

Chapter **1**

Overview

July 2023

This chapter should be cited as

Zen, F. and U. Iyer-Raniga (2023), 'Overview', in Fauziah Zen and Usha Iyer-Raniga (eds.), *Financing Infrastructure for Climate-Change Adaptation in Developing East Asia*. ERIA Research Project Report FY2023 No. 05, Jakarta: ERIA, pp.1-14.

Chapter 1

Overview

Fauziah Zen and Usha Iyer-Raniga

1. Introduction

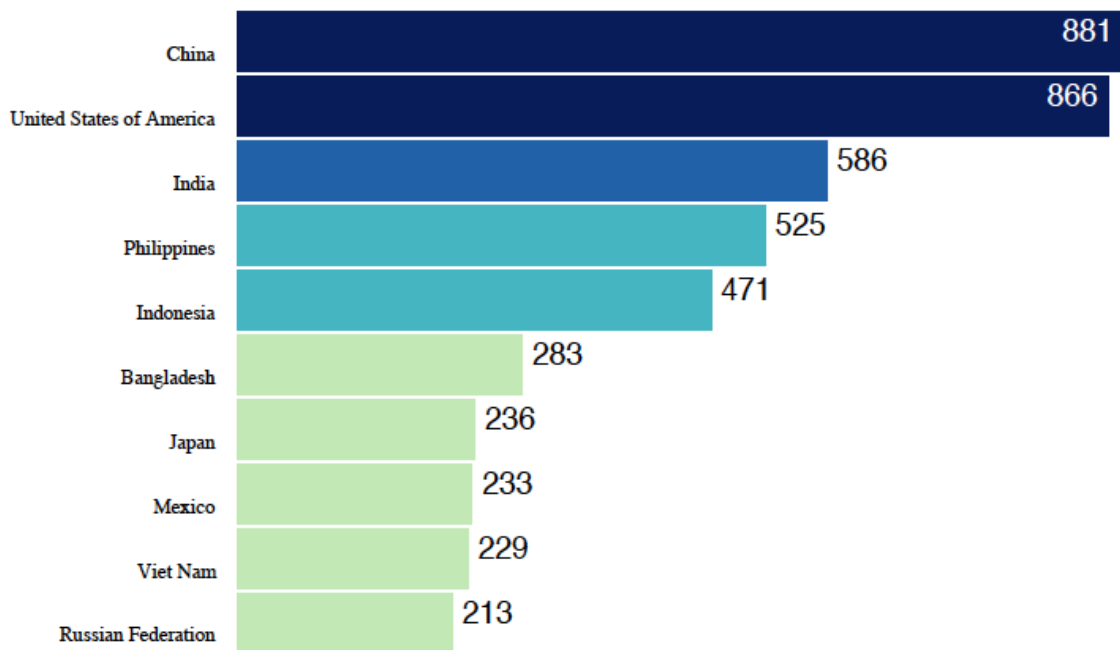
There are various definitions of disasters, depending on the institution defining them. This report uses the definition from the United Nations Office for Disaster Risk Reduction (UNDRR), 'a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts'.¹ Effects of disasters can be immediate and localised, but they are often widespread and can last for long periods. The Centre for Research on the Epidemiology of Disasters (CRED) – one of the leading institutions for disaster data and analysis – further classifies disasters into two groups: natural and technological.² Natural disasters consist of several sub-groups, including geophysical, meteorological, hydrological, climatological, biological, and extra-terrestrial. Technological disasters consist of industrial, transport, and miscellaneous accidents.

Due to its geography and associated features – the Pacific Ring of Fire, several major faults, and tropical weather – East Asia experiences a large number of natural disasters. Although China and the United States have the most number, many countries in East Asia rank in the top 10 globally of those having the most natural disasters (Figure 1.1).

¹ UNDRR, Disaster, Sendai Framework Terminology on Disaster Risk Reduction, <https://www.undrr.org/terminology/disaster>

² CRED, General Classification, EM-DAT: The International Disaster Database, <http://emdat.be>
<https://www.emdat.be/classification>

