chain has an efficient approach and able to return to their original condition, or even better in the post-destructive event. The indirect economic effect of the tsunami and COVID-19 epidemic on tourism in Pandeglang is therefore important to be understood so that Pandeglang's tourism hospitality supply chain can prepare and build resilience against it should another disaster occur in the future. Indirect impact is defined as the concurrent or indirect consequences of the direct damage, such as losses of business interruption (Gall et al., 2015). Indirect impact knowledge aims to increase the awareness of stakeholders and their capacity to plan for future events. Hence, this study aims to understand the indirect impacts of Sunda Strait Tsunami and COVID-19 pandemic and how it affects the resilience of tourism hospitality supply chain in Pandeglang.

To answer the study aims, this research uses qualitative research, where the indirect economic impact is seen from the losses in the hotel sector and other businesses that support its services. This research uses a qualitative method to describe the indirect impact of disaster in tourism hospitality supply chain focusing on the losses of economic function, business disruption between tourism business actors, and operational changes so that the Pandeglang tourism hospitality supply chain can prepare for these indirect impacts in order to enhance its resilience. The data collection methods used for this research are done through primary and secondary methods. The primary data collection was conducted through online in-depth interviews with the stakeholders of tourism sector in Pandeglang that are relevant to each of

the components and variables of the tourism hospitality industry supply chain in Pandeglang. Some of the stakeholders interviewed were Government of Tourism Office, and Regional Disaster Management Agency in Pandeglang Regency, Indonesian Hotel and Restaurant Association, Association of The Indonesian Tours and Travel Agencies, Pandeglang Community, and other stakeholders who represent each component. Secondary data collection is done through collection information or stories from popular media, journal articles, papers, as well as the authorities related to disasters, COVID-19 pandemic, and tourism in Pandeglang Regency.

With the background problem and the research methodology that have been explained above, this study provides an orderly explanation that include literature review on the direct and indirect impact of disasters; resilient supply chain in the context of tourism hospitality; indirect impacts of the double disasters (Sunda Strait Tsunami and COVID-19) to the Pandeglang tourism; and ways to enhance the resilient supply chain in hospitality industry in Pandeglang.

Indirect Impact of Disaster

The impact of the disaster can be divided based on the identification of the types of damage. The damages caused by disasters refer to physical destruction, measured by physical indicators, such as the number of deaths and injuries or the number of buildings destroyed. Meanwhile, Indirect Damages, the impact is more on the flow of goods that will not be produced and services that will not be provided after a disaster (Moore & Phillips, 2014). The increased costs lie in providing alternative services (alternative modes of production, distribution, and provision of goods and services). Estimation of indirect losses due to disasters in an attempt to measure and estimate losses that occur in a wider area. It can be assumed that identifying the indirect impact has a higher level of difficulty than measuring the direct impact of a disaster (National Research Council, 1999). The bottom line is the recovery of an area from disaster not only based on the level of damage, but also considering the efficiency and selection of tourism facilities, as well as good marketing to restore tourists' confidence. The indirect impact of a loss of trust will result in a decrease in tourist arrivals and losses due to business, income, and society (Blažin et al., 2014).

While the implications of impacts vary, this chapter focuses on indirect impacts. Within the scope of measurable impacts, the economic impact is related to loss of business functions, decreased income and sales, and business disruption among tourism business actors. Indirect impacts that can be characterized by physical losses can be divided into loss of income and maintenance costs for residents to increased operating costs (McKenzie et al., 2005). On the other hand, there are intangible impacts, these impacts cannot be measured in monetary terms. Assessment of the cost of the intangible effects of natural hazards and the psychological effects on society. These two things greatly affect the productivity of society (Markantonis et al., 2012). Each of these impacts is described below.

