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**Effects of Business Continuity Planning on
Reducing Economic Loss due to Natural
Disasters**

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Abstract: *The Association of Southeast Asian Nations (ASEAN) economy has developed rapidly since the 1980s, centred on the automobile industry, and has been connected to economic regions around the world, including Japan, through supply chains. However, the ASEAN region is one where natural disasters frequently occur, and a region damaged by a disaster will have an impact on the region's economy, and the region's supply chain will have a major impact on the world. Protecting the fast-growing and supply chain-connected ASEAN region from frequent natural disasters and reducing economic damage are important to Japan and the rest of the world. In 2015, the 3rd United Nations World Conference on Disaster Risk Reduction adopted the Sendai Framework, which focused on economic loss. To reduce economic loss caused by natural disasters, companies' capability to continue doing business must be strengthened. Japan's government has promoted business continuity planning to minimise economic loss. This paper examines the policy, reviews several devastating disaster case studies, and recommends policies for utilising the policy to reduce economic loss in the ASEAN region.*

Keywords: BCP, business continuity plan, supply chain, Great East Japan earthquake, Thailand flood

JEL Classification: D8, F1, F2, F6, H12, L1, L62

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1. Introduction

Natural disasters continue to cause significant loss of life in the Association of Southeast Asian Nations (ASEAN) region and East Asia, and trends suggest that direct physical losses are growing faster than regional expansion in gross domestic product (GDP) terms (ADB, 2013). Each physical loss has indirect impacts and secondary consequences. These impacts have taken many forms, including reduced output, disruptions to supply chains, and widening income inequalities. In absolute terms, disaster impacts are concentrated in larger, higher-income areas and hazard-exposed countries, where a greater concentration of economic assets and locations are exposed to hazards. However, higher incomes and better-quality institutions tend to reduce vulnerability (Fankhuser and McDermott, 2014), with benefits of higher incomes particularly pronounced in reduced mortality (Kahn, 2005). Whilst advanced countries such as Japan and developing countries in ASEAN are exposed to various types of disasters, the consequences – in terms of economic impact – tend to be much more severe in developing countries because of their lack of capacity and integrated policy frameworks.

A disaster occurs when a hazard interacts with an exposed and vulnerable asset – such as property and infrastructure, as well as people – the impacts of which can be direct and indirect. Direct impacts include damage to fixed assets and capital, including inventories, lost raw materials, crops, and natural resources. Indirect impacts are lost economic activity, particularly production of new goods and services that cannot take place following a natural disaster. Losses can be short term (from a few months to several years) and the long term, until reconstruction and recovery are complete.

In addition to direct and indirect damages, the resultant supply chain disruptions propagate across countries if they are integrated along the component trade. This situation is the most serious threat to business continuity in Japan and ASEAN countries in several decades. If private companies and policymakers do not learn from disasters and take mitigating measures, including business continuity plans (BCPs), uncertainties and risks along the supply chain cannot be cleared (Maruya, 2013).

Many ASEAN developing countries, however, increasingly appreciate the need to revise disaster legislation to reflect the broad shift from an essentially ex-post (reactive) approach to disaster risk management to a more comprehensive approach, with much

greater emphasis on ex-ante (anticipatory) risk reduction in the context of business continuing planning. Similarly, awareness is growing of the need to link disaster risk management and BCPs with climate change adaptation legislation (Petz, 2014; Lassa and Sembiring, 2017). Normally, a natural disaster may have an impact on companies and their supply chains because they lack information-sharing capacity and flexibility in policy design or adaptive capacity (Anbumozhi et al., 2019; Carvalho et al., 2012). Arising from internal business ecosystems and policy environments, these drawbacks are even more impactful when analysed from the perspective of Asian production networks (Anbumozhi and Kimura, 2000).

Disasters and their impact on company economic performance have been vividly demonstrated in Japan, where traditional disaster management strategies need to include BCPs. Researchers and practitioners are increasingly exploring how companies can overcome impacts arising from sudden natural disasters by means of BCPs and best policy practices. Although some researchers (Sawada, 2017; Kashiwagi et al., 2018; Haraguchi and Lall, 2014) have suggested better ways to understand policy factors, scant attention has been paid to investigating BCPs oriented to strengthening resilience along interconnected economies. Intra- and intersectoral disaster management policies, in particular, are responsible for national disaster risk management and raise the question of appropriate national integrated policy frameworks (Subbiah et al., 2009). To bridge this knowledge gap, this paper seeks to understand the role of BCPs in identifying and managing disaster risk management policies by applying systematic analysis and reviewing BCPs and disaster risk management policies. The study

- (i) briefly puts in context two main topics: policy frameworks for reducing economic losses within a country and across borders, and BCPs;
- (ii) introduces a situation in which a BCP dissemination policy was necessary to reduce economic damage in Japan and summarises methods for promoting BCPs;
- (iii) examines the current situation, in which Japanese companies, mainly in the automobile industry, are connected with supply chains and heavily dependent on the ASEAN region;
- (iv) introduces a BCP formulation study conducted by Asia-Pacific Economic Cooperation (APEC) in the ASEAN region;

- (v) examines the role of private companies and the effects of BCPs in the aftermath of two major disasters – the floods in Thailand and the Great East Japan earthquake, both in 2011;
- (vi) critically analyses how findings in the context of Japan and APEC can be applied to ASEAN; and
- (vii) draws conclusions and proposes an integrated and effective BCP approach.

2. Managing Disaster Risk and Strengthening Resilience

2.1. Disaster Risk Reduction Strategy of the United Nations

The number of natural disasters increased by about 2.5 times from 1980 to 2010, causing serious damage. Developing countries suffered most because, as industry developed, workers migrated from rural to densely populated lowland urban areas downstream of rivers, and river flood control measures and infrastructure development could not catch up with rapid population growth. The United Nations (UN) designated the 1990s the International Decade for Natural Disaster Reduction (IDNDR) and started discussing how to realise a framework for disaster prevention and mitigation. In 1994, the 1st UN World Conference on Disaster Risk Reduction was held in Yokohama, Japan, and adopted the Yokohama Strategy to prevent and mitigate disasters. The strategy proposed establishing the Asian Disaster Reduction Center (ADRC) and the UN International Disaster Reduction Strategy (UNISDR) (UN, 2011).

The 2nd UN World Conference on Disaster Reduction, held in Kobe, Japan in 2005, adopted the Hyogo Framework for Action, and set three strategic goals:

- (i) Integrate disaster risk considerations more effectively into sustainable development policies, planning, and programming at all levels, emphasising disaster prevention, mitigation, preparedness, and vulnerability reduction.
- (ii) Develop and strengthen institutions, mechanisms, and capacities at all levels, particularly in communities, to systematically build resilience to hazards.
- (iii) Systematically incorporate risk reduction approaches into the design and implementation of emergency preparedness, response, and recovery programmes in the reconstruction of affected communities.

The UN built a framework to incorporate the goals into discussions and encourage governments to achieve the goals. The UNISDR managed the progress of the implementation of emergency preparedness, response, and recovery programmes. On 1 May 2019, the UNISDR was renamed the United Nations Office for Disaster Risk Reduction (UNDRR).

The new agency was the first UN organisation to play a central role in managing disasters, defined as ‘A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources’ (UN, 2004: 17).

Community-based disaster risk management has since become mainstream, raising regional disaster prevention capabilities. Community disaster prevention is a method of educating residents to become physically and mentally prepared for crises. Activities vary greatly, depending on civil society’s maturity and residents’ cohesiveness, but they all aim to raise awareness of disaster prevention.

