Chapter 8

Japan

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Chapter 8

Japan

Yoshihiro Fujii

1. Overview

The number of natural disasters is increasing in Japan due to the acceleration of climate-change impacts. Japan placed the sixth globally in terms of the number of natural disasters occurring in the latest 2 decades per country, and fifth in Asia (CRED and UNDRR, 2020). The economic cost reached $439 billion, the third-highest value after natural disaster damage costs in the United States and China (CRED and UNDRR, 2020). In addition to earthquakes, floods and landslides are major causes of damage due to the intensification of typhoons and torrential rains. Therefore, expanding and strengthening climate-change adaptation projects and securing financing for climate-resilient infrastructure are key issues for Japan.

The latest weather data analysis in Japan showed that the current rate of torrential rainfall is in the 1-in-every-50-year class, which is occurring due to global warming. For example, in July 2017, damages caused by heavy rains in Kyushu increased 1.5 times and in Setouchi 3.3 times (Imada et al., 2020).

Potential damage from climate-related risks have not yet been officially indicated. In 2020, Mitsubishi UFJ Financial Group and other major banking groups estimated that the effects of torrential rains and floods in Japan will cause ¥125 billion in damages in their lending portfolios each year to 2050, decreasing the collateral value incurred by accounts for loans held and causing delays in loan repayments (Table 8.1). Based on these estimates, the annual amount of losses across the entire banking sector will be ¥306.5 billion per year, accumulating to ¥9.195 trillion. This estimate is limited to flood damage through the cost of climate-change adaptation; if damages other than flooding are included, the estimate is more than ¥10 trillion.

Table 8.1. Estimated Annual Climate Losses in Loan Portfolios of Selected Banks

(¥ billion)

	MUFG Bank	Mizuho Bank	Sumitomo Mitsui Banking Corporation
Transitional costs	30–270	120–310	60–300
Physical costs	38	52	30–40

Source: RIEF (2020).

However, despite identification of such massive global-warming impacts, Japan's policy response to climate-change adaptation is farther behind that of the European Union and other developed countries. A climate-change mitigation policy in Japan – the Law Concerning the Promotion of the Measures to Cope with Global Warming – was promulgated in 1998. It aims to

curb greenhouse gas emissions by introducing renewable energy and energy-efficient projects. However, it does not describe how to manage and to control such activities.

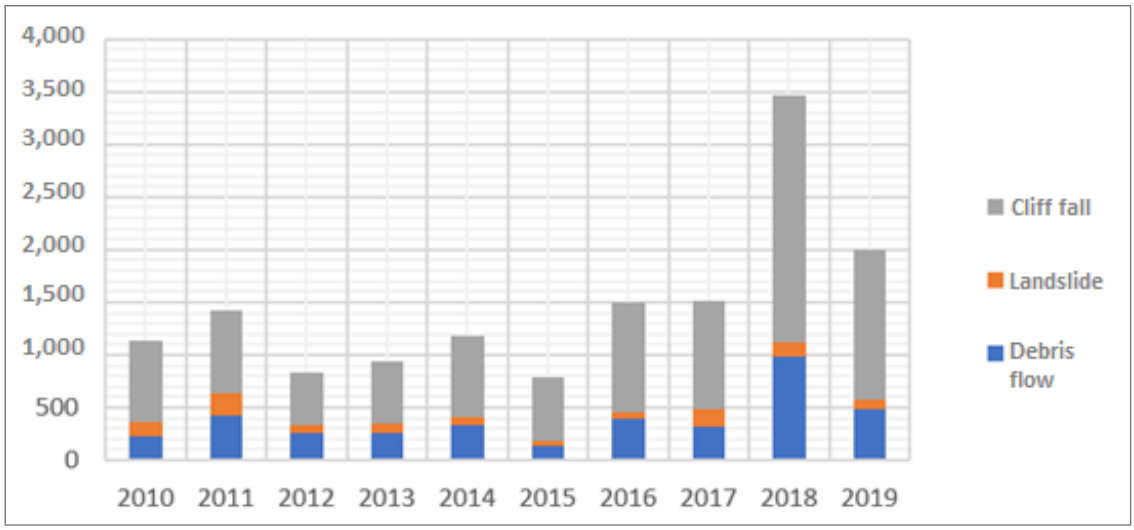
To ensure that Japan's climate-change framework was consistent with the 2015 Paris Agreement, Japan had two options: to revise the mitigation act to include adaptation measures, or to enact new laws for adaptation. The government decided to enact new adaptation laws, as it believes that mitigation and adaptation measures differ in their main objectives; therefore, the policy system should be separated. It also views the impacts of climate change as already in place and likely to expand, so it is necessary to proceed with adaptation measures regardless of mitigation measures.

Japan's climate-change adaptation plans were first established in November 2015. The Act on Adaptation to Climate Change, which guarantees the creation of a climate-adaptation plan, was, however, delayed until 2018. The adaptation act has four objectives: promoting climate-change adaptation, developing associated information infrastructure, strengthening adaptation in the region, and expanding adaptation measures internationally. Towards the first goal, it stipulates the roles of the national government, local governments, businesses, and citizens in adaptation activities. It states that prefectures and municipalities should deal with actual adaptation measures and activities. However, financing for these is not clearly indicated. The *National Adaptation Plan* mentions finance and insurance as part of industrial economic activities, but there is no indication of how to finance or to obtain insurance for adaptation projects by using private financial functions or markets (MOE, 2018).