- **The Losses of Financial Function.** This variable is explained as induced losses in sales, wages, and/or profits due to loss of function (Council National Research, 1999). The inability to operate may derive from either direct physical damage to commercial structures or from infrastructure failure. Those causes affect supply chain activity in the tourism hospitality industry as the industry have three crucial actors (Distributor, Supplier, and Customer) that is connected to each other (Breiling, 2016). In parallel with Breilings's (2016) study that acknowledged the costumer and the customer as the actors on the global or regional scale, it stated that The decrease of tourism as an

economic sector is affected to decrease in regional income (Carrera et al., 2015). Also, The loss of certain livelihoods following the disaster could change the level of development and capital investment on the island, as well as change structure and composition of economic activity (Benson & Clay, 2003). Tourism sector is prone to disruption as it is highly dependent on the number of tourists. Tourists have direct contact with employees from travel agencies, airlines, hotels, restaurants, shopping centres, and various tourist attractions (UNCTAD, 2020). A downward trend of the number of tourists resulted by disaster will make business in the tourism hospitality industry is expected to have difficulties in paying employees' wages. In the long term, it will result in many tourism-related jobs that are in danger of being lost. This is happened due to the drastic reduction in demand of supplier's products also distributor's services as the tourists positioned as customer in the supply chain (Steiner et al., 2011).

- **Business Disruption Between Tourism Business Actors.** This variable discusses the losses that affect the sustainability of the supply chain. This variable is the impact of the closure of business production (National Research Council, 1999). From this impact, it is necessary that the collaborative relations to be improved between similar tourism business actors in the local level (horizontal) and the collaboration of different types of tourism business actors in the local level (vertical) (Mananda & Dewi, 2019). Horizontal relations are the relations caused by differences in the steps of the production of goods and services, while vertical relations are caused by differences in the types of businesses (goods and services) that are given to customers. Improving these relations is one of the way to examine the sustainability of the relationship between business actors in the tourism supply chain and decreases demand and supply (Breiling, 2016).
- **Operational Changes.** Community employment can change after the impact of a disaster. This behaviour can be affected by damaged business capital or other more promising job opportunities (Sari & Kiswari, 2019). Changes in employment, production, and the low of goods are normal because damage to infrastructure is a direct disaster (Xu & Gursoy, 2015).

The consequences of disasters and the COVID-19 pandemic can cause various losses, both in the economic and demographic fields with a decrease in productivity, health, and the environment. The tourism sector is vulnerable to disaster as the disaster disrupts tourism activities both directly and indirectly. World Economic Forum (2013) recognized that disasters are considerable threat to tourism. Tourism is related to the sense of safety, comfort, and pleasure felt by tourists and even by other tourism actors (such as hotel managers, local crafters, or producers). Consequently, if a disaster occurs, tourists will begin to feel worried and assume that it is not safe to travel to disaster-prone areas. In the long term, a decrease of the number of tourists will generate the derivative impact called indirect damage (Cui et al., 2014). The decreased number of tourists will be resulted in the decreased demand of supplier's products (such as food and beverage (F&B), furniture, and souvenirs) also distributors' services (tourism agencies, hotels, and restaurants). Therefore, a deeper identification is needed in order to reduce the impact of disasters. The Council National Research in 1999 mentioned that the optional methods for indirect measuring effect are carried out by collecting detailed direct and indirect loss data followed by the consistent implementation of programs that support disaster response plans. This data collection also serves as the standard validity of certain policies. Quantifying the indirect losses from a

disaster is highly important so that countries can build preparedness and resilience against future disasters. Countries should prepare for the huge amount each year to cover future losses from disasters, in which expected annual losses in the future are now estimated at US\$314 billion as a result of earthquakes, tsunamis, cyclones, and flooding in the built environment alone. (UNDRR, 2015). Moreover, when the economic resilience is low, evidence at the country level indicates that indirect losses can surpass the direct costs (GFDRR, 2014; UNDRR, 2015). Evidence also suggests that the proportion of indirect impacts increases in larger disasters, and thus may constitute a larger total loss and damage in large disasters than in smaller disasters (Gordon & Richardson, 1995; Toyoda, 1997).

Resilient Supply Chain for Tourism Hospitality

The destructive impact of a disaster can threaten the sustainability of the Tourism Hospitality Supply Chain. Previous indirect damage experiments broadly framed the issue and centred on secondary ripple effects induced by bottlenecks in production (Carrera et al., 2015). The relationship of cooperation between similar tourism business actors needs to be improved and managed better to increase the economic sector (Mananda & Dewi, 2019). Therefore, the tourism sector needs to carry out recovery in order to restore economic, ecological, and social functions related to the sustainability of the tourism supply chain (National Research Council, 1999).