With innovations in natural disaster prediction and forecasting technology, improvements in early warning systems and communication technology, laws related to disaster countermeasures such as building codes, improvement of public awareness, promotion of urban development, and increased community disaster prevention activities, deaths from natural disasters since 2000 have been decreasing, not only in developed countries but also in developing ones.

What has become a problem in developed countries in recent years, however, is the increasing level of economic damage and loss caused by natural disasters. The reason is the high exposure due to concentration of personal assets and housing and of facilities such as buildings and factories in coastal areas, and industrial clusters, high value-added assets, and industrial parks established as a result of rapid urbanisation and industrialisation. Interest is rising worldwide in reducing economic damage by strengthening society and companies against disasters.

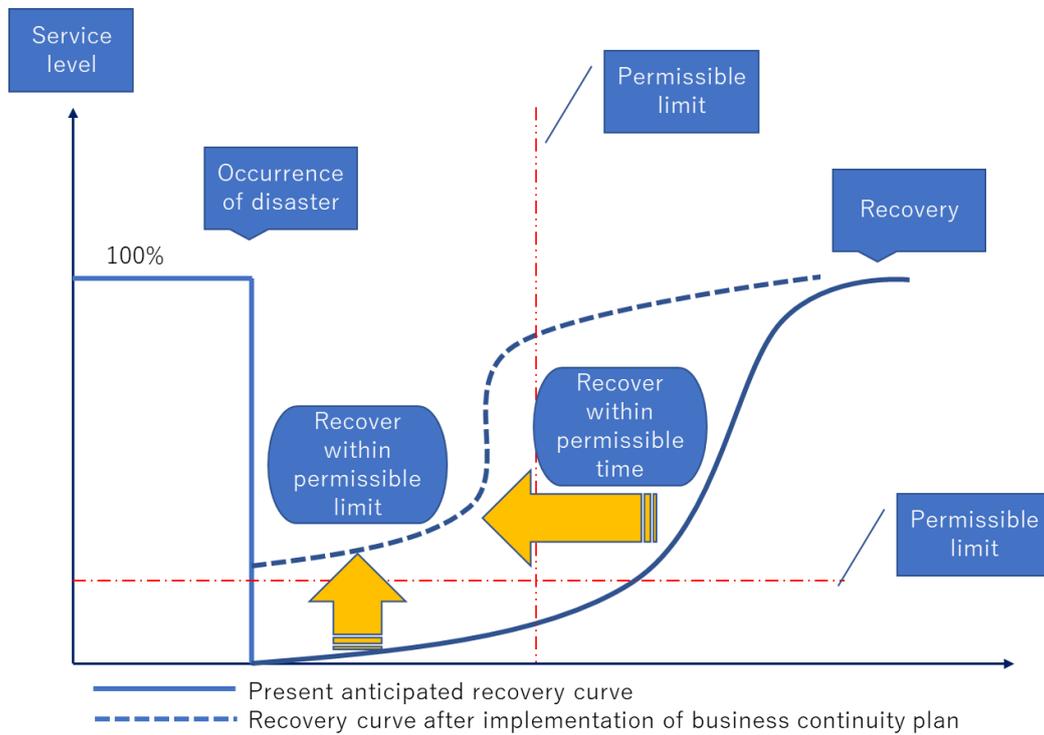
In March 2015, the 3rd United Nations World Conference on Disaster Risk Reduction, held in Sendai, Japan, adopted the Hyogo Framework for Action follow-up and the Sendai Framework, which focused more on economic loss.

2.2. Methods of Mitigating Economic Loss from Natural Disasters

To mitigate the economic damage caused by natural disasters, companies' economic activities must not stop, but if they do, the financial impact must be minimised. Business continuity is the capability of an organisation to continue delivering products and services within acceptable timeframes at predefined capability during a disruption. A BCP is documented information that guides an organisation in responding to a disruption and in resuming, recovering, and restoring the delivery of products and services consistent with its business continuity objectives (ISO 22301, 2019).

A BCP identifies the critical operational functions of an organisation and the potential impacts of a threat. Figure 1 shows the concept of business continuity and the recovery curve of an organisation's level of service before, during, and after a disaster. Developing a BCP helps an organisation identify what preparations must be made before a disaster strikes to secure its employees, assets, information communication technology systems, and information, as well as its reputation. A BCP specifies effective ways of responding and quick recovery measures so that business can continue to operate at acceptable levels and avoid disruptions for a specified period (Figure 1).

Figure 1: Concept of Business Continuity



Source: T. Ono (2020).

ASEAN has a population of over 600 million and the third-largest labour force in the world and, by 2050, ASEAN is expected to be the fourth-largest economy in the world (ASEAN, 2010; ASEAN, 2016). However, Asia is vulnerable to natural disasters (Asian Disaster Reduction Center, 2018): about 40% of them and about 60% of deaths occur in the region. Asia accounts for about 50% of the world's losses resulting from natural disasters. ASEAN must reduce the economic losses resulting from natural disasters and meet the Sendai Framework for Disaster Risk Reduction target by 2030. Japan's manufacturing industry expanded into ASEAN in the mid-1980s, and many manufacturers, particularly Japanese companies, are concentrated in industrial clusters. In 1990–2010, Japan's and ASEAN's exports and imports expanded by 5–10 times (Ministry of Economy, Trade and Industry, Japan, 2014). ASEAN has become extremely important for Japan's economy. Japan has experienced catastrophes and developed policies to reduce economic damage by disseminating BCPs to private companies. The following section analyses the possibility of deploying a similar approach and method in ASEAN and recommends policies.

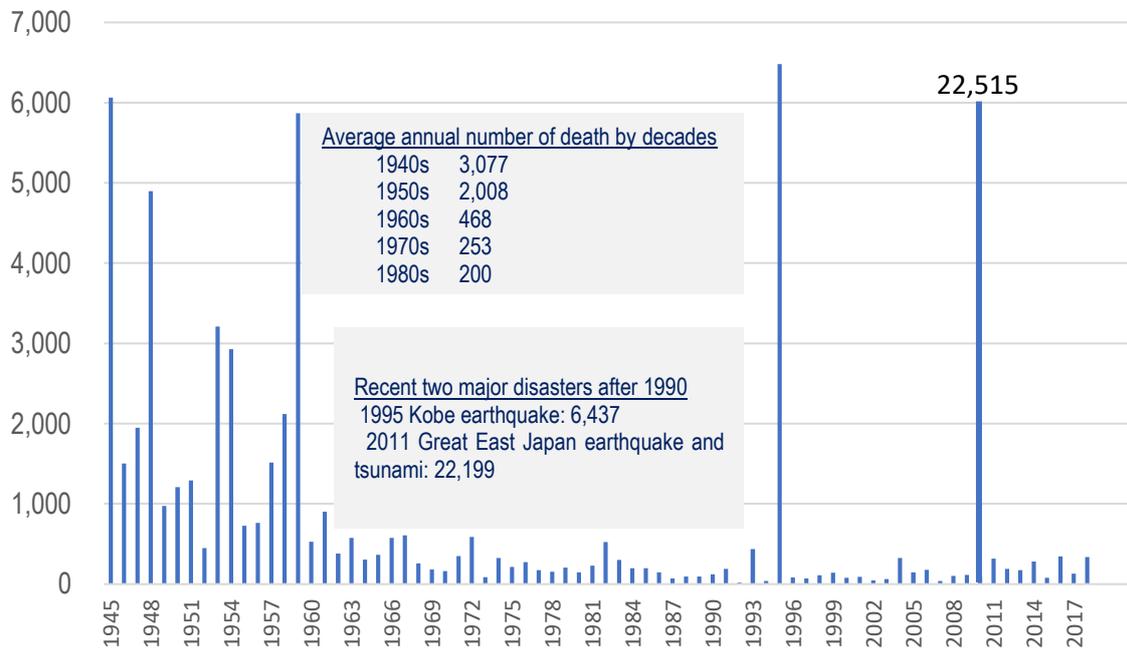
3. Policy Framework in Japan for Reducing Economic Loss from Natural Disasters

3.1. History of Disasters in Japan

Japan is in the Pacific Ring of Fire, where earthquakes and volcanic eruptions occur frequently. About 80% of the world's largest earthquakes occur along this area, and Japan has experienced several. Japan's many tectonic plates move slightly every year, accumulating stress that will cause tsunamis when the energy is released. Because of its geographical, topographical, and meteorological conditions, Japan is subject to frequent natural hazards such as typhoons, torrential rains, and heavy snowfall.