The Basic Act on Disaster Countermeasures, from November 1961, was enacted after Typhoon Vera hit the Chūbu Region in 1959, causing more than 5,000 deaths; it is still considered one of Japan's worst natural disasters. The act focussed on the emergency response in the event of a disaster and post-disaster recovery projects and activities. The adaptation act was based on this law, which states that the cost of disaster relief and recovery will be covered by the disaster-affected municipalities through the issuance of municipal bonds, which the national government will take on in its fiscal investment and loan plan. Thus, based on this provision, prefectures and municipalities are expected finance adaptation activities. However, as the impacts of climate change increase, it has become clear that public finance alone cannot finance sufficient climate-change adaptation projects and activities. Thus, the development of adaptation finance initiatives has become urgent.

According to the Ministry of Land, Infrastructure, Transport and Tourism, which examined landslides caused by natural disasters, the number of incidents that happened in 2019 was the fourth highest since 1982, while 2018 saw the highest (Figure 8.1). In 2019, the number of occurrences was also 1.8 times higher than the average.

Figure 8.1. Landslides in Japan, 2010–2019



Source: Ministry of Land, Infrastructure, Transport and Tourism.

Climate change has also increased landslide scale and strength. A traditional landslide, known as a surface collapse, is normally a 0.5-metre to 2.0-metre collapse of the soil layer of the slope in a mountain area. Now, landslides known as deep collapses are happening. Sometimes, an entire mountain ridge may suffer collapses due to heavy rainfall. Once these deep collapses happen, a much larger amount of sediment loosens, creating enormous debris flow and river-road blockages (i.e. landslide dams). This occurred in July 2018 in Western Japan, claiming over 200 lives.

In 2018, the Ministry of Land, Infrastructure, Transport and Tourism investigated about 21,000 rivers across the country after torrential rains in Western Japan. Results showed that most of the 147 sites that caused the levee collapses were out of scope for additional measures. In 2020, the heights of 84 river levees in 147 sites in the upper part of 75 large rivers – including Abukuma River (Fukushima Prefecture), Yoshida River (Miyagi Prefecture), Kuma River (Kumamoto Prefecture) in Kyushu and Eastern Japan – met the official disaster prevention planning levels of both the national and local governments. (*Asahi Shimbun*, 2020). However, damages from Typhoon Hagibis in October 2019 and heavy rains in July 2020 caused some to collapse. A levee for the Chikuma River (Nagano Prefecture) collapsed and overflowed from its breaking point over a distance of 70 metres, despite being reconstructed in 1984 with additional soil-reinforcement.

Many levees or river dams, which were originally constructed with adequate flood prevention function measures, now face risk of collapse or overflow. Natural disasters have dramatically changed due to intensifying climate change. Various rural areas in Japan, which have large rivers, are therefore forced to rebuild these levees or dams and to change their total evacuation systems.

In urban areas, cities are forced to develop two types of disaster prevention measures. The first type is for suburban areas, where people have cultivated fields and are often surrounded by mountains. They face landslide risks; thus, prevention measures focus on adjustment between the developed area and the undeveloped areas on the slopes. The second type of prevention

measures is for urban areas, including city centres. Natural disaster risks comprise floods caused by heavy rains or typhoons, which bring intensified water flow to the lowest areas in cities. Disaster prevention measures here focus on flood avoidance.

The Sendai Framework, established in 2015, covers natural disasters; human-caused disasters; and related environmental, technical, and biological disasters and risks (UNDRR, 2015). It is an international disaster prevention framework based on the declaration of the 3rd United Nations World Conference on Disaster Risk Prevention. It has four priorities for action: understanding disaster risk, and sharing information; strengthening disaster risk governance to manage disaster risk; investing in disaster risk reduction for resilience; and enhancing disaster preparedness for effective response and to build back better in recovery, rehabilitation, and reconstruction. It defines the concept of resilience as 'the ability of a system, community or society exposed to hazards to resist, absorb, accommodate and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions' (UNDRR, 2015). This concept is crucial to a range of other fields and disciplines, including sustainable development, poverty eradication, and climate-change adaptation.

The Sendai Framework also promotes international disaster prevention and reduction initiatives in response to increased natural disasters due to climate change. The priorities for action indicate investment to reduce the risk of disasters in its third point, but the development of adaptation finance based on the action continues to be insufficient.

By using artificial intelligence (AI)/machine-learning projects, disaster prevention and reduction initiatives can be piloted. Currently, these have been developed in three dimensions: simulating serious disasters, building an efficient and effective evacuation system, and developing useful communication tools for different languages other than Japanese. SOMPO Japan Insurance used an AI/machine-learning method to create a disaster prevention and reduction system with Kumamoto Prefecture in Kyushu, which suffered serious damages from the 2016 Fukushima earthquake and 2020 heavy rainfall. It is working to establish a resilience system throughout the city by estimating damage in three stages: before damage happens, by regional unit, and immediately after disasters happen. The United States start-up One Concern is responsible for the analysis through AI, and Weathernews, a private weather forecasting company in Japan, is responsible for providing and analysing the weather data. SOMPO provided its insurance data on the Kumamoto area.

