

# Chapter 3

## Indonesia

July 2023

**This chapter should be cited as**

Halimatussadiyah, A., F. R. Moeis, and M. Adriansyah (2023), 'Indonesia', 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.41-73.

# Chapter 3

## Indonesia

Alin Halimatussadiyah, Faizal Rahmanto Moeis, and Muhammad Adriansyah

### 1. Introduction

Indonesia is the world’s fourth most-populous nation, home to around 260 million people. Fifty-six percent of the country’s population lives in urban areas, and a majority lives in Java. One-half of employed persons works in the services sector, one-third works in agriculture, and the rest works in the industrial sector. Moreover, Indonesia is the world’s 10th largest economy, with a gross domestic product (GDP) of \$1.1 trillion in 2019. This economic level has recently prompted Indonesia to reach upper-middle income status. Geographically, the country is an archipelago situated in South-East Asia. As a country made up of multiple islands, Indonesia is more prone to climate-change effects, including rises in sea level and shifts in temperature and rainfall (Veron et al., 2019).

Climate change has affected every nation in the world. Activities in the past to improve economies – including the use of fossil fuels and deforestation – have impacted the environment. This has caused natural phenomena such as rising surface temperatures, rainfall, ocean temperatures, and sea levels, as well as extreme climate and weather events. These are also becoming increasingly erratic and extreme, which negatively impacts several sectors.

**Figure 3.1. Climate-Change Risks in Certain Sectors in Indonesia**

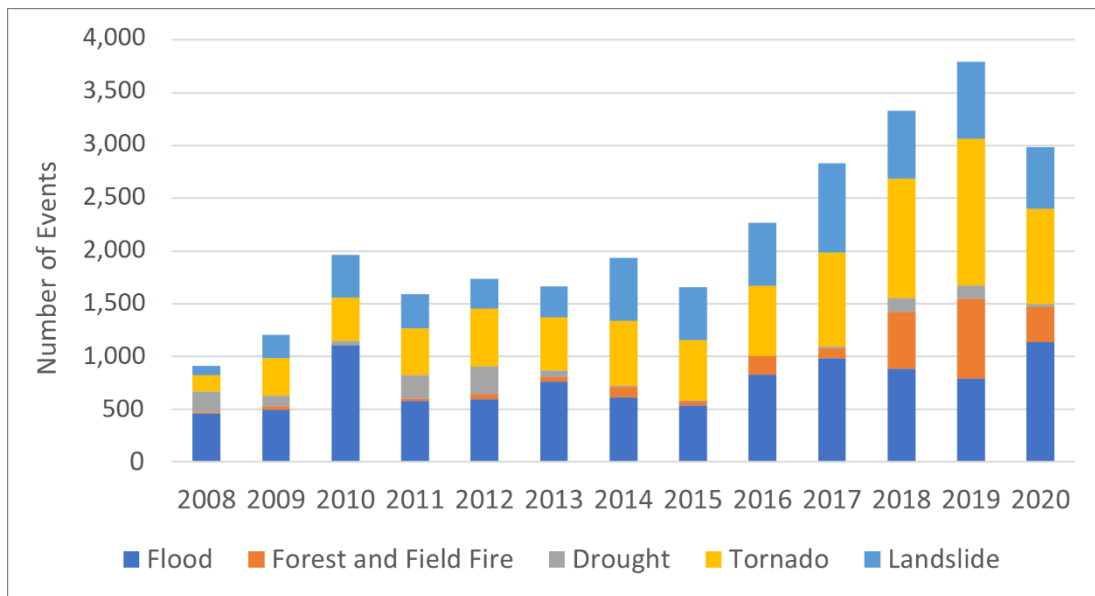
	Food Security	Energy	Health	Infrastructure	Housing	Ecosystem	Forestry	Urban Development	Coastal	Telecommunications	Transport
Surface Temperature	Light Orange	White	Light Orange	White	Light Orange	Light Orange	White	White	Light Orange	White	White
Rainfall	Red	Light Orange	Light Orange	Light Orange	Red	Light Orange	Light Orange	Red	Light Orange	Light Orange	Light Orange
Ocean Temperature	Red	White	White	White	Light Orange	Red	White	Light Orange	Red	White	Light Orange
Sea Level	Red	White	Light Orange	Light Orange	Red	Red	White	Light Orange	Red	Light Orange	Light Orange
Extreme Climate Events	Light Orange	Light Orange	White	Light Orange	Light Orange	White	Light Orange	Light Orange	Light Orange	Light Orange	Light Orange
Extreme Weather Events	Red	Light Orange	Light Orange	Light Orange	Light Orange	Light Orange	White	Light Orange	Red	Red	Red

Notes: Red = High Risk, Orange = Moderate Risk, Light Orange = Low Risk, White = No Risk.

Source: Bappenas (2014).

Figure 3.1 shows how each sector in Indonesia is affected by climate risks. For example, coastal areas are highly affected, as ocean temperature and sea-level changes disturb the livelihoods and settlements of coastal areas. Various transport modes are affected – water by sea level, air by weather, and land by road damage and floods. Buildings are also affected due to damage caused by increased heat, heavy rainfall, and extreme climate or weather events. Hecht (2016) calculated that climate change impacts – including those on crop production, health, and coastal areas – up to 2050 in Indonesia will cost Rp132 trillion.

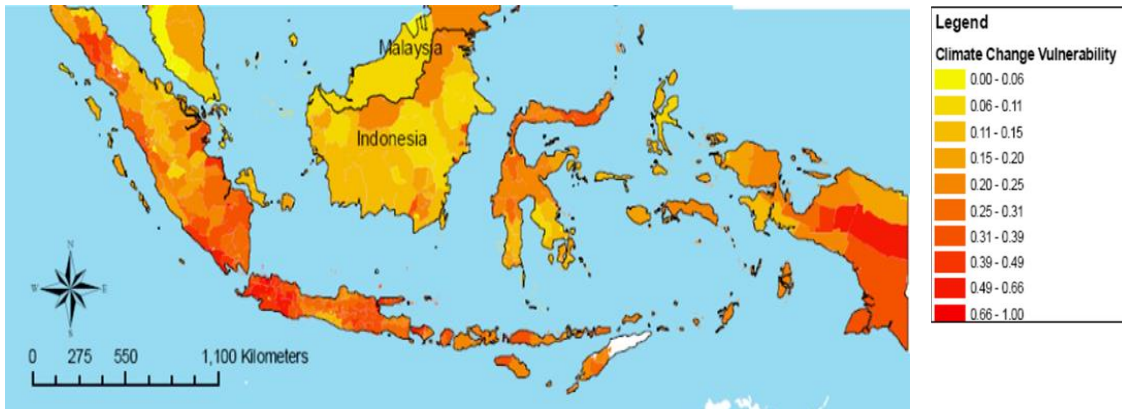
**Figure 3.2. Climate-Related Natural Disasters in Indonesia, 2008–2020**



Source: BNPB (2020).

Climate change also causes erratic and uncertain changes to climate-related phenomena, which may lead to natural disasters. Since 2015, there has been a continuous increase in climate-related disasters in Indonesia, which reached a peak in 2019. On average, these disasters have led to the deaths of 374 people and the destruction of 44,519 houses and 2,177 public facilities every year. Moreover, such disasters cost \$16.8 billion in damage and affected 8 million lives (Gunawan et al., 2016). The El Niño phenomenon in 2015 caused numerous major land and forest fires, which were estimated to have cost at least Rp221 trillion in damages, twice that of the reconstruction after the 2004 Indian Ocean earthquake and tsunami.

**Figure 3.3. Climate-Change Vulnerability Map**

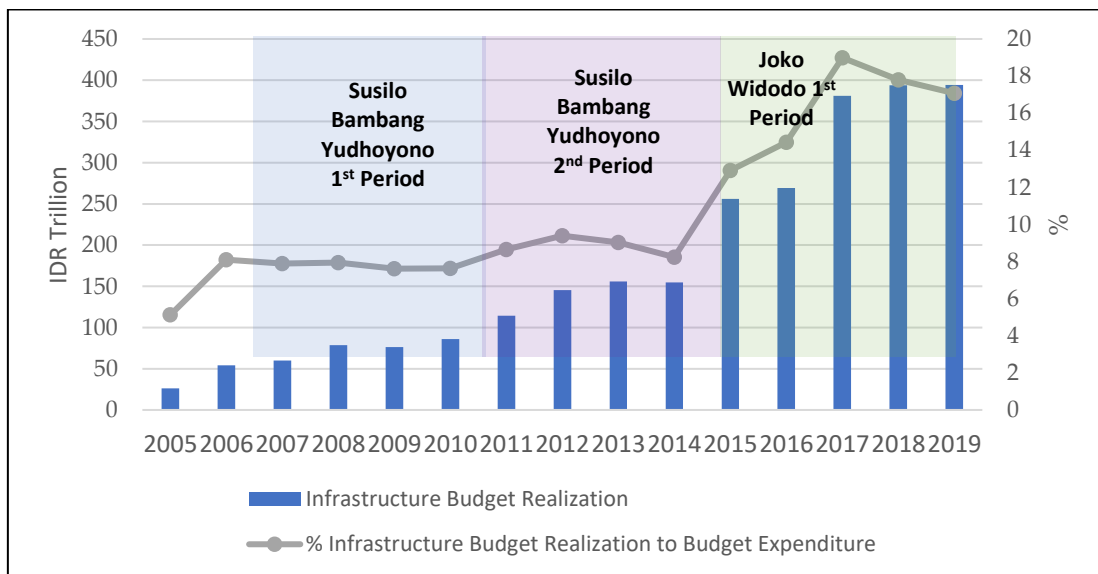


Source: Yusuf and Francisco (2009).

Regionally, Indonesia’s vulnerability varies amongst islands (Government of the Netherlands, Ministry of Foreign Affairs, 2018). Figure 3.3 shows the vulnerability of regions in Indonesia. Kalimantan has the least climate-change vulnerability, while Java, Papua, and Sumatra have the most areas that are vulnerable to climate change. Indeed, 77% of climate-related disasters from 2008 to 2020 occurred in Java, Papua, and Sumatra. Note that 82.02% of Indonesia’s 2019 GDP was from these three islands. Thus, if climate change goes unmitigated, damage to these areas will be catastrophic for Indonesia’s economy.

**Figure 3.4. Indonesia’s Infrastructure Budget, 2005–2019**

(Rp trillion)



Source: MOF (2020b).