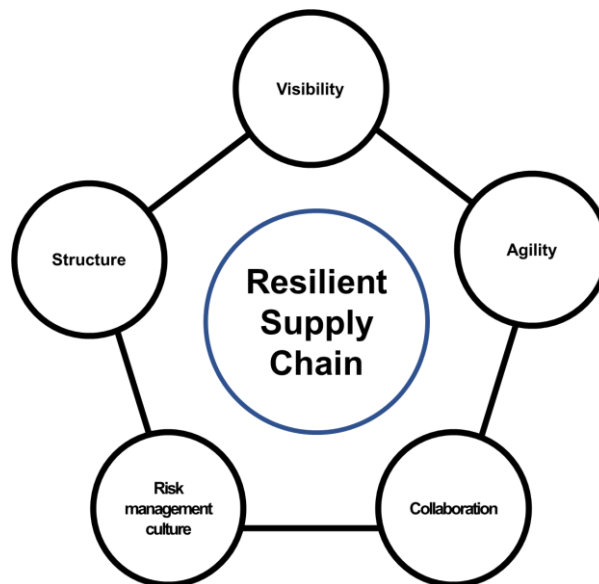
In the long term, post-disaster and disaster recovery will be provided for the restoration of the status quo, which in tourist destinations means returning to normal quickly (de Sausmarez, 2007). The efforts for marketing campaigns by rebuilding the image of the tourism area were an effective effort in building human resources (Puspitasarie et al., 2019). The recovery phase might be focused on the evaluation plan and the physical construction of the infrastructure needed during evacuation activities take place. This is also included in the recovery of the tourism supply chain as an illustration of the cycle of the sustainability of the local economy (Pahleviannur et al., 2020). Identification of the indirect impacts results in recommendations and efforts to reduce future losses (Carrera et al., 2015). Besides that, identifying the indirect impact on the supply chain will increase community awareness, evaluate conditions as consideration for facing economic difficulties, as well as estimate post-disaster tourist trends.

The role of tourism organizations in various places is very important. The tourism community or organization, including hospitality sectors, can find ways to minimize damage and speed recovery from the event (Faulkner, 2001). An established planning collaboration, cooperation between stakeholders, and development can create a resilient system. Each part of the supply chain has a purpose in the supply and demand cycle in the tourism supply chain. This greatly affects the economy in the tourism area. Developing several considerations in the tourism supply chain consisting of the producers, distributors, and customers (Xu & Gursoy, 2015). The first tier is the upstream part which acts as a supplier. This component has a role in providing primary elements, such as Food and Beverage (F&B) manufacturers or suppliers, furniture suppliers, water and energy suppliers, and complementary producers (for example, electronics providers or souvenir craftsmen). In the second tier, there are intermediaries or commonly known as distributors. Distributors consist of tourism services, hotels, and restaurants that distribute goods and services from producers to customers. Finally, the third tier is the main key to the cycle is customers (Kothari et al., 2005). Management that works well between each level of the supply chain makes the flow of the supply chain run well and is expected to save costs and foster customer satisfaction.

The tourism hospitality supply chain is an important cycle resulting from the economic activities of local communities. There was a severe and prolonged decline in economic activity caused by the COVID-19 and Tsunami pandemic in Pandeglang. The economic downturn was experienced by all sectors such as accommodation (hotels and homestays), supply tier, and a significant decline in the number of tourists due to the series of disasters. From this problem, the role of resilience is expected to maintain the sustainability of the hospitality supply chain and reduce losses so that key stakeholders, such as suppliers, distributors, and customers, can overcome the downturn in the economic recession.

Previous research has explained that resilient supply chain is able to provide a better capacity for the supply chain to cope up with disturbances such as disasters and pandemics (Carvalho et al., 2014; Mensah & Merkuryev, 2014; Ponomarov & Holcomb, 2009). There are five determinants to implement a resilient supply chain, namely: (1) A resilient supply chain requires visibility to help recognize changes and pace to react more effectively to changes (Christopher et al., 2004); (2) Agility in the supply chain to quickly adjust supply chain strategies for disturbance (Swafford et al., 2008); (3) Transparent coordination, collaboration and integration from a relational context (Ouabouch, 2015); (4) A resilient supply chain structure requires a balance between resilient and standard productivity measures (Barroso et al., 2015); (5) A well-adapted risk management in supply chain culture (Waters, 2011). All of these resilient supply chain determinants will equip Pandeglans' tourism hospitality supply chain to future risk for its industry.