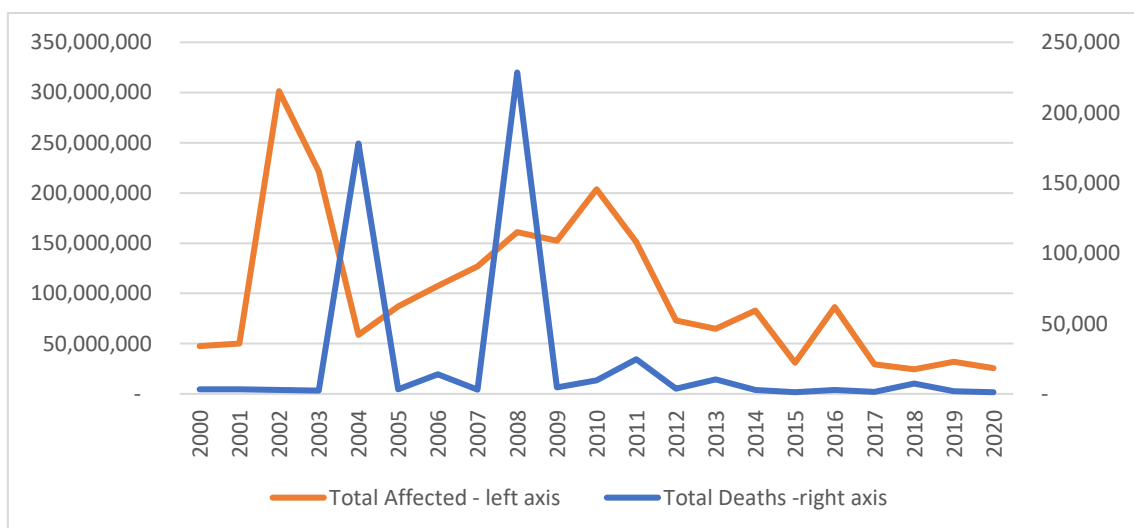
Figure 1.1. Natural Disasters by Country, 1980–2020



Source: CRED, EM-DAT: The International Disaster Database, Brussels, <http://emdat.be> (accessed February 2021).

Such disasters often lead to death, injuries, and the destruction of property and other assets (Figure 1.2). It also impacts people's sources of livelihood both immediately and into the future; thus, the costs of coping with disasters' long-term effects are typically underestimated, especially in countries with frequent – and sometimes overlapping – disasters.

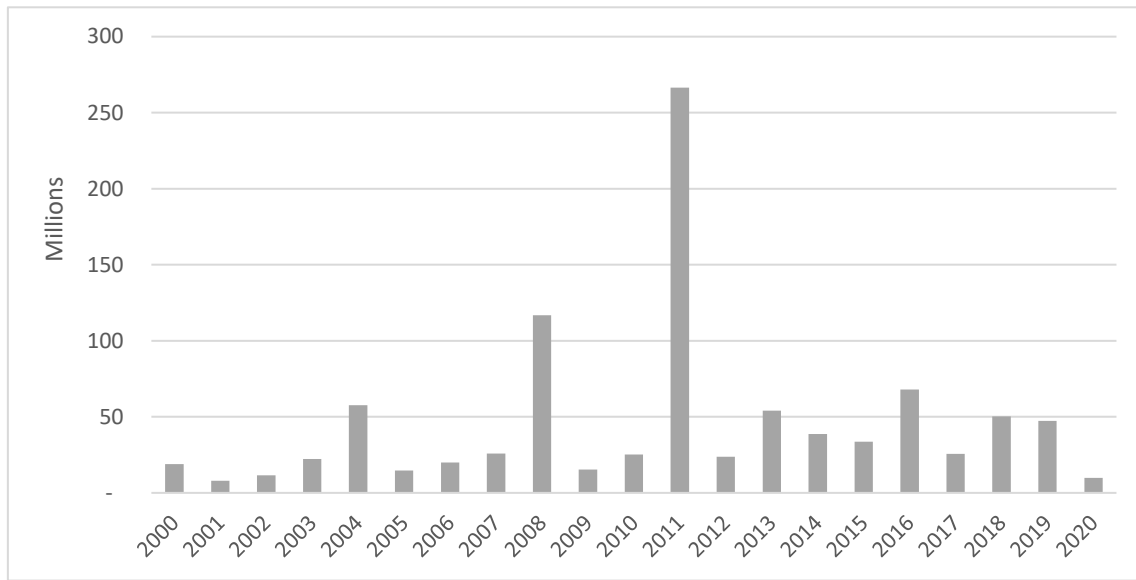
Figure 1.2. Humans Affected by Natural Disasters, East Asia, 2000–2020



Source: CRED, EM-DAT: The International Disaster Database, Brussels, <http://emdat.be> (accessed February 2021).

Damage costs from natural disasters are frequently enormous, with some years topping hundreds of millions of US dollars (Figure 1.3). In 2011, the Tōhoku earthquake and tsunami devastated Honshu, the main island of Japan. The disaster cost \$210 million – 80% of the total 2011 global damage costs from natural disasters. Moreover, the earthquake severely damaged the nuclear facility in Fukushima, leaving the area compromised for years due to radiation.