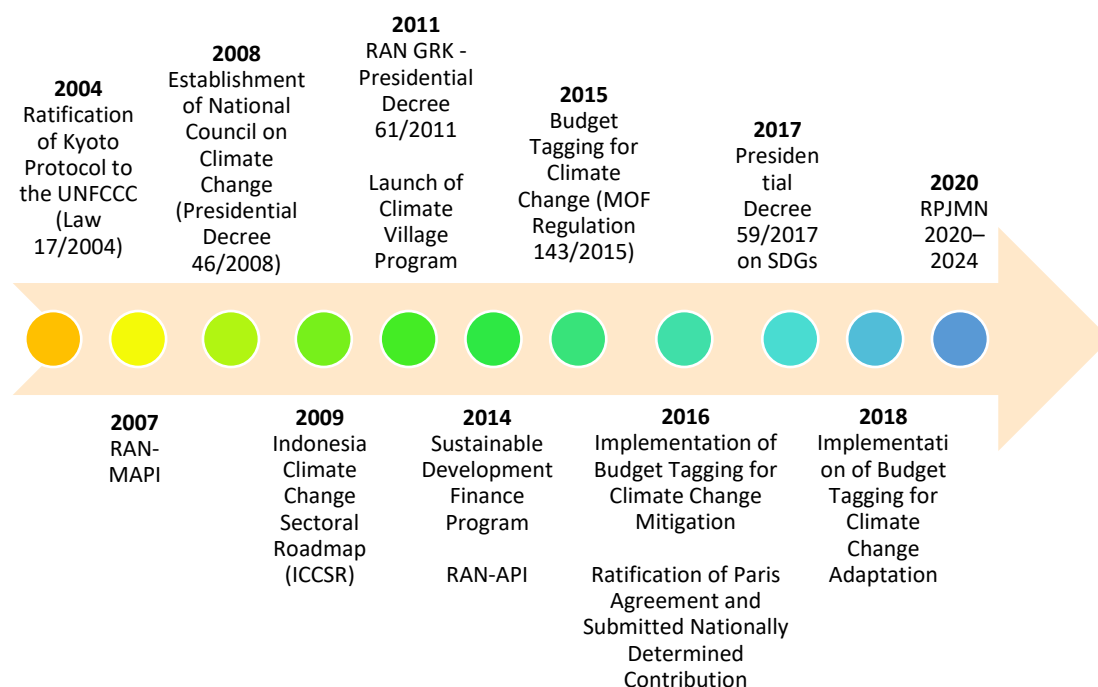
Indonesia's climate-change vulnerability poses risks to infrastructure development, which has become the focus of the current government. During President Susilo Bambang Yudhoyono's tenure (i.e. 2004–2014), infrastructure budget realisation was always less than 10% (Figure 3.4). This level was inadequate to achieve *National Medium-Term Development Plan (Rencana Pembangunan Jangka Menengah Nasional, RPJMN)* targets at a time that necessitated infrastructure investment of 7% of the GDP (Bappendas, 2020). By contrast, during President Joko Widodo's term (i.e. 2014–now), many reforms have increased infrastructure investment, which now exceeds 12% of the total state budget every year. Most of Indonesia's current infrastructure development is in Java and Sumatra, with more than 50% of national strategic projects built in these two regions.

The objective of developing climate-resilient infrastructure is to reduce vulnerability to climatic change and variability, thus reducing their negative impacts. The net benefit of adaptation is the damage avoided less the cost of climate resilience (Appendix 1). The cost of adaptation does become complicated, as additional upfront costs are needed for more resilient assets. However, the extra costs for building resilience are estimated only to be 3% of overall investment needs (Hallegatte et al., 2019). Moreover, such costs could be offset by lower maintenance and repair costs. Strengthening infrastructure assets exposed to natural hazards is beneficial, as 96% of cases have a cost–benefit ratio higher than 1, 77% have a cost–benefit ratio higher than 2, and 25% have a cost–benefit ratio higher than 6 (Hallegatte et al., 2019).

Indonesia is committed to contributing to climate-change mitigation and adaptation (Figure 3.5). In 2004, Indonesia ratified the Kyoto Protocol, which began Indonesia's international commitment to lowering greenhouse gas emissions. In 2007, the *National Action Plan for Climate Change Mitigation and Adaptation (Rencana Aksi Nasional Mitigasi dan Adaptasi Perubahan Iklim, RAN-MAPI)* was published (Government of Indonesia, 2014). This directs the Ministry of Public Works and Housing (MOPH) to develop infrastructure, including roads, bridges, and water and sewerage systems.

In 2009, Indonesia published its first climate change road map, *Indonesia Climate Change Sectoral Roadmap (ICCSR)* (Bappendas, 2010). It contains adaptation and mitigation efforts in certain sectors, including forestry, industry, and energy. In 2014, the government established its second climate-change road map, the *National Action Plan for Climate Change Adaptation (Rencana Aksi Nasional Adaptasi Perubahan Iklim, RAN-API)*, as the continuation of the ICCSR (Bappendas, 2014). In 2016, it ratified the Paris Agreement and submitted its nationally determined contribution (NDC), which targets a 29%–41% emissions reduction by 2030. In 2017, the government committed to implementing the Sustainable Development Goals (SDGs) through Presidential Decree No. 59/2017. Currently, the RPJMN aims to develop the environment and to improve disaster resilience and climate change (Bappendas, 2020).

**Figure 3.5. Indonesia's Milestones Regarding Climate Change**



MOF = Ministry of Finance, RAN-API = *National Action Plan for Climate Change Adaptation*, RAN-MAPI = *National Action Plan for Climate Change Mitigation and Adaptation*, RPJMN = *National Medium-Term Development Plan*, SDG = Sustainable Development Goal, UNFCCC = United Nations Framework Convention on Climate Change.

Source: Author.

Overall, climate-change risks are costly and affect many vital sectors in Indonesia, including infrastructure. Currently, the infrastructure gap in Indonesia is still high, and investing in infrastructure is the government's current focus to enhance the economy. Hence, the need for climate-resilient infrastructure to mitigate and to adapt to climate-change risks – while continuing to fill the infrastructure gap – will lead to sustainable development. However, climate resilience in infrastructure development is a relatively new concept in Indonesia and may face certain challenges. This chapter focusses on current climate-resilient infrastructure development in Indonesia, including financing and mainstreaming, and how the COVID-19 pandemic has impacted climate-resilient infrastructure development.

The chapter is presented as follows. Section 2 explains climate-resilient infrastructure, its financing gap, and alternative sources for its funding; Section 3 describes the challenges and opportunities for implementing infrastructure financing for climate-change adaptation in terms of mainstreaming, financing, and evaluation and monitoring, while Section 4 outlines policy considerations due to the COVID-19 pandemic. Section 5 synthesises findings from previous chapters and analyses financing gaps in Indonesia, and Section 6 concludes.

## 2. Climate-Change Adaptation and Climate-Resilient Infrastructure

### 2.1. Understanding Climate-Change Adaptation

Before discussing infrastructure for climate-change adaptation, it is necessary to understand the definition of climate-change adaptation. One of the most used definitions was created by the United Nations Framework Convention on Climate Change (UNFCCC). It defines climate-change adaptation as actions taken to help communities and ecosystems cope with changing climate conditions.<sup>1</sup>

In Indonesia, climate-change adaptation is defined in Law No. 32 (2009) on Environmental Protection and Management, Article 57, Paragraph 4. Climate-change adaptation is an effort to increase the ability to adapt to climate change, including climate diversity and extreme climatic events, so that the potential for damage due to climate change is reduced, the opportunities caused by climate change can be exploited, and the consequences of climate change can be overcome.

### 2.2. Understanding Climate-Resilient Infrastructure

For infrastructure to adapt to climate change, climate-resilient infrastructure must be built. Climate-resilient infrastructure 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 caused by these changing climate conditions. The definition of climate-resilient infrastructure is not only limited to new infrastructure development, however. Climate-resilient bridges may be identical objects to ordinary bridges, but they are managed with due regard to the impacts of climate change. EUFIWACC (2016) divided the types of infrastructure adaptation into two groups:

- (i) **Structural adaptation measure.** This first type distinguishes climate-resilient infrastructure from ordinary infrastructure by changing its structure (e.g. changing the composition of road surfaces so that they do not deform in high temperatures),
- (ii) **Management adaptation measure.** This type of adaptation does not require any structural changes to the infrastructure being built. The difference with ordinary infrastructure is in the way it is managed (e.g. enhancing the monitoring of existing infrastructure to reduce the risk of failure as climate conditions change).

As climate change is inevitable – and Indonesia has a propensity towards associated disasters – ensuring the development of infrastructure that is resilient is mandatory. In Indonesia, the framework for developing climate-change adaptation is arranged in the RAN-API; its main goal is to manage sectors and aspects of development affected by climate change, which is then divided into five main objectives – economic resilience, livelihood resilience, environmental services resilience, special areas resilience, and adequate support systems. Infrastructure is one of the areas discussed under the livelihood resilience objective. The main target of infrastructure is the enhanced coverage of services and strengthening of infrastructure to be reliable and of

---

<sup>1</sup> UNFCCC, <http://unfccc.int/>

standard quality in facing the impacts of climate change. To achieve that target, the government has created an action plan for 2013–2025 (Table 3.1).

**Table 3.1. Summary of the *National Action Plan for Infrastructure, 2013–2025***

No.	Action Plan	Scope	Priority Location	Institution Involved
1	Cluster 1: Analysing the concept of infrastructure resilience	Research and development of enhancing the resilience of climate-change adaptive infrastructure	National, coastline cities that are high risks	Ministry of Marine Affairs and Fisheries, Ministry of Public Works and Housing
2	Cluster 2: Improving access to roads and bridges	Reducing risks of disrupting access to roads and bridges due to climate-change impacts	National, coastline cities; pilot studies in high-risk areas	Ministry of Public Works and Housing, Bappenas, BNPB, regional governments
3	Cluster 3: Strengthening institutions	Submitting information on infrastructure that is climate-change-resilient  Providing infrastructure for climate-change resilient sanitation and waste processing	National, pilot studies in high-risk areas	Ministry of Public Works and Housing, regional governments
4	Cluster 4: Integrating sustainable development	Applying city and area concepts and structures based on studies of community vulnerabilities and application of green cities	National high-risk cities	Ministry of Public Works and Housing, regional governments, Bappenas, LIPI

BNPB = National Agency for Disaster Countermeasures (*Badan Nasional Penanggulangan Bencana*), LIPI = Indonesian Institute of Sciences (*Lembaga Ilmu Pengetahuan Indonesia*).