Figure 2. Resilient Supply Chain Determinants



Source: Adapted from Christopher et al., (2004), Swafford et al., (2008), Ouabouch, (2015), Barroso et al., (2015), and Waters, (2011)

Tourism is a sector that has the highest growth rate and is one of the largest industries in the world (World Tourism Organization (UNWTO), 2009). In the business and industry literature (including the hospitality industry), there are still few efforts before a disaster (preparation and mitigation) (Sydnor-Bouso et al., 2011). This further can have an impact on job discontinuity (ibid), which means that organizations cannot provide services and support for employees after a disaster. which means that organizations cannot provide services and support for employees after a disaster.

Not only causing an impact on job discontinuity, but disasters also cause a long recovery period for tourism destinations. According to Rittichainuwat (2006), Huang & Min (2002), a tourist destination takes more than one year to fully recover from a disaster. As a major component in the tourism supply chain, the hotel industry also needs to increase resilience. Moreover, the hotel vulnerability is very complex; where the factor that affects the risk is usually the motivation of the tourist to visit (Brown et al., 2017). As stated by Mahon et al., (2013), hotels have the responsibility to develop strategies to reduce disaster risk. Furthermore, hotels are also responsible for understanding their own risks and vulnerabilities (Mahon et al., 2013). This capability is related to the ability of a business, in this case the hotel, to be able to continue to operate during and after a disaster. Business continuity is an important foundation for the recovery process, not only for the business itself but also for a wider community (McManus et al., 2008).

Due to supply chain's interconnected structures, any change in tourism demand affects the national economy and results in changes in the level of livelihood and government incomes (Steiner et al., 2011). Hence, government role in strengthen tourism supply chain resilience is expected. Government's part on tourism sector supply chain as policy and regulation maker is carried out during pre-disruption period (Zhang et al., 2009). The government has an important role in drafting regulations regarding provisions that must comply with tourism companies to establish tourism resilience. Meanwhile, the role of the government as a provider of support, collaboration, and assistance for actors in the tourism supply chain was carried out during the post-disruption period. The role of government is crucial to stimulate supply chain's actors to bounce back to their original or desired conditions, even after being disrupted (Filimonau & De Coteau, 2019). In COVID-19 context, government role is emphasized in adaptation strategies and to facilitate recovery in the medium to long-term (OECD, 2020).

Table 1. Government's Impact on the Supply Chain Resilience

Role	Government's Impact on the Supply Chain Resilience	Source	
Policy makers and regulations related to the tourism supply chain	Customer	<ul style="list-style-type: none"> Regulate the tax policy for tourist Regulate the number of tourists who can visit the place Building the tourist's awareness for the potential disaster risk Establish a set of procedures for safe travel 	
	Distributor		<ul style="list-style-type: none"> Provide financial reliefs for distributors, such as restaurants, hotels, etc. Building the business's capacity to adapt and be agile at crisis moment Establish a set of procedures for health screening measures for employees
	Supplier		<ul style="list-style-type: none"> Provide financial reliefs for supplier Regulate the initial price (if needed) Building supplier's capacity to adapt at crisis moment
Providers of support, collaboration, and assistance to actors in the tourism supply chain to get back after disruption	Customer	<ul style="list-style-type: none"> Encourage the tourist's interest after disaster Build the image of the tourist destination, that it is safe to visit Restore tourist's confidence and stimulating tourism demand with new safe and clean labels Lifting travel restrictions with ensuring health needs are already addressed 	

Role	Government's Impact on the Supply Chain Resilience	Source
Distributor	<ul style="list-style-type: none"> Give financial, human development, and morale support for businesses Apply new health protocols for safe travel 	
Supplier	<ul style="list-style-type: none"> Give financial and technical support for the suppliers after disaster Encourage innovation and investment 	

Indirect Impact of Double Disaster in Pandeglang's Tourism Hospitality

In order to quantify the indirect losses of the Sunda Strait tsunami and COVID-19, this research adopts the Support Analysis Framework (SAF) presented by Petrucci (2012) with several relevant modifications. The SAF is a quantifying method in the form of a spreadsheet to appraise the components/indicators of indirect losses of a disaster. By adopting the SAF, this research aims to convert qualitative data of the indirect losses of the Sunda Strait tsunami and COVID-19 into numerical indices (Petrucci, 2012). No on-site surveys were done in formulating the SAF for this analysis because the data regarding the indirect losses of the Sunda Strait tsunami and COVID-19 were obtained by analysing the available qualitative/descriptive data from article journals and newspaper articles since difficulty to gather primary data due to COVID-19.

