Kementerian PPN/ Bappenas

LOW CARBON DEVELOPMENT INDONESIA

BOOK 5

MONITORING, EVALUATION, & REPORTING OF CLIMATE RESILIENCE ACTIONS IN THE FRAMEWORK OF NATIONAL DEVELOPMENT PLANNING

Ministry of National Development Planning/Bappenas. 2021

BOOK 5

MONITORING, EVALUATION, & REPORTING OF CLIMATE RESILIENCE ACTIONS IN THE FRAMEWORK OF NATIONAL DEVELOPMENT PLANNING

Kementerian PPN/ Bappenas

LOW CARBON DEVELOPMENT INDONESIA

EDITORIAL BOARD

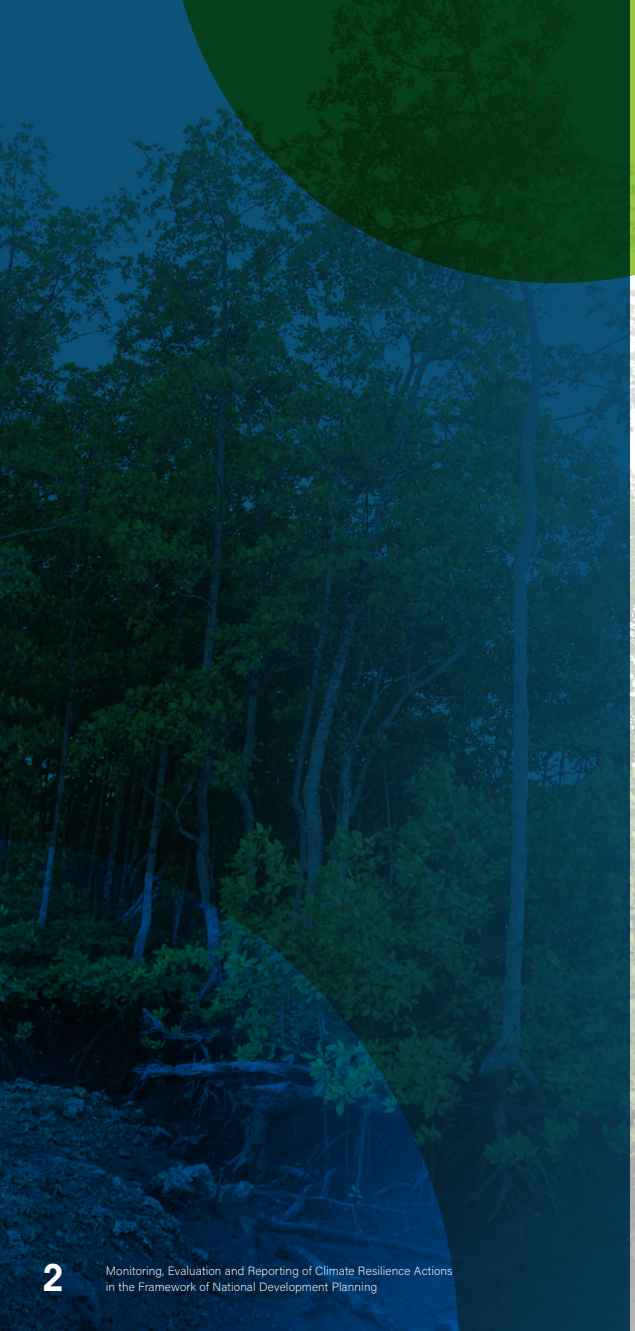


TABLE OF CONTENTS

Editorial Board **1**
Table of Contents **2**
List of Figures **3**
List of Tables **3**
List of Abbreviations **4**

Monitoring, Evaluation and Reporting on Climate Resilience Action 7
The Importance of Monitoring, Evaluation and Reporting on Climate Resilience Action **7**

Mechanism of Monitoring, Evaluation, and Reporting on Climate Resilience Action 9
Coordinating Framework and Monitoring institutional, Evaluation, and Reporting on Climate Resilience **9**
1. Implementator and Observer on Climate Resilience Action **10**
2. Implementator of Evaluation and Reporting on Climate Resilience Action **11**

Mechanism of Monitoring, Evaluation, and Reporting on Climate Resilience Action at National Level **12**
1. Developing Work Plan K/L **14**
2. Identification of the List of Action Plans for Climate Resilience in M/I's Work Plan **16**
3. Monitoring and Quantifying the Impact of Climate Resilience Action **17**
4. Evaluation and Reporting **19**

Methodology to Measure Achievements of Climate Resilience Action 20
Methodology for the Marine and Coastal Sector **23**
Methodology for the Water Sector **39**
Methodology for the Agricultural Sector **48**
Methodology for the Health Sector **58**

Closing 66

LIST OF FIGURES

Figure 1. Visualisation on Monitoring Institutional, Evaluation, and Reporting on Climate Resilience Action in the Implementation of National Development Plan **9**

Figure 2. The Mechanism of Monitoring, Evaluation, and Reporting on Climate Resilience **12**

Figure 3. Stages of Monitoring, Evaluation, and Reporting on Climate Resilience at National Level **13**

Figure 4. The Flow of Climate Resilience Action Monitoring and Reporting Process **18**

Figure 5. Correlation of Main and Supporting Activities in Achieving Climate Resilience Targets **20**

Figure 6. Grouping the Methodologies on Climate Resilience Action **21**

Figure 7. The Flow of Achievement for Reducing Economic Loss from Climate Resilience Action in the Marine and Coastal Sector: Marine Subsector **24**

Figure 8. The Flow of Achievement for Reducing Economic Loss from Climate Resilience Action in the Marine and Coastal Sector: Coastal Subsector **32**

Figure 9. The Flow of Achievement for Reducing Economic Loss from Climate Resilience Action in Water Sector **40**

Figure 10. The Flow of Achievement for Reducing Economic Loss from Climate Resilience Action in Agricultural Sector **49**

Figure 11. The Flow of Achievement for Reducing Economic Loss from Climate Resilience Action in Health Sector **59**

LIST OF TABLES

Table 1. Distribution of Related Stakeholders Based on Sector **10**

Table 2. RPJMN 2020-2024 Climate Resilience Indicators and Targets **14**

Table 3. Details of the Methodology for Calculating Outcomes of Main Activities in the Marine and Coastal Sector: Marine Subsector **25**

Table 4. Details of the Methodology for Supporting Activities in the Marine and Coastal Sector: Marine Subsector **28**

Table 5. Details of the Methodology for Calculating Outcomes of Main Activities in the Marine and Coastal Sector: Coastal Subsector **33**

Table 6. Details of the Methodology for Supporting Activities in the Marine and Coastal Sector: Coastal Subsector **36**

Table 7. Details of the Methodology for Calculating Outcomes of Main Activities in the Water Sector **41**

Table 8. Details of the Methodology for Supporting Activities in the Water Sector **45**

Table 9. Details of the Methodology for Calculating Outcomes of Main Activities in the Agricultural Sector **50**

Table 10. Details of the Methodology for Supporting Activities in the Agricultural Sector **54**

Table 11. Details of the Methodology for Calculating Outcomes of Main Activities in the Health Sector **60**

Table 12. Details of the Methodology for Supporting Activities in the Health Sector **62**

LIST OF ABBREVIATIONS

A

AIS	Automatic Identification System
AKSARA	*Aksi Pembangunan Rendah Karbon dan Ketahanan Iklim Indonesia* (Indonesia's Low Carbon Development and Climate Resilience Action)

B

Bappenas	*Badan Perencanaan Pembangunan Nasional* (National Development Planning Agency)
BMKG	*Badan Meteorologi, Klimatologi, dan Geofisika* (Meteorological, Climatology, and Geophysical Agency)
BNPB	*Badan Nasional Penanggulangan Bencana* (National Disaster Management Agency)
BPPT	*Badan Pengkajian dan Penerapan Teknologi* (Agency for the Assessment and Application of Technology)

F

FGD	Focus Group Discussion

G

GDP	Gross Domestic Product
GT	Gross Tonnage

K

KRISNA	*Kolaborasi Perencanaan dan Informasi Kinerja Anggaran* (Collaboration on Planning and Budget Performance Information)

L

LIPI	*Lembaga Ilmu Pengetahuan Indonesia* (Indonesian Institute of Science)

M

Min.	Ministry
Min. Village, UAT	Ministry of Village, Underdeveloped Areas and Transmigration
M/I	Ministerial and Institution
MER	Monitoring, Evaluation, and Reporting
MoAASP/ NLA	Ministry of Agrarian Affairs and Spatial Planning/National Land Agency
MoEF	Ministry of Environment and Forestry
MoF	Ministry of Finance
MoH	Ministry of Health
MoHA	Ministry of Home Affairs
MoMAF	Ministry of Marine Affairs and Fisheries
MoPWH	Ministry of Public Works and Housing
MoSA	Ministry of Social Affairs
MoT	Ministry of Transport

N

NGOs Non-Governmental Organizations
NP National Priority

R

RKP *Rencana Kerja Pemerintah* (Government Annual Work Plan)
ROV Remotely Operated Vehicle
RPJMD *Rencana Pembangunan Jangka Menengah Daerah* (Regional Medium-Term Development Plan)
RPJMN *Rencana Pembangunan Jangka Menengah Nasional* (National Medium-Term Development Plan)

S

Satu DJA *Sistem Aplikasi Terpadu Direktorat Jenderal Anggaran* (Integrated Application System of the Directorate General of Budget)
SDG Sustainable Development Goals
SPPN *Sistem Perencanaan Pembangunan Nasional* (Nasional Development Planning System)
SWRO Sea Water Reverse Osmosis

U

UNFCCC United Nation Framework Convention on Climate Change

V

VMS Vehicle Monitoring System
VTS Vehicle Traffic Service

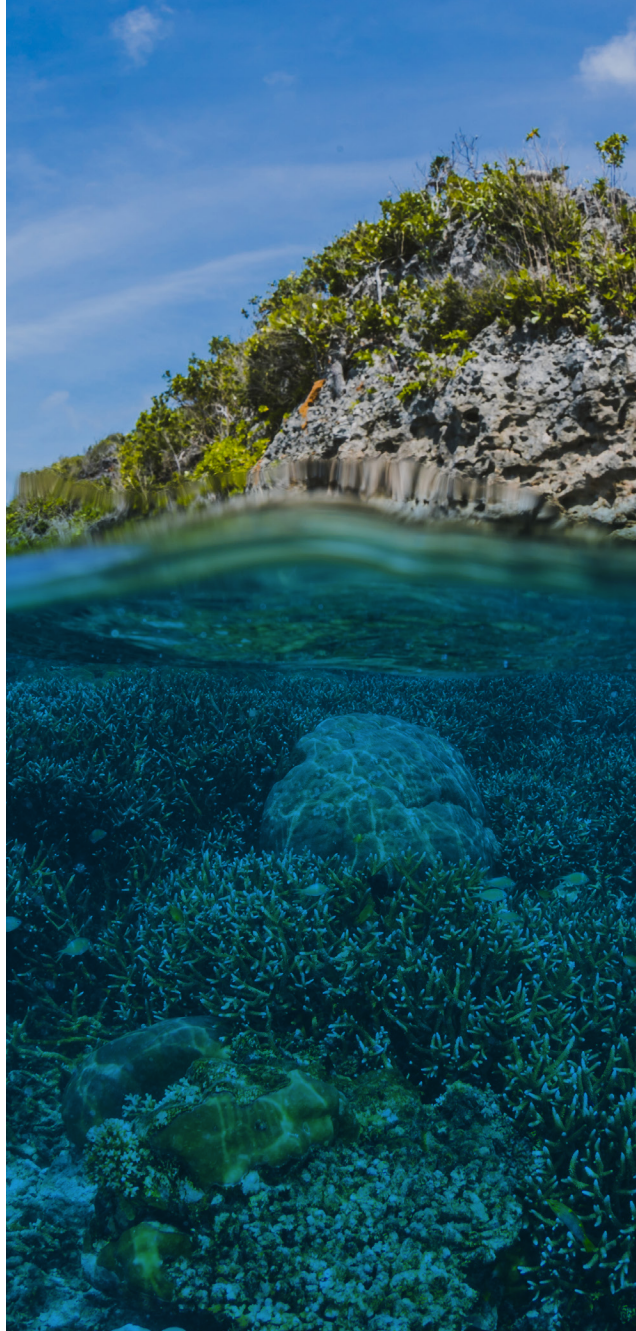


Photo courtesy of the CDJ Secretariat

Monitoring, Evaluation & Reporting on Climate Resilience Action

The Importance of Monitoring, Evaluation and Reporting on Climate Resilience Action

According to geographical location, Indonesia is one of the countries most vulnerable to climate change. Its location, regional characteristics, high population, and various sectors which support the livelihoods are highly dependent on climatic conditions, such as agriculture, marine, water resources, and health. Additionally, Indonesia also has historical and potential disaster events that can increase climate change vulnerability and risk. As a response to the threat and support of sustainable development targets number 2, 3, 6, 8, 13, 14, 15, and 17, the government shows a comprehensive effort. The government concerns increasing climate resilience through the identification of climate conditions and their potential dangers in the future as well as its potential economic loss in various development sectors.

These efforts are part of the national development plan RPJMN 2020-2024 under the 6th National Priority, Building the Environment, Increasing Disaster, and Climate Change Resilience, which is focused on four sectors, namely Marine and Coastal, Water, Agriculture, and Health. The current strategies to cope with the climate change and its impact on national development planning is in accordance with the mandate of Article 3.4 of the UNFCCC which states that climate change policies must be integrated into national development programs. In the RPJMN 2020-2024, the success of M/I's climate resilience programs and activities are measured by the percentage of potential GDP loss reduction due to climate hazards.

The climate resilience activities refer to planned and spontaneous anticipatory actions to reduce the potential losses due to hazards, vulnerability, impacts and risk of climate change on the lives of people in the affected areas by climate change. (Bappenas, 2020).

Based on Law Number 25 of 2004 on National Development Planning System, and Government Regulation Number 39 of 2006 on Procedures for Control and Evaluation of the Implementation of Development Plans, there are 4 stages of development planning cycle, which are:

1. Preparation of Plans,
2. Establishment of Plans,
3. Control of Plan Implementation, and
4. Evaluation of Plan Implementation.

Based on Government Regulation Number 39 of 2019, Control is a series of management activities intended to ensure that a program / activity is carried out in accordance with the established plan. Controlling the implementation of the development plan is intended to ensure the achievement of development goals and targets, as stated in the plan, is carried out through monitoring and supervision activities. On this basis, the Ministry of National Development Planning/

Bappenas has developed a mechanism for monitoring, evaluation and reporting on climate resilience activities in the National Medium-Term Development Plan (RPJMN) to improve efficiency, effectiveness or resource allocation, increase transparency and accountability in the management of development.

The book of Monitoring, Evaluation, and Reporting on Climate Resilience Actions in the Framework of National Development Planning includes:

1. Monitoring, Evaluation and Reporting Mechanisms for Climate Resilience Action in the Implementation of the National Development Plan and
2. Methodology to quantify the impact of action on Climate Resilience in the Implementation of the National Development Plan.

The writing process of this book was carried out collaboratively between Ministries and Institutions as well as related stakeholders.