Figure 1.3. Total Damage from Natural Disasters
(\$ million)

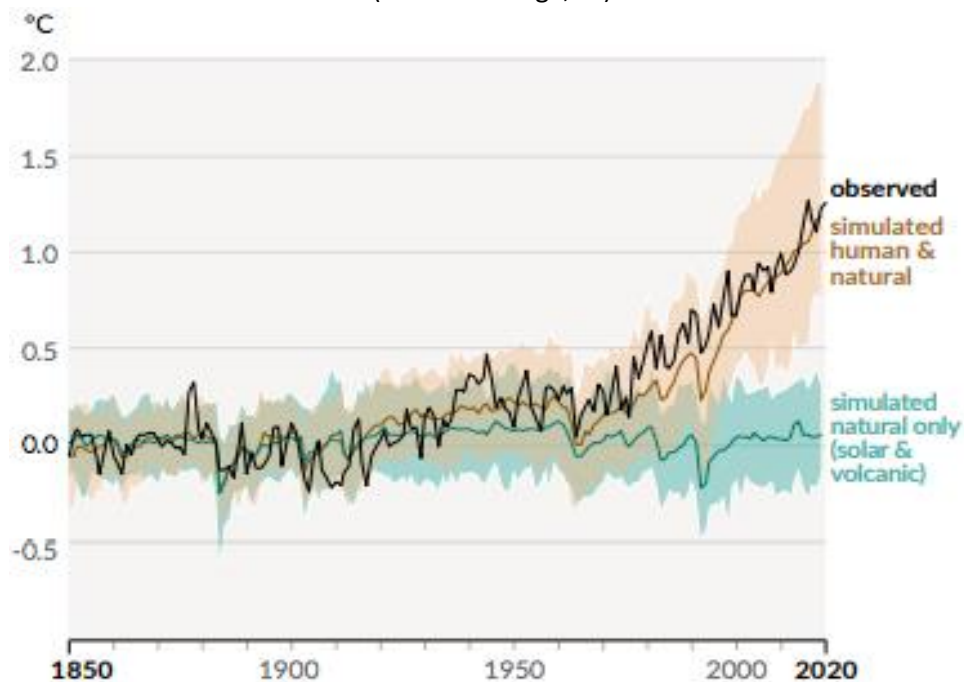


Note: Figures do not include indirect costs, such as rapid corrosion and deterioration of infrastructure, reduced productivity, and land-use changes.

Source: CRED, EM-DAT: The International Disaster Database, Brussels, <http://emdat.be> (accessed February 2021).

Over the past few decades and years, the number of natural disasters has increased, which is attributed to effects from climate change. The latest report from the Intergovernmental Panel on Climate Change (IPCC) showed that human activities are contributing significantly to alterations in global surface temperature (Figure 1.4).

Figure 1.4. Change in Global Surface Temperature, 1850–2020
(annual average, °C)

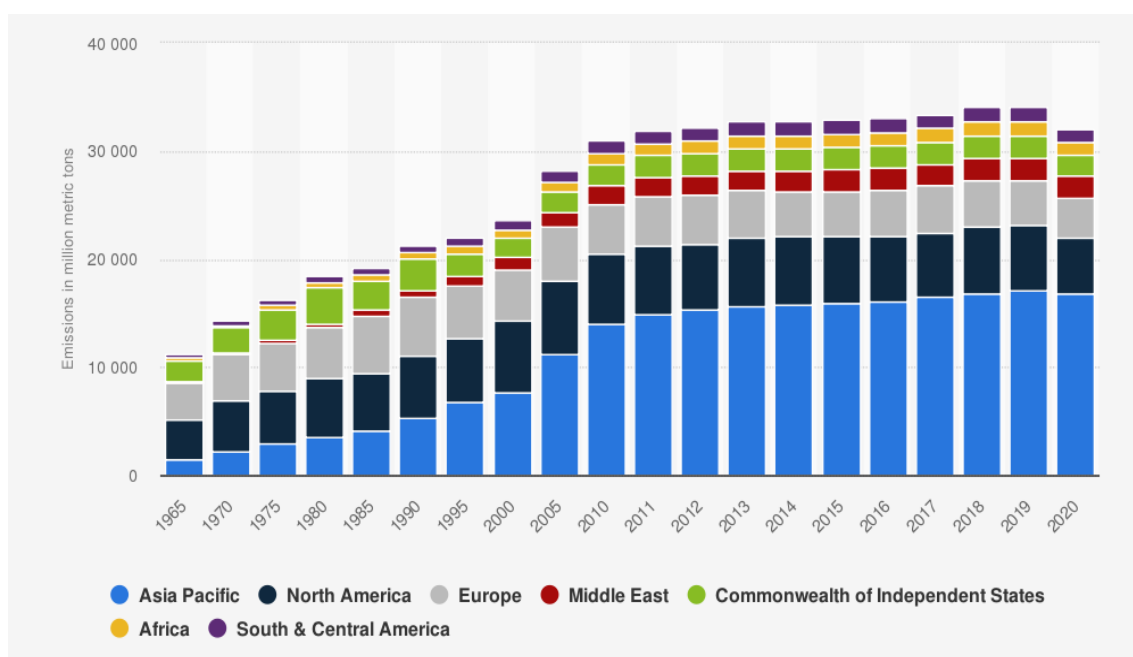


Note: As observed and simulated using human and natural, and only natural factors.