Although such initiatives are limited in Japan, visualisation of disaster hazard areas using hazard maps has progressed. Based on the revised Flood Prevention Law (2015),[1] a flood area can be modelled based on when the levee or embankment collapses, as well as the inundation-assumed area based on the depth of water at that time. In addition, in the designated target rivers or flood-prone areas, information on special warning water levels must be released to the public. The Sediment Disaster Prevention Act (2000) also stipulates the designation of sediment disaster warning areas and their mapping. The disclosure of such information related to natural

[1] Government of Japan, Ministry of Land, Infrastructure, Transport and Tourism, Land and Climate of Japan, https://www.mlit.go.jp/river/basic_info/english/land.html

disasters has helped prepare people and companies regarding disaster prevention and reduction actions.

2. Green Bonds

As municipalities manage and operate adaptation plans, they are willing to expand their adaptation activities if they receive money from the capital market by issuing bonds or receiving loans. Many municipalities are now facing a lack of financial resources for natural disasters. Almost every year, they have large expenses related to recovery or compensation due to disaster damages. Some have even run out of funds.

Thus, several municipalities are keen to connect with the capital market to induce money from investors through green bonds. So far, three prefectures, including the metropolitan city of Tokyo, have issued green bonds to finance their climate-change mitigation and adaptation needs. Tokyo was the first; it issued a trial version of a green bond in 2016; since that time, it has issued green bonds every year.[2] The proceeds from these green bonds have been focussed on climate-change mitigation projects.

In the case of a 5-year green bond issued in October 2020 in Tokyo at ¥10 billion for institutional investors, its proceeds are going to solar-power facilities and sewerage system maintenance. Proceeds of 30-year bonds are going to strengthening river walls, increasing adjustment ponds for natural disasters, and developing seawalls and flood gates for tsunamis. In the case of such long-term bonds, the majority of proceeds go to adaptation projects. The Tokyo government also issues green bonds for individuals denominated in foreign currency annually, and the use of these proceeds target both adaptation and mitigation projects.

Nagano Prefecture issued its first green bond in October 2020, and Kanagawa Prefecture issued its first green bonds in November 2020. Both issuances amounted to ¥5 billion. The proceeds of Nagano Prefecture's green bonds will be used for a river protection and renovation project regarding flood control, as well as mitigation projects such as the development of small hydroelectric power-generation projects and the introduction of energy-saving vehicles for third-sector railways (RIEF, 2020).

In March 2020, Kanagawa Prefecture declared a 'Kanagawa Climate Emergency', which followed a series of typhoons and torrential rains. It developed the *Kanagawa Prefectural Water Disaster Prevention Strategy*; all of the proceeds of its first green bonds will be used for adaptation projects within the prefecture, including emergency response river management projects, improvements to bottlenecks in watery areas and flow routes, development of coastal conservation facilities, and improvement of sediment disaster prevention facilities (Kanagawa Prefecture, 2020).

Table 8.2 details the adaptation projects and activities funded by the proceeds of these green bonds. They do not focus on building higher and stronger levees, dams, or coastal seawalls;

[2] Tokyo Metropolitan Government, Bureau of Finance, Tokyo Green Bonds, https://www.zaimu.metro.tokyo.lg.jp/bond/en/ir_library/tosai_ir_gb.html

instead, they focus on reinforcing and maintaining the weak points of the current disaster prevention infrastructure, which is a relatively soft approach.

Table 8.2. Climate-Change Adaptation Projects Covered by Green Bonds Issued by Kanagawa Prefecture

Project	Targets	Funds Allocated
Emergency response to rivers	Removal of sediment deposited in sections where the risk of flooding is particularly high (38 rivers)	11.2%
	Concrete raising work (3 locations)	3.2%
Development of bottlenecks in water and flow routes	Development of water-free areas (6 locations)	57.9%
Development of coastal conservation facilities	Establishment of facilities in front of coastal graves such as seawalls as a priority (4 locations)	1.9%
Development of a facility to prevent sediment disasters	Sabo dam construction (29 locations)	7.6%
	Slope construction in areas where cliffs collapsed (201 locations)	18.2%

Source: Kanagawa Prefecture (2020).

In addition to these projects, the prefecture has promoted adaptation measures that prevent people and companies from constructing buildings or houses in hazardous areas, as well as use hazard maps, direct regulations, and tax incentives. It has also prepared emergent evacuation systems for each region. These combinations of adaptation measures are also a soft approach.

Investors for these green bonds – mainly institutions including pension funds and insurance companies – are not limited to local companies and financial institutions related to the municipalities. Many institutional investors all over Japan have invested as part of their environmental social governance (ESG) investments. Fortunately, Japan has a huge amount of household assets, which are resources for insurance companies, pension funds, and deposits for financial institutions such as banks. The total amount of household assets was ¥1.883 trillion in the second quarter of 2020 (Bank of Japan, 2020).

For green bonds, it is usually difficult to push their proceeds to adaptation projects in comparison with mitigation projects. With mitigation projects, such as renewable energy, investors can see the cash flow quickly from the proceeds by, for example, selling their generated electricity to the market. Investors are satisfied with both the economic returns and green contributions. However, for adaptation projects, it is difficult to envision the expected direct cash flow from, for instance, improving river levees and preventing landslides. Institutional investors can be keen to invest in regional municipal bonds because of evaluation of their creditworthiness as public entities. However, increasing adaptation projects for municipalities raises their fiscal constraints. Thus, municipalities should introduce some kind of cash flow that does not influence their creditworthiness.