This analysis focuses on the indirect losses of the Sunda Strait tsunami and COVID-19 in Pandeglang tourism in the economic sector, namely the losses of the economic function. The losses of the economic function (the economic impact) are related to loss of business functions, decreased income and sales, business disruption among tourism business actors, and also operational changes, as has been explained in the literature review. In accordance with this, the authors have conducted interviews with key and relevant stakeholders of the Pandeglang tourism sector, with the total 6 stakeholders which include representative of both distributor and suppliers as following:

Table 2. List of Interviewees

Sector	Institutions
Distributor	Mutiara Carita Hotel
	Indonesia Hotel & Restaurant Association (<i>Perhimpunan Hotel & Restoran Indonesia/PHRI</i>)
	Indonesia Tourist Guide Association (<i>Himpunan Pramuwisata Indonesia/HPI</i>)
Supplier	Association of The Indonesian Tours and Travels Agencies (<i>Asosiasi Perusahaan Perjalanan Wisata/ASITA</i>)
	Generation of Indonesian Charm (<i>Generasi Pesona Indonesia/Genpi</i>)
	Tourism Awareness Group (<i>Kelompok Sadar Wisata</i>)

The interview results show that the losses of the economic function due to the Sunda Strait tsunami and COVID-19 include: (1) Decreased sales, wages, and/or profits from various components of the tourism sector suppliers and distributors in connection with customer sectors; (2) Loss of assets and capital after the impact of the disaster from the components of the distributor and supplier; and (3) Operational losses in the tourism sector. However, the interviewees gave various answers, especially to the second indicator, because it was difficult for them to give the exact numbers of the capital and asset losses that they experienced.

In formulating the SAF for this research, the 3 components/indicators of the indirect losses of the Sunda Strait tsunami and COVID-19 are presented and categorized into different levels based on the available data of each component/indicator (see Table 1).

Table 3. Support Analysis Framework for the Indirect Losses of Sunda Strait tsunami and COVID-19

No	Indicators	Level of Loss		
		L3 (1.00)	L2 (0.5)	L1 (0.25)
A	Losses of Financial Function → Includes induced losses in sales, wages, and/or profits due to loss of function experienced by various component of the tourism sector	Effect on both supplier and distributor components	Effect only on distributor's component	Effect only on supplier's component
B	Business Disruption Between Tourism Business Actors → Loss of assets and capital after the impact of the disaster experienced by suppliers and distributors which causes disruption in the supply chain, especially between suppliers and distributors.	Effect on both supplier and distributor components	Effect only on distributors component	Effect only on supplier component
C	Operational Changes → Operational losses in the tourism sector	Operational inactivity for >5 months	Operational inactivity for 3-4 months	Operational inactivity for 1-2 months

The SAF framework shows the components/indicators of the Sunda Strait tsunami and COVID-19 indirect losses and the scoring/leveling of each component/indicator. Based on the SAF theory the scoring level is differentiated into three levels, called Damage Index. The Damage Index of SAF are 0.25, 0.5, and 1 for Level 1 (L1), Level 2 (L2), and Level 3 (L3), respectively. Therefore, we adopt it as a form of assessment for each level of SAF for this research. The scoring of the indirect losses components/indicators is to show the extent of the economic loss it experienced. Based on that, the higher the scoring level of a component is, the bigger the economic loss it experienced because of the tsunami attack. Level of loss are set according to the actor effected by the indicators.

The indirect impact analysis process includes three indicators, A, B, and C (Table 2). Section A describes actions concerning the losses of financial function, includes induced losses in sales, wages, and/or profits by various component of the tourism sector. In this section, customer plays an important role, in connection with losses in sales and profit. Section B describes the losses that affect the sustainability of the supply chain, especially between suppliers and distributors. Last, section C describes operational changes experienced by distributor and suppliers.