Legal Foundation

1. Law Number 25 of 2004 on National Development Planning System
2. Government Regulation Number 39 of 2006 on Procedures for Control and Evaluation of the Implementation of the Development Plan
3. Government Regulation Number 8 of 2008 on Stages of Procedures for Preparing Control and Evaluation of the Implementation of Regional Development Plan
4. Government Regulation Number 90 of 2010 on Preparation of Work Plan and Budget of State Ministries / Agencies
5. Government Regulation Number 17 of 2017 on Synchronization of National Development Planning and Budgeting
6. Presidential Regulation Number 18 of 2020 on the 2020-2024 National Medium-Term Development Plan
7. Presidential Regulation Number 59 of 2017 on the Implementation of Achieving the Sustainable Development Goals
8. Presidential Regulation Number 39 Of 2019 on One Indonesian Data
9. Regulation of the Minister of National Development Planning /Head of Bappenas Number 1 of 2017 on Guidelines for the Evaluation of National Development
10. Regulation of the Minister of Home Affairs Number 86 of 2017 on Procedures For Regional Development Planning, Control and Evaluation, Regional Medium-Term Development Procedures, and Procedures For Changing Regional Development Plan, Regional Development Plan, and Regional Development Plan Change

Mechanism for Monitoring, Evaluation, & Reporting on Climate Resilience Action

Coordinating Framework and Institutional Monitoring, Evaluation, and Reporting on Climate Resilience

It is important to regulate the division of roles in the process of monitoring, evaluation, and reporting on climate resilience action in the implementation of the national development plan in order to avoid overlapping and to generate effective processes. The roles of stakeholders are divided into (1) Implementing and Monitoring Climate Resilience Action and (2) Evaluation and Reporting on the Implementation of Climate Resilience Action.

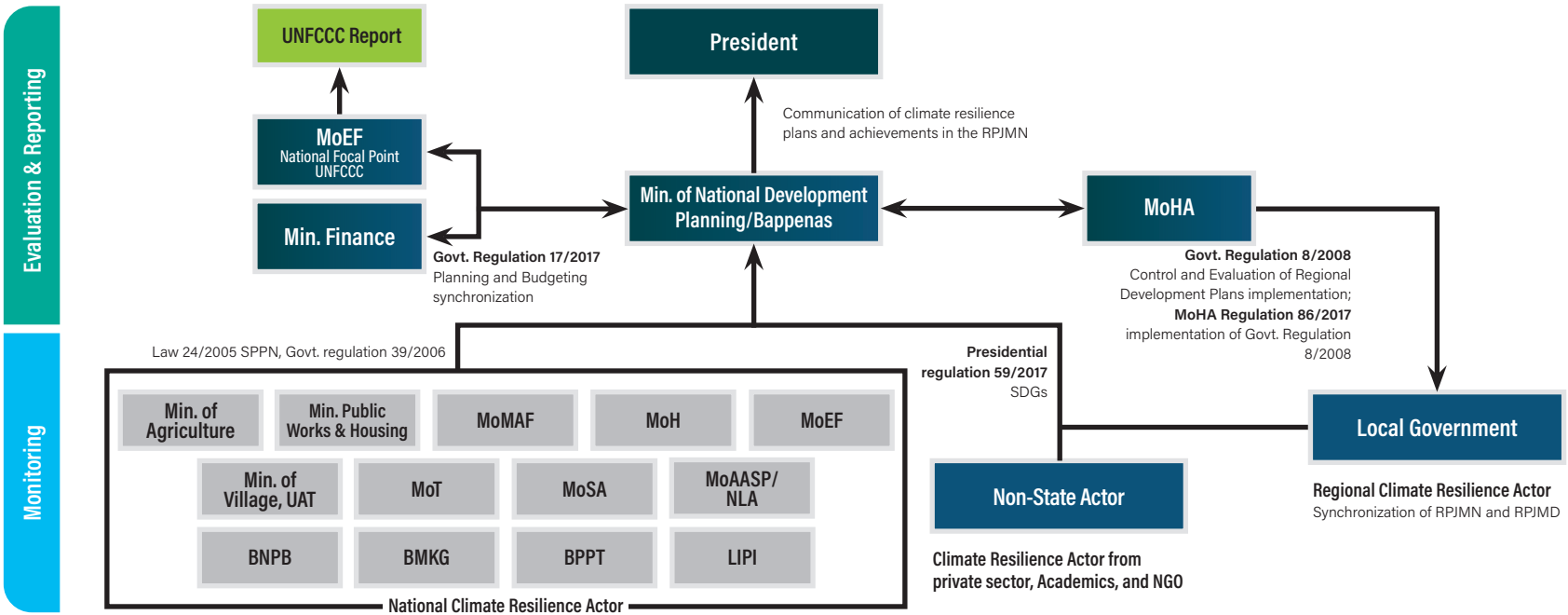


Figure 1. Visualization on Monitoring Institutional, Evaluation, and Reporting on Climate Resilience Action in the Implementation on National Development Plan

1 Implementer & Observer Climate Resilience Action

The Government Regulation Number 39 0f 2006 (PP 39/2006) stated that there are 2 roles of institutions that carry out control of climate resilience development, which are in the implementation of monitoring, and evaluation of climate resilience activities. Article 1 explains that implementers of climate resilience action are the parties who plan climate resilience activities and implement them according to definition and location of the action. The action implementer also monitors the output and performance achieved of the climate resilience activities in accordance with Article 2 and Article 4.

Monitoring, in PP 39/2006 Article 1 Act 2, is an activity to observe developments in the implementation of development plan, identify and anticipate problems that arise and / or will arise so action can be taken as early as possible. Monitoring the implementation of programs and activities is conducted on the progress of the realization of the absorption of funds, the realization of the achievement of the targeted output (output), and the obstacles faced.

While conducting climate resilience activities, the implementers of the action are also expected to collect technical data needed to measure the achievement of reducing potential economic loss. Details regarding general data and technical data can be seen in Chapter III Methodology to Measure Climate Resilience Action. The results of monitoring are conveyed to the implementers of the Climate Resilience Evaluation and Reporting Action. Implementers and observers for climate resilience action can be group into sectors, as follow:

Table 1. Distribution of Related Stakeholders by Sector.[1]

Sector	Ministries/Institutions
Maritime & Coastal	**Key Ministries/Institutions:** Ministry of Marine and Fisheries (KKP), Ministry of Transportation (MoT) **Ministries/Institutions and other Related Institutions:** Ministry of Villages, Disadvantaged Areas and Transmigration, Ministry of Public Works and Public Housing, Ministry of Transportation, Ministry of Social Affairs, Ministry of Environment and Forestry (MoE&F), National Disaster Management Agency (BNPB), Meteorology, Climatology and Geophysical Agency (BMKG), Agency for the Assessment and Application of Technology (BPPT), Indonesian Institute of Sciences (LIPI), Provincial Government, Non-Government Institutions (Private Sectors, Academics, Society, etc.)
Water	**Key Ministries/Institutions:** Ministry of Public Works and Public Housing (MoPWH), MoE&F **Ministries/Institutions and other Related Institutions:** National Disaster Management Agency (BNPB), Meteorology, Climatology and Geophysical Agency (BMKG), Agency for the Assessment and Application of Technology (BPPT), Indonesian Institute of Sciences (LIPI), Provincial Government, Non-Government Institutions (Private Sectors, Academics, Society, etc.)
Agriculture	**Key Ministries/Institutions:** Ministry of Agriculture **Ministries/Institutions and other Related Institutions:** MoPWH, Ministry of Villages, Disadvantaged Areas and Transmigration, Ministry of Social Affairs, National Disaster Management Agency (BNPB), Meteorology, Climatology and Geophysical Agency (BMKG), Agency for the Assessment and Application of Technology (BPPT), Indonesian Institute of Sciences (LIPI), Provincial Government, Non-Government Institutions (Private Sectors, Academics, Society, etc.)
Health	**Key Ministries/Institutions:** Ministry of Health **Ministries/Institutions and other Related Institutions:** MoPWH, Ministry of Social Affairs, National Disaster Management Agency (BNPB), Meteorology, Climatology and Geophysical Agency (BMKG), Agency for the Assessment and Application of Technology (BPPT), Indonesian Institute of Sciences (LIPI), Provincial Government, Non-Government Institutions (Private Sectors, Academics, Society, etc.)

[1] as Identified on RPJMN 2020-2024.

The roles of the implementer and observer of climate resilience action are:

1. Planning and implementing climate resilience action in accordance with the action's definition and location,
2. Monitor the climate resilience action through the PEP system in accordance with the policies of the implementer of evaluation and reporting.

2 Implementer for Evaluation & Reporting on Climate Resilience Action

PP 39/2006 Article 12 Act (1) and (2) Evaluation is carried out on the implementation of M/I's Work Plan and Government Work Plans (RKP) to assess the success of a program / activity based on performance indicators and targets and on the implementation of the RPJMN and Plans. Ministry & Institutional Strategic Plan to assess the efficiency, effectiveness, benefits, impact, and sustainability of the program.

Implementers of climate resilience evaluation and reporting are the parties that collect, analyze and compile reports on the implementation of climate resilience actions. Evaluation and reporting are coordinated by the Ministry of National Development Planning/Bappenas together with the Ministry of Finance in the evaluation process.

The role of the Implementer for the Evaluation and Reporting of Climate Resilience Action is:

1. Collect and analyze activity monitoring report to assess the progress of the implementation of planned activities and identify problems that require follow up (PP39/2006 Article 10),
2. Evaluate and report the achievements of climate resilience action activities in national development planning; namely assessing the success of the implementation of a program / activity based on performance indicators and targets, in order to obtain the efficiency, effectiveness, benefits, impact and sustainability of a program.

Mechanism of Monitoring, Evaluation, and Reporting on Climate Resilience at National Level

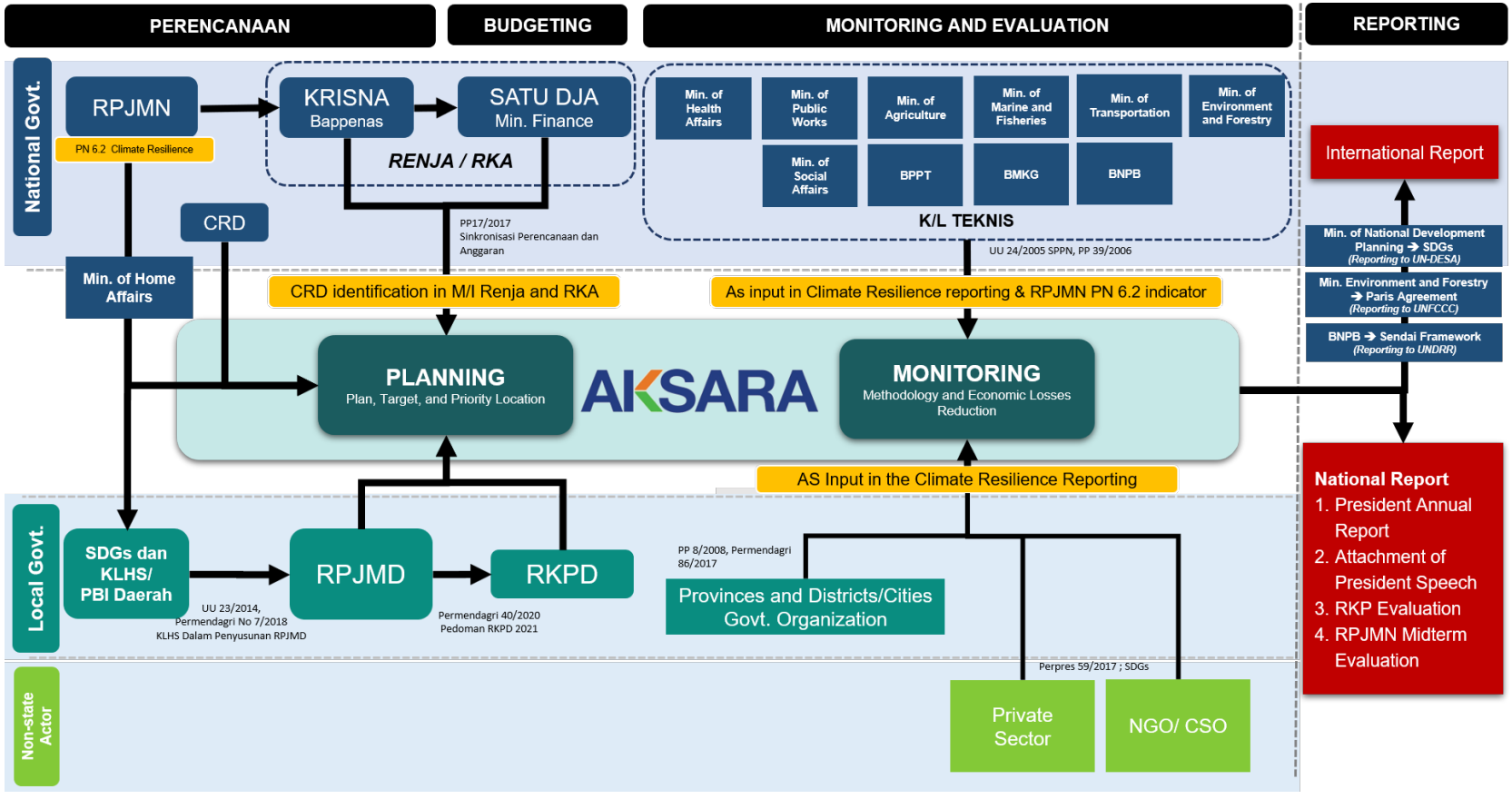


Figure 2. The Mechanism of Evaluation and Reporting on Climate Resilience

Bappenas, as the coordinator of Climate Resilience Action Monitoring, Evaluation and Reporting (MER) process in the RPJMN, has issued a MER design for climate resilience action as shown in Figure 2. The MER mechanism, as a whole, involves related Ministries / Institutions, Local Governments, and Non-Governmental Institutions including private sector and non-governmental organizations (NGOs). The MER system includes the MER process, outputs, and involved implementers, centering on an integrated MER system, that is the Application of Planning and Monitoring Action for Low Carbon Development and Indonesian Climate Resilience (AKSARA).

The stages of controlling climate resilience are carried out from the beginning of activity planning with reference to RPJMN plan and target. Meanwhile the MER mechanism being implemented takes into account the processes that have been used in the RPJMN, without creating a new process that is unaligned. In general, the control and evaluation process flow for climate resilience action includes 4 major processes as shown in **Figure 3**.

Figure 3. Stages of Monitoring, Evaluation and Reporting on Climate Resilience Action at the National Level (adopted from the Ministerial Regulation PPN/Head of Bappenas No.1 of 2017)

1 Developing Ministries/Institutions Work Plan

Period
(Y-1) Semester 2

Actors
Planning Bureau of Ministerial/ Institution, Reviewer (Ministry of Finance, Ministry of National Development Planning/Bappenas)

Activities
- Developing M/I's Work Plan in relation to climate resilience action that in line with RPJMN target and a list of locations, as well as climate resilience action;
- Marking of government work plan on climate resilience on the KRISNA application.

Expected Output
M/I's work plan that are in line with RPJMN and locations for climate resilience action and the result of accurate marking of climate resilience on KRISNA.

The process of preparing M/I's work plan follows Government Regulation Number 90 of 2010 on Formulation of Work Plan & Budget of State Ministries/ Institutions and Government Regulation Number 17 of 2017 on Synchronization of the National Development Planning and Budgeting Process, that is "the process of developing the work plan of State Ministries/Institutions for the fiscal year follows the national development priorities and an indicative ceiling, and reviewed by the Ministry of National Development Planning and agreed upon the Trilateral Meeting (TM) with the Ministry of Finance." Government work plans related to Climate Resilience that have been prepared and in accordance with the definition and location of climate resilience action are then entered into KRISNA Application. During the work plan developing process, the Planning Bureau can include activities that support the RPJMN Climate Resilience target, as follow:

Table 2. Climate Resilience Indicators and Targets in RPJMN 2020-2024.