3. Adaptation Credits

To attract investors towards climate-change adaptation projects, adaptation credits can be created. There are several precedents from around the globe, such as those for protecting the environment or respecting social rights. One example is the REDD+ credit system, which results in cash payments.

In Japan, several local municipalities have tried to introduce similar concepts to the REDD+ scheme for local flood-control systems. The paddy field dam system uses the water reserve capacity of paddy fields as absorption sites when excess water emerges around towns or villages during heavy rains or typhoons. It is an economically viable solution compared to, for instance, constructing higher levees along a river bank. Niigata Prefecture and its capital, Niigata City, have collaborated with various stakeholders to manage a paddy field dam system since 2009.

In Niigata, around 3,000 hectares of paddy fields were used within Niigata City for a reserve. Cash contributions to the Niigata pilot project were about ¥11,200 per 10 acres per year (Miyazu et al., 2013). The cost of using paddy fields as a reserve totaled only ¥200 per 10 acres per year, which comprised mostly compensation payments to paddy field owners (i.e. rice farmers) for their damaged crops. These payments were quite small compared to disaster-prevention benefits.

Indeed, the total reduction of disaster expenditures by using the paddy field system have been calculated at about ¥327 million per year. If these monetary benefits are regarded as negative costs for investors who want to buy green bonds issued by municipalities for this purpose or to invest in the paddy field system themselves, the paddy field system can be transformed to a cutting-edge adaptation investment. To ensure the creditworthiness of the adaptation credit, governments or municipalities should set adaptation objectives and collaborate to develop cost-effective adaptation tools and adaptation finance with market players.

Recently, other players have emerged in the green bond market in Japan, including government-supported corporations, such as the Japan Water Agency and Central Nippon Expressway Company. Both have set their own green and sustainability bond frameworks, including adaptation activities in 2020. The former has operated and managed many hydro dams, including flood-control dams; the latter has operated and managed high-speed roads in Central Japan. Both have issued their own corporate bonds to finance their business and operations, which include construction and maintenance of the dams and high-speed roads. After setting their own ESG bond framework, their issuing bonds became known as green bonds or sustainability bonds. Both have created cash flow from their own businesses providing water or toll-road services. Therefore, it is relatively easy for them to issue green bonds with project cash flow to institutional investors.

4. Insurance and Catastrophe Bonds

Companies and corporations are keen to protect their properties and operations from the impacts of natural disasters. According to Sawada et al. (2015), 68.6% of responding companies thought that they would suffer from more severe disasters in the future, and almost 50.0% responded that they would see maximum damages to their properties. The disaster insurance participation rate amongst respondents was 58.9% for large companies and 47.0% for micro,

small, and medium-sized (SME) enterprises in Japan. These rates are lower than the average of other advanced countries. The traditionally strong relationships between companies and banks in Japan – rather than between companies and insurance companies – may help explain this.

The survey also asked respondents about planned measures to cover their cash-flow shortages at times of future natural disasters. Answers included bank loans (43.44%), self-financing (38.75%), and insurance (11.79%). Loans are usually used to cover daily business operations rather than to transform their business structures to be more resilient against disasters.

Insurance companies themselves have suffered from the increasing number natural disasters, which denotes increasing insurance payments to their policyholders. As mentioned before, the governmental adaptation plan has already categorised insurance companies as an 'adaptation risk industry'.

Table 8.3. Ranking of Insurance Payments Based on Cases of Wind and Flood Damage

Ranking	Disaster	Area	Number of Payments	Insurance Paid (¥ billion)
1	Typhoon No. 21 (2018)	Hyogo, Kyoto, Osaka	857,284	10,678
2	Typhoon No. 19 (2019)	East Japan	295,186	5,826
3	Typhoon No. 19 (1991)	National	607,324	5,680
4	Typhoon No. 15 (2019)	Kanto	383,585	4,656
5	Typhoon No. 18 (2004)	National	427,954	3,874
6	Snow (2014)	Kanto	326,591	3,224
7	Typhoon No. 18 (1999)	Fukuoka, Kumamoto, Yamaguchi	306,359	3,147
8	Typhoon No. 24 (2018)	Kanagawa, Shizuoka, Tokyo	412,707	3,061
9	Heavy rain (2018)	Ehime, Hiroshima, Okayama	55,320	1,956
10	Typhoon No. 15 (2015)	National	225,523	1,642

Source: General Insurance Association of Japan.

Table 8.3 shows the top 10 insurance payouts for typhoon and heavy precipitation damage in Japan in the past 3 decades; 7 have been within the past 10 years. Typhoon No. 21 (2018) recorded the highest amount of insurance payments at over ¥10 trillion. In the same fiscal year, due to Typhoon No. 24 and more heavy rainfall in July, annual insurance payments increased 6.7 times from the previous year and reached over ¥1.5 trillion. In FY2019, the total amount decreased 22% from FY2018 but also exceeded ¥1.220 trillion due to heavy rainfall damages

from typhoons No. 15 and No. 19 and October rainfall. Insurance payments over ¥1 trillion were recorded for the second consecutive year.