Source: Government of Indonesia (2014).

### 2.3. Financing Gap

International reports have estimated the financing needs for climate adaptation worldwide, which range from \$28.7 billion to \$90.0 billion up to 2020 and \$247.2 billion to \$385.2 billion to 2030 (Fiscal Policy Agency, 2019). However, there is no formal document that estimates



Indonesia's financing needs for climate efforts. Indonesia uses the targets outlined in the NDC, but achieving the NDC requires significant funds. Indeed, Indonesia conveyed that the estimated funding needed to achieve its emissions reduction target is about \$247.2 billion (Government of Indonesia, 2018) (Appendix 2).

The energy and transport sectors, which are dominated by infrastructure development, lead the financing needs, with Rp3.307 trillion or 95.5% of the total funds. If calculated on an average basis from 2016, Indonesia needs financing of about Rp220 trillion per year to reach the 2030 target (Government of Indonesia, 2018). However, since Indonesia implemented climate budget tagging, the budget allocated for all sectors has only reached Rp89.6 trillion on average per year. Even if it is assumed that all funds are allocated for the energy and transport sectors, these funds only make up about 40.64% of the total annual funding required.

Another approximation that could be used is the financing needed to fulfil the MOPH strategic plan. This does not show the financing needs specifically for climate-resilient infrastructure nor the financing gap, but it could illustrate that Indonesia needs enormous funds to fulfil its targets in infrastructure development (Table 3.2). From these estimates, it can be concluded that there is still a huge gap in meeting both targets. This gap must be filled not only from the state budget but also from other sources.

**Table 3.2. Ministry of Public Works and Housing Vision for 2030**

<b>Focus</b>	<b>Target</b>	<b>Financing Needs (Rp trillion)</b>
Water Resources	Multi-function dam with a capacity of 120 cubic metres/capita/year	1,423
Roads and Bridges	99% steady road Toll road 2,000 kilometres New road 3,000 kilometres New bridge/flyover of 70,000 metres	838
Human Settlements	100% drinking water availability 100% sanitation services Reducing the area of urban slum settlements by 4.4% (to 0 hectares)	170
Housing	The housing backlog for low-income people at 3 million units, achieved through the construction of 4.88 million housing units	1,220
<b>Total</b>		<b>3,651</b>

Source: MOPH (2020b).

### 3. Financing Options for Climate-Resilient Infrastructure

This section explores the sources used to finance climate-resilient infrastructure projects and the types of projects that are suitable for each funding source. Broadly speaking, they are divided into public, private and blended, and international funds.

#### 3.1. Public Source Financing

Funding from the public sector should be used to finance basic public infrastructure such as water, sanitation, pioneer ports, and roads in border areas, and/or projects that are not financially viable. The government should also invest in projects that are strategic and can improve local and national economies. Some sources of public sector funding are as follows.

- (i) **State budget.** Budget tagging for climate change was first carried out by the central government in the 2016 budget. Up to 2020, the government budgeted Rp448.3 trillion for climate change or Rp89.66 trillion per year. In 2018, the budget allocated for climate change reached Rp109.7 trillion (4.9% of the total state budget), whereas most of the budget (i.e. Rp85.9 trillion) was used by MOPH for infrastructure construction. Mitigation efforts included train infrastructure and road reconstruction and construction, whereas adaptation efforts included the construction of dams, flats, and river normalisation (Appendix 3).
- (ii) **Government green bonds and green sukuk.** To support commitments to low-carbon policies and climate resilience, the government developed a green bond and green sukuk framework. In March 2018, Indonesia issued a global green sukuk worth \$1.25 billion, which was the first in the world. About 49% of the sukuk's value was backed by ongoing or future infrastructure projects. Projects financed by green sukuk include the double-track railway project on the North Java line and a solar power plant project in Sumbawa.

#### 3.2. Private and Blended Source Financing

The investment made by the private sector – or a combination of the public and private sectors – could be offered for financially and economically viable infrastructure with full cost-recovery and favourable rates of return. These infrastructure projects can take the form of toll roads, transport infrastructure, or housing. Some sources are as follows.

- (i) **PT Sarana Multi Infrastruktur green bonds.** PT Sarana Multi Infrastruktur (SMI) is an infrastructure finance company owned by the government that participates in non-public funding for climate change. In the first phase of 2018, PT SMI issued and offered sustainable green bonds with a principal amount of up to Rp1 trillion (PT SMI, 2018). The funds collected will be used to finance infrastructure development in several sectors.
- (ii) **OCBC NISP green bonds.** At the initial issuance, the International Finance Corporation collaborated with OCBC NISP and committed to finance bonds of \$150 million. It was followed by the issuance of Sustainable Bonds III Phase 1 with a value of Rp1 trillion. The fund is intended to increase the distribution of environmentally sound financing, a part of which is targeted at the development of green buildings, renewable energy, and infrastructure.

- (iii) **Bank Rakyat Indonesia green bonds.** In 2019, Bank Rakyat Indonesia issued a global sustainability bond of \$500 million as an alternative source of funding. The funds raised were partly used to finance housing, transport, and construction.
- (iv) **PT Sarana Multi Infrastruktur SDG Indonesia One.** SDG Indonesia One is an integrated platform that combines public and private funds to be channelled into infrastructure projects related to the achievement of the SDGs. Until October 2020, it collected commitments of \$3.03 billion from 32 financial institution partners and philanthropists.<sup>2</sup>

### 3.3. International Climate Funds

In contrast to public and private sources that target funding based on costs and returns generated by the projects, international climate funds are channelled to projects that match the investment criteria of the institution. The sources of funding are as follows.

- (i) **Global Environment Facility.** The Global Environment Facility is an incremental multilateral funding mechanism in which one of the activities is financing climate-change programmes. So far, the facility has financed 60 national projects in Indonesia, with total financing of \$281.6 million, and 77 regional or global projects that involve Indonesia, with total financing of \$1.02 billion. Several infrastructure projects that have been undertaken include the development of geothermal power plants, bus rapid transit, and pedestrian improvements in Jakarta.
- (ii) **Green Climate Fund.** As of 2020, the Green Climate Fund has channelled \$213.3 million to climate projects in Indonesia. An example of an infrastructure project is Climate Investor One, a multilateral project involving an investment fund of \$821.5 million to support the development of renewable energy projects for 18 countries, including Indonesia.

The availability of funding options is important, as each source has its advantages and disadvantages. Therefore, Indonesia needs to add more financing options so that it can finance a wider variety of projects and capture investors from various circles.

---

<sup>2</sup> PT SMI, SDG Indonesia One, <https://ptsmi.co.id/sdg-indonesia-one/>

**Table 3.3. Advantages and Disadvantages of Financing Options**

<b>Financing Option</b>	<b>Advantage</b>	<b>Disadvantage</b>
State Budget	Open to economically unviable projects Could be directed to national strategic projects	Limited fiscal space
Green Bonds	Big pool of funds High transparency Suitable for big and small players	Shallow market Inefficient financial market in Indonesia
SDG Indonesia One	Enormous funding Comprehensive benefits other than financial support	Projects tailored to the standards of donors and investors
International Climate Funds	Enormous funding	Have their own investment criteria More complicated requirements and procedures

SDG = Sustainable Development Goal.

Source: Author.

#### **4. Challenges in Climate-Resilient Infrastructure Financing**

##### **4.1. Classification**

Although climate-change adaptation is already defined in legislation, no document specifically classifies and standardises climate-resilient infrastructure in Indonesia. The development of such infrastructure will also face financing constraints. Without a clear classification, climate-resilient infrastructure projects will find it difficult to obtain funding specifically intended for climate-change efforts.

An example is when determining the allocation budget tagging. According to the Government of Indonesia (2018), five sectors need to be managed to achieve the NDC target. These five sectors have their own infrastructure needs and are managed by different ministries and agencies. Without rigid standards, selecting infrastructure projects that will receive funding from the government budget cannot be undertaken systematically. The determination of the participating projects can only be made at the discretion of the respective ministries and agencies.

##### **4.2. Mainstreaming Efforts to Local Governments**

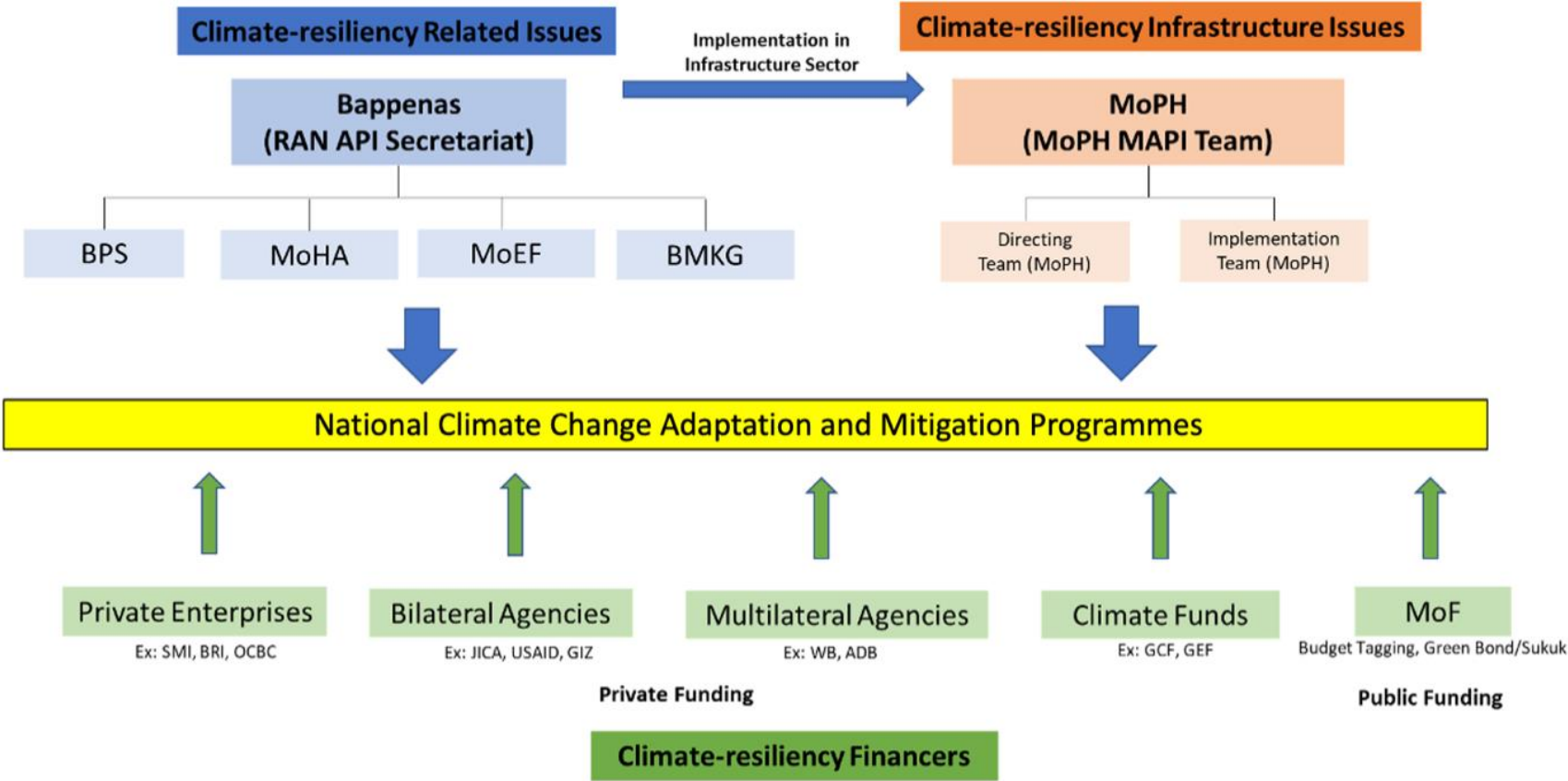
In Indonesia, infrastructure development is tiered at the regional and national levels. Governments at the city and provincial levels usually have their own infrastructure development plans, separate from the central government plans. This system has challenges. First, the differences in planning can lead to a priority mismatch in infrastructure development. Second, in terms of standards, infrastructure development at the regional level usually has lower standards than development at the national level. Third, only a few regions have carried out budget tagging for climate, which mostly focussed on mitigation activities. In terms of climate-change adaptation, although the national government already has a plan for the infrastructure