Every year a great number of people lose their lives and property because of natural disasters. Until the mid-1950s, numerous large typhoons and earthquakes caused extensive damage and thousands of casualties (Figure 2). However, Japan's capability to mitigate disasters has progressed. The country has developed disaster management systems, promoted national land conservation, improved weather-forecasting technologies, and upgraded disaster information communication systems. As a result, the number of deaths caused by natural disasters declined from the 1940s to the 1980s (Figure 2).

Figure 2: Number of Deaths from Natural Disasters



Source: Cabinet Office (2018).

Despite such efforts, however, more than 6,400 people died in 1995 in the Great Hanshin–Awaji earthquake or the Kobe earthquake. In 2011, the Great East Japan earthquake and tsunami killed more than 20,000 people. The probability of large earthquakes occurring in the coming decades is high.

Japan’s disaster management framework has been developed and strengthened based on experiences of large-scale disasters. The government started to strengthen the comprehensive disaster management framework after the Ise Bay typhoon in 1959, which killed over 5,000 people (Cabinet Office, 2018). In response, the government passed the Disaster Countermeasures Basic Act in 1961, which provides a comprehensive and strategic disaster management framework. Laws and systems have been revised based on lessons learned from large-scale disasters. For example, the government established earthquake insurance after the 1964 Niigata earthquake, revised disaster relief funding schemes after heavy rains in 1967, and amended the Building Standards Act in the aftermath of the 1978 Miyagi earthquake.

The disaster management framework covers prevention, mitigation and preparedness, emergency response, and recovery and rehabilitation. The national and local governments have clear roles and responsibilities, and public and private sector stakeholders collaborate on implementing various disaster countermeasures.

The Disaster Countermeasures Basic Act established the Central Disaster Management Council in the Cabinet Office. The council consists of all ministers, critical infrastructures, and experts and is chaired by the Prime Minister.

3.2. Policy Framework for Reducing Economic Loss Caused by Natural Disasters

In the next few decades, a large earthquake could strike several areas in Japan, including Tokyo. In 2005, the Central Disaster Management Council estimated the damage to the Tokyo metropolitan area in the event of a magnitude 7.3 earthquake with its epicentre in northern Tokyo Bay: one scenario assumes about 11,000 deaths, the total collapse of 850,000 buildings, and a maximum economic loss of JPY112 trillion (Cabinet Office, 2005). The council established the Strategy for Tokyo Inland Earthquakes (Central Disaster Management Council, 2005) to ensure the continuity of functions in the capital, and to establish countermeasures to reduce the death toll by 50% and economic losses by 40%. The council set strategic goals, including increasing earthquake-proof houses and buildings to 90% and fixed furniture to 60%.

The strategy promotes business continuity planning for the private sector. Companies must secure the safety of their customers and employees and continue their business activities to mitigate social and economic difficulties. The Cabinet Office started promoting the improvement of private sector disaster reduction activities. Some types of companies such as business-to-business are not seen by the public, but all businesses, regardless of type, support the local economy by creating jobs, paying local taxes, and ensuring stability. Companies are important not only in times of normalcy but also in emergency situations requiring response and recovery, such as delivery of food and gasoline, road repair, amongst others.

In 2005, the Cabinet Office published business continuity guidelines. After learning lessons from the Great East Japan earthquake and the 2009 swine flu pandemic, it revised and published business continuity guidelines, version 3, in 2013.

The government set a target (Central Disaster Management Council, 2005) of convincing all large companies and 50% of medium-sized companies to develop BCPs. In 2006, the Small and Medium Enterprise Agency published the BCP guidelines for small and medium-sized enterprises (SMEs).

Since then, industrial associations, chambers of commerce, and local governments have published guidelines, toolkits, and case studies, and the concept of BCP has become widespread amongst private companies.

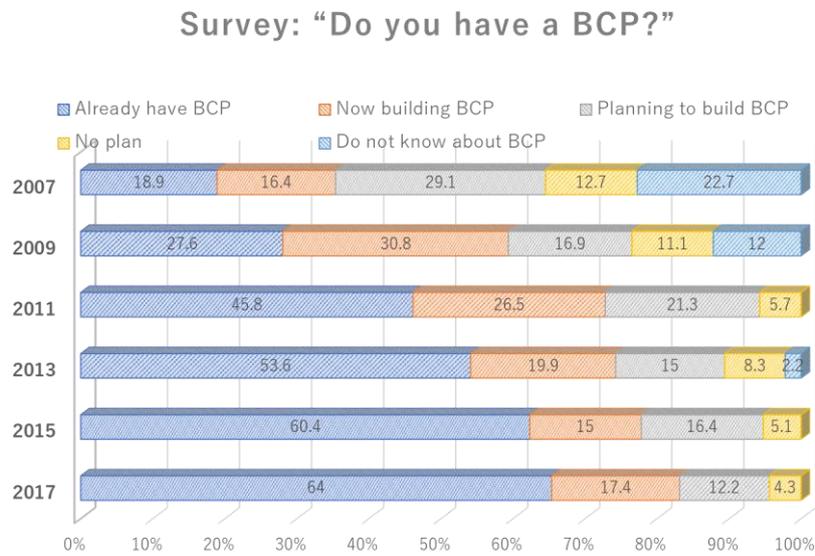
In this way, the central government has played a critical role in encouraging the development and implementation of BCPs.

BCPs have become well-known but also cause confusion. Since the aim and content of each guideline differs, companies need to decide which guidelines to use after verifying the purpose of business continuity and comparing the characteristics of each guideline.