Priority Activity/ National Priority Projects	Indicators	Target				
			2021	2022	2023	2024
Priority Activity: Climate Resilience Improvement	Percentage of potential reduction in GDP loss due to climate hazards in the marine and coastal sector (percent)	0.256	0.412	0.543	0.650	0.732
	Percentage in potential GDP loss due to climate hazards in the water sector (percent)	0.009	0.028	0.045	0.060	0.072
	Percentage of reduction in potential GDP loss due to climate hazard in agricultural sector (percent)	0.054	0.107	0.156	0.207	0.251
	Percentage of potential reduction in GDP loss due to climate hazards in the health sector (percent)	0.024	0.044	0.062	0.078	0.093

Priority Activity/ National Priority Projects	Indicators	Target				
			2021	2022	2023	2024
Priority Projects: Protection to the vulnerability at Marine and Coastal Sector	Number of coastal areas and small islands with increased resilience to disasters and the impacts of climate change (region)	12	12	12	12	12
	Number of ports that have maritime weather information services and wave height forecasts with an accuracy of more than 80 percent (ports)	20	20	20	20	20
	Length of sea dikes and other coastal protection structures constructed or upgraded (km)	22	31	37	43	42
Priority Projects: Protection of Water Security in Climate Risk Areas	Additional raw water discharge in water prone area (m^3/second)	2	3	4	3	5
	Number of river basins that resiliency of its vital infrastructure is enhanced against the risk of disasters and climate change (river basins)	10	20	20	20	20
Priority Projects: Protection of Food Security against Climate Change	Number of building for water and environmental conservation to increase agricultural areas (unit)	200	200	200	200	200
	Number of outreach officers whose understanding on climate have improved through attendance at Climate Field School (person)	1,000	1,275	1,450	1,650	1,650
Priority Projects: Protection of Public Health and Environment from the impact of climate change	Number of districts/cities that administer healthy regencies/cities (districts/cities)	110	220	280	380	420

The Planning Bureau of M/I can refer to the list of climate resilience actions as mentioned in the Book of Climate Resilience Locations and Action during the preparation of climate resilience activities, therefore the marking process on the KRISNA Application will be easier. The preparation of climate resilience activities can also refer to the results of the previous year evaluation and reporting on climate resilience action. The reviewers of government work plan from the Ministry of National Development Planning/Bappenas play an important role in examining, correcting, and providing input, hence M/I's work plan is aligned with the RPJMN target, list of activities, and locations for climate resilience actions.

2 Identification of the List of Action Plans for Climate Resilience in Ministerial/Institution's Work Plan

Period
(Y) Year of the M/I's work plan is in progress - Semester 1

Actors
The Climate Resilience Team of the Ministry of National Development/ Bappenas, Planning Bureau and Technical unit of M/I

Activity
Identify and clarify the work plan as well as M/I's work plan and budget related to their sustainability in accordance with the definition and location of climate resilience action.

Expected Output
- Agreement on the identification list of work plan as well as M/I's work plan and budget related to climate resilience action, and in accordance with the definition and location of climate resilience.
- Then this list is entered into the climate resilience MER system as activities or actions to be reported.

Data Requirement
Government work plan data and or M/I's work plan and budget

In this process, the climate resilience team of the Ministry of National Development Planning/ Bappenas identifies climate resilience action in the work plan and in the M/I's work plan for the current year, in accordance with the following stages:

A Collecting M/I's Work Plan

The compiling process of climate resilience activities in the work plan is carried out comprehensively to all units involved with climate resilience action, both those marked as "Climate Resilience Action" in the KRISNA Application or not. Apart from identification, it also aims to evaluate the results of the marking so that the quality of the marking carried out through the system increases every year. The data collected came from KRISNA, Satu DJA, and the Planning Bureau of M/I.

B Identification of Climate Resilience Action

The resilience team identifies the suitability of the Ministerial/ Institution's work plan with the location and target for climate resilience of the RPJMN 2020-2024. Activities in the Ministerial/ Institution's work plan that match the criteria will be marked as potential climate resilience activities.

C Focus Group Discussion (FGD) Clarifies the Result of the Identification of Climate Resilience Action

FGD is initiated by the Ministry of National Development Planning / Bappenas which invites other related ministries and institutions. While the result of the identification of climate resilience action will be presented in the M/I's work plan for the current year as part of the FGD implementation. The discussion will be clustered based on the climate resilience sector, which is (1) Clarification of the activity plan, (2) Clarification of the location of activities, (3) The need for data to calculate the target achievement of reducing potential economic loss.

D Agreement on the List of the Result of the Identification of Climate Resilience Action

FGD result is made in a form of a list of activities from the work plan and M/I's work and budgeting plan agreed as climate resilience action, then control and evaluation is conducted. The list of activities is entered into AKSARA application for the implementation of monitoring, evaluation, and reporting when the activity implementation period ends.

3 Monitoring & Quantifying the Impact of Climate Resilience Action

Period
(Y+1) January - April

Actors
Planning Bureau and Technical unit of M/I

Activity
- Realization plan and action technical data entry into the AKSARA system;
- The AKSARA system will calculate the potential for reducing economic loss and other sectoral impact.

Expected Output
- Climate resilience action is included in the AKSARA system;
- The value of the potential economic loss that was successfully reduced and other sectoral impact of the action.

Data Requirement
General data and technical data on climate resilience action[2], methodology for quantifying the impact of action on climate resilience.

In accordance with Government Regulation Number 39 of 2006 Article 4, which states that the Head of Ministries/Institutions monitors the implementation of M/I's Work Plan which includes the implementation of programs and activities in accordance with their duties and authorities; and Article 9, regarding the role of the Ministry of National Development Planning/Bappenas in compiling and analyzing the report; then at the beginning of the first semester after the work plan period ends (Y + 1), the Ministries/Institutions is obliged to report the achievement of the implementation of the activities.

Regarding NP 6.2.2 Climate Resilience, the Ministry of National Development Planning/ Bappenas provides an integrated online monitoring portal, which is AKSARA, which developed in purpose to facilitating the process of compiling climate resilience action activities, therefore the achievement of RPJMN can be monitored optimally and on time. AKSARA can be accessed online at *https://pprk.bappenas.go.id/aksara*, further information regarding AKSARA is available in the AKSARA manual book for monitoring, evaluation and reporting on climate resilience action.

[2] Described further in the Methodology chapter.

The monitoring and reporting process of the realization of climate resilience action using AKSARA is briefly described as follows:

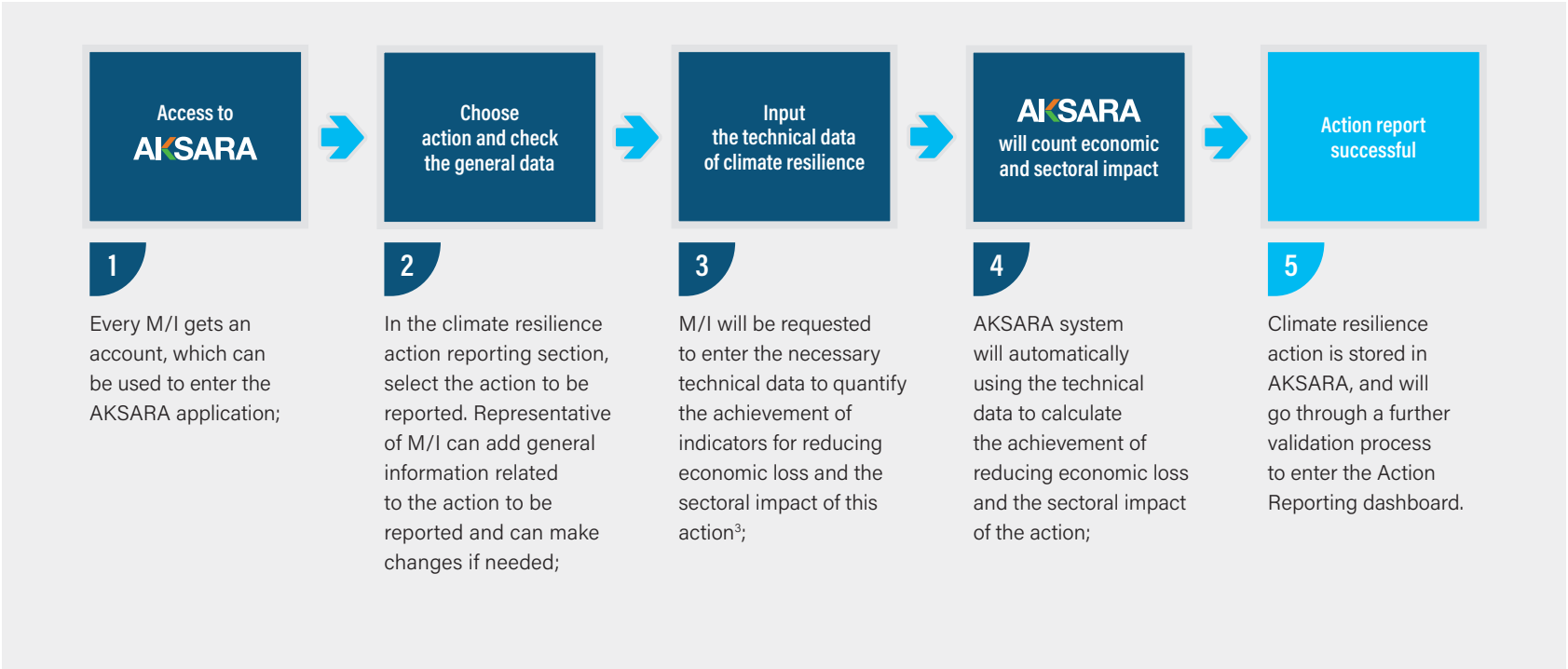


Figure 4. The Flow of the Climate Resilience Action Monitoring and Reporting Process

The reported data will be checked, by the climate resilience team, to ensure data quality is maintained. Corrections or questions will be submitted through the system, hence the repair process can be done directly. Data that has passed validation will be included in the dashboard of climate resilience achievements to answer the target in RPJMN.

[3] Further explanation regarding the calculation methodology and technical data requirements is presented in the Methodology chapter

4 Evaluation & Reporting

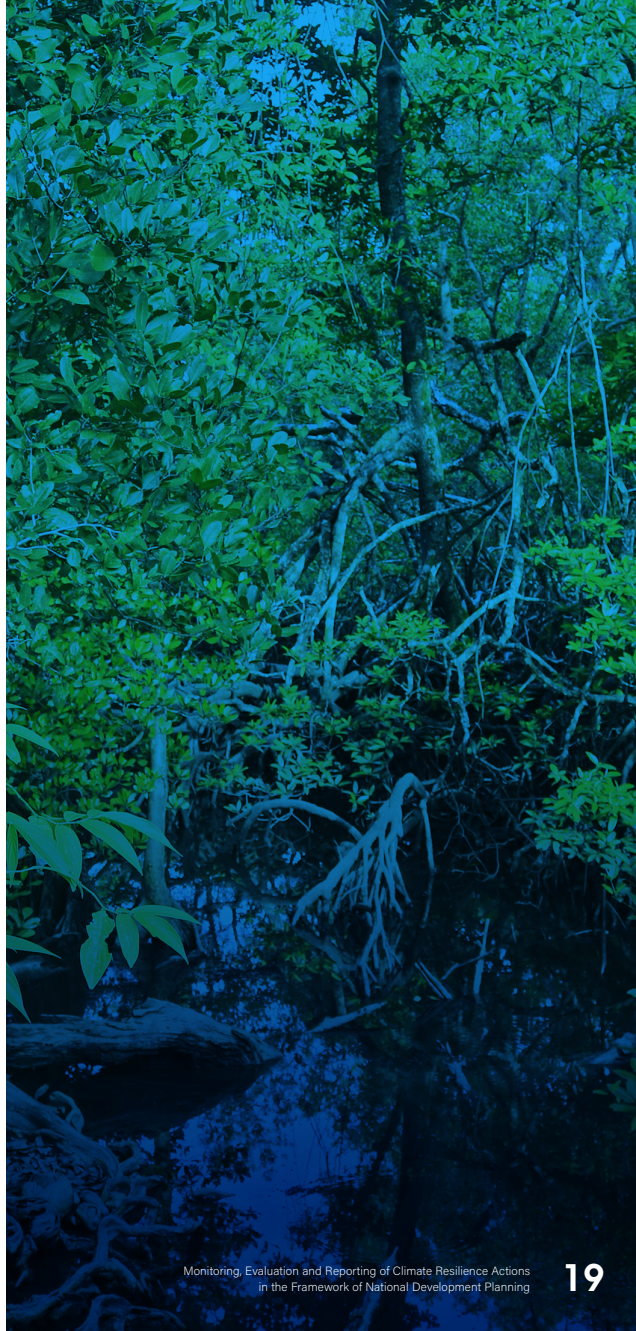
Period
(Y+1) Semester 2

Actors
Planning Bureau and Technical unit of M/I

Activities
- The calculated impacts of climate resilience action in comparison to the RPJMN's target;
- Evaluation to the achievement of activity.

Expected Output
- Annual progress reports to be communicated to planner, reviewer, and implementer of action;
- Input from M/I's work plan for the following year.

Evaluation and reporting is the final stage of the monitoring, evaluation and reporting cycle. At this stage, the result of the realization of climate resilience actions is going through a further analysis and compared to the RPJMN's achievement target, which is effectiveness and efficiency of the implementation of these actions. The expected output from this process is in the form of an annual progress report on climate resilience action, which plays as an accountability report for the implementation of the RPJMN and can be used by M/I and reviewers as input during the preparation process of the work plan for the following year.



Methodology to Measure Achievements of Climate Resilience Action

In the RPJMN 2020-2024, Climate Resilience Development has a main indicator, which is the amount of economic loss that can be avoided by implementing climate resilience action. Climate resilience action includes activities in the field of infrastructure, technology, capacity building and governance, which take into account the sustainability of ecosystems and aspects of inclusivity (gender equality, people with disabilities, children, senior citizens, and other vulnerable groups).

The contributions of climate resilience activities in reducing economic loss can be grouped into activities that directly reduce economic loss in the climate-affected sectors, and activities that indirectly reduce economic loss, such as increasing the capacity for climate resilience and reducing the level of regional vulnerability which are beneficial to reduce the risks of sectoral hazards. Therefore, climate resilience activities can be grouped into these two following categories:

1 Main Activity

The main activity is climate resilience action activity which can directly contribute to reducing economic loss in four priority sectors. Output from main activities can be converted into rupiah value of GDP. Activities in the main category include the development and provision of infrastructure, dissemination and application of technology that supports production improvement, prevention of damage and loss of assets, and so on.

2 Supporting Activity

Supporting activity is development activities which output is difficult or cannot be converted into the rupiah value of GDP; therefore, they are indirectly contributing to reducing economic loss in the four priority sectors. Output from supporting activities reduces the risks of sectoral hazards through increased capacity for climate resilience and reduced level of vulnerability, which have implications for reducing economic loss due to climate change. Activities in this category include capacity building, resource management, increasing access to funding, and formulation of regulations that can support the implementation of main activities, as well as having an impact on improving the welfare of the communities in the affected areas.

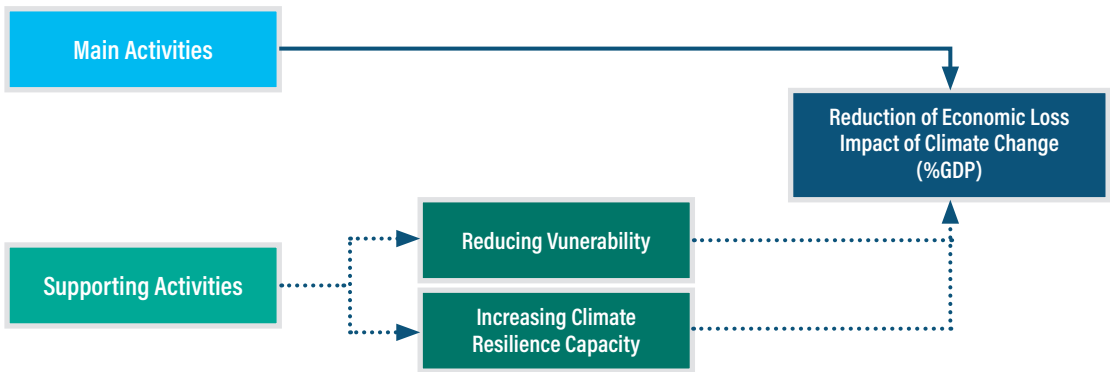


Figure 5. Correlation of Main and Supporting Activities in Achieving Climate Resilience Targets

Based on the activity categories mentioned above, only main activities can calculate the value of reducing economic loss using the methodology described in the Methodology Chapter. The formulation of a methodology for measuring the achievements of climate resilience action involves a team of experts from related M/I and academics. Several actions in the main activities that have the similar output characteristics are grouped into one action group by one calculation method.