sector in the RAN-API, not all regions in Indonesia have regional action plans. This is due to differences in issues and challenges faced in the planning of mitigation and adaptation activities amongst regions. The institutional capacity of each region also determines its readiness to create planning and budget tagging for climate action. Given the key role of regions, these barriers can hinder the development of climate-resilient infrastructure.

#### **4.3. Tracking Instruments**

Monitoring and evaluation are crucial to ensure that climate resilience is implemented properly. Figure 3.6 shows the institutional arrangements involved in the climate-resilient process at the national level. In terms of planning, monitoring, and evaluation of the RAN-API, local governments and line ministries are responsible and report to Bappenas. The monitoring data at the regional level are gathered by the Ministry of Home Affairs. Based on these reports, Bappenas can revise the RAN-API accordingly. Budget tagging for climate change is also conducted by Bappenas to grasp the status of mainstreaming practices of adaptation in other plans. Bappenas also conducts the scoring process to evaluate and to prioritise adaptation policies and actions.

Figure 3.6. Institutional Arrangements for Climate Resilience in Indonesia

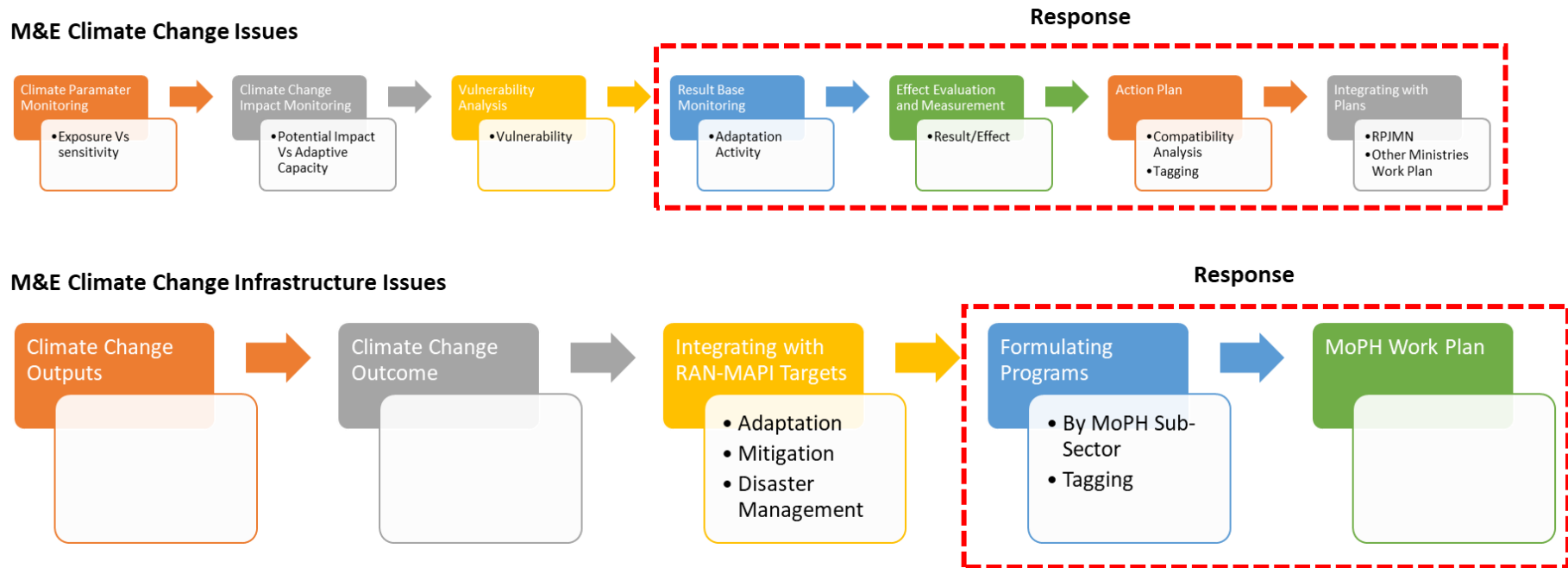


BMKG = Meteorology, Climatology, and Geophysical Agency; BPS = Statistics Indonesia; MOF = Ministry of Finance; MOEF = Ministry of Environment and Forestry; MOHA = Ministry of Home Affairs; MOPH = Ministry of Public Works and Housing; RAN-API = *National Action Plan for Climate Change Adaptation*. Source: Adapted from Government of Japan, Ministry of the Environment (2015) and MOPH (2018).

The monitoring and evaluation of climate resilience require the collection of data relating to associated measures (Figure 3.7). Bappenas relies on databases that already exist, such as climate data from the Indonesian Agency for Meteorology, Climatology, and Geophysics (*Badan Meteorologi Klimatologi Geofisika*, BMKG) and vulnerability assessment data from the Ministry of Environment and Forestry. These databases are used to monitor climate-resilient activities such as PEP (*Pemantauan, Evaluasi dan Pelaporan*), which monitors programmes and estimates each contribution to lowering greenhouse gases; SRN (*Sistem Registri Nasional*), which monitors the programme, budget, and estimation of greenhouse gas reduction; and KRISNA (*Kolaborasi Perencanaan dan Informasi Kinerja Anggaran*), which monitors the programme and budget.

MOPH is responsible for the implementation of the RAN-MAPI. To carry out monitoring and evaluation activities, it created a RAN-MAPI team, which consists of a directing team and an implementation team. The team is composed of several directorate-generals in MOPH. In general, the planning process begins by calculating the outputs and outcomes of climate change, which is integrated with one of three RAN-MAPI goals (i.e. climate-change mitigation, adaptation, and disaster management) (Figure 3.7). Through this process, MOPH may form programmes by sub-sector, which are then melded into the MOPH work plan.

Figure 3.7. Indonesia's Climate Resilience Monitoring, Evaluation, and Planning



M&E = monitoring and evaluation, MOPH = Ministry of Public Works and Housing, RAN-API = National Action Plan for Climate Change Adaptation, RPJMN = National Medium-Term Development Plan.

Source: Adapted from Bappenas (2014) and MOPH (2020a).



The Ministry of Finance (MOF) has implemented budget tagging of climate-change mitigation and adaptation, which is monitored using performance-based budgeting under MOF Regulation 214/2017. For climate resilience, outcomes regarding climate-change mitigation targets (i.e. reduction of greenhouse gases) and adaptation targets (i.e. increasing resilience to climate change impacts) are noted. The monitoring of the budget uses the KRISNA system. These evaluations are also used as references for green bond and green sukuk financing (Fiscal Policy Agency, 2019).

There are limited official documents explaining the methods and outcomes used for the monitoring and evaluation of the RAN-API or RAN-MAPI. Moreover, the database for monitoring climate resilience is not integrated, causing some climate-resilient programmes to be recorded on one database and not on others. Each ministry also has its own methods for calculating mitigation impacts, which should be integrated amongst ministries. There have also been issues regarding the difficulties of calculating the indirect impacts of climate-change adaptation programmes on greenhouse gas reduction (Fiscal Policy Agency, 2019). With these issues in mind, the database for monitoring and evaluation of mitigation efforts is still considered more established compared to adaptation efforts, which are still in development.<sup>3</sup>

#### **4.4. Challenges in Accessing International Climate Funds**

Several international funds have provided financial support for climate efforts in Indonesia. However, Indonesia is still having trouble accessing funding from these institutions.

There are at least three main challenges. The first is the strict requirements and high standards for obtaining funds. Since international funds need to filter thousands of different project proposals from different countries, they need to set standards to promote high-quality projects that can impact climate change. These standards are difficult and time-consuming for project developers in Indonesia to implement, as they are accustomed to working on projects with less stringent standards and requirements.

The second obstacle is the need to match infrastructure projects with the criteria set by the funds and/or by the state. A project may have a large positive impact or have a high economic contribution, but when the project does not meet the investment criteria of a funding institution or national development priority, the project will have difficulty obtaining funds.

The last challenge is the lack of knowledge about the opportunity of accessing international climate funds. Many infrastructure developers in Indonesia have promising proposals but are not always aware of opportunities to access funding from international climate funds. If they are aware, they often do not know the criteria, requirements, and methods needed to access those funds.

---

<sup>3</sup> While the SIDIK (*Sistem Informasi Data Indeks Kerentanan*) was created for adaptation monitoring and evaluation, no established method nor standard can be used by all ministries to estimate impacts on planned or ongoing adaptation programmes.