3.3. Promoting Business Community Planning in Japan

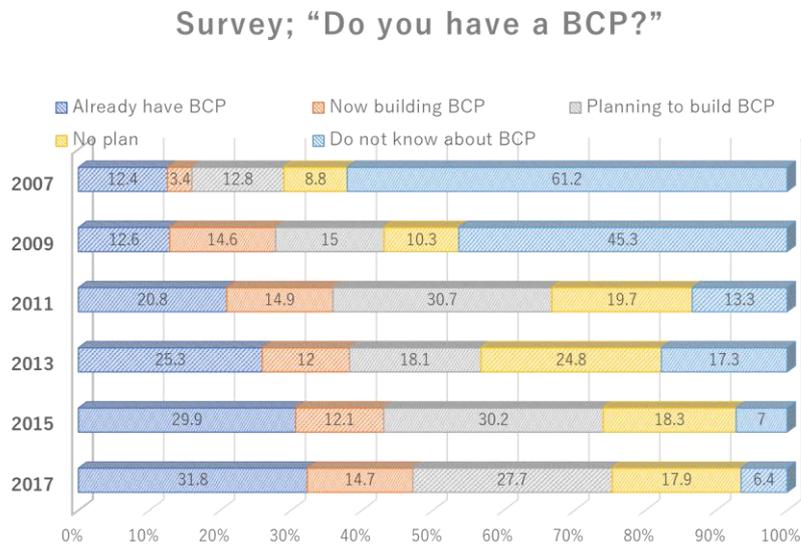
Since the government wants all large and 50% of medium-sized companies to develop their own BCPs, the Cabinet Office has conducted an industry survey once every 2 years since 2007 to ascertain the situation of business continuity planning and promotion. For the 2017 survey, the government distributed the questionnaire to about 5,000 companies; almost 2,000 companies responded. Of respondent large companies, 64.0% claimed they had written BCPs and 17.4% said their BCPs were being drafted (Figure 3). Of respondent medium-sized companies, 31.8% claimed they had written BCPs and 14.7% said their BCPs were being drafted (Figure 4). Clearly, companies with BCPs and those planning to have them have been increasing since 2007.

Figure 3: Status of Business Continuity Plans amongst Large Companies



BCP = business continuity plan.
Source: Cabinet Office (2018).

Figure 4: Status of Business Continuity Plans amongst Medium-sized Companies



BCP = business continuity plan.
Source: Cabinet Office (2018).

The concept of the BCP has spread, but whether a BCP will be properly activated when a disaster occurs has yet to be verified.

4. Japanese Manufacturing Industries Connected to the ASEAN Economy by Supply Chains

4.1. Trade Dependency between Japan and ASEAN

Japan's exports to and imports from European Union (EU) and North American Free Trade Agreement (NAFTA) countries about doubled from 1990 to 2018. However, imports from and exports to Asian countries, such as China, and the ASEAN region expanded by 5–10 times (Tables 1 and 2) (Ministry of Economy, Trade and Industry, Japan, 2012).

Table 1: Trading Amount and Ratio of Intermediate Goods, 1990 (US\$ billion)

Exports from Imports to	Japan	ASEAN	China	EU	NAFTA
Japan	-	29.3 (50%)	14.0 (30%)	38.1 (40%)	62.4 (40%)
ASEAN	36.8 (60%)	-	8.0 (50%)	24.9 (50%)	24.4 (50%)
China	23.5 (50%)	9.8 (50%)	-	20.7 (40%)	17.9 (40%)
EU	67.4 (30%)	23.4 (30%)	24.4 (30%)	-	125.1 (40%)
NAFTA	101.5 (30%)	29.6 (30%)	28.3 (30%)	119.1 (40%)	-

ASEAN = Association of Southeast Asian Nations, EU = European Union, NAFTA = North American Free Trade Agreement.

Source: The Research Institute of Economy, Trade and Industry – Trade Industry Database (2018) .

Table 2: Trading Amount and Ratio of Intermediate Goods, 2018 (US\$ billion)

Export from Import to	Japan	ASEAN	China	EU	NAFTA
Japan	-	102.8 (50%)	157.8 (38%)	85.3 (38%)	95.3 (45%)
ASEAN	97.8 (74%)	-	196.4 (61%)	111.2 (56%)	97.7 (65%)
China	165.4 (65%)	221.7 (66%)	-	264.9 (45%)	189.3 (48%)
EU	96.5 (50%)	174.9 (40%)	464.1 (35%)	-	393.7 (51%)
NAFTA	166.4 (46%)	213.2 (40%)	636.8 (34%)	559.2 (49%)	-

ASEAN = Association of Southeast Asian Nations, EU = European Union, NAFTA = North American Free Trade Agreement.

Source: The Research Institute of Economy, Trade and Industry – Trade Industry Database (2018).

Regarding the types of cargo traded, ASEAN countries and China have a high share of final goods (such as finished goods) in their exports to Japan and Western countries, but with regard to exports from Japan and Western countries to ASEAN countries, the ratio of intermediate goods (such as parts) is high.

Within the ASEAN region, intermediate goods comprise the main type of trade. The reason is that Japan exports intermediate goods (mainly parts) to other Asian countries, assembles them into finished products where labour and transport costs are relatively low, and exports them to final consumption areas such as Europe, the United States (US), and Japan.

The division of production is progressing within the ASEAN region, and because of the dispersion of production bases across borders, an interregional manufacturing structure has been developed. This means that intermediate goods continue to add value within the ASEAN countries until they become finished products.

The changes in the amount of trade in parts of the ASEAN region from 2000 to 2012 show that Singapore and Malaysia were at almost the same level based on actual value, but mutual export and import values expanded by several tens of times in Thailand, Indonesia, Malaysia, Viet Nam, the Philippines, and Cambodia. Industrial accumulation in the region centring on intermediate goods has progressed and a mutually dependent relationship amongst ASEAN countries has been established (Tables 3 and 4) (Ministry of Economy, Trade and Industry, Japan, 2014).

Table 3: Auto Parts Trading in ASEAN, 2000 (US\$ million)

	Indonesia	Cambodia	Singapore	Thailand	Philippines	Viet Nam	Malaysia
Indonesia	-	no data	346	135	34	3	89
Cambodia	no data	-	3	5	no data	no data	1
Singapore	1,809	no data	-	2,637	2,685	19	11,678
Thailand	195	no data	1,382	-	875	206	1,498
Philippines	50	no data	995	391	-	2	513
Viet Nam	10	1	216	36	6	-	31
Malaysia	667	no data	5,718	1,386	1,775	68	-

ASEAN = Association of Southeast Asian Nations.

Source: The Research Institute of Economy, Trade and Industry- Trade Industry Database (2018).

Table 4: Auto Parts Trading in ASEAN, 2012 (US\$ million)

	Indonesia	Cambodia	Singapore	Thailand	Philippines	Viet Nam	Malaysia
Indonesia	-	non	2,920	2,572	221	100	690
Cambodia	1	-	7	8	1	8	8
Singapore	2,885	3	-	2,232	5,006	223	13,074
Thailand	1,066	25	1,647	-	1,322	376	3,274
Philippines	253	no data	2,008	858	-	131	771
Viet Nam	213	1	991	1,005	406	-	442
Malaysia	619	no data	6,724	3,384	819	1,154	-

ASEAN = Association of Southeast Asian Nations.

Source: The Research Institute of Economy, Trade and Industry- Trade Industry Database (2018).

The division of production in Asia was largely related to the aggressive overseas expansion of Japan's manufacturing facilities to Asia after the 1985 Plaza Accord and the establishment of local subsidiaries. The percentage of Asian subsidiaries is rising every year and is close to 80% of the worldwide total. Manufacturing companies often set up affiliated companies responsible for sales and procurement to build a local network with a group companies of the same capital relationship.

In the ASEAN region, the automobile industry procures about 30% of parts from Japan, mostly from parent companies. Local procurement, however, sits at about 60%. About 30% of local procurement is from local Japanese companies and about 70% from local companies.

In this way, Japan's manufacturing industry has contributed to the rapid growth of ASEAN industries while remaining deeply dependent on the ASEAN region.

Japan's manufacturing industry has expanded its supply chain in Asia and built industrial agglomerations, thereby greatly supporting Asian industry whilst securing its own profits and achieving growth. Japan is highly dependent on each country in the ASEAN region through supply chains.

4.2. Natural Disasters and Business Continuity Planning in Asia

About 40% of natural disasters (Asian Disaster Reduction Center, 2018) and about 60% of resulting deaths occur in Asia. The number of victims in Asia is overwhelmingly large, accounting for nearly 90% of the total. Asia's GDP is about 30% of the world's GDP, but economic loss due to disasters is about 45% of the world's losses, and Asia is

more vulnerable to economic damage than other regions.