Figure 6. Grouping the Methodologies on Climate Resilience Action

The book on monitoring, evaluation and reporting on climate resilience action in the framework of national development planning is a "living document"; which means that it can be updated regularly to improve the accuracy of the calculation result. All methodologies for quantifying the achievements of reducing economic loss, as mentioned in this book, are included in the AKSARA system, so that all calculation processes can be carried out by the system to facilitate monitoring evaluation and reporting of climate resilience actions.

The need for data and information on climate resilience action is divided into two types, which are:

1 General Data

General data on climate resilience activities, all actions from various sectors will have the same general data. For example, name of activities, implementers, locations, budgets, etc.

2 Technical Data

Data that derives from main climate resilience activities that is used for calculating the achievements of reducing economic loss. This technical data is categorized into two types:

A Primary Technical Data

The main variable used to calculate the reduction in economic loss. It is difficult to calculate without the existence of this main data.

B Secondary Technical Data

Supporting variable data, which provides additional information or forms a conversion factor from the primary data to an economic loss reduction value.

Some technical data is also required for supporting activities as a benchmark to assess the reduction at the level of vulnerability and increased capacity for climate resilience from climate resilience actions. The method of determining the achievement of increasing climate resilience in supporting activities uses a qualitative analysis approach from the reported primary and secondary data.

Photo by Quang Nguyen Vinh on Pexels

Methodology for **Marine & Coastal Sector**

In the RPJMN 2020-2024, the Marine and Coastal Sector is targeted to contribute to a reduction in total economic loss of 2.592% of GDP which comes from the marine and coastal subsectors.

Marine Subsector

The main challenge in the marine subsector is disruption to shipping safety which also affects fisheries, especially small-capacity vessels and those equipped with inadequate technological facilities. Climate change alters fishing patterns, including fishing that is further away from the coastline, erratic fish FADs, and unpredictable weather using conventional methods. Reduction of economic loss from climate change impacts from the Main Activities of climate resilience actions in the Marin Subsector is shown in the following chart and table:

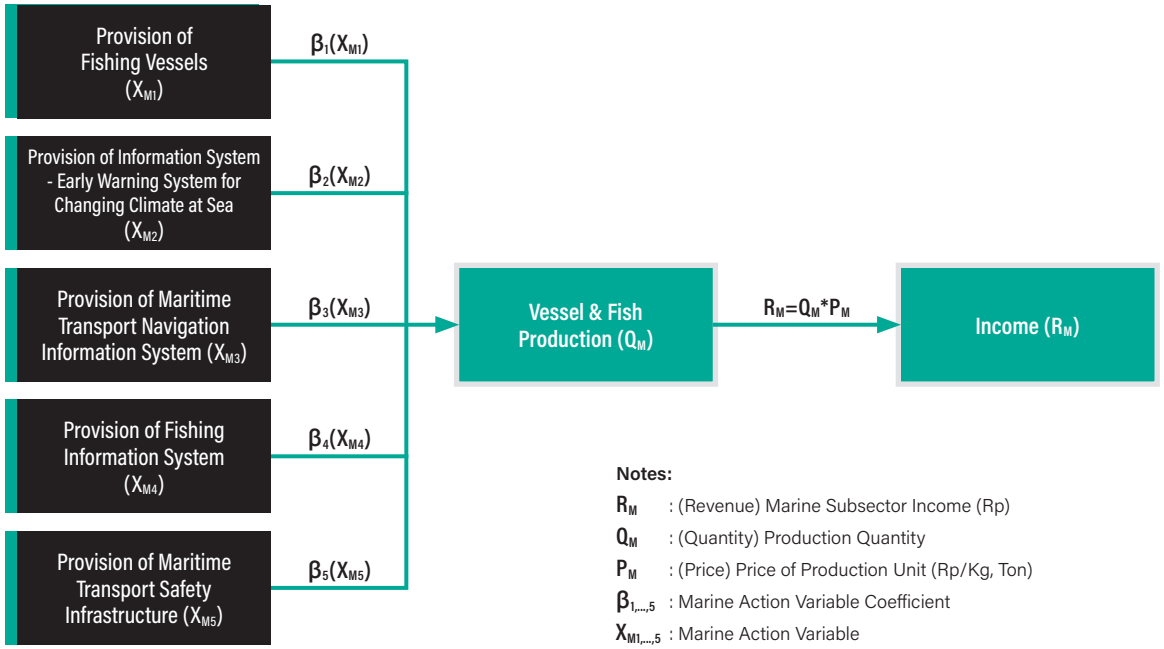


Figure 7. The Flow of Achievement for Reducing Economic Loss from Climate Resilience Action in the Marine and Coastal Sector: Marine Subsector

Details of the Methodology for Calculating Outcomes of Main Activities in the Marine and Coastal Sector: Marine Subsector

Table 3. Details of the Methodology for Calculating Outcomes of Main Activities in the Marine and Coastal Sector: Marine Subsector

Main Activities

Actions	Output Indicators	Data Requirement	Calculation Concept
Provision of fishing vessels			
Provision of fishing vessels that are adaptive to the dangers of high sea waves	Fishing boat beyond 10 GT (unit)	**Primary Data:** Number of vessels (unit) **Secondary Data:** ▪ Engine power capacity (mil) ▪ Catch capacity (ton/vessel) ▪ Vessel property value (Rp/vessel) ▪ Number of crew (person) ▪ Data on the number of vessels and their types (unit) ▪ Ship accident data (unit and incident)	I. Based on the results of the assessment, vessels <10GT are more likely to experience accidents or loss due to increased wave height; II. Efforts that can be made by fishermen with a small boat capacity include reducing the range of journey (limited to safe sea areas for small vessels), improving vessel's capacity (changing to >10GT), and increasing the power and distance capacity (replacing the vessel's structures with the stronger ones, so it is safer at sea (less accidents)). III. The reduction in economic loss is obtained from replacing and strengthening the capacity of fishing vessels, shown in the following calculation flow: Replaced vessel of improved capacity (unit) → Less accident at sea → Value of the vessel (Rp), fishery production (Rp/ton), and crew income (Rp/person) that can be maintained Provision of fishery vessels with engine size >10GT and improvements for vessels <10GT are potential in reducing numbers of accidents at sea and can improve the amount of catch or fishery production which is beneficial to improve the marine and fishery income.
Application of fiberglass material innovation on small fishing boats and accordingly to standards	Fishing boat below 10 GT with fiberglass material (unit)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Provision of information system – early warning system for changing climate at sea			
Strengthening the climatology information system and maritime technology (wave, current, and wind) - example: buoy ocean climatology	Information system of ocean climatology and early warning (unit)	**Primary Data:** Numbers of fishing vessels that access maritime climate information (unit) **Secondary Data:** The size of ocean that is supported by the information system and early warning maritime climate (mil^2)	I. By accessing the information and early warning system of maritime climate, vessels can prepare and anticipate for disasters as well as extreme sea conditions, such as waves; so obstacles and accidents could be avoided as early as possible; II. The reduction of economic loss obtained from vessels that utilize the information and early warning system of maritime climate is shown in the calculation flow below: Provision of information infrastructure & early warning maritime climate (unit) → Utilization on vessels in the area (unit) → Improved shipping safety and reduced ship accidents → Value of vessels (Rp), fishery production (Rp/ton), and crew income (Rp/person) that can be maintained Through the provision of information facilities and early warning of maritime climate (units), fishermen can prepare and anticipate disasters and sea extreme conditions, which affect the level of ship accidents and the amount of catch or fishery production. It has direct impacts on increasing marine and fisheries income.
Provision of maritime transport navigation information system			
Implementing Automatic Identification System - AIS and Vehicle Monitoring System - VMS, for Vehicle traffic service - VTS)	Tracking system (unit)	**Primary Data:** Number of vessels that access navigation information (unit) **Secondary Data:** ▪ The area of safe shipping lanes that can be traced (mil^2) ▪ The area of the sea that can be supported by navigation vessels (mil^2)	I. Disruption to shipping and vessels accidents can be prevented, one of which is by determining safe area for shipping; Tracking technology can improve marine traffic information services, making it more secure and accurate; II. Navigation vessels can also provide shipping lane security information, which can be used by fishing vessels; III. A reduction in economic loss is obtained from vessels utilizing navigation information to avoid disturbances and accidents as shown in the following calculation flow: Provision of shipping navigation service (unit) → Utilization on vessels in the area (unit) → Safe paths are formed and can reduce vessels accidents → Value of vessels (Rp), fishery production (Rp/ton), and crew income (Rp/person) that can be maintained
Provision of shipping navigation vessels	Navigation Vessels (unit)		Through the provision of shipping navigation services (units), fishermen can find disruptions to shipping, and vessel accidents can be prevented. This affects the level of vessel accidents and the amount of catch or fishery production; and will have direct impacts on increasing marine and fisheries income.

Actions	Output Indicators	Data Requirement	Calculation Concept
Provision of fishing information system			
The application of marine survey technology (Remotely Operated Vehicle - ROV)	Marine survey technology (unit)	**Primary Data:** Number of vessels accessing fishing information (unit) **Secondary Data:** ▪ Areas with high catch potential (location) ▪ Size of fishing grounds that ROV can survey (mil^2) ▪ Vessels productivity (ton/ unit fish catch)	I. By using marine survey technology, fishing ground can be identified in advance, so that the journey is more effective and efficient; apart from avoiding disturbances and accidents, production can also be increased; II. The reduction in economic loss obtained from vessels utilizing marine survey technology is shown in the following calculation flow: Marine survey and fishing information system (unit) → Utilization by fishing boats → Sailing duration efficiency reduces fishing cost and increases production (Rp/ton) The provision of a fishing information system (units) can increase the amount of fish catch or fishery production, which will have a direct impact on increasing marine and fisheries income.
Provision of maritime transport safety infrastructure			
Construction and rehabilitation of marine navigation bases – building and facilities (e.g. lighthouses, monitoring posts, etc.)	Navigation building (unit)	**Primary Data:** Number of fishing boats that access marine navigation and guarding facilities (unit) **Secondary Data:** ▪ The size marine area that can be supported by navigation facilities (mil^2) ▪ The size of marine and coastal area that can be supported by marine and coastal safeguards (mil^2)	I. Besides utilizing the marine navigation system in the maritime traffic services, safe shipping lane information can also be obtained from the navigation base and the coast guard posts provided; II. The reduction in economic loss obtained from ships utilizing marine navigation and guarding facilities is shown in the following calculation flow: Provision of maritime transport safety infrastructure (unit) → Utilization by ships in the area (unit) → Improvement on the safety of maritime transport → Value of the vessels (Rp), fishery production (Rp/ton), and crew income (Rp/person) that can be maintained Through the provision of navigation and coast guard facilities (unit), fishermen can find out information on safe ship routes to avoid accidents, which will also affect the amount of catch or fishery production. This will have a direct impact on increasing marine and fisheries income.
Development of coast guard facilities	Coast guard and beach rescue building (unit)		

Table 4. Details of the Methodology for Supporting Activities in the Marine and Coastal Sector: Marine Subsector

Supporting Activities

Actions	Output Indicators	Data Requirement	Calculation Concept
Strengthening integrated marine management			
Development of fisheries production management centers	Integrated marine and fisheries center (unit)	Marine areas that are managed in an integrated manner (%)	▪ Management of marine areas can increase the resilience capacity of the coastal marine sector, especially the marine subsector, through the provision of facilities and infrastructure to support management, including information and early warning of weather and extreme climates, mentoring for fishing communities, business partnerships, and others; ▪ The more marine areas are managed in an integrated manner, the resilience capacity of fishing communities can be increased, thus supporting increased productivity in fisheries, which also impacts the income of the marine and fisheries sector.
Development of technology and marine information system			
Development of maritime transport information system and early warning for extreme weather	Information system that is being developed (unit)	Number of marine information and technology systems (unit)	▪ Research and technology development in the marine sector, especially related to changes in the marine climate, can be utilized for the implementation of strategies to improve marine safety; ▪ The availability of technological innovations can be further utilized through mass production, which is distributed to fishing communities to support efforts in improving marine safety (information systems on weather and extreme climate) as well as increasing fishery production; ▪ Additionally, researches that are being continuously developed can increase the accuracy and assurance of marine models and technologies, which can also support the capacity of the sector to anticipate climate change; ▪ Contribution of research and technology development in reducing the level of vulnerability at a sector is based on the amount and types of research produced; the more research, the more the resilience capacity increases.
Development of cellular-based fish detection in the water column (e.g. acoustic radar, Nusantara Marine Application)	Fish detector application that is being developed (unit)		
Strengthening the information system on fishing spot prediction map	Number of Distribution maps (unit)		
Development of an integrated vessels accident record database in the big data center	*Number of Database (unit)*		

Actions	Output Indicators	Data Requirement	Calculation Concept
Improving the capacity of the government related to marine affairs			
Improving the capacity of central and local government that has direct involvement in the management of maritime transport and fishing safety	Government officials who attend training (person)	Civil services related to marine subsector who consider climate resilience in activities in their institution (%)	▪ The government plays a role in preparing legislation, provision of public good and services, social security, management of national income, economic stability, and other, especially in the marine subsector; ▪ Government awareness and commitment can be enhanced by improving their understanding and capacity related to agricultural climate resilience; thus, they support climate resilience policies, and implement them in their respective work areas, e.g. in the provision of facilities and infrastructure for maritime transport safety, marine management, and maritime transportation; ▪ Capacity building for the government has a significant contribution (the effect of increasing resilience is higher than increasing the capacity of fishing communities), because it can carry out the program in the previous point, as well as making direct cooperation with local governments and providing assistance to fishermen; ▪ The contribution of action to increasing climate resilience capacity is obtained from the percentage of government employees who have realized the importance of increasing climate resilience and have the ability to implement climate resilience actions in their institutional duties and functions.
Capacity building related to shipping and fishery safety			
Implementing education and outreach related to climate threats (e.g. Weather Field School for fishermen)	Fishermen who receive training (person)	Fishermen who implement shipping safety improvement in their activities (%)	▪ The more fishermen understand better the importance of the climate change impacts on disrupting shipping safety and fisheries production, the better the shipping safety will improve, such as installing marine applications and radar on their ships. ▪ Training on utilizing the technology can improve fishermen's skills in using safety technology for shipping and fishing, which could affect fisheries production. ▪ The contribution of fishermen improved capacity to the level of vulnerability of the marine sub sector yields from the percentage of fishermen who apply knowledge and skills socialized in their shipping activities.
Dissemination of shipping information system and early warning of sea extreme weather	Fishermen who receive training (person)		
Training in ships manufacture that are resistant to high wave threats, such as fiberglass boats (from the design stage, material selection, to ready-to-use)	Fishermen who receive training (person)		
Training on the utilization of fishing technology, including fish stock detection tools	Fishermen who receive training (person)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Strengthening the marine management regulations			
Reassessing and strengthening the content of marine and coastal regulation that have considered the dangers of climate change (e.g. RTRLN derivative regulations and RZWP3K Regional Regulation)	Adapted marine and coastal area management regulations (regulation unit)	Regulations and guidelines for marine management that have considered climate resilience aspects (unit)	▪ Marine management policies need to be strengthened through statutory regulations, either through government regulations, ministerial regulations, regional government regulations; thus, technical ministries, OPD, industries, communities and other users will participate. ▪ The existence of regulations in one of the guarantees for the protection of marine areas and compliance with shipping safety regulations; ▪ The number of marine management regulations prepared contributes to the reduction of vulnerability of the marine sub sector in areas affected by climate change.
Strengthening regulations on the arrangement of sea traffic and fishing routes, including provisions for fishing in no-take zones or marine protected areas	Regulation that is being prepared (regulation unit)		
Improvement on financial access for fishermen			
Increased access to fishermen insurance based on weather index and climate risk (Weather Index Insurance)	Fishermen who access premium insurance (person or customer)	Fishermen who access finance and insurance (%)	▪ Funding is required to sustain the shipping and fishery production activities; ▪ Most fishermen, particularly traditional fishermen, have financial constraints, especially when they experience an accident and a decreasing amount of their catch; ▪ Provision of financial assistance can be guarantee for fishermen to have capital in carrying out shipping and fishing activities; the effort supports improving the resilience capacity of fishing communities; ▪ The more fishermen with access to finance, the higher the resilience capacity of fishing communities is in the area.
Strengthening cooperative institutions and fishermen groups against the dangers of climate change	Fishermen cooperatives that receive assistance (unit)		
Development of more accessible innovative financial service mechanisms for coastal communities	Accessible financial services (service unit)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Provision of diversification of fishermen's income			
Training and introduction to income diversification for fishermen's families	Families who receive training (person)	Fishermen with alternative livelihood (%)	▪ Fishermen who own boats with small catches and capacities are mostly people who are less prosperous in their area, especially if their only income is from fishing; ▪ Alternative income sources for fishermen's families can provide additional income or support to finance their shipping and fishing activities, as well as to fulfill the daily needs of fishermen's families; ▪ Provision of diversification of fishermen's income contributes to increased capacity for resilience towards the climate change impacts, which is calculated from the percentage level of fishermen who have alternative income sources.
Provision of diversification of fishermen's livelihoods	Provided alternative income sources for fishermen (number of new professional vacancies)		