Source: IPCC (2021).

The Asia-Pacific region emits around half of the world's total carbon dioxide (Figure 1.5). These emissions can be reduced by implementing appropriate climate-change adaptation measures, including in the planning, design, implementation, management, and utilisation of various infrastructure. The following study explores financing climate-change adaptation infrastructure in select developing East Asian economies, with additional chapters on Australia and Japan as advanced economies in the region.

Figure 1.5. Carbon Dioxide Emissions by Region, 1965–2020
(million metric tonnes of carbon dioxide)



Source: BP (2021).

2. Analytical Framework

Infrastructure is both affected by climate change and can help increase human resilience towards climate-change effects. Simultaneously, poor design and management of infrastructure can contribute to climate change.

Climate-resilient infrastructure is needed; that is, infrastructure that is planned, designed, built, and operated in a way that anticipates, prepares for, and adapts to changing climate conditions (OECD, 2018). It is also expected to withstand, respond to, and recover rapidly from disruptions – that is, natural disasters – caused by these changing climate conditions.

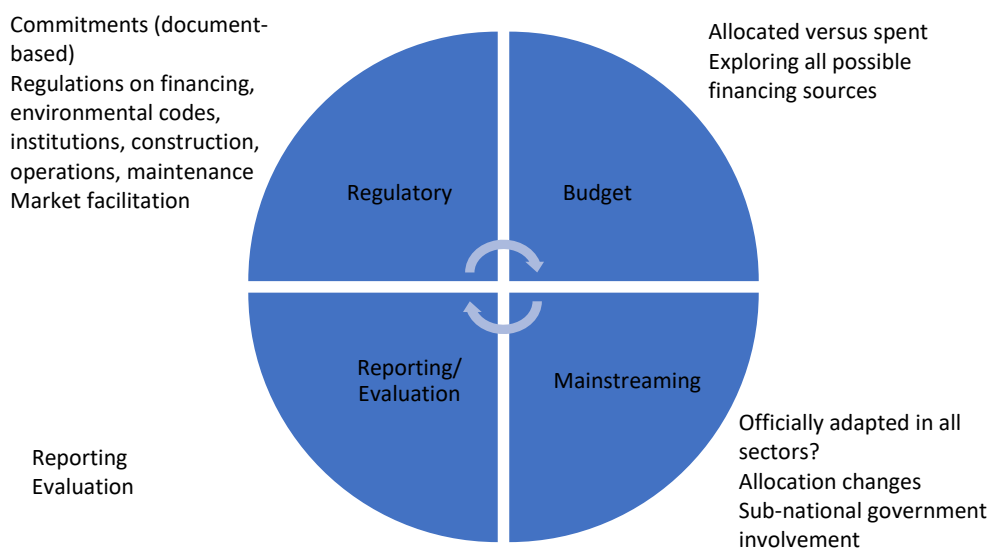
Efforts responding to climate change can be grouped into adaptation and mitigation. Adaptation involves efforts to adjust to actual or expected future climate conditions, to reduce negative impacts, and to make use of potential benefits. Mitigation is concerned with endeavours to lessen the rate of climate change, such as by reducing carbon emissions. Mitigation also aims to minimise the effects of human interference in the climate system.

The European Financing Institutions Working Group on Adaptation to Climate Change (EUFIWACC) (2016) divided infrastructure climate-change adaptation into two main groups. Structural adaptation measures distinguish climate-resilient infrastructure from ordinary infrastructure by changing its actual physical structure (e.g. altering the composition of road surfaces so that they do not warp or crack in high temperatures, or adopting riverbank naturalisation to stabilise a river). Management adaptation measures do not require any structural changes; the difference is in the way the infrastructure is managed (e.g. enhancing monitoring of existing infrastructure to reduce the risk of failure as climate conditions change).

Both the public and private sectors contribute to adaptation efforts based on their interests. Profit motives or social responsibility may drive the private sector, while governments have clearer mandates to showcase and to lead environmental responsibility. However, climate-adaptive infrastructure requires additional efforts, including adopting new technology, incorporating social and environmental considerations, and creating a green-and-transparent governance system. This new approach resulted in higher upfront investment costs and required a modern institutional setup. This is a serious challenge, especially for developing economies.