After the 2011 flood in Thailand, automobile-related companies around the world that had business with the damaged factories in Thailand were forced to stop production because parts supply was suspended. The lesson is that, to minimise the impact of disasters in and outside the region, business continuity planning of each organisation connected with supply and value chains must be understood, and the organisation must cooperate to improve companies' disaster risk reduction capabilities.

The APEC Emergency Preparedness Working Group (EPWG) conducted a survey in 2011 on the formulation and recognition of BCPs for private companies in the APEC region (APEC, 2011). The EPWG approached private companies through the chamber of commerce and industry of each economy and industry group, with the cooperation of the APEC Business Advisory Committee.

The survey received a total of 272 responses from 18 economies. Regarding what risk or risk experience was felt as a threat, the largest number of companies answered that it was an earthquake, especially in Indonesia, Japan, Peru, Philippines, Taiwan, and Thailand. The answers show that the risks that were felt as threats differed depending on the economy. For example, Singapore companies considered a pandemic as the greatest threat, whilst companies in Brunei, Malaysia, Mexico, Thailand, and the US considered floods as the most threatening (Table 5).

Table 5: Risk Experiences Felt as a Potential Threat

Number of Responses	R e s p o n d e n t s	Threat													
		E a r t h q u a k e	F i r e	B l a c k o u t	F l o o d	T e r r o r i s m	P a n d e m i c	T s u n a m i	T y p h o o n	N a c c l i d e a e r t	V e r o l u c p t a t i o n	D r o u g h t	L i n f e c t a t i o n	S n o w	W i l d f i r e
Responses	<u>272</u>	<u>174</u>	<u>157</u>	<u>138</u>	<u>129</u>	<u>126</u>	<u>115</u>	<u>93</u>	<u>79</u>	<u>59</u>	<u>49</u>	<u>30</u>	<u>23</u>	<u>22</u>	<u>18</u>
Philippines	<u>40</u>	32	25	28	30	19	17	7	21	3	14	9	7	-	3
Japan	<u>40</u>	37	25	35	17	23	30	29	19	20	10	3	1	5	3
Thailand	<u>35</u>	13	9	10	18	14	5	10	7	8	4	6	3	2	3
Singapore	<u>33</u>	10	24	21	11	19	26	5	4	6	3	1	2	1	1
Peru	<u>27</u>	24	13	3	7	15	3	15	-	2	-	3	4	-	-
Indonesia	<u>16</u>	13	8	6	12	11	8	10	2	1	11	2	2	-	2
Republic of Korea	<u>16</u>	7	12	6	4	2	2	2	5	4	1	-	-	2	-
Taiwan	<u>15</u>	13	9	7	5	4	5	2	4	6	-	1	-	1	1
Russia	<u>12</u>	3	9	6	2	5	1	-	2	2	-	2	1	4	2
United States	<u>10</u>	6	6	4	8	7	7	4	7	4	2	1	1	6	1
Viet Nam	<u>8</u>	5	4	3	4	3	1	3	2	2	2	-	-	-	2
Malaysia	<u>7</u>	2	3	3	4	1	1	1	-	-	-	-	-	-	-
New Zealand	<u>5</u>	5	5	1	1	1	4	3	4	-	2	-	1	-	-
Brunei Darussalam	<u>2</u>	1	1	1	2	-	1	-	-	-	-	1	1	-	-
Hong Kong, China	<u>2</u>	2	1	1	1	-	1	2	2	1	-	-	-	1	-
Mexico	<u>2</u>	1	2	2	2	1	1	-	-	-	-	-	-	-	-
Australia	<u>1</u>	-	1	1	1	1	1	-	-	-	-	1	-	-	-
China	<u>1</u>	-	-	-	-	-	1	-	-	-	-	-	-	-	-

Source: APEC (2011).

Since they assume specific natural disasters, BCPs vary because different countries face different natural disasters.

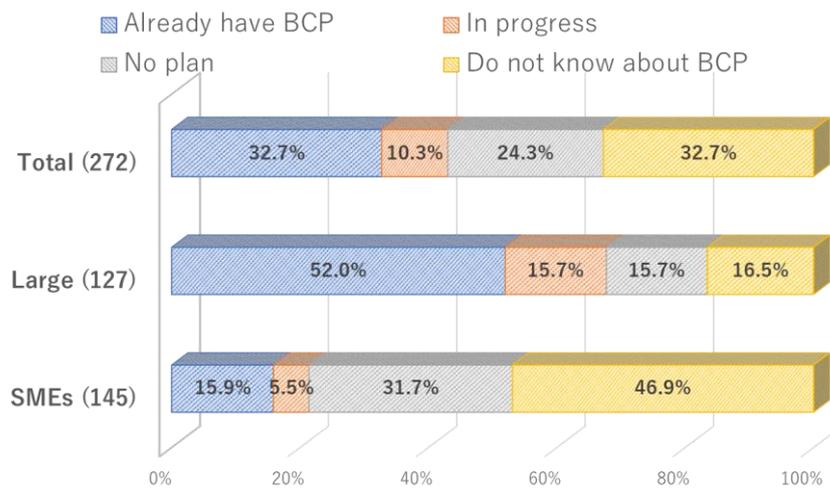
Regarding the status of BCP development, 32.7% of companies answered that they had a BCP, whilst 32.7% did not know about BCPs (Figure 5).

There was a big difference in the development rate depending on whether SMEs and large companies were listed or unlisted, and whether they had experienced a disaster. BCP

development status varied greatly depending on company size: 15.9% of SMEs had developed a BCP, 52.0% of large companies said they had a BCP, 43.5% of listed companies had a BCP, whilst only 24.8% of unlisted companies had a BCP. Disaster-related experiences made a difference: about half of the companies that had suffered from a disaster responded that they had a BCP, whilst only about a quarter that had not suffered from a disaster had a BCP. It is notable that awareness of BCPs amongst SMEs was significantly lower that 46.9% answered they did not know about BCPs.

Figure 5: Business Continuity Plan Building Status

Survey: “Do you have a BCP?”



BCP = business continuity plan, SMEs = small and medium-sized enterprises.
Source: APEC (2011).

The APEC survey is sufficiently informative because ASEAN and APEC members overlap. The survey results show that the rates of BCP concept penetration and development in ASEAN are still low. It is necessary to support BCP development, especially for vulnerable SMEs.

5. Effective Business Continuity Planning Using Lessons Learnt

5.1. Public–Private Partnership: Great East Japan Earthquake

On 11 March 2011, at 14:46 JST (5:46 GMT), a 9.0 magnitude earthquake occurred off the coast of north-eastern Japan. Its epicentre was about 70 kilometres (km) east of the Pacific coast of Tohoku, and the hypocentre was about 32 km below ground. Multiple epicentres were linked, resulting in a source area 400 km long and 200 km wide.

It was the most powerful known earthquake ever to have hit Japan, and the fourth most powerful earthquake in the world since modern record-keeping began in 1900. The earthquake triggered powerful tsunami waves, which reached the coast about 30 minutes after the shock. Along the coast, observed tsunami heights reached about 20 metres (m). In some areas, geographic conditions caused run-up heights of more than 30 m that travelled up to 10 km inland.

About 20,000 people were left dead or missing and as many as 75,000 were evacuated; 120,000 buildings were completely destroyed and 180,000 were partially destroyed. The economic loss was estimated at JPY17 trillion, greater than the losses resulting from Hurricane Katrina in 2005 and the Kobe earthquake in 1994.