Coastal Subsector

The major issue in the coastal subsector is the inundation of coastal areas due to rising sea level. This affects economic activities or community productivity in coastal areas. Reduction of economic loss from climate change impacts from the main activities of climate resilience action in the coastal subsector is described in the following chart and table:

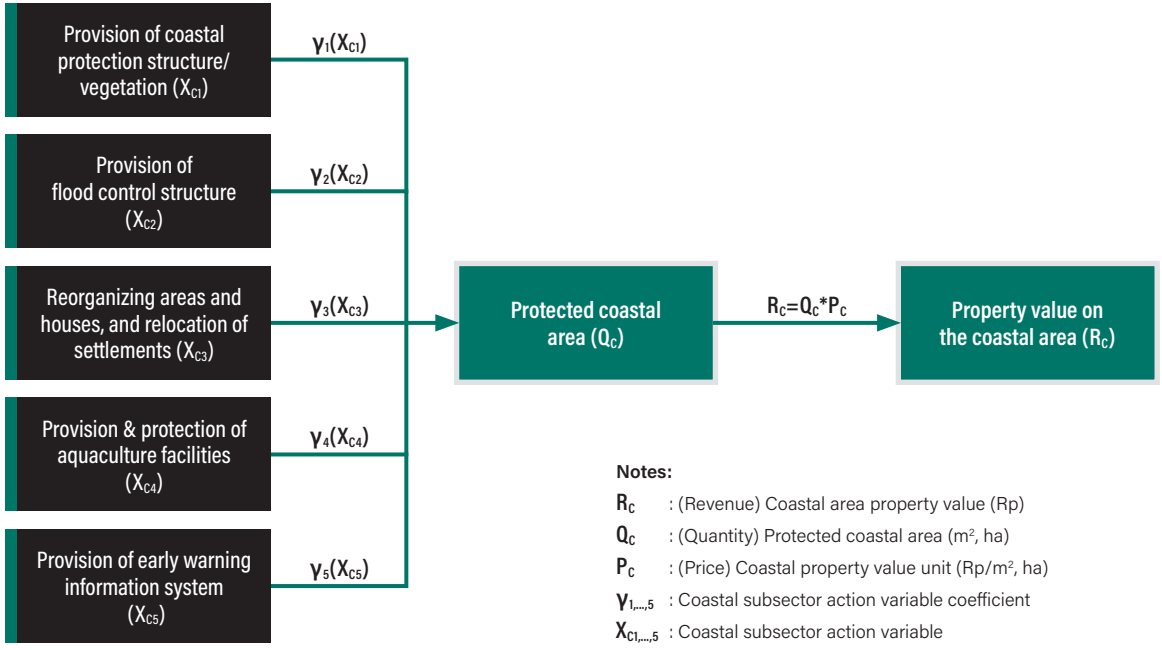


Figure 8. Flow of achievement for reducing Economic Loss from Climate Resilience Action in the Marine and Coastal Sector: Coastal Subsector

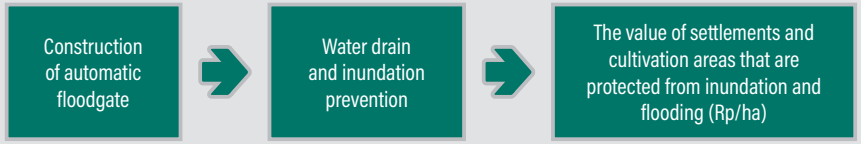
Details of the Methodology for Calculating Outcomes of Main Activities in the Marine and Coastal Sector: Coastal Subsector

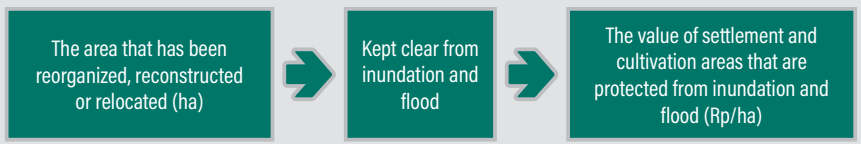
Table 5. Details of the Methodology for Calculating Outcomes of Main Activities in the Marine and Coastal Sector: Coastal Subsector

Main Activities

Actions	Output Indicators	Data Requirement	Calculation Concept
Provision of coastal protection structures/vegetation			
Construction of coastal protection hybrid structures (e.g. geotextile sacks)	Length of hybrid structure (km)	**Primary Data:** Protected coastal area (ha) **Secondary Data:** ▪ Property value on the coastal area (Rp/ha) ▪ The type and the size of property in the area (type and ha)	I. Coastal protection structures can prevent coastal area, either in the form of settlements or aquaculture areas, being inundated and flooded; II. Coastal protection structures can be divided into several categories, which affect their strength or effectiveness in protecting the coastal areas (e.g. mangroves are quite effective in coastal area with moderate to high vulnerability, while hard structures are more effective in the areas with very high vulnerability); III. The reduction in economic loss obtained from the value of the protected coastal area is shown in the following calculation flow: Construction of coastal protection structure (km) → Coastal areas that protected from inundation and flooding (ha) → The value of settlements and cultivation areas that are protected from inundation and flooding (Rp/ha) Provision of coastal protection structures/vegetation can prevent coastal areas on the landform inundation and flooding, which will directly impact the protection of property values in the area.
Construction of hard coastal protection structures (e.g. gabions and seawalls) Development and rehabilitation of soft coastal protection structures using an ecosystem-based adaptation approach (e.g. planting and rehabilitating mangroves)	Length of hard protection structure on the shoreline (km) Length of soft structure area or mangrove (km)		

<table>
<tr><th>Actions</th><th>Output Indicators</th><th>Data Requirement</th><th>Calculation Concept</th></tr>
<tr><td colspan="4">Provision of flood control structure</td></tr>
<tr><td>Construction of automatic floodgates to reduce flooding in the coastal areas</td><td>Composite sluice built (spot)</td><td>Primary Data:
The protected coastal area (ha)

Secondary Data:
▪ Property value in coastal area (Rp/ha)
▪ The type and the size of property in the area (type and ha)
▪ The area that the floodgates can drain
▪ (ha/unit)</td><td>I. Automatic floodgates can discharge stagnant water and flooding in coastal areas to other areas; thus, the inundation period does not last long;
II. It has a similar mechanism to the shoreline protection structure, which is preventing inundation and flooding in the coastal area.
III. The reduction economic loss is obtained from the value of the area of the coastal area that flooding has been successfully reduced, as shown in the following calculation chart:
  </td></tr>
<tr><td colspan="4">Reorganizing areas and houses, and relocation of settlements</td></tr>
<tr><td>Fishing village areas planning</td><td>The size of fishing villages (ha)</td><td rowspan="3">Primary Data:
Coastal areas saved from inundation and flooding (ha)

Secondary Data:
▪ Property value in coastal area (Rp/ha)
▪ The types and the sizes of properties in the area (type and ha)</td><td rowspan="3">I. The areas faced inundation threats which caused loss prior to area planning, reconstruction, and relocation;
II. Coastal areas are protected from inundation and flooding due to area planning, reconstruction and relocation;
III. The reduction in economic loss obtained from the area that its physical resilience has been successfully enhanced or saved from inundation is shown in the following calculation flow:
 
Through reorganization of the area, reconstruction, and relocation, coastal areas that are prone to inundation can be protected from inundation and flooding, which affects the value of the area.</td></tr>
<tr><td>Implementation of reconstructing adaptive coastal areas of human settlements, public and social facilities</td><td>The size of reconstructed settlements (ha)</td></tr>
<tr><td>Provision and implementation of relocating coastal communities affected by flood or tidal flood</td><td>Relocated settlement areas (ha)</td></tr>
</table>

Actions	Output Indicators	Data Requirement	Calculation Concept
Provision and protection of aquaculture facilities			
Distribution of superior fish seeds which are resistance to high temperature and salinity	Distributed fish fry (unit)	**Primary Data:** Fishery culture area which is protected or its production increased (ha) **Secondary Data:** ▪ Fish culture productivities (ton/ha) ▪ Property value in the fish culture areas (Rp/ha) ▪ Fish culture production value (Rp/ton)	I. Fish culture area in the coastal area is one of the properties that is vulnerable to inundation and changes in marine parameters that can damage and decrease fishery production; II. The property value in the fish culture areas can be increased or protected from flood and inundation through efforts to increase production and protection in the cultivation areas; III. The use of superior fish seeds and nutritious fish feed can maintain or increase production, while a strong culture medium can withstand inundation and flood. IV. The reduction in economic loss obtained from the increase in fishery productivities and the area strengthened is shown in the following calculation flow: Provision of cultivation areas and protection of cultivation areas (ha) → Increased fishery production and cultivated areas protected from inundation and flooding (Rp/ha) The provision and protection of aquaculture production facilities can protect properties in the cultivated areas from flooding and inundation threats, which affects the fishery production value and the property value in the area.
Distribution of nutritious fish feed	Distributed fish feed (unit)		
Development of ecosystem-based climate resilience aquaculture media – Ecosystem Approach to Aquaculture 9, e.g. ponds, rainfed ponds, cages, etc.)	Fish culture facilities (unit)		
Constructions of pond irrigation network	Number or length of irrigation network (unit or length – m)		
Application of fully environmentally-controlled fish hatchery technology	Hatchery facility (unit)		
Provision of early warning information system			
Provision and implementation of extreme weather early warning information systems (flood information, tidal flood)	Early warning information system applied (unit)	**Primary Data:** Coastal areas that use early warning system (ha) **Secondary Data:** ▪ Property value in coastal area (Rp/ha) ▪ The type and the size of property in the area (type and ha)	I. Early warning system in the form of sea level markers which can provide information that can be used as a reference for anticipation; II. The resulting information is the rate of sea level rise and the impacts of inundation (estimated height and area of inundated coast) in a certain period of time (so many years); III. By utilizing this early warning system, the communities and government can prepare an evacuation strategy as early as possible; IV. The reduction in economic loss obtained from communities and inundated areas that were successfully evacuated is shown in the following calculation flow: Application early warning system → Community who use and evacuate → The value of settlements and cultivation areas that are protected from inundation and flooding (Rp/ha) By providing an early warning system in the form of a sea level marker, the communities can anticipate inundation and flooding in coastal areas, thereby protecting the value of fishery production and the property value in the area.

Table 6. Details of the Methodology for Supporting Activities in the Marine and Coastal Sector: Coastal Subsector.

Supporting Activities

Actions	Output Indicators	Data Requirement	Calculation Concept
Coastal protection technology development			
Development of innovative designs for a sea wall that is sturdy and environmentally-friendly	Sea embankment design (design)	Research and development results of coastal protection technology (unit)	▪ Coastal protection in the form of a sea wall needs to have a strong design and construction to effectively protect the coastal areas; ▪ Innovation in the design or a sturdy and environmentally-friendly embankment is expected to increase effectiveness in protecting coastal areas, including having long-lasted buildings, not easily destroyed or damaged; ▪ The existence of research and development that produces this innovation contributes to increasing climate resilience in coastal areas, as an alternative that can be applied to coastal protection structures.
Adaptive fish seed and feed development			
Conducting fishery research for superior broodstock or superior seeds	Broodstock/ superior fish seed produces (species)	Research and development result of aquaculture technology (unit)	▪ Cultivation areas in coastal are also affected by climate change, such as sea level rise, sea surface temperature and sea water salinity, which can have an impact on decreasing fishery production to the mass death of fish in aquaculture ponds; ▪ Superior fish seeds that are resistant to high temperature and salinity can maintain and even increase aquaculture production in the event of disturbance; ▪ Research and development of superior fish seeds and feed that can increase production can be an opportunity to increase aquaculture products and fishermen's income; ▪ Contribution of research and development efforts on seeds and adaptive fish feed to increase resilience to climate change is calculated from the number of appropriate and applicable innovations.
Development of aquaculture biotechnology that is adaptive to climate change	Aquaculture biotechnology invented (research)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Capacity building regarding coastal areas for government			
Capacity building for central and local government regarding sustainable coastal area management	Government officials who attend training (person)	Officials related to the coastal subsector who consider climate resilience in activities in their institutions (%)	▪ The government plays a role in the preparation of coastal area legislation and management including economic activities, industries, tourism and settlements; ▪ Government that understands the importance of considering the threats of disasters and climate change in coastal management can include them in policies and regulations that support increased achievement of reducing economic loss due to climate; ▪ The higher the percentage of the government's participation in capacity building related to climate resilience in coastal areas, and in applying it in their reals of work, the higher the support for increasing climate resilience.
Capacity building in safeguarding the coastal areas			
Dissemination of knowledge regarding coastal ecosystem and shallow marine water (e.g. Indonesian Beach School)	Socialized residents (person)	Communities who can work together and apply the aspects of coastal area safeguarding in their environment (%)	▪ Communities, as the local residences who conduct most of their activities in the area, play a very important role in protecting coastal areas against the threats of disasters and climate change; ▪ Communities that understand the importance of protecting coastal areas from the effects of climate change can consciously apply climate resilience in their daily activities, such as moving from and not living in coastal areas that are vulnerable and have high threats of inundation and coastal flooding, following early warnings, and getting prepared for disasters and climate change impacts; ▪ The active role of the communities can reduce the number of coastal areas that are at risk or experience economic loss; ▪ The contribution of efforts to increase community capacity to increase climate resilience is calculated from the percentage level of people in the area who have received socialization and mentorship, and apply it.
Community mentorship in reconstructing houses that are adaptive to climate change (due to flood, tidal flood)	Mentored residents (person)		
Mentorship on aquaculture activities in coastal areas for fishermen	Mentored fishermen (person)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Strengthening regulations in coastal areas			
Review of disaster related regulations in the coastal areas and small islands	Prepared regulation (document)	Coastal area management regulations and guidelines that consider aspects of climate resilience (unit)	▪ Spatial planning and coastal areas, such as the distance between building and shoreline, construction of coastal protection structures, and determination of location of settlements, centers of the economy, industry, and tourism that consider disaster and climate aspects need to be confirmed in statutory regulations, so it has clear rules, and followed by the government, business actors, and the public having an interest in it; ▪ The existence of regulations related to the coastal area planning to support the protection of coastal areas so it becomes more resilient to the threats of climate change and disasters; ▪ The contribution of this effort in reducing vulnerability in coastal areas is calculated from the number of regulations that are compiled and followed through appropriate area and building arrangements.
Preparation of disaster risk maps in coastal areas	Prepared regulation (document)		
Provision of innovative financing mechanism			
Development of an innovative financing mechanism for coastal aquaculture that is easily accessible	Funding scheme developed (service)	Aquaculture fishermen who access funding (%)	▪ Aquaculture fishermen in coastal areas also often have obstacles to the sustainability of their businesses, especially small-scale fishermen with small ponds, in the event of disruption by disaster or climate change; ▪ Provision of funding for aquaculture fishermen in coastal areas can make it easier for them to obtain capital for the sustainability of the culture business; ▪ The existence of insurance can also provide guarantees for fishermen to receive capital; ▪ The contribution of the action group to provide innovative mechanisms to increase resilience capacity in coastal areas is calculated from the percentage of fishermen who have access to finance, so they can continue to produce.
Increased access to aquaculture insurance financing	Fishermen who insured (person)		
Strengthening fishermen group cooperative institutions in handling the impacts of climate change in coastal areas	Fishermen cooperatives that have access to funding (people)		