For the first indicator of the indirect impact of the tsunami and COVID-19 in section A (decreased sales wages, and/or profits from various components of the tourism sector suppliers and distributors), in term of sales and profit, representative of Mutiara Carita stated that the hotel experienced a decrease in sales due to the occupancy rate post-tsunami was only 30%. Moreover, the representative of PHRI stated that the decrease in sales, including all the members, was approximately 200 billion rupiahs and the visitor visit for restaurants was decreased by 70%. The representative of ASITA also stated that all of its members experienced a decrease in sales compared to their normal sales before the tsunami hit, and it's getting worst after COVID-19 break in 2020. Meanwhile in wages, both representatives from distributor and supplier stated that due to instability of tourism condition affected by

tsunami and COVID-19, some of workers have experienced pay cuts up to 50%. From this information, it can be understood that both suppliers and distributors in the Pandeglang tourism sector were disadvantaged by the tsunami and COVID-19, thus, the first indicator of the indirect impact is categorized as L3 (effect on both supplier and distributor components).

In giving answer for the second indicator (loss of assets and capital after the impact of the disaster from the components of the distributor and supplier), as mentioned before, the interviewees gave various answers because it was difficult for them at that time to give the exact numbers of the loss of assets and capital that their businesses experienced. Mutiara Carita Hotel representative stated that they suffered approximately IDR 4-7 billion loss due to the loss of assets and capital due to the tsunami attack. The representative of PHRI stated that its members experienced assets loss of approximately 25-30%. ASITA representative also stated that its members experienced assets and capital loss, but it was difficult for them to give the exact numbers. Since both suppliers and distributors were affected, the second indicator of the indirect impact of the tsunami on Pandeglang tourism is also categorized as L3.

For the third indicator (operational losses in the tourism sector), representative of Mutiara Carita Hotel stated that after the tsunami attack, their hotel was closed for four months. The representative of PHRI also stated that the hotels were closed for four months, while the representative of Genpi stated that only hotels located near the beach area (which were hit the most by the tsunami) were closed for seven months. Based on this information, most of the interviewees stated that their businesses were closed for four months, and only the ones located near the beach were closed for seven months. Therefore, the third indicator of the indirect impact of the tsunami on Pandeglang tourism is categorized as L2 (operational inactivity for 3-4 months).

Based on the indicator of SAF analysis Table 2 and data collected from stakeholder interview that has been explained above, the assessment of indirect losses of the Sunda Strait tsunami can be presented as follows (Table 3):

Table 4. The Assessment of Indirect Losses of the Sunda Strait Tsunami and COVID-19 on Pandeglang Tourism

No	Indicators	Assessment of losses
1	Decreased sales, wages, and/or profit from various component of the tourism sector suppliers and distributors	1.00
2	Loss of assets and capital after the impact of the disaster from the components of the distributor and supplier	1.00
3	Operational losses in the tourism sector	0.5

The value of losses obtained from the lines of the SAF are converted into losses indices by means of the simple calculations. There are three section of indirect losses above, so for each section, the Losses of Section can be defined below:

Losses of Section 1 (Ls_1): 1.00

Losses of Section 2 (Ls_2): 1.00

Losses of Section 3 (Ls_3): 0.5

For each section, the maximum value of Ls (Max Ls) is calculated based on the occurrence of losses to all the listed elements that are supposed to suffer the highest level of loss. Next, Ls is normalized to MaxLs to obtain Normalises Losses of Section (NLs), as in equation:

$$NDs = Ls/MaxLs$$

From the equation, the Normalise Losses of each section can be defined as below:

$$NLs_1 = 1.00/1.00 = 1.00$$

$$NLs_2 = 1.00/1.00 = 1.00$$

$$NLs_3 = 0.5/1.00 = 0.5$$

To obtain the Index of Losses of each section (ILs), the value of NLs is classified as follows L3: high losses ($1 < L3 \leq 0.5$); L2: medium losses ($0.5 < L2 \leq 0.25$); or L1: low losses ($L1 < 0.25$).

The Normalised Indirect Losses (N.I.L.) is calculated using equation below, where 3.00 is the maximum indirect losses that SAF can assess. The Index of Indirect Losses (I.I.L.) is obtained by classifying it into one of the three classes listed above (L3, L2, or L1).

$$N.I.L. = \sum LS_{123} / 3.00$$

From that calculation the result of N.I.L is $2.5/3.00 = 0.8$, then by classifying it to the four classes listed above (L3, L2, or L1), the index of indirect losses/losses from Sunda Strait Tsunami is in the third class which is **high losses**.