Tokio Marine & Nichido Risk Consulting conducted a survey in 2011 on BCP status of private companies in the devastated area before and after 11 March; 286 out of 1,000 companies responded.

The responses showed differences in BCP development by company size. Amongst large companies, 50%–60% had prepared BCPs before 11 March, whilst only 15% of SMEs had done so. About 80% of large and medium-sized companies said their BCPs were effective in the response and recovery phase after 11 March, and all SMEs said their BCPs were ‘very’ or ‘partly’ effective.

According to the survey on the Actual Situation of Companies in Business Continuity by the Cabinet Office (2007, 2009, 2011), the diffusion ratio of BCP for Japanese companies had risen in recent years. In 2011, 45.8% of large companies completed formulating their BCPs, compared with 27.6% in 2009 (Maruya, 2013). As for medium-sized companies, the diffusion ratio was still 20.8%. However, the ratio of companies that did not know about BCPs decreased from 45.3% to 15.1%.

Until recently, business disruptions caused by disasters of a certain scale were

tolerated as they were considered to constitute force majeure. The most common responses from companies as to why their BCPs did not function included ‘the damage was much greater than predicted’, ‘because the companies followed government scenarios that underestimated reality’, and ‘not enough training was conducted, so nobody could take the necessary actions’.

Public opinion has shifted since 11 March. Now, even if the scale and intensity of a disaster exceeds assumptions and predictions, disruptions are deemed to constitute negligence, and top managers are expected to be able to take measures to ensure the continuity of critical operations.

According to the survey conducted by the Cabinet Office (2007, 2009, 2011), the major reason for developing BCPs was ‘disaster experience’ for large and medium-sized companies. The percentage of companies that developed BCPs increased significantly after a series of recent severe disasters. Requirements from parent companies, compliance with company policy, customer requirements, and legal requirements were all popular answers, as well.

A trigger event is inarguably important to spur an organisation to develop a BCP, but the most important action is not just to develop a BCP but also to improve its effectiveness continuously.

This research shows that private companies’ BCPs worked effectively, but the ratio of companies without a BCP was still high, and consciousness of and attitude towards mega disasters differed greatly amongst businesses regardless of size and industry.

At the time of the Great East Japan earthquake, many local governments were damaged, lost their functionality, and suspended the initial response actions that were necessary immediately after the disaster. The loss of functionality greatly impacts lives and private companies. The lifeline services, however – most transport, electricity and gas, communications, hospitals, convenience stores, and supermarkets – are all operated by private companies. Many private companies have mutual disaster support agreements with local government.

The stakeholders’ responsibilities and roles in civil society are intertwined with and interdependent on economic development. Private companies play a major role in creating jobs, supporting the local economy, and ensuring regional sustainability.

In the event of a disaster, companies help protect the area. Their large resources and capital make them able to provide relief supplies and evacuation space. After a disaster, corporate activities are essential to maintain and improve the living environment by, for example, restoring infrastructure and securing employment for residents.

Based on these experiences, many companies have begun to take a perspective of cooperation with local governments and communities when considering their BCPs. There are also an increasing number of cases of joint drills with local governments and neighbouring companies to verify the effectiveness of their BCPs.

5.2. Supply Chain Management: Flood in Thailand, 2011

In October 2011, the vast area from the Chao Phraya River basin in northern Thailand to Bangkok experienced prolonged flooding. The industrial park in Ayutthaya in northern Bangkok was paralysed, forcing automobile parts manufacturing companies to suspend production for several months and greatly damaging the automobile industry. The flood caused great economic loss.

After an unusually high amount of rainfall, the Chao Phraya River's flood control limit was exceeded and flood gates and breakwaters unexpectedly collapsed. The river has an exceedingly low gradient and Ayutthaya, 100 km upstream from the mouth of the Gulf of Thailand, has an elevation of only 2 m, which hindered drainage, leading to protracted inundation. Systems were inadequate for government organisations to share meteorological and hydrological observation information for flood control. Affected Japanese companies were confused by the conflicting flood warning information from the government and from the industrial parks, and the initial response was delayed because information was in Thai language only.

The 804 companies in the seven industrial parks were directly damaged and disrupted, and of these, 451 were Japanese companies (Ministry of Economy, Trade and Industry, 2012). Many companies directly damaged by the flood manufactured key electrical and electronic parts for automobiles. The suspension of parts supply affected automobile assembly, causing great indirect damage to automobile manufacturers.

Fortunately, some automobile manufacturers did not suffer direct flood damage as their assembly factories were in the industrial park in the south-eastern part of Bangkok, which had not flooded. Production recovery was relatively swift after the flood in

Ayutthaya subsided.

In October, immediately after the flood, automobile production decreased by 67% from the same month the year before and, by November, it had decreased by 85%. The suspension of supply for specific parts affected the number of automobiles produced in ASEAN countries. In November, when production in Thailand rapidly dropped, the Philippines had a 22% decrease, Viet Nam 11%, and Malaysia 2% (Table 6). The export volume of automobile engines and parts fell sharply: by 27% in China, 78% in Australia, and 59% in the US (Table 7).

When the flood occurred in Thailand, Japanese automobile manufacturers held over 90% of the production share in Thailand, Indonesia, and the Philippines. Thailand is the hub in the parts supply network for neighbouring countries and the ASEAN region.

Suspension of production of certain parts affected not only ASEAN countries but also China, Australia, the US, and other global markets because the automobile and machinery industries are heavily concentrated in Thailand.

Table 6: Trends in Automobile Production

Year on Year		Indonesia	Philippines	Viet Nam	Malaysia	Thailand
2011	Oct	22.6	▲11.7	2.7	▲5.2	▲67.6
	Nov	0.7	▲22.1	▲11.3	▲2.5	▲85.0
	Dec	28.6	2.4	▲15.6	▲22.8	▲27.6
2012	Jan	8.5	▲11.9	▲29.7	▲14.7	▲4.0

Source: Industrial statistics from each country.

Table 7: Export Trends of Auto Parts

Cell Destination											
Year	Month	Japan	China	Taiwan	Indonesia	Malaysia	Viet Nam	Philippines	Cambodia	Australia	United States
2011	Sep	17.3	0.8	6.0	37.7	10.3	28.8	▲31.2	31.7	▲39.4	39.3
	Oct	4.3	▲38.2	▲46.3	10.1	▲19.9	▲3.0	▲39.8	▲18.5	▲93.6	▲39.2
	Nov	▲14.4	▲27.3	8.8	▲16.3	▲29.1	▲13.0	▲30.9	▲89.0	▲78.7	▲59.4
	Dec	26.1	3.4	▲21.5	9.0	4.4	▲5.0	▲14.8	▲15.3	4.7	67.9
2012	Jan	9.2	19.7	▲35.9	21.5	13.6	▲40.3	0.4	65.5	▲63.7	8.1
	Feb	14.8	53.3	▲39.3	20.9	31.1	▲10.6	20.0	49.9	▲55.7	▲16.8
	Mar	13.7	81.4	▲39.1	13.1	31.5	▲4.9	▲10.2	35.9	▲57.3	20.8

Source: World Trade Organization (2012); Global Trade Information Services, Global Trade Atlas (2012).

Following the 2011 flood, many Japanese companies reconsidered continuing to operate at the same location and started to assess the conditions and location of each supplier in their supply chain.