Photo by Eberhard Grossgasteiger on Pexels

Methodology for **Water Sector**

Climate change has the potential to cause drought and a sharp decrease in water availability, which could affect the economic activities of communities where water is one of the main sources of life. In the RPJMN 2020-2024, the Water Sector is targeted to contribute to reducing total economic loss by 0.214% of GDP. This target is planned to be achieved from the development activities of water catchment and storage, conservation of upstream watershed areas and others that can increase the discharge of water resources. Reduction of economic loss from climate change impacts from the Water Sector Climate Resilience Main Action Activities are described in the following chart and table:

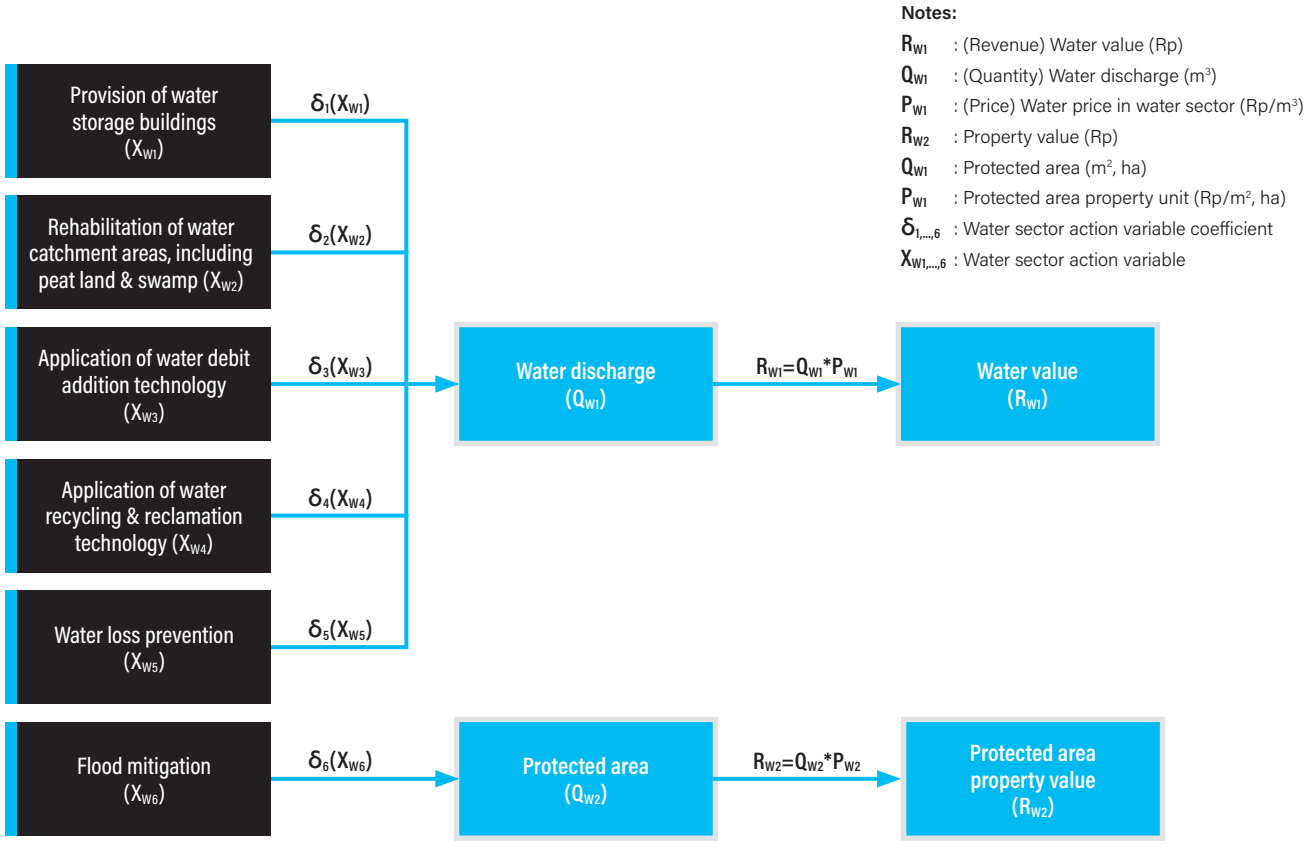


Figure 9. Flow of Achievement for Reducing Economic Loss from Action on Climate Resilience in the Water Sector

Details of the Methodology for Calculating Outcomes of Main Activities in the Water Sector

Table 7. Details of the Methodology for Calculating Outcomes of Main Activities in the Water Sector

Main Activities

Actions	Output Indicators	Data Requirement	Calculation Concept
Provision of water storage buildings			
Dam construction	Dam (unit)	**Primary Data:** Water discharge (m^3/second) **Secondary Data:** ▪ Volume of dam, reservoir, rainwater retaining well and water tank (m^3) ▪ Lake and reservoir discharge (m^3/second) ▪ Water price (Rp/water discharge)	I. Water storage structures can increase the volume and discharge of rainwater and runoff that can be collected, thereby increasing the availability of water to meet agricultural, household and industrial needs; II. The reduction in economic loss is obtained from the water discharge that can be generated by the water storage building, shown in the following calculation flow: Construction of water storage structures → Additional water discharge is available (m^3/second) → The disadvantages of reduced water availability are avoided (Rp/water discharge)
Water reservoir construction	Water reservoir (unit)		
Construction and adaptation of rainwater storage media for drought resistance	Rainwater storage wells (unit)		
Construction of water tanks of reservoirs in coastal areas and islands that are affected by the scarcity of fresh water due to drought and sea water intrusion	Intake building, filter tub, reservoir (unit)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Rehabilitation of water catchment areas, including peat land and swamp			
Protection and rehabilitation of wetland ecosystem (e.g. planting and construction of canal block)	Rehabilitated wetland ecosystem (ha)	**Primary Data:** Water discharge (m^3/second) **Secondary Data:** ▪ The area planted (ha) ▪ The coefficient of increasing water discharge from vegetation (m^3/second) of the catchment area (ha) ▪ Water price (Rp/water discharge)	I. Vegetable surface can absorb and store rainwater, and can increase the discharge of water bodies; II. Through planting in catchment areas, more rainwater can be absorbed and stored to maintain water availability; III. Water content on peatland and swamp can be maintained by planting swamp and peat plants as well as construction of canal blocking (preventing water loss); IV. The reduction in economic loss is obtained from the water discharge generated by vegetated areas and the water potential of peatland and swamp, as shown in the following calculation flow: Adding the vegetated areas (forest, peat and swamp) - (ha) → The potential for additional water discharge is available (m^3/second) → The disadvantages of reduced water availability are avoided (Rp/water discharge)
Vegetative land and forest rehabilitation	Forest and land rehabilitated (ha)		
Provision of quality and productive forest vegetation seeds	Provision of seeds (unit)		
Application of water debit addition technology			
Application of weather modification technology[4] (to prevent drought as well as in filling water bodies, such as lake and dam)	Technology application (number or location of application)	**Primary Data:** Water discharge (m^3/second) **Secondary Data:** ▪ Weather modification coverage (ha) or additional discharge of water bodies (m^3/second) ▪ Water injection capacity (m^3/unit) ▪ Coefficient of addition of water infiltration discharge (m^3/second of the infiltration area -ha) ▪ Water price (Rp/water discharge)	I. Anticipation of drought and a decrease in water availability can be done through increasing water discharge by making weather modifications, water injection, and building water absorption in built up areas which simultaneously prevent excess runoff; II. In addition, for land or areas threatened by drought, weather modification technology can also be used to fill water bodies such as lake and dam; III. The reduction in economic loss is obtained from the additional water discharge generated, as indicated by the following calculation flow: Application of debit addition technology (area) → The potential for additional water discharge is available (m^3/second) → The disadvatages of reduced water availability are avoided (Rp/water discharge)
Application of water injection technology from flood inundation	Utilization of water injection (unit)		
Construction of infiltration wells and water absorbing asphalt (pore block) to overcome excess rainwater runoff to prevent drought	Water absorption area (ha)		

[4] The application of weather modification technology that is beneficial in increasing water discharge in order to maintain water availability, as well as drought prevention

Actions	Output Indicators	Data Requirement	Calculation Concept
Application of water recycling and reclamation technology			
Application of Sea Water Reverse Osmosis (SWRO) in the archipelago	Provided SWRO (unit)	**Primary Data:** Water discharge (m^3/second) **Secondary Data:** ▪ SWRO capacity and discharge to provide clean water (m^3/second) ▪ Capacity and discharge of waste recycling to provide clean water (m^3/second) ▪ Water price (Rp/water discharge)	I. One of the adaptation efforts to maintain water availability on the demand aspect is through water recycling and transformation from seawater to clean water, especially in coastal areas and islands with limited fresh water bodies and groundwater replenishment; II. The reduction in economic loss comes from the water discharge that can be generated by seawater treatment and recycling waste into clean water, as shown by the following calculation flow: Water recycling capacity (m^3/second) → Additional water discharge is available (m^3/second) → The disadvantages of reduced water availability are avoided (Rp/water discharge) The application of water recycling and reclamation technology is also an effort to improve water efficiency.
Application of waste recycling technology (water recycle) into clean water	Waste recycling technology (unit)		
Water loss prevention			
Construction, maintenance and repair of pipelines	Distribution pipe network (unit)	**Primary Data:** Water discharge (m^3/second) **Secondary Data:** ▪ Transmission pipe size and discharge (diameter, m^3/second) ▪ Transmission pipeline discharge that applies leak detection technology (m^3/second) ▪ Sensor sensitivity ▪ Open drains evaporation coefficient (m^3/second) ▪ Pipe leak coefficient (potential discharge from a leaky pipe - m^3/second) ▪ Water price (Rp/water discharge)	I. One of the efforts to reduce water availability and drought in the demand aspect is to prevent water loss, so that water utilization can be maximized, through transmission pipelines (by reducing evaporation and channeling of water to areas farthest from water bodies) and transmission pipeline leak detection technology; II. The reduction in economic loss is obtained from the water discharge which has been prevented from loss by evaporation and leakage, as indicated in the following calculation flow: Network repair and application of pipeline leak detection technology → The potential for prevented leakage of pipe leakage (m^3/second) → The disadvantages of reduced water availability are avoided (Rp/water discharge)
Application of water pipe leak detection technology	Pipe leak detector (unit)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Flood mitigation			
Development and infrastructure of water resources for flood disaster	Flood control – floodgates or canal blocking (unit)	**Primary Data:** Protected area (ha) **Secondary Data:** ▪ Controllable runoff discharge through floodgates and canal blocking (m^3/second) ▪ Drainage capacity and discharge (m^3/second) ▪ Increasing capacity of holding and discharge water bodies (m^3/second) ▪ Coefficient of area covered by river banks (ha) ▪ Coefficient of area covered by drainage and dredged water bodies (ha) ▪ Property value in the area (Rp/ha)	I. One way of dealing with floods is through the application of infrastructure and technology that can protect the area and the economic activities of the people in it; II. Economic loss due to flooding come from the value of the area or property damaged or lost by runoff (destructive force of water), such as due to inundation and flooding in coastal areas; III. Though infrastructure and technology that can protect the area from destructive power of water, a reduction in economic loss from the value of the area that can be saved will be obtained; as indicated by the following calculation flow: Construction of protective structures and runoff channels → Protecting the area from flooding and the destrcutive force of water (ha) → The value of the settlement that is protected from flooding (Rp/ha)
Development of drainage that is adaptive to climate change (considering increased rainfall/ inundation point)	Drainage (unit and length)		
Construction of river bank protection (made of concrete or vegetation)	The length of cliff and river cover (m)		
Dredging reservoirs, lakes, rivers and waterways	Increased capacity or water bodies (m^3)		

Table 8. Details of the Methodology for Supporting Activities in the Water Sector

Supporting Activities

Actions	Output Indicators	Data Requirement	Calculation Concept
Development of innovation and watershed protection technologies			
Development and application of information technology-based watershed ecosystem and damage detectors	Developed information system (unit)	The result of watershed management technology development (unit)	▪ There are numbers of watershed in the islands of Indonesia, some of which are interconnected, but have different characteristics (width and depth or river flow, flow type, etc.): ▪ Reliable data and information related to watershed condition can be the basis for the need of protection to watershed (maintaining flow rates); thus, they are still able to meet community needs; ▪ Technology that can detect changes in watershed flow is also needed to anticipate the threats of decreasing water availability; hence, prevention efforts can be formulated; ▪ In this case technological innovation in the field of water resources can increase the capacity of regional resilience to climate change in the water sector; as measured by the number of innovations and technologies produced that are accurate and applicable.
Development and application of Online Monitoring Technology for detection of river water level, groundwater level, and environmental damage/pollution	Developed information system (unit)		
Development of monitoring the vulnerability of water supply systems and network to the impacts of climate change in real time	Developed information system (unit)		
Development of technology that reduces silting of river, reservoir, dam and other water reservoirs	Constructed technology (unit)		
Development of Eco hydraulic technology on river	Constructed technology (unit)		
Dissemination of vulnerability information system for raw water supply ecosystem and water supply network	Developed information system (unit)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Capacity building for government regarding water resource			
Capacity building for central and local government on climate resilience in the water sector	Government officials who attend training (person)	Government employees related to the water sector who consider climate resilience in activities in their institutions (%)	▪ The government plays an important role in formulating water resource management policies and regulation, also in providing supporting facilities and infrastructure, as well as outreach and mentorship to business actors and community; ▪ Government that understands the effects of climate change on drought and reduced water availability can integrate climate resilience efforts into its programs and activities; thus, the level of water availability can be maintained and the impacts of drought can be avoided; ▪ Increasing climate resilience of the action group is measured based on the percentage level of government employees of institution that consider climate resilience in their institutional work plan.
Conducting technical guidance on water resources infrastructure standard that is adaptive to climate change	Civil servant of Public Work Office in the District/ City who attended (person)		
Training for operation and maintenance officers of dam, reservoir, and other water storage structures	Officers who attended (person)		
Community capacity building related to water resource			
Household mentorship for conservation and efficient use and management of water	Numbers of household (household)	Communities who apply the effectiveness and efficiency of the use of water resources (%)	▪ Communities play an important role in protecting water resources by participating in the conservation of water catchment areas, maintaining water storage and infiltration, and using water more effectively; ▪ Increased public understanding and provision of special skills to increase water discharge can support the resilience of water resources, especially against the impacts of climate change; ▪ The contribution of this action group to increase climate resilience in the water sector is measured by the percentage level of people who understand and apply the effectiveness and efficiency of the use of water resources.
Socialization of utilization of water treatment technology based on desalination of seawater and recycled water	Numbers of person who attend the socialization (person)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Strengthening regulations on water resource			
Preparation of policy on special space restriction for groundwater protected areas	The number of regulations prepared (unit of regulation)	Water resources management regulations and guidelines that consider aspects of climate resilience (unit)	▪ The availability of technical rules and provision in the framework of water resource management facilitates the development of watershed areas and water utilization activities that take into account the sustainability of water resource availability; ▪ These efforts are able to support protecting water resources, so that they are resistant to the threats of disasters and climate change, especially those related to the potential for drought and decreased water availability; ▪ The contribution of strengthening water resources regulations in increasing climate resilience is measured by the number of regulations and guidelines for water resource management that consider aspects of climate change, and are implemented.
Preparation of Norm, Standard, Procedure, Criteria (NSPC) Development of a master plan for drinking water supply system	The number of regulations prepared (unit of regulation)		
Preparation of Norm, Standard, Procedure, Criteria (NSPC) Development in the field of water resource	The number of regulations prepared (unit of regulation)		
Regional spatial plan assessment (Regency/City spatial plan, Regency/City detailed spatial plan)	Regency/City spatial plan and detailed spatial plan assessed (unit)		
Development of Payments for Ecosystem services	The number of regulations prepared (unit of regulation)		