## **5. Financing Mitigation Infrastructure**

This section discusses the climate-resilient infrastructure that was built specifically to mitigate climate change or climate-related disasters. As of 2020, Indonesia has several strategic national priority projects related to mitigation-specific efforts, including 48 dam projects, 1 flood embankment project, and 1 seawall project. Most of these projects are financed through state or local budgets.

In contrast to ordinary infrastructure that is designed with mitigation or adaptation capabilities, infrastructure built specifically for mitigation purposes tends not to be financially viable (Andersen et al., 2017). It lacks a clear revenue stream and tends to generate indirect economic benefits in the long run. This situation makes investors less likely to finance such projects.

While mobilising private funds for mitigation-specific infrastructure poses challenges, there have been some success stories. For example, Korea built a 33.9-kilometre dike for the Saemangeum Dam, of which 97% of the cost was financed by the private sector (Van Dijk, 2016). The Government of Indonesia may try to promote public–private partnerships through viability gap funds and availability payment schemes to encourage the private sector to contribute to mitigation-related infrastructure.

## **6. Potential Opportunities for Climate-Resilient Infrastructure Development**

### **6.1. Initial Efforts to Identify Climate-Resilient Infrastructure**

Although Indonesia does not yet have specific standards for climate-resilient infrastructure, several initial efforts have been made. In addition to action plans in the RAN-API that specifically discuss infrastructure, MOPH also has an infrastructure development plan for climate-change efforts within the RAN-MAPI (Table 3.4).

**Table 3.4. Climate-Change Adaptation Efforts in the National Action Plan for Climate Change Mitigation and Adaptation**

<b>Sub-Sector</b>	<b>Focus</b>	<b>Strategies</b>
Water Resources	Implementation of network system rehabilitation of water-efficient irrigation, and implementation of the National Partnership Movement Program Water Rescue (GNKPA)	Increase the feasibility and performance of water resources infrastructure in supporting water supply and food security  Develop disaster risk management for disaster impacts of climate change
Roads and Bridges	Reduced risk of road damage due to impacts of climate change	Reduce the risk of disruption of road functions that can result from the impact of flooding, sea-level rise, and other climate-change disasters
Engineering	Activation of the Water Saving Movement, and handling of a drainage system that anticipates the impact of extreme rainfall	Create an urban settlement and infrastructure development strategy following the direction of urban development, including adaptation to climate change  Encourage the application of environmentally sound drainage technology to anticipate the impact of extreme rainfall  Develop clean water supply technology that is environmentally friendly and anticipates the impacts of climate change
Spatial Planning	Identification of districts/cities that are vulnerable to the impact of climate change through assistance in the preparation of detailed spatial plans	Provide access to data related to climate change on spatial planning  Identify districts/cities that experience the impacts of climate change

Source: MOPH (2012).

To complement this effort, MOPH procured Regulations No. 02/PRT/M/2015 on green buildings and No. 02/PRT/M/2015 on guidelines for sustainable construction. These two regulations can be the basis for determining climate-resilient infrastructure standards. Moreover, MOPH has 811 standards related to infrastructure development, which are contained in Indonesian

National Standards. These contain procedures, methods, and specification standards for infrastructure development, some of which could be a basis for creating standards for climate-resilient infrastructure.

## 6.2. Financing Opportunities

Financing opportunities for projects related to climate change continue to increase, in line with increasing global awareness of the issue. The following are several financing opportunities that can be used in Indonesia.

- (i) **Green bonds.** The government already has green bonds and a green sukuk framework. When Indonesia first issued its green sukus, both were oversubscribed by 3.8 times the issuance value. When the government issued a green sukuk again in June 2020, it was oversubscribed 6.7 times (CNBC Indonesia, 2020). Funding opportunities from bond issuance are also still wide open from the private sector. To date, only three private entities have issued green bonds for climate change funding: PT SMI, OCBC NISP, and Bank Rakyat Indonesia. These companies also recorded oversubscriptions on each of their offerings. This could be because the green bond market is rising at a fast pace and is perceived to have a significant potential for growth in various countries relative to other financing alternatives. Indeed, compared to 2014, the number of green bonds issued in 2019 increased almost seven times, reaching around \$247 billion (Climate Bond Initiative and UniCredit, 2020). Seeing the high market appetite for funding green projects, there is still an opportunity to enliven the green bond market, especially for climate-resilient infrastructure financing.
- (ii) **Hajj savings.** The Ministry of Religious Affairs provides a savings account facility for prospective Hajj pilgrims. As a country with the largest Muslim population in the world, Indonesia has a huge amount of Hajj savings. As of 2020, the total Hajj savings managed by the Hajj Financial Management Agency (*Badan Pengelola Keuangan Haji*, BPKH) reached Rp143.1 trillion (BPKH, 2020). Usually, BPKH only invests its funds in conventional bonds, sukus, and state securities. However, with its nature of long-term construction and income streams, climate-resilient infrastructure could serve as an ideal investment alternative in the Hajj savings portfolio.
- (iii) **Sovereign wealth fund.** The government, in January 2021, authorised the establishment of a sovereign wealth fund under the name Indonesia Investment Authority (INA). INA will manage investment funds from outside and inside of the country as an alternative financing source. The emergence of INA is a significant opportunity, as infrastructure development is at the core of its mandate. For this reason, the government should seize the opportunity to allocate part of the financing for climate-resilient infrastructure projects. As of January 2021, INA received initial capital of Rp75 trillion and has also received interest from various investors around the world (Oleh, 2021).
- (iv) **Pension funds.** Infrastructure projects are long-term investments that require time to be constructed and to generate economic value. The criterion could match the long duration of pension liabilities. Indonesia also has a large potential for pension funds. As of 2019, the total pension funds managed by Indonesia reached Rp279 trillion (OJK, 2019).

**Table 3.5. Indonesia Pension Fund Investments**

Type of Investment	Amount (Rp billion)
Savings	615
Deposits on call	1,273
Time deposits	73,621
Certificates of deposit	747
Surat Berharga Bank Indonesia (Bank Indonesia securities)	684
Surat Berharga Negara (Government securities)	63,807
Stocks	31,828
Corporate bonds and sukuk	61,645
Regional bonds and sukuk	1
Mutual funds	15,664
Medium-term notes	175
Asset-Backed Securities Collective Investment Contract (KIK-EBA)	852
Real Estate Investment Fund (DIRE)-KIK	45
Infrastructure Investment Fund (DINFRA)-KIK	50
Direct investment	9,584
Total land and buildings	13,552
<b>Total investment</b>	<b>273,962</b>

Source: OJK (2019).

However, as can be seen from the data above, 95% of the funds are spent on financial instruments, where most are invested in time deposits, government securities, corporate bonds, stocks, and mutual funds. It can be assumed that the proportion used from these investment funds for infrastructure development – especially for climate-resilient infrastructure – is not large. If pension funds are to be used as an alternative source, the investment allocation from financial instruments can be shifted to direct investments in climate-resilient infrastructure (Kusuma, 2019).

## **7. Reprioritisation of Infrastructure Projects due to COVID-19**

As the COVID-19 pandemic hit the nation, infrastructure projects were reprioritised, as nearly half of the infrastructure budget was reallocated. While this has caused certain infrastructure projects to be delayed, none have been cancelled. MOF considered previous crisis experiences in which jump-start costs for cancelled projects were costly (Minggu, 2020). Although the reallocation was necessary to mitigate the impacts of COVID-19, the infrastructure sector is still deemed vital for the ongoing economic recovery as it is labour-intensive. Evidently, Indonesia's 2021 financial note stated that one of the focusses for 2021 would be labour-intensive infrastructure, supporting industry and tourism and finishing delayed priority infrastructure from 2020 (MOF, 2020).

In May 2020, amidst the pandemic, the number of strategic national projects approved for 2020–2024 totalled 89 new projects, with 156 other projects rejected. This included 15 road projects, 13 dam and irrigation projects, 12 energy-related projects, 7 clean water projects, 1 seawall project, and 1 waste management project. For every Rp1 trillion spent, it must directly or indirectly utilise 14,000 workers (Kompas, 2020). The emphasis on labour absorption is important to reinvigorate Indonesia’s economy. Other criteria for strategic national projects are that investment limits of infrastructure are up to Rp500 billion per project, which is likely due to budget constraints.

While the government has shown a commitment to prioritise infrastructure projects for the post-COVID-19 recovery, it is important for these projects to accommodate climate-resilient aspects. Currently, there are only a few strategic national projects relating to climate-resilient infrastructure, which include a seawall and a flood embankment project. Integrating climate resilience in the infrastructure sector will allow Indonesia to tackle both economic recovery and climate-change adaptation and mitigation. Thus, climate-resilient infrastructure will ensure a sustainable recovery for Indonesia.

The COVID-19 pandemic reallocated the infrastructure budget to other sectors, such as health and social protection. The initial 2020 infrastructure budget was Rp489.2 trillion, which was revised down to Rp281.1 trillion after the issuance of Presidential Decree No. 72/2020. MOF will encourage public–private partnerships, blending finance, direct appointment to state-owned enterprises, and limited concessions schemes to fill the gap caused by the pandemic (Kontan, 2020). Local governments are also incentivised to use funds from the Country Economy Recovery (*Pemulihan Ekonomi Negara*, PEN) programme loan provided by PT SMI, which can be combined with a direct appointment to regional-owned enterprises as blended financing. At the same time, the state budget will still support infrastructure as a catalyst for increasing private sector participation, as the 2021 infrastructure budget is planned to be Rp414.0 trillion, nearly twice the infrastructure revised budget.

Indonesia’s state budget can only fulfil 34% of its climate-resilient funding needs. The climate-change mitigation and adaptation budget also decreased from Rp91.0 trillion in 2019 to Rp79.6 trillion in 2020. The government must thus tap into alternative methods or resources to continue investments in climate-resilient infrastructure. Domestically, MOF plans to create tax holidays or tax allowances for the renewable energy sector, including excises and VAT (Setyorini, 2020). MOF also raised \$718 million in green bonds. Internationally, MOF issued green bonds while actively seeking out partnerships in infrastructure financing from others, such as Association of Southeast Asian Nations (ASEAN) Members and the United States.

Potential funding includes the ASEAN Catalytic Green Finance Facility. This financing facility provides loans for sustainable transport, clean energy, green cities, and resilient water systems for eight ASEAN Members, including Indonesia. Also, other funding sources, such as the Forest Carbon Partnership Facility and BioCarbon Fund, are being assessed.