Therefore, major non-life insurance companies – such as Tokio Marine Holdings, SOMPO Holdings, and MS&AD Insurance Group Holdings – had to raise their insurance premiums by 6% to 7% from the national average in October 2019. These will be raised again in January 2021. In addition, they will shorten their insurance policy period of up to 10 years to 5 years to make it easier to change contracts when insurance payments increase over time. If insurance premiums become too high, there is a possibility that the number of people who do not have insurance will rise.

Under these circumstances, catastrophe bonds, which are directly linked to capital markets, are regarded as risk management measures for insurance companies to continue to insure and to reduce the risk of adaptation. In April 2020, MS&AD Group's Mitsui Sumitomo Insurance issued a $100-million catastrophe bond, Akibare Re 2020-1, in the Singapore market (Mitsui Sumitomo Insurance, 2020). This bond is the subject to two types of climate risk, typhoons and floods, in Japan. The period will be 4 years, until the end of March 2024. The yield on the issue amount of $100 million is high at +2.75% of the yield of the secured bond. Singapore is very keen to revitalise its market by subsidising the issuance of insurance-linked securities such as catastrophe bonds in its market. Mitsui Sumitomo Insurance is the first Japanese insurance company to issue such bonds in Singapore.

5. Business Continuity Plan Loan

In general, natural disaster damage covers large geographic areas. For this reason, regional financial institutions, such as regional banks, provide several types of loans to customers – both SMEs and individuals – in the event of disasters, based on traditionally strong relations with local companies.

Banks have provided various types of disaster-related loans to these entities, and most of them are short-term finance to cover periods of emergency. Among them, the Bank of Fukuoka, a regional bank in Fukuoka Prefecture in Kyushu, began to provide a new loan, a business continuity plan (BCP) support loan (Fukuoka Bank, 2020). For these loans, the bank formed a partnership with Tokio Marine Insurance, which provides insurance to a company when obtaining a secured loan from the Bank of Fukuoka when disaster happens. The BCP support loan is an adaptation measure undertaken by companies to prepare for future risks, including natural disasters. It is different from current disaster loans in Japan, which provide emergency finance when disasters occur. Under BCP support loans, the bank makes loan agreements with its customers before a disaster happens; companies can also secure additional finance when disasters or other types of difficulties occur. The bank often requests that the companies change their business structures to be more disaster resilient.

Other regional banks have followed in providing similar loans to their business customers. In addition to the collaboration with insurance companies, they can also use governmental resilience certification labels. This certification is provided by the National Resilience Promotion Headquarters to promote the development of disaster prevention measures for companies –

mainly earthquake countermeasures.[3] The government provides the certification to companies that prepared disaster prevention and reduction measures. Companies can then use their certification to verify their disaster prevention and mitigation management and to develop their evaluations into ESG marketing. Certified companies can also partake in public loans with lower interest rates[4] provided by the Development Bank of Japan, a public financial institution.

The Bank of Nagoya in Aichi Prefecture provides BCP loans using the governmental certification (Bank of Nagoya, 2017). It also collaborates with InterRisk Research and Consulting, a risk-consulting company under the MS&AD umbrella, to evaluate a customer's potential disaster risk before taking out a loan agreement. In addition, the bank provided a new type of flood-risk loan with a principal exemption special contract in the summer of 2020 (Bank of Nagoya, 2020). It was limited but focussed on seasonal flood risk in collaboration with insurance companies. Companies with this loan do not have to pay back their principal if any natural disasters match predetermined quantified conditions in the designated areas.

Shizuoka Bank, in Shizuoka Prefecture, provided a commitment line for targeting floods risk for its customers as a kind of BCP loan in March 2019 (Shizuoka Bank, 2019). It promised to provide a loan to a borrower when needed within a set period and loan limits. Within the limit, the borrower can borrow and repay funds as many times as it likes.

6. Estimation of the Climate Adaptation Finance Scale in Japan

Current adaptation financing amounts in Japan can be estimated based on adaptation activities by each sector. In the case of municipality green bonds, although adaptation costs depend on geographic differences or weather conditions, almost every prefecture or region cannot escape from climate change-related damages.

Kanagawa Prefecture issued ¥5.0 billion of adaptation green bonds, so potential adaptation costs in all 47 prefectures in Japan can be assumed to be ¥235.0 billion annually, accumulating to about ¥7.05 trillion by 2050. However, this estimate is for only damages by floods and torrential rains and does not include those from droughts, forest fires, and poor crop yields. Therefore, it is likely to exceed ¥10.00 trillion by 2050. This estimate is almost the same amount of the abovementioned total physical risks, which the Japanese banking industry has in its loan portfolio by 2050.

Issuance of catastrophe bonds by insurance companies means to change the adaptation risktaker from insurance companies to investors in the capital market – not the adaptation costs themselves. Therefore, the amount cannot be calculated as other financial products such as green bonds and BCP loans, both of which can reduce adaptation costs. In the case of BCP loans, the total of the amount of estimated climate-related physical risk should be used, which is calculated as ¥306.5 billion annually. Therefore, the total amount of both municipal green bonds and BCP loans by banks as adaptation finance is ¥541.5 billion per year. If the annual amount of

[3] Association for the Promotion of Resilience Japan, Resilience Certification Evaluation, http://www.resilience-jp.biz/certification/about/

[4] Japan Finance Corporation, Social Environment Facility Development Funds, https://www.jfc.go.jp/n/finance/search/19_syakaikankyotaiou_m_t.html

flood damage of ¥1 trillion per year continues at an accelerated pace, the total adaptation costs can be halved by both green bonds and BCP loans.