Photo courtesy of LCDI Secretariat

Methodology for **Agriculture Sector**

The main challenge faced by the Agricultural Sector due to climate change is the availability of water from agricultural land and a decrease in the production of plant biomass. In the RPJMN 2020-2024, this sector is targeted to have a contribution in reducing total economic loss by 0.214% of GDP. This target is planned to be achieved from activities to increase agricultural productivities; protection against flood, drought, and pest attacks and other plant pests; increasing understanding of farmers; and agricultural management. The calculation concept and data required for the calculation of economic loss in main activities are described as follow:

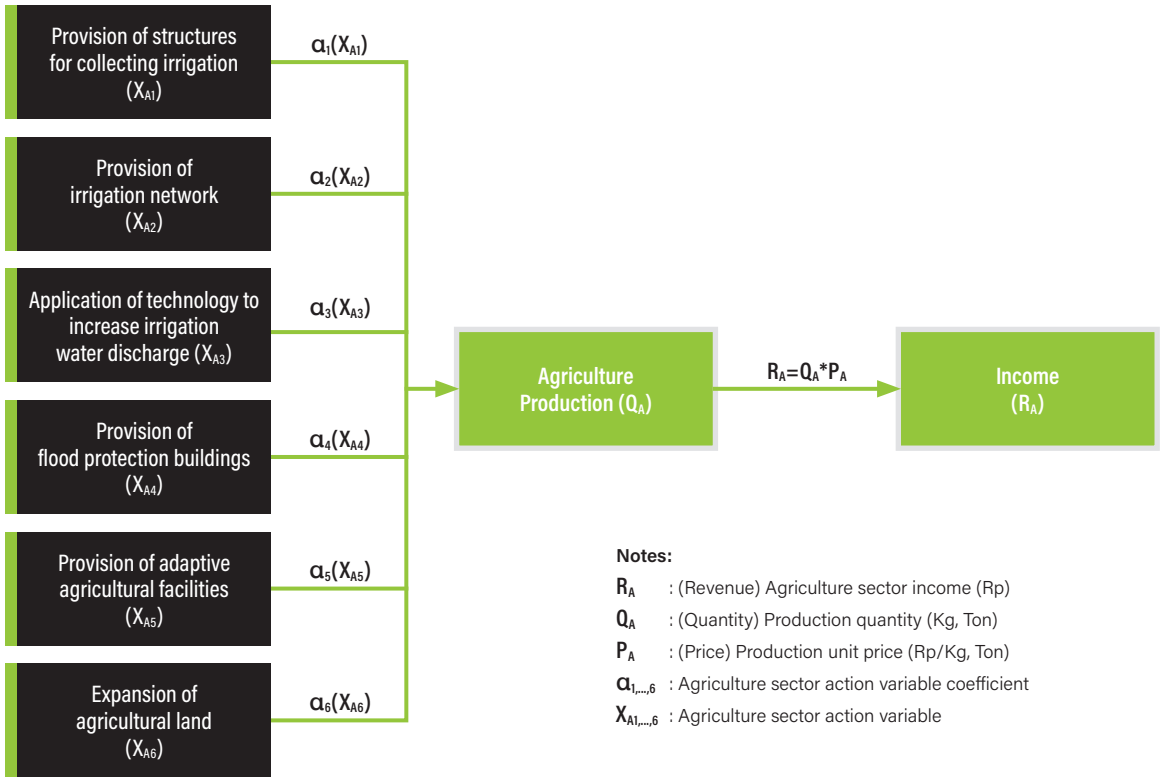


Figure 10. The Flow of Achievement for Reducing Economic Loss from Climate Resilience Action in Agricultural Sector

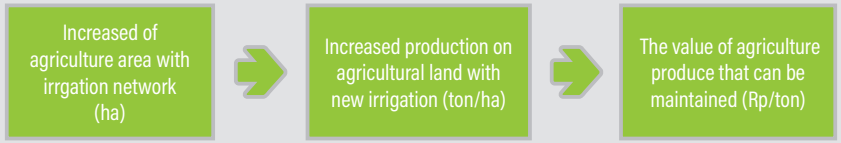
Details of the Methodology for Calculating Achievement of Main Activities in the Agricultural Sector

Table 9. Details of the Methodology for Calculating Achievement of Main Activities in the Agricultural Sector

Main Activities

Actions	Output Indicators	Data Requirement	Calculation Concept
Provision of structures for collecting irrigation water			
Construction of the dam, reservoir, and detention-retention pond for agricultural irrigation	Dam, reservoir and detention-retention pond (volume - m^3; discharge - m^3/second)	**Primary Data:** Irrigation discharge (m^3) **Secondary Data:** ▪ Plant water coefficient (m^3/ton) ▪ Agriculture land productivity (ton/ha) ▪ Price of rice (Rp/kg)	I. Dam, reservoirs, and detention-retention ponds can provide water for irrigation, which is measured as the volume or irrigation water; II. The use of this water to irrigate agricultural land can be measured by its contribution to the formation of plant biomass using the plant water coefficient, resulting in tons value of rice production; III. The reduction in economic loss is obtained from the conversion of the amount of additional irrigation water that can be provided into potential for additional rice production (tons), as shown in the following calculation flow: Increased of irrigation water discharge (m^3/second) → Increased production using irrigation water (ton/m^3) → Maintained agricultural production value (Rp/ton) The availability of water storage structures, that can provide water for irrigation, will affect the production value of agricultural commodities and have an impact on the amount of revenue or income earned by the farming communities.
Rainwater harvesting through small integrated reservoirs around agricultural land for irrigation	Integrated small reservoirs (volume m^3; debit - m^3/second)		
Rehabilitation of dam/reservoir, and other water storage structures for irrigation	Rehabilitated dam/reservoir, and other water reservoirs (volume - m^3; discharge - m^3/second)		

<table>
<tr><th>Actions</th><th>Output Indicators</th><th>Data Requirement</th><th>Calculation Concept</th></tr>
<tr><td colspan="4">Provision of irrigation network</td></tr>
<tr><td>Development of tertiary irrigation network in agricultural land</td><td>Tertiary irrigation network - the number of networks (unit) or the length of network (m)</td><td rowspan="3">Primary Data:
Irrigated area (ha)

Secondary Data:
▪ Irrigation flow coefficient (unit/ha) or by direct observation in the field
▪ Agriculture land productivity (ton/ha)
▪ Price of Rice (Rp/kg)</td><td rowspan="3">I. Irrigation networks are used to distribute water evenly throughout agricultural lands: the use or tertiary irrigation networks can reach small areas of land, meanwhile the use of irrigation water can be more effective through the use of irrigation pipes, drip irrigation and sprinklers;
II. The reduction in economic loss is obtained from the area of agricultural land that can be flowed by the irrigation networks; thus, it can carry out the production process, as shown in the following calculation flow:
 
Provision of irrigation networks that distribute water evenly to all agricultural lands will affect the production value of agricultural commodities produced and have an impact on the amount of revenue or income that the farming communities receive.</td></tr>
<tr><td>New construction and modification of irrigation system into piping irrigation and sprinklers</td><td>Irrigation piping, drip irrigation, and sprinklers – number of networks (unit)</td></tr>
<tr><td>Irrigation network rehabilitation and maintenance</td><td>Rehabilitated and maintained irrigation network – numbers of networks/ length (m)</td></tr>
<tr><td colspan="4">Application of technology to increase irrigation water discharge</td></tr>
<tr><td>Application of weather modification technology to prevent flooding and drought on agricultural lands</td><td>Weather modification technology applied (application)</td><td>Primary Data:
Luasan area dihujani (ha)

Secondary Data:
▪ Agricultural and productivity (ton/ha)
▪ Price of rice (Rp/kg)</td><td>I. The use of weather modification technology can produce rainfall in the agricultural areas that prone to drought and water shortage; through increasing the water content in the soil, the area is prevented from drought, and plants can produce optimally;
II. The reduction in economic loss is obtained from the area of agricultural land that receives artificial rain, as shown in the following calculation flow:
 
*Previously made predictions of rain during the growing season, in areas that are predicted to be dry when weather modification was carried out.</td></tr>
</table>

Actions	Output Indicators	Data Requirement	Calculation Concept
Provision of flood protection buildings			
Restoration and construction of polder in paddy field	Paddy field polder (m)	**Primary Data:** Protected agricultural land (ha) **Secondary Data:** ▪ Coefficient of area protected by river embankment (ha/m) or through direct observation in the field ▪ Agricultural and productivity (ton/ha) ▪ Price of rice (Rp/kg)	I. Apart from drought, agricultural land also has the potential to fail crops and experience a decline in production due to flooding; II. Construction of rice field polder and river embankments can protect agricultural land from inundation from rainwater runoff and river overflows; III. The reduction in economic loss is obtained from the area of agricultural land protected by polder and embankments; therefore, the production (tons) can be saved. It is shown in the following calculation flow: Construction of rice field polder and river embankments → Protected agriculture land by polder and embankments (ha) → Agriculture production potential to be refrained from flood (ton/ha) → Value of agriculture produce that can be maintained (Rp/ton)
Construction of river embankments around agricultural land to prevent flood overflow	River embankment (m)		
Provision of adaptive agricultural facilities			
Provision of superior plant seeds with high productivity and resistant to climate and pest stress	Disseminated superior plant seeds (unit)	**Primary Data:** Intervention area (ha) **Secondary Data:** ▪ Land productivity (ton/ha) ▪ Potential for increased productivity from seedlings (ton/ha) ▪ Potential increasing productivity from organic fertilizer (ton/ha) ▪ Potential increasing productivity from tools and machinery (ton/ha) ▪ Price of rice (Rp/kg)	I. Increasing production through agricultural intensification includes the use of superior seeds with high productivity and climate stress resistance, organic fertilizer that increase production, pest control and plant pest organism to avoid crop failure, and the use of agricultural tools and machines that streamline the production process (speed of land processing, planting and harvesting) II. The reduction in economic loss was obtained from the increase production area of agricultural land, as shown in the following calculation flow: Provision of facilities to increasing agricultural productivity (ha) → Increased agriculture production (ton/ha) → Maintained value of agriculture production (Rp/ton)
Provision of organic fertilizer	Distributed organic fertilizer (unit)		
Provision of pest and pest control	Distributed pest control (unit)		
Provision of modern agricultural equipment and machines that streamline the production process (e.g. moisture and nutrient content sensors for automated watering and fertilization, multi-function tractors)	Distributed agriculture tools and machinery (unit)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Expansion of agricultural land			
Creating new rice fields on unproductive land	New agriculture land (ha)	**Primary Data:** New rice fields (ha) **Secondary Data:** ▪ Agriculture land productivity (ton/ha) ▪ Price of rice (Rp/kg)	I. Besides agricultural intensification, climate resilience efforts in the agricultural sector to maintain food availability can be done through agricultural extension, such as the provision of new agricultural land; II. The reduction in economic loss is obtained from the production as the result of the new agricultural land is shown in the following calculation flow: An increasing number of new agricultural land (ha) → Potential production (ton/ha) → The added value of agricultural production that is maintained (Rp/ton)

Table 10. Details of the Methodology for Supporting Activities in the Agricultural Sector

Supporting Activities

Action	Output Indicators	Data Requirement	Analysis Concept
Research and development of agricultural technology			
Development of superior plant varieties that are resistant to climate stress and plant pest	Numbers of superior seeds produced (varieties)	Research and the result of the development of agricultural technology (unit)	▪ Research and development of agricultural technology produce agricultural facilities that can be used to increase crop yields and streamline to the production process; thus, these facilities able to maintain food availability even though affected by climate change; ▪ Through research and development of agricultural technology, the government and other stakeholders who focus on agricultural activities, including farmers and other actors in agriculture industry, have assurance of reliable technology for production; ▪ These efforts can increase the capacity of climate resilience in the agricultural sector (proportion of sectoral vulnerability); ▪ The amount of research and technology development produced contributes to increasing the capacity for climate resilience.
Development of planting calendar adjustment system that takes climate change into account	Numbers of cropping calendar created (unit)		
Water balance modeling and plant nutrition on agricultural land and development of geographic information system for distribution points of nutrients and water	Numbers of research done (unit)		
Development of efficient agricultural equipment and machinery for agricultural production processes	Agricultural tools and machinery made (unit)		
Agricultural information system development			
Development of an integrated agricultural information system application	System created (unit)	Database and agricultural information system created (unit)	▪ Data and information are the most basic things to consider in decision making, including the utilization in research and development (observation for validation and evaluation of result), data on the result of activity implementation can be considered for planning further activities and so on;

Action	Output Indicators	Data Requirement	Analysis Concept
Mapping data and information sources to support the development of agricultural information system	Database created (unit)		▪ Complete and accurate agricultural data and information that can be relied upon in finding the right solution to the problem, and search for data records can be done in an efficient manner through system development; ▪ The availability of an agricultural information system can increase the capacity of the communities, government and other stakeholders to increase resilience to the impacts of climate change; ▪ The required data and information related to climate resilience in the agricultural sector, including the location of agricultural land with attributes attached to it, such as climate condition, irrigation network, soil fertility, land owner, planting plan, and others. ▪ The number and types of information system, as well as the database produced, contribute to increasing the capacity for climate resilience.
Conducting an audit of party fields and irrigation network performance in the framework of land use evaluation and inventory	Database created (unit)		
Building government capacity on agriculture			
Building the capacity of central and local government that are directly involved in agricultural management	Number of government officials who attend the training (person)	Government employees related to the agricultural sector who consider climate resilience in activities at their institutions (%)	▪ The government plays a role in drafting legislation the provision of public goods and services, social security, management of national income, economic stability, and other, especially in the agricultural sector; ▪ By increasing government understanding and capacity related to climate resilience on agriculture, government awareness and commitment can be increased; thus, they support climate resilience policies and implement them in their respective areas of work; ▪ Capacity building for the government has a significant contribution (twice as high as farmer capacity building activities), because it can carry out programs that increase production, provide agricultural facilities and infrastructure, as well as working directly with local government and providing mentorship to farmers; ▪ The contribution of action to increasing climate resilience capacity is obtained from the percentage of government employees who have realized the importance of increasing climate resilience and have the ability to implement climate resilience action in their institutional duties and functions;
Training for officers, agriculture outreach officers, and agricultural institution on adaptation to the agricultural sector	Number of agriculture officers who attend the training (person)		