As illustrated in Figure 1.6, the public sector approach to climate-change adaptation can be evaluated through its policy, such as regulatory setup, budgeting, programmes, and monitoring. Indeed, analysing the relationship between regulations and programmes is important to ensure that the regulations are resulting in correct actions (i.e. programmes). Since climate-change adaptation is a cross-sectoral issue as well, policies must be mainstreamed across all relevant sectors.

Figure 1.6. Analytical Framework of Infrastructure Financing for Climate-Change Adaptation



Source: Author (2020).

One of the most challenging issues in climate-change adaptation is financing. Climate-change adaptation financing should be as important as that for other national priorities, such as education, health care, and security. Financing climate-change adaptation requires prioritisation, innovation, and participation from outside of the public sector as well.

Fiscal policy plays a significant role in directly influencing climate-change adaptation at all stages – mitigation, adaptation, and transition to a greener economy. Fiscal policy can be used to mobilise sources of financing and as an instrument to influence human behaviour by providing incentives or disincentives. Some countries adopt a mainstreaming strategy, initiated by the

view that climate change adaptation is a cross-sector issue; hence, efforts should be embedded in all related sectors. To monitor and track dedicated funds for climate-change adaptation, governments usually mark those budgets – known as ‘climate budget tagging’. This is an important monitoring and evaluation tool for governments and helps promote the efforts to public as well as private investors.

This study attempts to provide an analytical report on key aspects of infrastructure financing in selected Asian developing economies. It begins with this overview chapter, including key messages from the countries covered in this study, followed by country chapters (arranged alphabetically, followed by the advanced economies), and a conclusion. The COVID-19 pandemic is also included in the discussion.

3. Key Messages

3.1. China

China implemented the National Climate Change Programme through the *Work Plan for Controlling Greenhouse Gas Emissions* during its *12th Five-Year Plan* period of 2011 to 2015. Since then, it established the China National Committee for Biodiversity Conservation and enacted the *China Biodiversity Conservation Strategy and Action Plan (2011–2030)*. In 2013, the *National Strategy for Climate Change Adaptation* was released, focussing on climate-change challenges such as extreme weather conditions and impacts on livelihoods. The National Development and Reform Commission also published *China’s Policies and Actions for Addressing Climate Change* to detail the country’s climate-change mitigation and adaptation activities, low-carbon pilots, strategic planning, capability building, broad participation, international negotiation, information exchange, and cooperation on the matter.

Aside from strengthening laws and policies for green development, green finance is also being encouraged to better develop green technological innovations. Multilateral banks, bilateral development agencies, climate funds, Certified Emission Reductions and the Clean Development Mechanism, and the national carbon emission trading scheme are helping leverage multiple sources of financing, therefore enabling the projects covered in the case study. Moreover, for green bonds, there are more varieties of issuance, including financial bonds, corporate bonds, medium-term notes, asset-backed securities, Panda bonds, and non-public targeted debt financing instruments.

The government is also supporting green financing. In 2012, the China Banking and Insurance Regulatory Commission issued *Green Credit Guidelines*, and at the end of 2015, the People’s Bank of China and National Development and Reform Commission issued, respectively, *The Green Bond Endorsed Projects Catalogue* and *Green Bond Guidelines*. In 2016, the Shanghai Stock Exchange and Shenzhen Stock Exchange issued notices to encourage investment in green corporate bonds. Also in 2016, seven ministries and commissions jointly issued *Guidelines for Establishing the Green Finance System* to elevate the development of a green finance system to the national level and to cultivate new economic growth. It also helps guide social capital to participate in green projects, reduce entry barriers for funding and fundraising, and promote healthy development of the economy.

3.2. Indonesia

Indonesia is committed to working on climate action through its nationally determined contributions and the adoption of the Sustainable Development Goals. In 2009, the government formulated the *Indonesia Climate Change Sectoral Roadmap*, followed by *Rencana Aksi Nasional – Perubahan Iklim* (RAN-API) in 2014, the national action plan for climate change adaptation. Moreover, in 2012, Ministry of Public Works and Housing (MOPH) formulated *Rencana Aksi Nasional Mitigasi dan Adaptasi Perubahan Iklim* (RAN-MAPI), a road map focussing on climate change mitigation and adaptation in the infrastructure sector. Indonesia does have several regulations regarding green buildings and sustainable construction, but specific guidelines for climate-resilient technical specifications and risk estimation are needed and should be implemented during the planning of infrastructure.