According to a survey by Japan External Trade Organization (JETRO) Bangkok (2012), 80% of the directly affected companies said they would continue to operate at the same location, and about 20% said they would move to another location in Thailand. Some companies have opted relocating to the eastern border of Thailand near Cambodia and the Lao People's Democratic Republic.

However, with a supply chain of industrial agglomerations, including suppliers and business partners, already in place, it is difficult to move operations. Thus, most companies decided to stay and strengthen flood control measures. Thailand government was forced to take action to consider early flood control planning, provision of prompt and accurate information, and establishment of an insurance system.

To discourage companies from moving out, industrial parks have installed drainage pumps and waterproof dikes in double and triple layers to prevent flooding even in case of heavy rainfall. Companies should understand and utilise the policies and support measures of their local government to strengthen their supply chains. Also, companies must not only employ flood countermeasures for themselves but also assess their

suppliers' and contractors' location to minimise disruption to the supply chain.

5.3. Indirect Loss and Risk Finance

The Great East Japan earthquake took many lives and hindered corporate activities. According to a Teikoku Databank (2016) survey, 650 private companies, with around 10 thousand workers, went bankrupt within 1 year following the event. However, only 101 companies were in Tohoku, accounting for only 15% of the total. Most bankrupted companies were SMEs scattered throughout the country, having suffered 'indirect loss'. All businesses, including SMEs realised that they needed to incorporate supply chain and indirect loss concerns into their BCPs.

The flood in Thailand in the same year, which forced automobile parts manufacturers to suspend production for several months, greatly damaged the automobile industry in Japan.

As a result of these experiences, the company recognised the need to include a risk financing perspective in its BCP considerations.

Behaviour changes depending on the company's risk sensitivity. In general, if measures are sufficiently taken to reduce the possibility of risk, the need to introduce further measures will decrease, and if measures are insufficient, then the need to introduce further measures will increase.

Companies that were damaged by a large-scale disaster required funding for

- (i) repair costs for assets, buildings and/or equipment,
- (ii) decrease in sales during the business interruption period,
- (iii) emergency response measures and/or extra costs for business continuity,
and
- (iv) damage and/or recurrence prevention costs.

Demand for funds, damage cases, and recovery status after a large-scale disaster vary from company to company.

Many companies think that insurance is an important source of recovery funds, but they must recognise that insurance might not be suitable for all funding. Costs to prevent damage and/or recurrence are paid in advance and generally not covered by insurance.

Hard measures include earthquake-proof reinforcement of buildings, land level elevation, preparation of generators, and stockpiling, while soft measures include training to raise employee awareness and preparation of manuals to prevent disasters.

Even if a company's building facilities do not suffer direct loss, a business might be interrupted by disruptions in infrastructure such as electric power, gas, and transport, or damage to suppliers or customers. Business impact analysis and risk assessment are needed to determine where internal and external management resources are at risk and what financial impact might be incurred under an expected scenario. A company that takes sufficient preventive measures, such as recurrence and damage prevention, is unlikely to be physically damaged. If a company duplicates and makes a backup of management resources, it could reduce the risk of business interruption. Governments and the insurance sector must introduce a scheme that more accurately reflects the amount of risk, according to the advance efforts of companies, in the insurance premium rate.

6. Policy Recommendation

Since natural events are inevitable, countries and organisations must prepare to reduce the scope and duration of the impact of disasters, prepare to respond, and refine the required knowledge and skills to do so.

Methods of disaster risk reduction can be categorised into structural measures such as building dams and dykes, and non-structural measures such as enactment of rules and laws for public–private sector cooperation and dissemination of BCPs. Effective disaster risk reduction policies can be realised by combining these measures. The combination of structural and non-structural measures will differ according to the maturity level, rules, and mechanisms of a country or organisation. There is no unified policy approach.

A BCP can minimise the economic damage caused by natural disasters. It is a plan that describes the policies, framework, and procedures to continue critical business operations uninterrupted or, even if disrupted, to restore them within the shortest period of time possible. It is important to ‘maintain and update the BCP, as well as to carry out management activities from times of normalcy for continuous improvement.

First, the concept, effects, and importance of BCPs must be made widely known

to the industry. The ministry responsible for the economy and disaster prevention should create a policy to promote BCPs and provide ongoing support to implement it. The target is all industries, but requirements for business continuity planning vary depending on industry and location. Surveys have shown that many financially vulnerable SMEs have not yet developed a BCP or have no knowledge of BCPs. The government can raise awareness of the importance of business continuity planning through campaigns, guidelines, and toolkits, and through national and local governments, chambers of commerce, industry associations, amongst others.

Next, the government must teach the industry how to formulate a BCP. In Japan, the BCP has become widely known through government policy, but a survey (Cabinet Office, 2018) shows that many companies say that BCPs' effectiveness is minimal as the companies lack the skills and know-how to implement the plans. The government must, therefore, establish a system to build the skills and know-how that companies need to draft a BCP, including through seminars, training of trainers, training of consultants, and provision of guidelines and toolkits.

To formulate a BCP, a company must conduct a risk assessment to know which critical resources will become unavailable in case of a disaster. The results of the risk assessment, and the maximum tolerable period of disruption of a company's critical operations, as determined by a business impact analysis, will guide the company's countermeasures. For example, if a critical resource requires electricity, the company should have information to help it predict how long it will take to restore electricity in the event of an earthquake of a certain scale. Real-time information on the amount of water in rivers during heavy rainfall, for example, and information to predict flooding are necessary for decision-making. A system is needed, therefore, that can provide disaster-related hazard maps and real-time information when needed.

BCPs must implement strategies and solutions to reduce risks, but these solutions can be extremely costly. Examples include the introduction of backup power sources in case of power outages, relocation of factories that are near rivers as a flood countermeasure, duplication of IT servers, and introduction of remote work in case of a pandemic. Training and education to ensure that the initiatives are spread throughout the organisation will incur costs.

The government should offer preferential interest rates on loans to cover these

costs. The public and private sectors should see the cost of risk mitigation as a necessary investment.

Society consists of the complex interaction of local governments; lifelines such as transport, electricity, gas, water, and telecommunications; schools; hospitals; businesses; local communities; and individuals. Rather than strengthening just one part of society, the whole society should be reinforced to ensure that it is resilient and will not be disrupted by natural disasters. Strong and high-level BCPs are needed to ensure that services such as electricity, communications, and transport support critical company operations. BCPs are needed for local governments, which are essential to the critical operations of private companies. BCPs must, therefore, be the result of a public–private partnership.

The flood in Thailand and the Great East Japan earthquake have taught us that SMEs must be trained in risk financing that considers the possibility of bankruptcy because of supply chain disruption, indirect losses during business interruptions, and fixed costs such as employee salaries.

A policy to make the BCP concept well-known (*what*) and a policy to develop procedure (*how*) would encourage the development BCPs but might be insufficient to ensure their quality. People should be made fully aware of the reasons for having a BCP (*why*). Education and training will deepen the understanding of the BCP concept and lead to well-embedded BCPs.

A BCP's effectiveness must be verified and improved through drills, training, and education. Training and education require skills and know-how, so toolkits such as training manuals and videos are needed.

To establish the steps to formulate and improve a BCP, the government must provide the motivation and incentives to establish one. Incentives might include a programme to award excellent efforts, tax incentives, lower non-life insurance premiums, or subsidies to companies that have adopted a BCP. A system that allows the market to evaluate companies' initiatives will promote efforts to formulate and improve BCPs and lead to their diffusion.

The procedures for developing a BCP are standardised in ISO 22301 (2019), 'Security and Resilience – Business Continuity Management Systems – Requirements', but there are no methods to evaluate the effectiveness and level of a developed BCP. A method for measuring the effectiveness of a BCP is expected to be introduced soon.