Based on the calculation above, the index of indirect losses from the Sunda Strait Tsunami and COVID-19 is in the third class which is **high losses**. As has been stated before, the higher the scoring level of a component is, the bigger the economic loss it experienced because of the tsunami attack. In other words, the Sunda Strait Tsunami had caused huge losses on the Pandeglang tourism sector, affected suppliers, distributors, and costumers, also forced the tourism businesses to stop operating for several months. This reality is in line with the explanation in the literature review, that the destructive impact of a disaster can threaten the sustainability of the Tourism Hospitality Supply Chain (Carrera et al., 2015). Therefore, as stated in the literature review (by UNDRR, 2015), building and enhancing the resilience of the supply chain in the tourism sector is highly important to prepare it for future possible disasters. Building resilience, as also has been explained, is expected to maintain the sustainability of the hospitality supply chain so that key stakeholders can overcome the economic losses caused by the disasters.

Enhancing Resilient Supply Chain of Hospitality Industry

Therefore, it is important for the hotel industry in Pandeglang Regency to create a business continuity plan. Business continuity plan can be useful for the hotel itself, and for supporting the hospitality industry, as hotel is categorized as a part of distributor, a center in hospitality industry supply chain which is connected supplier and customer. Paton & Hill (2006) mentioned several wide range functions of business continuity plans; (1) sustainability of management and information systems for businesses to function; (2) management's ability to switch to crisis mode; (3) ensuring operational capacity during emergencies (preparedness plan).

Based on the results aforementioned, the indirect impact of the tsunami and COVID-19 in Pandeglang is classified as high impact since the Sunda Strait Tsunami and COVID-19 pandemic caused huge losses on the Pandeglang tourism sector, affected suppliers, distributors, and customers, also forced the tourism businesses to stop operating for several months. Looking at how both disasters have disrupted the Pandeglang tourism supply chain, this paper outlines some of the interventions that can be carried out to increase the resilience of tourism and hospitality supply chains in Pandeglang, especially against the risk of disasters and the COVID-19 pandemic. The recommended interventions are based on resilient supply chain determinants mentioned in the previous chapter, adjusted with the data that gathered through the interview process with the relevant stakeholders in Pandeglang tourism sector that have been analysed in the previous chapter.

Table 5. The recommended interventions based on resilient supply chain determinants

Visibility	In this case, the all the component of tourism hospitality industry needs to understand and acknowledge the disaster risks also the changes that can occur suddenly and continuously (such as the COVID-19 outbreak situation) and how the potential impact on business is.
Agility	Responsiveness is needed to face disruption of disaster and presistent pandemic situation. Example of responsiveness act by distributors in pandemic situation is to prepare and carry out health protocols to run the business. Meanwhile, for disaster, distributors need to assess the loss and predict the future trend to foresee potential revenue. Suppliers can reasses their potential markets then switch over to online platform to maintain the sales of their products. Both distributors and suppliers can immediatly execute the BCP (business continuity planning) if they have. Agility requires an implementable plan/procedure that considers the safety aspect.
Collaboration	Collaboration means transparent coordination and communication between suppliers, distributors, and customers. Distributors (hotels, restaurants, and travel agencies), as a centre, can play a role in providing information to both suppliers and customers. To suppliers, distributors should identify potential disruptions and develop its coping strategies together to enhance their capacities. To customers, distributors could promote safe travels through social media.
Risk management culture	The hotel industry and its suppliers can adopt a comprehensive supply chain risk management approach that taking into account their suppliers and customers. Like disaster risk management in general, supply chain risk management is carried out in several stages, namely (1) identifying risks and updating them over time—direct and indirect losses from disasters and pandemics, (2) conducting risk analysis to understand the impact of threats on the business by considering partners who have an influence on sales/profits—mapping the specific industry's supply chain, (3) mitigating risk in both preventive and reactive measures. Mitigation actions taken will consider risks based on an understanding of the location of the supplier (and possible back-up

	suppliers) and the probability of the occurrence of threats. Another thing that can be done is to identify sources of assistance and use insurance.
Structure	A resilient supply chain structure requires a balance between resilient and standard productivity measures. A robust supply chain structure requires a balance between durability and standard productivity measures. Therefore, it is important to consider suppliers' and distributors' product durability and productivity standards, especially when the transportation system is disrupted because of disasters or pandemic, especially in developing business continuity planning.