Indonesia implements climate budget tagging; uses several innovative financing options, especially green bonds; and has access to funding from various international climate funds. However, it still needs to create an enabling environment to improve infrastructure financing for climate-change adaptation by creating standardisation for climate-resilient infrastructure, strengthening the existence of de-risking instruments, and providing incentives for developers. The government could also tap into other funding sources, such as pension funds, *Hajj* savings, and the sovereign wealth fund.

Infrastructure development in Indonesia is tiered at the regional and national levels. Although the government has a plan for creating climate-resilient infrastructure through the RAN-API, not all regions have regional action plans for climate-change adaptation. Moreover, climate budget tagging is still centred at the national level; only a few regions have budget tags for climate action.

The COVID-19 pandemic may be an opportunity to achieve sustainable recovery by integrating current infrastructure plans with climate resiliency. The government has emphasised that the infrastructure sector should spearhead economic recovery, as it has a strong output and labour multipliers that can reinvigorate the country's economy. The 2021 budget aims for infrastructure financing to return to the levels of the original 2020 infrastructure budget (i.e. twice the infrastructure budget of 2020 after COVID-19 revision). It is using PT Sarana Multi Infrastruktur to distribute loans for infrastructure to local governments and has sought international funding to support climate-change adaptation programmes.

The increasing role of MOPH to implement climate-resilient infrastructure guidelines for strategic national projects may improve compliance with climate resiliency in infrastructure. Mainstreaming climate-resilient infrastructure and involving local governments through Bappeda may also further the implementation of climate-resilient infrastructure. In addition, the Ministry of Finance needs to incorporate the *Climate Change Financing Framework* for climate-change adaptation financing, which will sharpen budget tagging and synchronise climate activities and funding.

3.3. Malaysia

Malaysia has increased its budget for climate-change adaptation measures, from RM282 billion in 2018 to RM308 billion in 2021. The increase is also reflected in the share of adaptation-related activities to the overall budget, which grew from 0.24% to 0.44%. The largest allocation is for flood-mitigation plans and urban drainage; the second-largest allocation is for modernising paddy irrigation.

In the longer term, allocations for flood-mitigation projects have substantially increased. Under the *12th Malaysia Plan (2021–2025)*, RM16 billion is allocated for flood mitigation projects, which is similar to the RM17 billion allocated from the entire period from 2005 to 2020. A major reason for the increase in flood-mitigation funding is due to the visible impacts and shocks that Malaysia has recently suffered. In particular, in late 2021 to early 2022, Malaysia faced one of the worst flooding incidents in its history, resulting in 54 deaths, about 100,000 displaced persons, and economic losses of \$1.46 billion.

External funding for climate change in Malaysia is focussed on mitigation. Adaptation funding is concentrated on policies and information such as developing a national adaptation plan and conducting vulnerability assessments.

3.4. Philippines

The Philippines is the ninth most at-risk country in the world in terms of disasters arising from earthquakes, cyclones, floods, droughts, or sea-level rise. Around 60% of its 110 million people lives in coastal areas vulnerable to climate change-induced disasters. The primary government agency responsible for climate adaptation advocacy is the Climate Change Commission (CCC), which works to coordinate, monitor, and evaluate government programmes on climate change and to ensure the mainstreaming of climate-change concerns in national, sub-national, and sectoral development plans.

Climate-change efforts are based on relevant regulations. The CCC formulated the *National Framework Strategy on Climate Change, 2010–2022*, which is a road map for a national programme on climate change. It details climate-change planning, research and development, extension services, monitoring of activities, and climate financing. The *National Disaster Risk Reduction and Management Plan, 2011–2028* is also being implemented, through the four mutually reinforcing thematic areas of disaster preparedness, disaster response, disaster prevention and mitigation, and disaster rehabilitation and recovery.

Funding for infrastructure for climate-change adaptation occurs through the government budget. The government is practising climate-change expenditure tagging in national agencies' budgets and local government unit budgets. The National Disaster Risk Reduction and Management Fund and local disaster risk reduction and management funds are also sources of financing since some resiliency measures can be considered adaptation responses.

International climate finance sources being tapped include the Climate Investment Funds, Green Climate Fund, and Global Environmental Facility. Potential additional sources include the Adaptation Fund through a regional project proposed by the United Nations Development Programme (UNDP), and the Joint Crediting Mechanism. The private sector also plays a role in

climate-change adaptation, such as through the Sustainable Energy Finance Program by Bank of the Philippine Islands, activities of the Philippine Business for Social Progress, and activities of the Philippines Disaster Resilience Foundation.