Surveys should be conducted periodically to know the status of BCP introduction, the dissemination ratio of BCPs, and obstacles to their development, and to establish a process to utilise the results in policies. There is more than one way to promote BCP. As with disaster risk reduction policies in general, the promotion method of BCPs should be examined in the most appropriate combination whilst understanding the differences amongst countries and organisations in terms of their maturity level, rules, and social mechanisms.

Governments and regional associations such as ASEAN, working in cooperation with knowledge institutes and the private sector, can establish open-source, online information platforms to facilitate knowledge exchange and capacity-building programmes to strengthen understanding across governments and society of the potential returns on investments in BCP.

References

- Anbumozhi, V., M. Breiling. and V.R. Reddy (2019), ‘Distributional Effects of Disasters and Climate and Economic and Food Security Implications’, *in Towards a Resilient ASEAN*, Jakarta: Economic Research Institute for ASEAN and East Asia, pp.1-14.
- Anbumozhi, V. and F. Kimura (2020), ‘Regional Frameworks for Advancing Supply Chain Resilience and Business Continuity Plans’, *in* V. Anbumozhi, F. Kimura, and S. Thangavelu (eds.), *Supply Chain Resilience: Reducing Vulnerability to Economic Shocks, Finance Crisis and Natural Disasters*. New York, NY: Springer, pp.307–38.
- ASEAN Agreement on Disaster Management and Emergency Response (AADMER) Work Programme 2010–2015.
[https://www.asean.org/storage/images/resources/ASEAN%20Publication/2013%20\(12.%20Dec\)%20-%20AADMER%20Work%20Programme%20\(4th%20Reprint\).pdf](https://www.asean.org/storage/images/resources/ASEAN%20Publication/2013%20(12.%20Dec)%20-%20AADMER%20Work%20Programme%20(4th%20Reprint).pdf)
- ASEAN (2016), *ASEAN Vision 2025 on Disaster Management*. Jakarta: ASEAN.
https://www.asean.org/storage/2012/05/fa-220416_DM2025_email.pdf
- Asian Development Bank (ADB) (2013), *Investing in Resilience: Ensuring a Disaster Resistant Future*. Manila: ADB.
- Asian Disaster Reduction Center (2018), *Natural Disaster Data Book 2018*. Kobe: ADRC.

- Asia-Pacific Economic Cooperation (APEC) Emergency Preparedness Working Group (2011), *BCP Status of the Private Sector in the APEC Region 2011*. Singapore: APEC Secretariat. <http://publications.apec.org/Publications/2011/12/BCP-status-of-the-Private-Sector-in-the-APEC-Region-2011> (accessed 30 April 2020).
- Cabinet Office (Japan) (2005), *Loss Estimate of Tokyo Inland Earthquake*. Tokyo.
- Cabinet Office (Japan) (2011), *White Paper on Disaster Management 2011*. Tokyo.
- Cabinet Office (Japan) (2012), *White Paper on Disaster Management 2012*. Tokyo.
- Cabinet Office (Japan) (2014), *White Paper on Disaster Management 2014*. Tokyo.
- Cabinet Office (Japan) (2014), *Survey on BCP Status in Japan 2013*. Tokyo.
- Cabinet Office (Japan) (2016), *Survey on BCP Status in Japan 2015*. Tokyo.
- Cabinet Office (Japan) (2018), *Survey on BCP Status in Japan 2017*. Tokyo.
- Carvalho, V.M. (2016), 'Supply Chain Disruptions: Evidence from the Great Japan Earthquake', *Columbia Business School Research Paper*, 17-5.
- Central Disaster Management Council (Japan) (2005), *Strategy for Tokyo Inland Earthquake*. Tokyo. http://www.bousai.go.jp/jishin/syuto/pdf/jishin_taikou.pdf (accessed 30 April 2020).
- Haraguchi, M. and U. Lall (2014), 'Flood Risks and Impacts: A Case Study of Thailand's Flood in 2010 and Research Questions for Supply Chain Decision Making', *International Journal of Disaster Risk Reduction*, 14(3), pp.256–72.
- ISO 22301 (2019), *Security and Resilience – Business Continuity Management Systems – Requirements*.
- JETRO Bangkok (2012), *Announcement of the results of a survey on the affected companies by Thailand flood 2011*. <https://www.jetro.go.jp/news/announcement/20120203731-news/result.pdf> (accessed 30 April 2020).
- Kahn, M. (2005), 'The Death Toll from Natural Disasters: The Role of Income, Geography and Institutions', *The Review of Economics and Statistics*, 187(2), pp.271–84.
- Kashiwagi, Y., Y. Todo, and P. Matous (2018), 'International Propagation of Economic shocks through Global Supply Chains', *WINPEC Working Paper*, No. E1810. Tokyo: Waseda Institute of Political Economy, Waseda University.
- Lassa, J.A. and M. Sembiring (2017), 'Towards Policy Integration of Disaster Risk, Climate Adaptation and Development in ASEAN', *NTS Insight*. Singapore: Nanyang Technological University.
- Maruya, H. (2013), 'Proposal for Improvement of Business Continuity Management (BCM) Based on Lessons from the Great East Japan Earthquake', *Journal of JSCE*, 1, pp.12–21.
- Ministry of Economy, Trade and Industry (Japan) (METI) (2012), *White Paper on International Economy and Trade 2012*. Tokyo.

- Ministry of Economy, Trade and Industry (Japan) (METI) (2014), *White Paper on International Economy and Trade 2014*. Tokyo.
- Ono, T. and M. Ishiwatari (2011), *Business Continuity Plans*. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/16125> (accessed 30 April 2020).
- Ono, T. (2017), ‘Area Business Continuity Management Approach to Build Sustainable Communities’, *Journal of Disaster Research*, 12(4), pp.806–10.
- Ono, T. (2015), *International Cooperation and Disaster Management, Chapter 6 ‘Towards Community Resilience and Private Partnership against Hazards in Asia’*. Kyoto: Kyoto University Press. (in Japanese)
- Petz, D. (2014), *Strengthening Regional and National Capacity for Disaster Risk Management: The Case of ASEAN*. Washington, DC: Brookings Institution.
- Sawada, Y. (2017), ‘Natural Disasters: Financial Preparedness of Corporate Japan’, *REIETI Discussion Paper Series*, No. 17-E-014. Tokyo: The Research Institute for Economy, Trade and Industry.
- Subbaya, A.R., L. Bildan, and R. Narasimhan (2009), ‘Regional Integrated Multi-hazard Early Warning System: Background Paper on Assessment of the Economics of Early Warning Systems’. Paper submitted to the World Bank Group Global Facility for Disaster Risk Reduction and Recovery, Asian Disaster Preparedness Centre, Bangkok.
- Teikoku Databank 2016, Trend survey of ‘Bankruptcy related to the Great East Japan Earthquake’ (cumulative for 5 years after the outbreak), <https://www.tdb.co.jp/report/watching/press/p160301.html>
- United Nations (2011), *Global Assessment Report on Disaster Risk Reduction 2011*. <https://www.undrr.org/publication/global-assessment-report-disaster-risk-reduction-2011>
- United Nations (2015), *Sendai Framework for Disaster Risk Reduction*. <https://www.preventionweb.net/drr-framework/sendai-framework> (accessed 30 April 2020).
- Tokio Marine & Nichido Risk Consulting Co., Ltd (2011), TALISMAN. Tokyo: Tokio Marine Nichido.

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