## 8. Analysis of Climate-Resilient Infrastructure Financing in Indonesia

**Table 3.6. Current Assessment and Gap Analysis**

Type	Aspects	Current Assessment	Gaps Identified
Regulatory	Commitments, regulations on financing, environmental codes, institutions, construction operation and maintenance, market facilitation	<p>Indonesia has ratified climate-change commitments and formulated its national climate-change road maps.</p> <p>Indonesia has created standards for green buildings and sustainable infrastructure.</p> <p>The government has allowed financing mechanisms, such as budget tagging and green bonds, for climate-change projects.</p>	<p>The general and infrastructure climate-change road maps must be updated.</p> <p>Lack of urban climate-change road map</p> <p>Assessment of current and planned infrastructure for climate change and greenhouse gas emissions</p> <p>Detail guidelines and standards for resilient infrastructure</p>
State budget and other financing options	State budget allocation, alternative financing utilisation	<p>Indonesia already has budget tagging for climate efforts.</p> <p>Indonesia has successfully issued state and private green bonds.</p> <p>Indonesia has successfully secured funding from international climate funds.</p>	<p>Climate budget realisation is not optimal.</p> <p>Not all regions have budget tagging for climate efforts.</p> <p>There is no fiscal framework available for climate efforts.</p> <p>The number of private green bonds issued is still minimal.</p> <p>Other alternative funding, such as pension funds and Hajj savings, are still unused.</p>
Main-streaming	Adaptation in all sectors, allocation changes, sub-national government involvement	<p>Indonesia has made initial plans to map the infrastructure needs for mitigation and adaptation action in the RAN-MAPI.</p> <p>Indonesia has infrastructure development planning at the central and regional levels.</p>	<p>There is no clear taxonomy and standards for climate-resilient infrastructure.</p> <p>The current RAN-MAPI only targets limited sectors.</p> <p>Central and local government development planning has not been synchronised.</p>
Reporting and evaluation	Reporting and evaluation	MOPH has a team to report on and to evaluate the progress of infrastructure climate-change adaptation.	There is no public document explaining the specific monitoring and evaluation process.

Type	Aspects	Current Assessment	Gaps Identified
		Databases for climate change monitoring have been created.	Databases for climate change monitoring must be integrated amongst ministries and improve calculations. Periodical publicly available evaluation of climate-change adaptation progress

MOPH = Ministry of Public Works and Housing, RAN-MAPI = National Action Plan for Climate Change Mitigation and Adaptation.

Source: Author.

## 9. Assessment of Current Regulatory Framework

The regulatory framework for climate change in Indonesia is sufficient. Since 2007, the government has established institutions and regulations regarding climate-change actions due to the commitments made by Indonesia, including the Kyoto Protocol, Paris Agreement, and SDGs. The road maps of Indonesia's climate-change adaptation and mitigation efforts have been established and integrated into the RPJMN. Regarding climate-resilient infrastructure, road maps have considered infrastructure as a sector at risk due to climate change, which has demonstrated the need for mitigation and adaptation efforts for infrastructure. In 2015, MOPH issued regulations regarding sustainable infrastructure, green buildings, and Indonesia National Standards (*Standar Nasional Indonesia, SNI*), which regulated the construction, operation and maintenance, and specification of the infrastructure. The government opened mechanisms for external funding of climate change and raised funds through new instruments such as green bonds and sukus. However, the MOPH road map for climate-change adaptation and mitigation has not been updated since 2012. As infrastructure has become a focus of the government, it must continue to integrate adaptation and mitigation aspects in infrastructure development, as the sustainability and benefits of climate-resilient infrastructure are vital for the economy.

Indonesia's climate-resilient infrastructure regulatory aspects may still improve. Firstly, while Indonesia already has a rural climate-change road map (i.e. *Program Kampung Iklim, ProKlim*), Indonesia still lacks an urban climate-change road map (UN-Habitat, 2015). This is essential, as most economic activities and infrastructure are in urban areas. Secondly, as examples, the United Kingdom and Australia identify current crucial infrastructure in need of resilience, which in the United Kingdom has been accommodated in a national risk assessment (World Bank, 2016). Moreover, in the United Kingdom, nationally significant infrastructure projects are required to apply projections regarding greenhouse gas emissions, potential vulnerability due to climate-change projections, and climate-change risks. Projects there have detailed flood risk assessments, while in Australia, public-private partnership regulations allow flexibility to facilitate adaptation in the procurement process (e.g. technical specifications and risk assessments). The European Union also published a guide that contains a methodology and step-by-step guidance to assess the climate-change resilience of infrastructure projects to improve their sustainability and liability in uncertain climate conditions (European Commission, Directorate-General for Climate Action, 2011; European Commission, 2013). The planning of infrastructure financing for climate-change adaptation in urban areas and climate-change



assessments for current and planned strategic infrastructure are crucial for Indonesia's climate-change resilience.

## 10. Paving the Way

Currently, Indonesia has several funding options to finance climate-resilient infrastructure projects, including the state budget, other public funding sources, private and blended funding sources, and international climate funds. Indonesia must take advantage of all of these options. It cannot rely upon the development of climate-resilient infrastructure solely from state funding due to limited fiscal space.

However, not all funding sources have been fully utilised, even from the state budget itself. Based on data from the Fiscal Policy Agency (2019), the realisation of the climate-change budget only reached 69% in 2017 and 86% of targets in 2018. To solve this, contributions from various stakeholders are needed. For the government, it is necessary to develop a public funding framework to sharpen budget tagging for climate efforts. MOF has made initial efforts by planning the creation of the Climate Change Fiscal Framework, which can be developed from several previously published documents such as the *Indonesia Mitigation Fiscal Framework* (MOF, 2012) and *Climate Public Expenditure Review* (World Bank, 2020). Besides being able to improve budget tagging, the framework can also encourage the harmonisation of climate-change control activities and funding amongst the central and local governments, the private sector, and other non-public parties. Several countries have prepared similar documents, such as Bangladesh, Cambodia, and Nepal. Apart from maximising existing funding sources, the Government of Indonesia also needs to take advantage of other funding options, such as pension funds and Hajj savings. These two options are still untapped despite their large financing potential and suitable long-term liabilities for infrastructure projects.

So far, only three entities have issued green bonds for financing climate-change projects amidst a high investor appetite for climate-action financing. Sweden, however, issued 61 green bonds in 2020 only (Bhadare, 2020). Private institutions should be integrating climate change-related risks and opportunities into their analyses, but this is still not done by most companies in Indonesia. Given how big the threat of climate change is and how high investors' appetites for climate-change action are, this kind of analysis is crucial.

This lack of utilisation also occurs in funding from international climate funds. Of the overall plans and potential for infrastructure projects in Indonesia, very few have received funding from international climate funds, as discussed previously. High project standards, strict investment criteria, the need to conform to national priorities, and lack of knowledge from project developers about those funds are some obstacles to using international climate funds. To maximise funding from international climate funds, the government, through related institutions, needs to intensify the socialisation of international climate funds to related ministries and institutions as well as project developers. Socialisation includes defining the institutions that offer funding, standards that need to be met, and investment criteria. Through this socialisation, the government can help create good concept notes or project proposals so that they can be accepted by international climate funds.

### **10.1. Mainstreaming Efforts**

The mainstreaming efforts of climate-change adaptation and climate-resilient infrastructure in Indonesia face several obstacles. Although climate-change adaptation is already defined clearly in legislation, no document specifically classifies and standardises climate-resilient infrastructure. The planning for the development of mitigation and adaptation infrastructure contained in the RAN-MAPI also has a limited scope by only incorporating water resources, roads and bridges, engineering, and spatial planning. In this case, Indonesia can use the United Kingdom as a benchmark. Since 2011, it has had a government policy on infrastructure that specifically discusses climate-resilient infrastructure (Government of the United Kingdom, 2011). In this policy, the Government of the United Kingdom also discussed climate issues for infrastructure broadly, covering transport, energy, water, and information and communications technology.

Another obstacle is a lack of integrated planning between the central government and local governments. Often, the central government's development planning is not in accordance with regional development priorities. In fact, local governments have important tasks in climate-resilient infrastructure development, especially in a country as big as Indonesia. There are at least three items that make mainstreaming and synchronising at the sub-national level crucial (OECD, 2010). First, climate-change impacts are manifested locally, affecting local livelihood activities. Second, vulnerability and adaptive capacity are determined by local conditions. Third, adaptation activities are often best observed at the local level. Indonesia should model the Government of Australia in its *National Adaptation Framework* (Government of Australia, 2007). This framework provides guidance on actions by jurisdictions to generate the information and tools needed by decision-makers to adapt to climate-change impacts. In practice, all jurisdictions need to evaluate and to share information about the extent to which planning and development systems promote decisions that increase resilience to the impacts of climate change and discourage decisions that increase vulnerability and consider changes where appropriate. The Local Government and Planning Ministers' Council then can coordinate a national report based on these assessments.

### **10.2. Strengthening and Synchronising Reporting and Evaluation**

Based on the RAN-API, Bappenas has a key role in the evaluation of climate-change policies with other ministries, with local governments reporting the conditions at local levels. Bappenas has the authority to evaluate the RAN-API and its direction based on these reports. However, discussions are ongoing to revise the RAN-API. The government has also established many databases needed for reporting and evaluation of climate change-related policies. These databases are vital to trace the impact and efficiency of climate-change programmes. While climate-change monitoring and evaluation databases have been well established, adaptation monitoring and evaluation are still lacking. This is worrisome, as adaptation is an important aspect of infrastructure finance for climate-change adaptation, as many economic benefits are based on adaptation ability. However, there are still a few issues regarding the database, including a lack of integration amongst databases, a lack of integration in the calculation method amongst ministries, and difficulties in calculating indirect impacts.

Periodic monitoring and evaluation reports regarding adaptation efforts will influence planning in the following period. For example, the United Kingdom requires lead government departments to produce annual sector resilience plans that assess current situations and critical plans for the following year. The European Union also conducted a local assessment of climate impacts that are important for location-specific guidance regarding climate-change actions. Improving databases for regional analysis is important for Indonesia, as climate risk vulnerability varies amongst regions. Moreover, the European Union attributes indirect impacts of climate change, which have not been calculated in Indonesia's database.