3.5. Singapore

Singapore has adopted whole-of-government efforts for climate-change adaptation. At the centre, supporting cross-departmental outcomes, is the National Climate Change Secretariat. Early adaptation efforts are reflected in the *Singapore Green Plan 2012* and *Sustainable Singapore Blueprint 2015*. Climate adaptation is focussed on coastal protection, water resources management, and drainage and flood protection. To protect Singapore's coasts in the long term, Singapore is assessing the possible impacts of coastal inundation under various scenarios of climate change and developing long-term strategies and adaptation measures best applicable to Singapore's coasts. In addition, it is taking a holistic approach to manage its drainage system, considering its water needs and flood risks. Flexibility and adaptability are the two key pillars in the approach to stormwater management.

The Second National Climate Change Study for Singapore provides information on anticipated climate change. The study was carried out in two phases. Phase 1 provided projections of changes in the main climate variables of interest to Singapore, while Phase 2 of which began in 2014, aims to provide the best available scientific information on the spatial and temporal scales most relevant to Singapore.

Singapore has aligned its adaptation efforts with green growth. Green growth has five thematic areas – clean technology, test bedding, clean information and communication technology (ICT), carbon services, and climate finance and climate risk management. Along with these areas, Singapore has developed a low-emissions development strategy for adaptation focussing on coastal protection, water resources and drainage, buildings and infrastructure, network infrastructure, biodiversity and greenery, public health and food security, and the urban heat island effect.

Singapore is focussed on three key adaptation actions in the long term – developing the country's resiliency framework, building climate science capabilities, and establishing adaptation measures. For climate actions in the long term, Singapore is implementing these actions through eight thematic areas – a future electricity grid, Energy Efficiency Fund, transport, buildings, Green Towns Programme, waste and water, Energy Grid 2.0, and sustainable finance.

3.6. Australia

The country's climate-change adaptation measures are guided by the *National Climate Resilience and Adaptation Strategy, 2021–2025*; however, specific goals to support resilience are the responsibility of state and local governments. Industries have also responded to existing pressures, leading to a multipronged approach with no clear strategic direction due to lack of leadership by the national government.

As a large country with a low population density, infrastructure plays a significant role in the economy, accounting for nearly 10% of the gross domestic product (GDP), with transport alone accounting for nearly 20% of Australia's greenhouse gas emissions. The ownership and

management of public infrastructure are either by state or national governments. Again, however, lack of national leadership has not supported effective climate-change adaptation in the infrastructure sector. Increasingly, responding to climate change is falling to local governments as they respond to community pressures.

Some private companies, such as the Brisbane Airport Corporation, have incorporated adaptation measures, such as responding to sea level rise by building a new sea wall and tidal channels. The cost for these were split amongst1 shareholders, loans, and an increase in landing fees and airline fees.

Australia has supported other countries largely through overseas development aid (ODA), derived as a proportion of the country's annual budgeting process. Australia's budget for ODA is well below the international agreed level of 0.7% of its total budget and has not increased in recent years, although the way it is packaged has changed. Determining the level of aid offered relies on a strategic approach and willingness to deal with climate change and related impacts, shifting to low-emissions development in the region and supporting innovation, including private sector investments.

The COVID-19 pandemic has impacted funding, with efforts being directed towards economic recovery activities rather than climate change and adaptation activities. Despite the impact on transport and global travel resulting in lower carbon emission levels, overall temperatures are expected to rise over the continent, leading to changes in weather patterns and to further uncertainties related to climate change, unless concerted actions to deal with emissions are not taken urgently.

3.7. Japan

The country's climate-change adaptation plan was developed in November 2015. However, its enactment was delayed until 2018. The mitigation policy – the Law Concerning the Promotion of the Measures to Cope with Global Warming – was established in 1998. Thus, mitigation and adaptation policies for climate change are dealt with separately in Japan.

The government has decided to enact new laws on adaptation on the grounds that mitigation and adaptation measures differ in their main objectives and measures, and the impacts of climate change are already in place and are likely to increase in the future. The laws centre on promoting adaptation, developing information infrastructure, strengthening adaptation in the region, and expanding adaptation internationally.

The position of adaptation finance remains insufficient, but there are increasing efforts to prepare for potential natural disasters. Japan also links the climate-resilience concept with other relevant sectors such as sustainable development, poverty eradication, and climate-change adaptation. Both the government and private sector have been putting serious efforts into financing climate-change adaptation.

4. Financing: A Collective Effort

Financing climate-adaptive infrastructure requires huge budgets, because many effects are still unknown or uncertain – especially the probability and scale of future disaster events. Consequently, it requires lengthy, resource-rich research efforts, and the transition process to new methods and technology often entails delaying important projects and asking for higher upfront investment costs. This has thus been met with some challenges in the learning process to comply with environmental requirements, along with limited government fiscal capacity and sources of financing.