7. Overseas Financing

Article 18 of the Act on Adaptation to Climate Change states that Japan should promote technical assistance and other international cooperation for adaptation projects and activities in developing countries. This also denotes the need to increase financial resources from the financial market rather than from public funds.

At the 2019 Asia-Pacific Economic Community (APEC) Finance Ministers' Meeting, participating countries agreed to strengthen disaster risk finance insurance schemes. The joint statement said that 'disaster shocks increase government expenditure and hamper economic activities, and fiscal risks may arise in those economies where governments shoulder a significant share of disaster costs' (APEC, 2019). Following their meeting in September 2020, they expressed the possibility of adding future pandemics to the scope of disasters in disaster risk finance insurance.

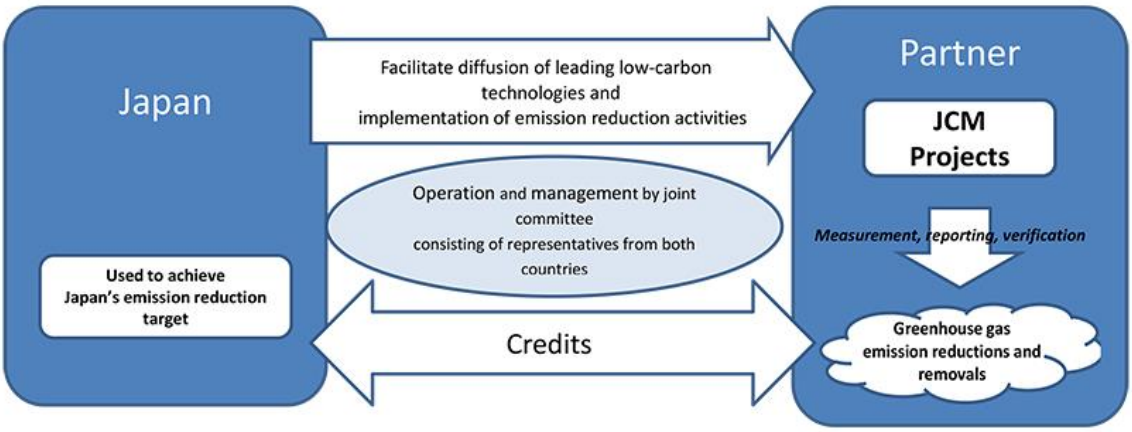
Developing qualified and resilient infrastructure, as well as risk transfer through insurance and capital markets, are common interests in the region. Financial instruments to achieve those common interests are catastrophe bonds and financial instruments linking insurance industries with capital markets. During the COVID-19 pandemic, the Pandemic Emergency Financing Facility was triggered to incorporate catastrophe bonds into the scheme. Financial assistance was provided by Germany, Japan, and other countries. The facility was set up in 2017 with maturity of 3 years. Just before it expired, the scheme was triggered, allocating $195.84 million to 64 of the poorest countries in the world with reported cases of COVID-19 (World Bank, 2020).

A similar scheme helped issue catastrophe bonds that collectively cover disaster risks in multiple countries in Asia, using financial contributions from developed economies and financial instruments linked to the capital market. In 2018, for earthquake countermeasures, Pacific Alliance countries in Central and South America issued collective catastrophe bonds in the amount of $1.36 billion supported by the World Bank (World Bank, 2018). By combining public contributions with capital market instruments, the credibility of those financial products can be increased for institutional investors.

Another possibility is the Joint Crediting Mechanism (JCM)[5] (Figure 8.2). Japan developed the JCM as its own policy contribution scheme for reducing international carbon dioxide emissions and transferring climate-related technologies, systems, products, services, and infrastructure to developing countries. It was introduced in the 2012 United Nations Climate Change Conference in Qatar in 2012 and was admitted in Article 6 of the Paris Agreement as a collaboration approach. So far, 17 countries, including as Indonesia, Thailand, and Viet Nam, have signed partnership agreements with Japan.

[5] Government of Japan, Ministry of Foreign Affairs, Climate Change: Joint Crediting Mechanism, https://www.mofa.go.jp/ic/ch/page1we_000105.html

Figure 8.2. Structure of the Joint Crediting Mechanism



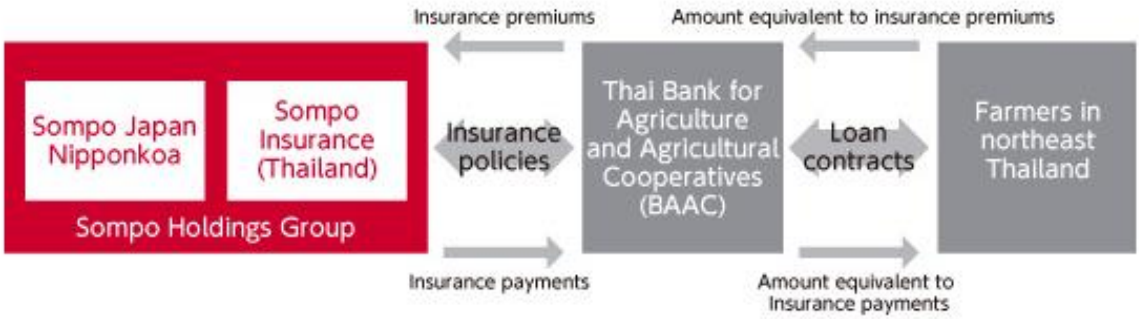
JCM = Joint Credit Mechanism.
Source: Ministry of Foreign Affairs.