In addition to the general recommendations for the tourism hospitality sector explained above, increasing resilience can also be carried out on a broader scale. We propose several recommendations for the government by combining the general recommendation (Table 3) and recommendations developed by Breiling (2016).

- Government should consider developing risk-related governmental agencies (in this case BPBD and Health Agency) and increase their role as sources of risk information so that experiences in dealing with disasters can be considered in dealing with disasters that may occur in the future. In the case of BPBD and the Health Agency, they can document information and experiences as a form of lessons learned in the process of policy/program formulation. Lesson learned can help to recognize changes and pace to react more effectively to changes and quickly adjust supply chain strategies for disturbance.
- The government should consider disaster risk in tourism planning, which can be done by providing hazard maps for tourism actors. In this case, BPBD Pandeglang Regency can provide a hazard map to the Pandeglang Regency Tourism Agency as well as all relevant actors and recommend efforts that can be made. In addition, it is also important to provide a forum for discussion between stakeholders so that there is better coordination of who is doing what. Transparent coordination, collaboration, and integration also important to involve upstream to downstream actors for the tourism and hospitality industry in Pandeglang Regency. To manage risks to health hazards, it is also important that the Health Agency be involved in this discussion.
- Government should prepare a disaster fund for uninsured risks as a quick response to disaster-affected tourism businesses, whenever possible. When this is not possible, then the approach to promoting disaster insurance to businesses in disaster-prone areas needs to be improved to raise awareness of hoteliers as the main component of the supply chain.
- In preparing sustainable tourism concepts, it is necessary to include indicators of disaster risk mitigation and supply chain management. It will help to planning a well-adapted risk management in supply chain culture to face future risk for its industry.

Conclusion

This chapter has discussed indirect impacts of Sunda Strait Tsunami and COVID-19 pandemic and how it affects the resilience of tourism hospitality supply chain in Indonesia's Pandeglang Regency. Indirect impact is defined as the concurrent or indirect consequences of the direct damage, and in this chapter, the indirect economic impacts are seen from the losses in the hotel sector and other businesses that support its services. This chapter identified 3 indirect economic impacts caused by the 2018 tsunami and COVID-19 in Pandeglang's hospitality tourism sector, namely the losses of economic function, business disruption between tourism business actors, and operational changes.

This research adopts the Support Analysis Framework (SAF) to quantify the indirect losses of the Sunda Strait tsunami and COVID-19. Based on the SAF and calculation that have been presented, the index of indirect losses from Sunda Strait Tsunami and COVID-19 is in the third class which is high losses, meaning that they had caused huge losses on the Pandeglang tourism sector, affected suppliers distributors, and customers, also forced the tourism businesses to stop operating for several months. These findings are in line with what has been explained in the literature review, that as the indirect impact of a disaster, the economic impact of is related to loss of business functions, decreased income and sales, and business disruption among tourism business actors. It is also in line with the literature review that stated the decreased number of tourists post-disasters resulted in the decreased demand of supplier's products and distributors' services, showing how a disaster can disrupt the whole of tourism hospitality chain. Therefore, understanding indirect impact of a disaster is crucial in order to reduce the impact of disasters.

In this context, disruption in tourism hospitality supply chains poses more threats than ever. Hence, one of the strategies that can be carried out is building and strengthening the tourism hospitality industry resilient supply chain management. Therefore, this paper presents some of the interventions that can be carried out to increase the resilience of tourism and hospitality supply chains in Pandeglang based on resilient supply chain determinants. The interventions are assessing the visibility of upcoming disasters; strengthening agility against disasters, establishing transparent coordination and communication between all relevant stakeholders; implementing risk management culture; and building a resilient supply chain structure by ensuring the balance between resilient and standard productivity measures. This paper has also presented measures that can be taken to increase resilience on a broader scale, by emphasizing the expected roles of the government in the process of building resilience for the tourism hospitality sector.

Limitation

Due to the difficulty to gather primary data due to COVID-19, the data obtained by conducting interview with several key stakeholders and analysing the available qualitative/descriptive data from article journals and newspaper articles. The interview conducted in this research did not, for the most part, yield statistically significant result. Rather, the interview led the team to get a sample of diverse key stakeholders from which to draw conclusion. This research also limited by the case study disaster and location, which tsunami and COVID-19 occurred in Pandeglang. Furthermore, as we modified the framework based on the data available, it may be differing when applied to the other assessment for indirect impact of disaster.

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