Another challenge to embracing green infrastructure is that investment typically requires substantial upfront costs, while most benefits from these adjustments are seen only in the long term or in the form of avoiding potential damages. Business models can face difficulties translating these benefits into project business plans. The burden of the high upfront costs is thus often distributed to other stakeholders, especially governments. However, many countries with limited government funding – usually small and/or developing countries – are those most vulnerable to the impacts of climate change. Pacific island countries, for instance, face various economic obstacles including geography; market sizes; remote locations; distances amongst islands; and increasing threats of climate change such as rising sea levels, rising earth and seawater temperatures, hurricanes and typhoons, and floods.

During the COVID-19 pandemic, community vulnerability increased, particularly in poorer areas often most affected by climate change. This double burden is something that is becoming increasingly clear, providing an even stronger argument for all parties – especially governments – to work to prevent rapid climate change. Indeed, the costs incurred to adopt climate-change mitigation efforts are less than those from the damage caused if stakeholders do not adopt them (Hallegatte, Rentschler, Rozenberg, 2019).

Global efforts have been made to facilitate green investments, but the pace has moved slowly. Attempts to include the intangible benefits of green investments have been made in some estimates, but it is challenging to transform them into actual project finance. Economic benefits and saving economic losses may have indifferent impacts on private investors, especially if the figures are high – they cannot directly enter the project's income statement and rate of returns. This is where non-business stakeholders, such as governments and multilateral agencies, should play a prominent role.

The abovementioned challenges make key stakeholders call for 'innovative finance'. Some schemes under public-private partnerships are using climate-change adaptation principles. Another effort is the creation of blended finance schemes, which mix funds from multilateral agencies, development agencies, the private sector, philanthropic foundations, and other donors. Apart from financial sources, the diverse actors in blended finance have various complementary roles. For instance, philanthropic foundations, donors, and development agencies typically have higher risk tolerance than the private sector. The funding from these actors can be used to de-risk the project so it will be more attractive to private investment. They can also provide indirect investment, such as through technical assistance grants, demonstrating the initial initiatives and then taking on subordinate positions.

Blended finance is a relatively new scheme in infrastructure finance; however, it has become more popular, especially for projects adopting environmental, social, and governance (ESG) principles. Complexities in climate adaptive projects are multidimensional; not only do they contain size, technological, and risk-measurement challenges, but the causes and impacts are borderless. For these reasons, this report asks that this issue be considered a collective measure.

Country reports show the need to respond globally when countries face a huge burden in dealing with a grave, immediate situation – such as the COVID-19 pandemic. Climate-change adaptation should thus be a collective effort of the Earth's inhabitants, because the externalities of climate change and environmental damage do not recognise administrative, territorial, or other barriers created by humans. The greenhouse effect, to which industrial and consumptive human actions contribute, will be experienced by all humans and living creatures.

References

- BP (2021), *Statistical Review of World Energy*, London.
- Centre for Research on the Epidemiology of Disasters (CRED), EM-DAT: The International Disaster Database, Brussels, <http://emdat.be> (accessed February 2021).
- General Classification, EM-DAT: The International Disaster Database, <http://emdat.be> <https://www.emdat.be/classification>
- European Financing Institutions Working Group on Adaptation to Climate Change (EUFIWACC) (2016), *Integrating Climate Change Information and Adaptation in Project Development: Emerging Experience from Practitioners*, https://econadapt.eu/sites/default/files/2016-11/EUFIWACC_Adaptation_Note_Version_1.0_ENGLISH_FINAL_20160601%5B1%5D.pdf
- Hallegatte, S., J. Rentschler, and J. Rozenberg (2019), *Lifelines: The Resilient Infrastructure Opportunity*, Washington, DC: World Bank.
- Intergovernmental Panel on Climate Change (IPCC) (2021), 'Summary for Policymakers,' in V. Masson-Delmotte, et al. (eds.), *Climate Change 2021: The Physical Science Basis – Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge: Cambridge University Press.
- Organisation for Economic Co-operation and Development (OECD) (2018), 'Climate-Resilient Infrastructure: Policy Perspective', *OECD Environment Policy Papers*, No. 14, Paris.
- United Nations Children's Fund (UNICEF), United Nations Development Programme (UNDP), and SMERU Research Institute (2021), *The Socio-Economic Impact of COVID-19 in Post-Disaster Areas: Rapid Assessment in West Nusa Tenggara and Central Sulawesi*, Jakarta: UNICEF.
- United Nations Office for Disaster Risk Reduction (UNDRR), Disaster, Sendai Framework Terminology on Disaster Risk Reduction, <https://www.undrr.org/terminology/disaster>