## **11. Conclusions**

The new, recent focus on infrastructure has propelled the process of infrastructure construction in Indonesia, reducing Indonesia's prolonged infrastructure gap. While the influx of infrastructure in Indonesia has been positive, it is prone to climate change. In addition to being an archipelago that is more disposed to climate change, Indonesia has been hit by more costly climate-related natural disasters due to the destruction of infrastructure. To strengthen its resilience to climate change and its impacts, infrastructure – which is the capital of Indonesia's economy – must integrate climate resilience. Moreover, due to the COVID-19 pandemic, its infrastructure sector has been deemed vital to achieving economic recovery. The timing of this situation may become an opportunity for the government to adjust the infrastructure development to accommodate climate resilience to ensure that Indonesia achieves sustainable recovery and growth in the future.

Indonesia has shown its commitment to climate-change actions through its NDC, SDG implementation, and national climate-change road maps. In 2009, Indonesia formulated the ICCSR, followed by RAN-API in 2014, which identified the infrastructure sector at risk of climate change. In 2012, MOPH also formulated its climate change road map, RAN-MAPI, which mainly focusses on roads and bridges, water, waste, and spatial planning. All of these road maps have not been updated, however. There are still issues regarding mainstreaming these aspects to local governments as well. Local governments do not have to integrate climate-change adaptation aspects in their regional development plans. This may become a challenge in implementing a specific infrastructure climate-change adaptation work plan at the local level. However, local governments play an important role in infrastructure provisions such as roads and schools.

In addition to the policy framework for climate action, climate-resilient infrastructure development also needs to be supported by funding. Currently, public financing has provided alternatives such as climate budget tagging and issuance of green bonds and sukus to support financing climate-change programmes, which are mostly utilised for climate-resilient infrastructure projects. However, financing for the infrastructure sector is still not optimal. Financing at the regional level also faces obstacles since only a few regions have implemented climate budget tagging.

Apart from the public sector, financing from the private sector is also considered sub-optimal. Higher financing needs, investment plans that still tend to be conventional and have not adopted sustainability aspects, and the existence of a maturity mismatch are several reasons that hinder

the private sector from financing climate-resilient infrastructure. Meanwhile, funding from international climate funds is also difficult to access due to certain investment criteria, high project standards, and a time-consuming tapping process.

To tackle these issues, there must be an enabling environment for better climate-resilient infrastructure financing. First, there must be clear taxonomy and standards for climate-resilient infrastructure. This will help better allocate budget tagging and expand the adoption or upscaling of innovative financing. Second, the existence of de-risking instruments – such as loan guarantees and public equity co-investments – must be strengthened to attract the private sector to invest. Third, an incentive – such as a certificate or rating – must exist that indicates the resilience of infrastructure. Projects labelled ‘climate-resilient infrastructure’ will find it easier to access sustainable or green financing. Lastly, socialisation on how to access international climate funds and utilisation of other financing options such as pension funds, Hajj savings, and sovereign wealth funds also needs to be done.

To further integrate climate resilience in the infrastructure sector, the roles of key actors may need to be enhanced. Bappenas should integrate its climate-change road maps to enhance synchrony. As the road maps have not been updated, this is an opportunity to integrate them and to expand the sectors for climate-resilient infrastructure. MOPH should be involved and implement guidelines for climate-resilient infrastructure when selecting strategic national projects relating to infrastructure, as mostly the decisions for these projects are under the Coordinating Ministry for Economic Affairs.

It is also important to increase local government participation in climate-resilient infrastructure provision, which includes mainstreaming climate-resilient infrastructure in local government planning. Enhancing Bappenas to enforce climate-resilient aspects may strengthen the implementation of climate-resilient infrastructure at local levels.

In terms of monitoring and evaluation, databases have been well established. However, adaptation monitoring and evaluation, integration of databases and methodologies amongst ministries, and incorporation of indirect impacts must be improved to strengthen the climate-resilient infrastructure policies. Meanwhile, MOF needs to incorporate the Climate Change Fiscal Framework in planning for climate action financing. This framework is expected to not only sharpen budget tagging but also synchronise climate activities and funding at the central and regional levels, the private sector, and other non-public parties.

## References

- Andersen, F. et al. (2017), *Unlocking Private Capital to Finance Sustainable Infrastructure*, Meister Consultants Group.
- Badan Nasional Penanggulangan Bencana (BNPB) (2020), *Data Informasi Bencana Indonesia* (Indonesian Disaster Information Data), December, <https://dibi.bnpb.go.id/>
- Badan Pengelola Keuangan Haji (BPKH) (2020), *Socialization of the 2020 Hajj Fund Management Performance and Development Report by BPKH*, Jakarta.
- Badan Perencanaan Pembangunan Nasional (Bappenas) (2014), *National Action Plan for Climate-Change Adaptation (RAN-API)*, Jakarta.
- Bhadare, S. (2020), 'Record-Breaking Green Bonds despite Covid-19', ICLG.com, 14 October, <https://iclg.com/ibr/articles/14778-record-breaking-green-bonds-despite-covid-19>
- Climate Bond Initiative and UniCredit (2020), *The Green Bond and ESG Chartbook*, Milan: UniCredit.
- CNBC Indonesia (2020), 'Oversubscribed 6,7X, Sukuk Global RI Kebanjiran Permintaan', 18 June, <https://www.cnbcindonesia.com/market/20200618183343-17-166404/oversubscribed-67x-sukuk-global-ri-kebanjiran-permintaan>
- European Commission (2013), 'Adapting Infrastructure to Climate Change', *Commission Staff Working Documents*, 16 April, <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:52013SC0137>
- European Commission, Directorate-General for Climate Action (2011), *Non-Paper Guidelines for Project Managers: Making Vulnerable Investments Climate Resilient*, Brussels.
- European Financing Institutions Working Group on Adaptation to Climate Change (EUFIWACC) (2016), *Integrating Climate Change Information and Adaptation in Project Development*, Brussels.
- Fiscal Policy Agency (2019), *Pendanaan Publik Untuk Pengendalian Perubahan Iklim Indonesia 2016–2018*, Jakarta.
- Government of Australia (2007), *National Climate Change Adaptation Framework*, Canberra.
- Government of Indonesia (2018), *Indonesia: Biennial Update Report (BUR) – BUR 2*, <https://unfccc.int/documents/192165>
- Government of Indonesia, Bappenas, (2010), *Indonesia Climate Change Sectoral Roadmap, Jakarta*.
- (2014), *National Action Plan for Climate Change Adaptation (RAN-API)*, Jakarta.
- (2020), *National Medium-Term Development Plan, 2020–2024 (Rencana Pembangunan Jangka Menengah Nasional)*, Jakarta.

- Government of Indonesia, Ministry of Finance (MOF) (2012), *Indonesia's First Mitigation Fiscal Framework*, Jakarta.
- (2020a), *2021 State Budget Statement*, Jakarta, <http://media.kemenkeu.go.id/getmedia/287bee92-01a7-40c9-ad5f-09eeb48e66d6/buku-ii-nota-keuangan-beserta-apbn-ta-2021.pdf>
- (2020b), *Anggaran Infrastruktur* (Infrastructure Budget), December, <https://data-apbn.kemenkeu.go.id/lang/id/post/12/anggaran-infrastruktur>
- Government of Indonesia, Ministry of Public Works and Housing (MOPH) (2012), 'Attachment to Regulation of the Minister of Public Works of the Republic of Indonesia', No. 11/PRT/M/2012, Jakarta.
- (2020a), *Perencanaan dan Pemograman Infrastruktur Sektor PUPR Responsif Perubahan Iklim dan Lingkungan*, <https://bpiw.pu.go.id/article/detail/perencanaan-dan-pemograman-infrastruktur-sektor-pupr-responsif-perubahan-iklim-dan-lingkungan>
- (2020b). *Rencana Strategis Tahun 2020-2024 Kementerian Pekerjaan Umum dan Perumahan Rakyat*, <https://pu.go.id/assets/media/1927846278Buku%20Renstra%20Kementerian%20PUPR%202020-2024.pdf>
- Government of Japan, Ministry of the Environment (2015), *How to Mainstream Adaptation into Local Level Planning in Indonesia*, Tokyo.
- Government of the Netherlands, Ministry of Foreign Affairs (2018), *Climate Change Profile: Indonesia*, The Hague.
- Government of the United Kingdom (2011), *Climate-Resilient Infrastructure: Preparing for a Changing Climate*, London.
- Gunawan, I. et al. (2016), *Building Indonesia's Resilience to Disaster: Experiences from Mainstreaming Disaster Risk Reduction in Indonesia Program*, Washington, DC: World Bank.
- Hallegatte, S. et al. (2019), 'Strengthening New Infrastructure Assets – A Cost-Benefit Analysis', *Policy Research Working Papers*, No. 8896, Washington, DC: World Bank.
- Hallegatte, S., J. Rentschler, and J. Rozenberg (eds.) (2019), *Lifelines: The Resilient Infrastructure Opportunity*, Washington, DC: World Bank, <https://doi.org/10.1596/978-1-4648-1430-3>
- Hecht, J.E. (2016), *Indonesia: Cost of Climate Change 2050*, Washington, DC: Chemonics.
- Kompas* (2020), 'Pemerintah Rekomendasikan 89 Proyek Strategis Nasional Baru Senilai Rp1.422 Triliun', 29 May, <https://nasional.kompas.com/read/2020/05/29/15053551/pemerintah-rekomendasikan-89-proyek-strategis-nasional-baru-senilai-rp-1422>