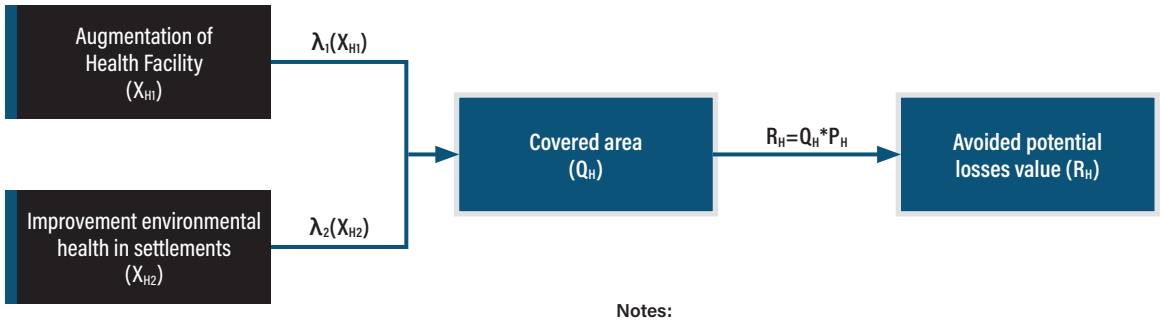
Action	Output Indicators	Data Requirement	Analysis Concept
Building community capacity on climate smart agriculture			
Mentoring and facilitation of farmers related to climate resilience sustainable agricultural production (e.g. climate field school)	Farmers who receive mentorship (person)	Farmers who apply precision and sustainable agriculture (%)	▪ An increase of community capacity is important in increasing the understanding and skills of the communities, especially farmers, in implementing sustainable and climate resilience agriculture as a solution to the climate change impacts; ▪ Through capacity building programs, communities especially farmers are given the opportunity to practice managing their physical, social, economic, cultural and environmental resources to increase agricultural production; ▪ By having the ability to read climate data and information related to agriculture and the use of precision agricultural tools, the production process can be improved; ▪ In line with the government capacity building program, communities and farmers who increase their capacity on agricultural production and implement them can contribute to reducing the level of vulnerability, such as through increasing the capacity for climate resilience (the percentage of communities and farmers who understand the importance of climate resilience)
Village community mentorship regarding agricultural and food production for food security (e.g. Climate Village Program, Disaster Resilience Village)	Mentored farming communities (person)		
Training for farmers on the use of agricultural production application, tools, and machineries that support precision farming and smart farming	Farmers who attended training (person)		
Building access to agricultural finance			
Building access to agricultural business credit for poor farmers	Farmers who receive business credit assistance (person)	Farmers accessing agricultural finance (%)	▪ Decreased production, mainly due to the lack of capital that make farmers unable to cultivate, plant, fertilize, protect from pest and harvest; ▪ One of the efforts is provision of government facilities and infrastructure aids, as well as an increased access to agricultural finance, so farmers can have capital loan to carry out the production process; ▪ Agricultural insurance is also one of the guarantees to get the capital back to continue to the next production, because by having insurance, the cost incurred can be replaced should there be crop failure caused by climate; ▪ The ability of this effort to increase farmer's climate resilience capacity is calculated from the percentage of farmers, in affected locations, who can access capital aids or receive agricultural insurance subsidies.
Strengthening Village Owned Enterprise, and Small and Medium Enterprise for agricultural sector	Agricultural business group who receive funds (person)		
Farm protection through agricultural insurance based on weather index insurance	Farmers who receive insurance premium assistance (person)		

Action	Output Indicators	Data Requirement	Analysis Concept
Providing alternative income for farmers			
Training and introduction to income diversification for farming families	Farmers/farming families who attended training (person)	Farmers who have alternative income (%)	▪ One indicator of vulnerability is community welfare; farmers who depend their livelihood only on agricultural production are vulnerable to becoming poor when crop failures occur or productions decline due to climate change; ▪ Farmers' welfare can be maintained or improved through alternative income sources or other business development for farmers and families; ▪ Income from alternative livelihood can be used to finance agricultural production process or to fulfill farmers' daily needs; ▪ These efforts are able to reduce the sensitivity level of farmers, and increase their resilience capacity to climate hazards, although they are not directly related to the production in the agricultural sector. ▪ Contribution of action to build the climate resilience capacity is calculated from the percentage of farmers who attend skill training and have alternative income sources.
Increase farmer involvement in development/ maintenance/ rehabilitation of agricultural infrastructure through labor intensive schemes	Farmers who participate in labor intensive activities (person)		

Photo by jcomp - www.freepik.com

Methodology for **Health Sector**

Besides having an impact on the environment, climate change also has a direct impact on the mutation of bacteria and disease vectors which leads to an increase in the incident rate of dengue, malaria and pneumonia. Late detection might accelerate the spread of the disease, which will have impacts on communities and even national economic activities. In the RPJMN 2020-2024, the Health Sector is targeted to contribute to reducing total economic loss by 0.302% of GDP. This target is planned to be achieved from activities to improve health facilities services and improve public health, as well as the environment. The reduction of economic loss from climate change impacts from the health sector's main climate resilience action is described in the following chart and table:



Notes:

R_H : Avoided potential losses value in health sector
Q_H : (Quantity) Covered area
P_H : (Price) Economic losses of area
$\lambda_{1,2}$: Health sector action variable coefficient
$X_{H1,2}$: Health sector action variable

Figure 11. Flow of Achievement for Reducing Economic Loss from the Health Sector Climate Resilience Action

Details of Methodology for Calculating Outcomes of Main Activities in the Health Sector

Table 11. Details of Methodology for Calculating Outcomes of Main Activities in the Health Sector

Main Activities

Actions	Output Indicators	Data Requirement	Calculation Concept
Augmentation of Health Facility			
Improving the capacity of health facilities (hospital, health center, public clinic, etc.)	Improved capacity of health facilities (lives)	**Primary Data:** People who can access health service pre-outbreak, and get treatments if an outbreak occurs (lives) **Secondary Data:** ▪ Prediction of disease case or the incidence rate of outbreak (incidence rate) ▪ Estimated case (lives) ▪ Health cost (Rp/lives) ▪ Disease treatment cost (Rp/lives)	Through fulfillment of adequate numbers of health services, the communities have higher opportunity to access health services; hence, there is an increase at the level of public health and protection from disease outbreak. I. Health facilities and micro health services can provide health improvement services for communities in their area so people can be prevented from having the disease; II. Health services can also inform early detection of an outbreak for prevention. III. In addition, health facilities can provide treatments when an outbreak occurs to minimize the consequences; IV. The reduction in economic loss is obtained from the number of communities that can be served, as shown in the following calculation flow: Improving capacity and health service (unit) → Decrease in indicative rate of disease outbreak (case) → Cost of increase in disease outbreak avoided (Rp/case)
Development of micro scale health service centers in the residential areas (Integrated Health Service Center, Integrated Foster Center, and others)	Micro health service capacity (lives)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Improvement of environmental health in settlements			
Development of integrated residential areas that in harmony with nature and consider the aspects of climate change	Integrated residential areas (area)	**Primary Data:** People who are healthy and have strong immunity (lives) **Secondary Data:** ▪ Settlement area (ha) ▪ Average population in the residential areas (lives) ▪ Support capacity of sanitation facilities and infrastructure (lives) ▪ Support capacity of clean water facilities and infrastructure (lives) ▪ Support capacity of simple technology to prevent the development of mosquito larvae (lives) ▪ Immunity level of the communities ▪ Prediction of disease case of outbreak indication rate (incidence rate) ▪ Estimated case (lives) ▪ Health cost (Rp/live) ▪ Disease treatment cost (Rp/live)	By creating healthy settlements, public health can be improved, disease outbreaks can be avoided, and health and disease treatment cost that need to be incurred can be reduced. I. By striving for a healthy residential area, public health can be improved, so that the potential for disease outbreak can be prevented (it is assumed that there will be no outbreak and the incidence rate in healthy areas will reduce); II. The health of residential areas can be achieved through spatial planning that aligns with nature, and is equipped with adequate and standard sanitation and clean water; III. In addition, disease outbreaks can also be prevented through the use of technology to suppress the development of germ; IV. The reduction in economic loss is obtained from the number of healthy people living in healthy residential areas, as shown in the following calculation flow: Increased capacity of healthy residential (area) → Decreased of disease outbreak incident rate (case) → Cost of increase in disease outbreak avoided (Rp/case)
Construction of sanitation facilities and infrastructure in settlements	Sanitation facilities and infrastructure (unit)		
Construction of clean water facilities and infrastructure	Clean water facilities and infrastructure (unit)		
Utilization of simple technology to prevent the development of mosquito larvae	Simple technology utilized (unit)		

Table 12. Details of the Methodology for Supporting Activities in the Health Sector

Supporting Activities

Actions	Output Indicators	Data Requirement	Calculation Concept
Improvement in early detection of disease and outbreak			
Development of health biomonitoring tool for disease caused by climate change	Numbers of tool (unit)	The result of research and technology development (unit)	▪ Early detection of disease is necessary to prevent a wider and more massive spread of disease, so disease outbreaks can be prevented; ▪ Research and development of technology that produce early detection tools for disease play an important role in reducing vulnerability and increasing resilience to the impacts of climate change in the health sector; ▪ The contribution of this action group to the level of vulnerability and resilience of this particular sector is calculated from the number of research and development of technology that produce appropriate and accurate innovation for early detection of dengue, malaria, and pneumonia.
Development of disease susceptibility models	Number of assessment (unit)		
Quality improvement of laboratory examination equipment, especially for dengue fever, malaria, and pneumonia	Number of assessment (unit)		
Health information system development			
Development of climate-based disease early warning and information system	Information system generated (unit)	Developed information system (unit)	▪ The availability of complete and accurate data and information related to health condition and disease is required to plan efforts in dealing with disease outbreaks caused by climate and to improve public health, so the communities are more resilient to threats.; ▪ Data and information are the main priorities which are then used to conduct other activities; ▪ The utilization of information system, that integrate health data and information, facilitate the process of storing and retrieving required data; easier distribution and wider reach of data and information, for example by connecting the information system to communication device owned by the people; ▪ The increase in climate resilience pursued by this action group is measured by the existence of an information system that contains accurate data and information on disease outbreak prevention that can be utilized by policy makers and the public.
Mapping of data and information needed for the development of an integrated health system	Map of the distribution of data and information generated (unit)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Improvement of government capacity related to health			
Mentorship to central and local government (National, Provincial, District/City) for the preparation of response maps for climate related disease outbreaks and their actions	Government officials who attended (person)	Government employees related to the health sector who consider climate resilience in activities in their institutions (%)	▪ Governments that understand the effects of climate change to health can integrate climate resilience efforts into policies formulated in their institutions. ▪ The government needs to organize programs and activities aimed at improving public health and the environment; thus the government is resilient to the threats of disasters and climate change; ▪ The government also plays a role in the provision of supporting facilities and infrastructure, as well as community mentorship and outreach to encourage the communities to always implement a healthy lifestyle and environment; ▪ The increase in climate resilience in the health sector from the government capacity building action group is measured by the percentage level of government employees who have an understanding of and consider climate resilience in the programs and activities that are carried out.
Training for health educators on climate risks in health sector	Health educators who attended (person)		
Increasing the community capacity regarding the prevention of disease outbreak			
Socialization of prevention and control of vector disease prevention and control of vector disease in area with potential endemic (e.g. climate healthy village program)	Socialized household (household)	Communities that implement health improvement and anticipate disease outbreaks (%)	▪ Communities are the one most affected by the effects of climate change in the health sector; an increase in the incidence of disease that has the potential to spread to all levels of society especially those with low level of immunity and living in unhealthy settlements; ▪ Public awareness needs to be improved to pay more attention to the health of themselves and their environment; thus, supporting the prevention of disease outbreak; ▪ Health and disease prevention socialization need to be given thoroughly, starting from children to senior citizen, from the smallest to the masses of society, in order to strengthen the network of public understanding; ▪ The more people understand the impacts of climate change on health, and adopt a healthy lifestyle, the higher the resilience to climate change in the region; ▪ Simulations are required to determine the anticipation needed to reduce the disease case number when disease outbreaks occur.
Early education on the impacts of climate change on health and the environment	The number of student age population who received early education (person)		
Implementation of health crisis simulation	Conducted simulation (unit)		
Implementation of community-based disease prevention and control by utilizing natural resources and local wisdoms	Household (household)		

Actions	Output Indicators	Data Requirement	Calculation Concept
Strengthening health regulation			
Supervision to the implementation of building and building health standard	Reports (document unit)	Environmental and community health regulations and guidelines that consider aspects of climate resilience (unit)	▪ Regulations for the provision of healthy building and settlements are needed to ensure building and settlement built meet the building and environmental health standard, thus supporting the prevention of disease outbreak; ▪ Minimum service standard is also needed in order to meet minimum requirement to achieve public and environmental health; ▪ The regulation and supervision on realization of minimum service standard for a healthy environment contributes to a reduction in the level of vulnerability of the health sector.
Supervision to minimum service standard of health services	Reports (document unit)		
Health financing			
Providing aid to finance health services	Residents who receive aid (person)	People who access health financial aid (%)	▪ Health financing, among others, to access health services, such as the cost of health check and disease treatments; the greater the percentage of people who receive it, the higher the level of climate resilience capacity; ▪ The less well-off communities, most of whom do not have allocation fund for health, have high vulnerability and risks to the threats of disease outbreaks; ▪ Health financing aid provides people with relief, guarantees and access to health service facilities, so they can reduce the incidence rate of disease; ▪ Contribution of financing to increase community resilience from the proportion of people who receive financial aid.

Photo courtesy of GCA Secretariat

Closing

The process of monitoring, evaluation and reporting on climate resilience action in the Development Planning Framework written in this book is a process of building mechanisms that aims to monitor and evaluate the achievements of Climate Resilience Development in the RPJMN 2020-2024 (PN 6.2.2) accurately, transparently, and on time. These efforts follow the integration of Climate Resilience Actions in Development Planning, Budgeting, Monitoring, Evaluation, and Reporting System, both at the national and regional levels.

The list of action groups and the concept of measuring action outcomes compiled in this book make a living document that will continue to develop along with the development of research including research carried out by relevant institutions in each sector. Further detailed descriptions of the calculation formulas, constants, and conversion factors of each action group, as well as instructions for using the MER system, are compiled in the form of guidance documents and technical instructions for measuring the achievements of climate resilience activity.

A structured MER mechanism which involves all related parties will facilitate and increase the accuracy of measuring the achievement of climate resilience actions in reducing economic loss from the impacts of climate change. Indonesia's climate resilience targets that have been set in the 2020-2024 National Medium-Term Development Plan can be achieved through a strong commitment between related institutions to synergize.

Photo courtesy of LCDI Secretariat

Photo courtesy of LCDI Secretariat

BOOK 5

MONITORING, EVALUATION, & REPORTING OF CLIMATE RESILIENCE ACTIONS IN THE FRAMEWORK OF NATIONAL DEVELOPMENT PLANNING

Kementerian PPN/ Bappenas

LOW CARBON DEVELOPMENT INDONESIA

Ministry of National Development Planning/Bappenas
Jl. Taman Suropati No.2 Jakarta, 10310
Phone: (+62 21) 3193 6207

lcdi-indonesia.id
lcdi.id @lcdi.id @LCDI_Indonesia
Low Carbon Development Indonesia