Under the JCM, Japan provides leading low-carbon technologies or services – including financing – to mitigation projects in partnership countries, evaluates its contributions to greenhouse gas emission reductions, and then uses them to achieve Japan's emissions reduction target. It should also create adaptation credits from joint adaptation projects such as renovating levees, construction of hydro dams with flood-control functions, and revetment strengthening. If Japan and host countries agree to admit such adaptation credits through such joint adaptation projects, business entities and companies can obtain cash flow from their committed adaptation business to sell credits to the market or to other entities.

8. Private Sector Financing in Developing Countries

An example of adaptation finance in developing countries through Japanese financial institutions is weather index insurance developed by SOMPO Holdings in Thailand and Myanmar (Figure 8.3). It is a kind of micro-insurance for farmers using data-driven derivative methods. In 2010, SOMPO launched weather index insurance for farmers in North-East Thailand, aiming to reduce their damages caused by droughts. SOMPO Insurance Thailand, its subsidiary, developed the scheme with the Bank for Agriculture and Agricultural Cooperatives (BAAC) to offer the product to farmers who maintain loan contracts with BAAC. In the case of traditional agro-insurance, time – as well as technical experts – is needed to estimate the total amount of damage occurs due to natural disasters. These conditions are challenging, especially for low-income farmers. However, this insurance scheme sets a weather index, comprising weather data such as temperature, wind speed, rainfall, and hours of sunshine. If weather-related disasters happen and fulfil certain conditions on the index, the company pays out contractually predetermined insurance amounts to policyholders without estimating real damages by experts.

Figure 8.3. Weather Index Insurance



Source: SOMPO Holdings (2018).

In North-East Thailand, SOMPO supports rice farmers, expanding the insurance to longan farmers in 2019 using satellite data. It also developed the same agro-insurance product that covers drought risks for rice and sesame farmers in Central Myanmar as a pilot project in 2018. In Myanmar, weather-related data were collected to develop the insurance product, but it was not easy to get them due to insufficient meteorological station systems there. Thus, it collaborated with the Japan International Cooperation Agency to provide 30 automated weather acceleration systems and 3 weather radars to Myanmar's Department of Meteorology and Hydrology. The second collaboration was with Japan Aerospace Exploration Agency (JAXA); SOMPO used JAXA Global Rainfall Watch, which provides the world's rainfall distribution in partnership with the Remote Sensing Technology Center of Japan. According to its analysis in the targeted area, the correlation coefficient between the data from the ground rain gauge and satellite is 0.79 (Fukuwatari and Okada, 2019).

The company also sells weather index insurance in the Philippines due to the typhoons. There is no data shortage because Japan has a lot of typhoon-related weather data. Targeted companies include agri-businesses that are developing large-scale agriculture farming, such as for bananas in Mindanao. SOMPO is also planning to sell weather index insurance in Indonesia.

These experiences show that there are two key factors in expanding adaptation finance in Asian countries. One is to work with local partners such as BACC in Thailand to oversee sales. The second is to secure detailed and timely weather data.

9. Possibilities of Adaptation Finance

Another adaptation activity is by Tokio Marine Holdings, but it is a social contribution rather than a business activity. In 1999, Tokio Marine Holdings celebrated the 120th anniversary of its founding; it decided to undertake a commemorative planting project in Asian coastal areas to help deter damage from tidal waves or sea-level rise. So far, it has planted mangrove trees in nine Asian countries – Bangladesh, Fiji, India, Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Viet Nam. The total planted area was about 10,930 hectares as of March 2019. It calculates its economic impacts to be ¥118.5 billion, which includes contributing to local fisheries, hiring local women in the tree-planting activities, and contributing to tourism and ecotourism in the areas. In addition, Tokio Marine Holdings is offsetting its carbon dioxide

emissions with the total carbon dioxide absorption of the trees. The company has enjoyed carbon neutrality for 1 decade.

The lesson from this social contribution activity is that it is possible to raise potential cash flow as well as carbon dioxide emissions reduction effects through voluntary activities. It may be possible to generate a certain amount of cash flow, which could be of interest to institutional investors. Adaptation credits should be regarded as cash flow; in addition, creating jobs in rural areas and avoiding or mitigating physical damages by natural disasters also may generate cash flow by reducing disaster costs.

References

Asahi Shimbun (2020), 'Recent Typhoons, Storms Defeated Riverbanks Rated up to the Task', 13 October.

Asia-Pacific Economic Cooperation (APEC) (2019), *2019 APEC Finance Ministers' Joint Statement,* Santiago, 15 October.