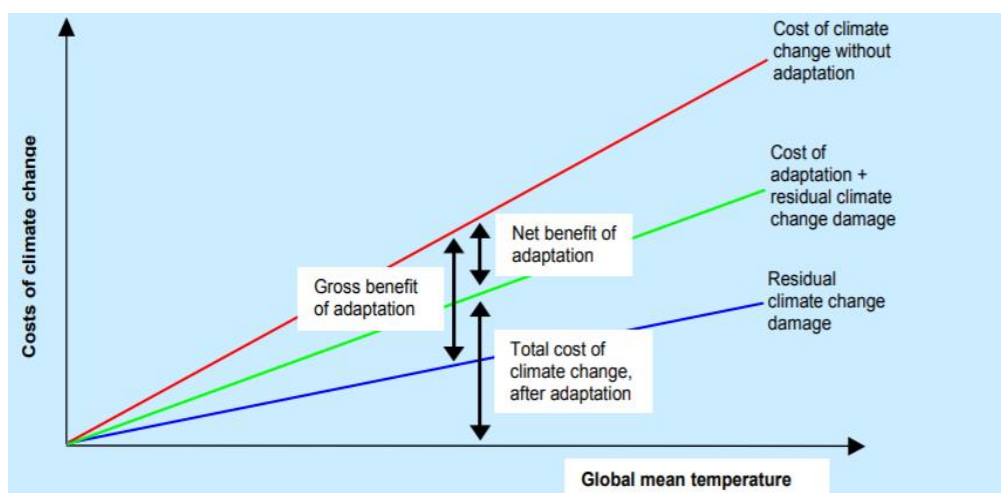
- Kontan (2020), 'Wabah Corona Membuat Pendanaan Infrastruktur Dari APBN Jadi Lebih Berat', 11 July, <https://industri.kontan.co.id/news/wabah-corona-membuat-pendanaan-infrastruktur-dari-apbn-jadi-lebih-berat>
- Kusuma, C. (2019) *Dana Pensiun dan Pembiayaan Alternatif Infrastruktur Berkelanjutan*, Bogor City: IPB Press.
- Minggu, (2020), 'Ini Cara Indonesia Melakukan Pembiayaan Hijau Sekaligus Tangani Covid-19', *Detak.co*, 11 October, <https://detak.co/detail/berita/ini-cara-indonesia-melakukan-pembiayaan-hijau-sekaligus-tangani-covid19>
- OJK (2019), *Pension Fund Statistics*, <https://ojk.go.id/id/kanal/iknb/data-dan-statistik/dana-pensiun/Documents/Pages/Buku-Statistik-Dana-Pensiun-dan-Buku-Statistik-Jaminan-Sosial---Tahun-2019/Buku%20Statistik%20Dana%20Pensiun%20Tahun%202019.pdf>
- Oleh, A.O.V. (2021), *Bos Plataran Group hingga Komisaris Hermina Akan Jadi Pengawas LPI*, Katadata, 20 January, <https://katadata.co.id/agustiyanti/finansial/6007f1d9335df/bos-plataran-group-hingga-komisaris-hermina-akan-jadi-pengawas-lpi>
- Organisation for Economic Co-operation and Development (OECD) (2018), 'Climate-Resilient Infrastructure', *OECD Environment Policy Papers*, No. 14, Paris.
- PT Sarana Multi Infrastruktur (SMI), *SDG Indonesia One*, <https://ptsmi.co.id/sdg-indonesia-one/>  
 ——— (2018), *Green Bonds*, Jakarta.
- Setyorini, O.V.P. (2020), 'Dana-dana Pengendalian Perubahan Iklim Indonesia', *Antara*, 28 August, <https://www.antaraneews.com/berita/1693602/dana-dana-pengendalian-perubahan-iklim-indonesia>
- Stern, N. (2007), *The Economics of Climate Change: The Stern Review*, Cambridge, UK: Cambridge University Press, <https://doi.org/10.1017/CBO9780511817434>
- UN-Habitat (2015), *Expert Group Meeting on Mainstreaming Climate Change into National Urban Policies*, 17–18 March, Bangkok.
- United Nations Development Programme (UNDP), *Governance of Climate Change Finance in Indonesia*, <https://www.climatefinance-developmenteffectiveness.org/countries/indonesia>
- United Nations Framework Convention on Climate Change (UNFCCC), <http://unfccc.int/>
- Van Dijk, M.P. (2016), 'Financing the National Capital Integrated Coastal Development (NCICD) Project in Jakarta (Indonesia) with the Private Sector', *Journal of Coastal Zone Management*, 19(5).
- Veron, S. et al. (2019), 'Vulnerability to Climate Change of Islands Worldwide and Its Impact on the Tree of Life', *Scientific Reports*, 9, <https://doi.org/10.1038/s41598-019-51107-x>
- World Bank (2016), *Emerging Trends in Mainstreaming Climate Resilience in Large Scale, Multi-Sector Infrastructure PPPs*, Washington, DC.
- (2020), *Indonesia Public Expenditure Review 2020 : Spending for Better Results*. Retrieved from <http://hdl.handle.net/10986/33954>

Yusuf, A.A. and H. Francisco (2009), *Climate Change Vulnerability Mapping for Southeast Asia*, Singapore: Economy and Environment Program for Southeast Asia.



## Appendices

**Appendix 1: Annual Cost of Climate Damage and Net Benefit of Adaptation**



Source: Stern (2007).

**Appendix 2: Estimated Financing Needs to Achieve the Nationally Determined Contribution Target**

Sector	Policies and Programmes	Potential Emission Reduction	Financing Needs (Rp billion)	Financing Needs (\$ billion)
Forest and land use	Forest conservation and protection programme Forest fire prevention	655 million tonnes of CO <sub>2</sub>	77,824	5.557
Energy and transport	Construction of renewable energy power plants Clean technology investments	398 million tonnes of CO <sub>2</sub>	3,307,197	236.214
IPPU	Mostly for cement and steel industries	3.25 million tonnes of CO <sub>2</sub>	40,774	0.379
Waste	Solid and liquid waste management at household and industrial levels	26 million tonnes of CO <sub>2</sub>	30,339	2.907
Agriculture	Low-emission rice varieties, improving irrigation, biogas use, and feed additives	4 million tonnes of CO <sub>2</sub>	5,175	2.164
<b>Total</b>			<b>3,461,309</b>	<b>247.221</b>

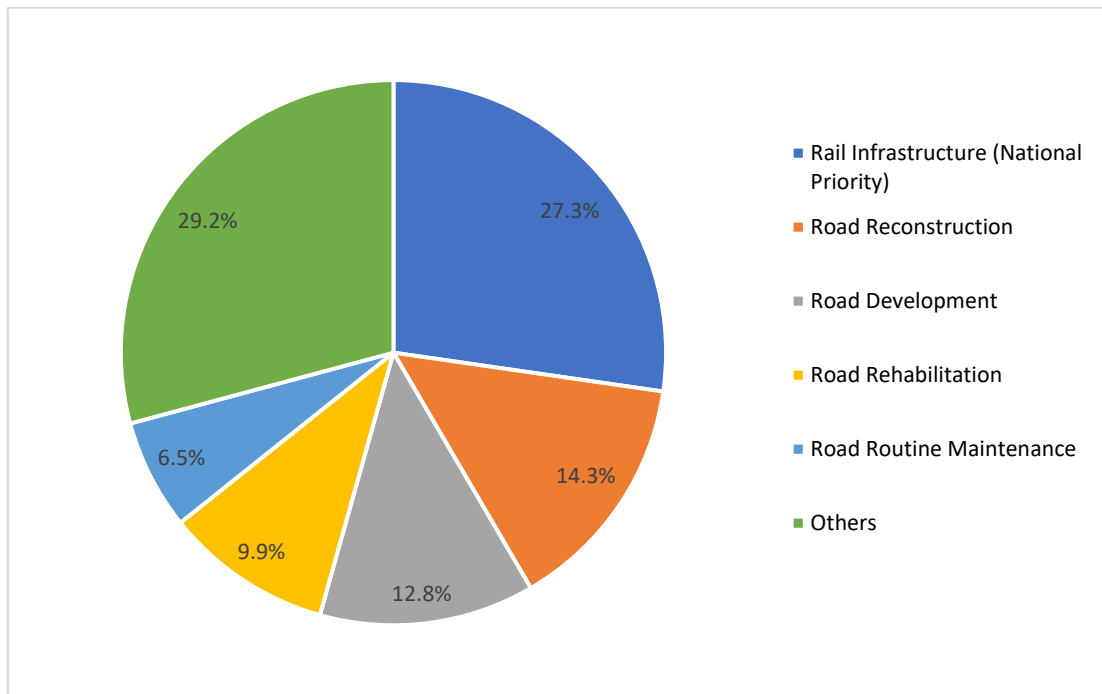
CO<sub>2</sub> = carbon dioxide.

Note: To achieve the 2030 target based on the business-as-usual scenario.

Source: Government of Indonesia (2018).

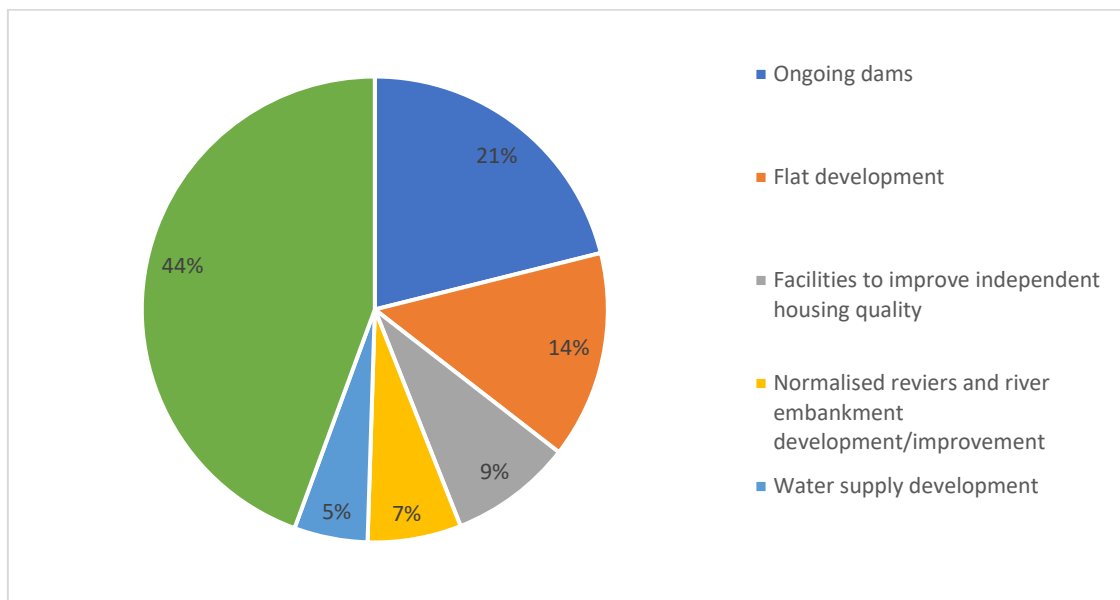
### Appendix 3: Top Mitigation and Adaptation Programmes Percentages to Budget, 2018

#### Appendix 3.1: Mitigation Programmes (share of budget, 2018)



Source: Fiscal Policy Agency (2019).

#### Appendix 3.2: Adaptation Programmes (share of budget, 2018)



Source: Fiscal Policy Agency (2019).