Association for the Promotion of Resilience Japan, Resilience Certification Evaluation, http://www.resilience-jp.biz/certification/about/ [in Japanese]

Bank of Fukuoka (2020), 'Begun Handling BCP Support Loan, a Loan Product for Business', press release, 11 August, https://www.fukuokabank.co.jp/pdf/20200811_bcp.pdf [in Japanese]

Bank of Japan (2020), *Basic Figures: Flow of Funds for the Second Quarter of 2020,* Tokyo, https://www.boj.or.jp/en/statistics/sj/sjexp.pdf

Bank of Nagoya (2017), 'On the Start of Handling of BCP Support Package', press release, 29 October, https://www.meigin.com/release/files/472b205101c9ab174273776d58993aba7276a854.pdf [in Japanese]

——— (2020), 'On the Handling of the Flood Disaster Countermeasure Loan with Principal Exemption: Special Contract Flood Disaster Anshin Loan', press release, 30 September, https://www.meigin.com/release/files/20200930suigai_ansin.pdf [in Japanese]

Centre for Research on the Epidemiology of Disasters (CRED) and United Nations Office for Disaster Risk Reduction (UNDRR) (2020), *Human Cost of Disaster: An Overview of the Last 20 Years, 2000–2019,* Brussels, https://reliefweb.int/sites/reliefweb.int/files/resources/Human%20Cost%20of%20Disasters%202000-2019%20Report%20-%20UN%20Office%20for%20Disaster%20Risk%20Reduction.pdf

Fukuwatari, K. and K. Okada (2019), *Research and Technical Assistance for Weather Index Insurance Using Earth Satellite Data,* Washington, DC: Keidanren [in Japanese].

Government of Japan (1961), *Basic Act on Disaster Countermeasures,* Tokyo.

Government of Japan, Ministry of the Environment (MOE) (2016), *National Adaptation Plan,* Tokyo, https://www.env.go.jp/en/earth/cc/adaptation/mat02.pdf

Government of Japan, Ministry of Foreign Affairs, Climate Change: Joint Crediting Mechanism, https://www.mofa.go.jp/ic/ch/page1we_000105.html

Government of Japan, Ministry of Land, Infrastructure, Transport and Tourism, Land and Climate of Japan, https://www.mlit.go.jp/river/basic_info/english/land.html

Imada, Y. et al. (2020), 'Advanced Risk-Based Event Attribution for Heavy Regional Rainfall Events', *Climate and Atmospheric Science,* 3.

Japan Finance Corporation, Social Environment Facility Development Funds, https://www.jfc.go.jp/n/finance/search/19_syakaikankyotaiou_m_t.html [in Japanese]

Kanagawa Prefecture (2020), 'City Public Offering Bond (Green Bond)', press release, 23 October, https://www.pref.kanagawa.jp/docs/v6g/greenbond2.html [in Japanese]

Matsumoto, J. (2016), *The Citizen's Guide to the Sendai Framework for Disaster Risk Reduction, 2015–2030,* Tokyo: Japan CSO Coalition for Disaster Risk Reduction (JCC-DRR), http://jcc-drr.net/wpJD/wp-content/uploads/2017/03/SFDRR_EN_1a.pdf

Mitsui Sumitomo Fire Insurance (2020), 'Issuance of Catastrophe Bond "Akibare Re 2020-1" in Singapore', press release, 7 April https://www.ms-ins.com/news/fy2020/pdf/0407_1.pdf, [in Japanese]

Miyazu, S. et al. (2013), 'Economic Evaluation of Flood Mitigation Measures Using Paddy Field Dam in Wanaka Paddy Field', *Journal of Japan Society of Civil Engineers,* 69(4).

Nagano Prefecture (2020), 'Green Bond Issued by Nagano Prefecture', press release, 7 October, https://rief-jp.org/ct4/107275 [in Japanese]

Research Institute for Environmental Financing (RIEF) (2020), 'According to MUFG TCFD Recommendations, Transition Risk Is up to ¥270 Billion by 2050, and Physical Risk Is ¥38 Billion per 3 Banks', press release, 19 October, https://rief-jp.org/ct1/107589 [in Japanese]

Sawada, Y. et al. (2017), 'Current Status and Issues on Disaster Risk Finance in Japanese Industries', *Research Institute of Economy, Trade and Industry (RIETI) Policy Discussion Paper Series,* No. 17-P-002, Tokyo, https://www.rieti.go.jp/jp/publications/pdp/17p002.pdf [in Japanese]

Shizuoka Bank (2019), 'Start of the Commitment Line for Flood Damage Risk – For the First Time, a Japanese Bank Supports Financing for Large-Scale Flood Disasters', press release, 28 March, https://www.shizuokabank.co.jp/pdf.php/3493/190328_NR.pdf [in Japanese]

SOMPO Holdings (2018), *SOMPO Holdings CSR Communication Report*, Tokyo.

United Nations Office for Disaster Risk Reduction (UNDRR) (2015), *Sendai Framework for Disaster Risk Reduction 2015–2030,* Geneva.

World Bank (2018), *Super-Sized Catastrophe Bond for Earthquake Risk in Latin America,* http://pubdocs.worldbank.org/en/192341554318525877/case-study-financial-products-Pacific-Alliance-final-4-1-2019.pdf

——— (2020), 'Fact Sheet: Pandemic Emergency Financing Facility', brief, 27 April https://www.worldbank.org/en/topic/pandemics/brief/fact-sheet-pandemic-emergency-financing-facility