TNA TECHNOLOGY NEEDS ASSESSMENT

Taxonomy of Climate Change Adaptation Technology

A guidebook for countries conducting
a Technology Needs Assessment for Adaptation

UNEP DTU PARTNERSHIP

GREEN TECHNOLOGY CENTER

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More on Technology Needs Assessments (TNAs) can be found at

http://tech-action.unepdtu.org

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List of Abbreviations

CTC Climate Technology Classification
CTCN Climate Technology Center and Network
ETDE Energy Technology Data Exchange
GTC Green Technology Center
IRENA International Renewable Energy Agency
LDC Least Developed Country
LULUCF Land Use, Land-Use Change and Forestry
MSIT Ministry of Science and ICT
MOU Memorandum of Understanding
NDC Nationally Determined Contribution
SIDS Small Island Developing States
TAP Technology Action Plan
TERI The Energy and Resources Institute
TNA Technology Needs Assessment
UNESCO United Nations Educational, Scientific and Cultural Organization
UNEP United Nations Environment Programme
UNFCCC United Nations Convention on Climate Change
UDP UNEP-DTU Partnership
WIPO World Intellectual Property Organization

01 Introduction

> “The TNA Adaptation Taxonomy helps to accurately understand the current status of technology demands in developing countries and provides useful information for decision making to successfully lead projects.”

The international community such as UNFCCC has adopted technology as a key solution to response to climate change. The development of technology is important to achieve the Net-Zero goal. Moreover, it is also important to reduce further greenhouse gas production through the technology transfer of already developed technologies.

The success of climate technology transfer will be determined by technology needs of the recipient country and technology development needs of donor countries at the planning phase, and by stakeholders harmonization, mutual trust, understanding and cooperation at the implementation stages. The international community have put an emphasis on technology transfer to tackle climate change. However, it is difficult to discuss technology transfer efficiently between donor and recipient countries because the scope and definition of climate technology has not been systematically reviewed.

The Technology Needs Assessments (TNA) seeks to promote the transfer of environment friendly technologies and know-how by forming a portfolio of climate technology projects. It needs to include the perspectives of both soft and hard technology for mitigation and adaptation, institutional supportive mechanism, financing and financial incentives, and capacity building.

The TNA Adaptation Taxonomy helps to accurately understand the current status of technology demands in developing countries and provides useful information for decision making to successfully lead projects by matching the supply and demand of technology in developed and developing countries.

After going through a multi-step approach such as integration and adjustment process, the technology classification system will guide technology recipients with insights to find technology solutions to tackle climate change and it is expected to help add to the concreteness of the shortfall.

02

TNA Adaptation Trends

2.1. Introduction to the Technology Needs Assessment project
2.2. Key adaptation sectors and technologies prioritized in TNAs
2.3. Success Stories
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2.1.

Introduction to the Technology Needs Assessment project

Enhancing the development, transfer and uptake of technology is a key pillar of the international response to climate change. With funding from the Global Environment Facility, UNEP through the UNEP DTU Partnership, supports developing countries in preparing their Technology Needs Assessments (TNAs) and Technology Action Plans (TAPs) within the global Technology Needs Assessment (TNA) project. Since 2009, close to a hundred developing countries have joined the project: twenty-four countries in the Latin America and Caribbean region, thirty-seven in the African region, and thirty-nine in the Asia-Pacific region.

The objective of the TNA project is to assess and articulate countries' technology needs in relation to climate change adaptation and mitigation. TNAs provide information about the potential, ability and scale of climate technologies, and they can play a unique role in the formulation and implementation of NDCs. They are a highly practical tool that provides an effective and solid foundation upon which developing countries can both scale up and implement action on climate technologies. Countries can therefore pursue both the targets they agreed under the Paris Agreement and their national Sustainable Development Goals.

TNAs were strongly emphasized in the Paris Agreement, and they play a central role in the newly agreed UNFCCC Technology Framework, which provides overarching guidance to the UNFCCC's Technology Mechanism. Greater support to developing countries in conducting effective TNAs and implementing Technology Action Plans (TAPs) will be instrumental in enhancing implementation of the Paris Agreement.

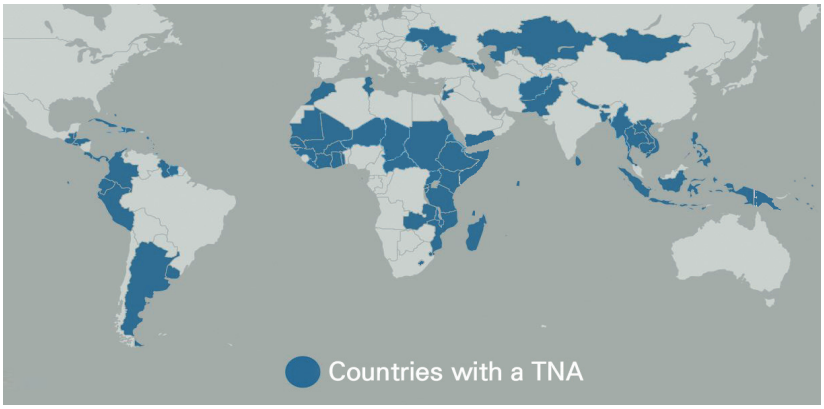


Figure 1: Map of countries participating in the TNA project

2.2.

Key adaptation sectors and technologies prioritized in TNAs

During their TNA process, seventy-one countries across the regions of Africa, Asia-Pacific and Latin America & the Caribbean prioritized key adaptation sectors and technologies to enhance resilience to climate change.

Across all three regions, the most highly prioritized adaptation sectors are the agriculture sector, the water sector and the coastal zones sectors. To a lesser extent, countries identified the sectors of land use, land-use change, and forestry (LULUCF & Forestry), natural disasters and public health.

Countries in the three regions are characterized by rapid economic and demographic growth, which trigger urbanization and changes in consumption. Such socio-economic changes put pressure on the region's agricultural and water sectors, which are, at the same time, severely impacted by climate change. As a consequence, eighty-seven percent of TNA countries across all regions prioritized the water sector as a key sector to adapt to climate change hazards, and eighty-six percent identified the agriculture sector as a key adaptation sector.

In addition, countries worldwide are affected by increases in temperatures and droughts, rising sea levels and flooding events, but also natural disasters such as tropic cyclones and typhoons. These hazards put a stress on the availability of freshwater and food security, and negatively affect the countries' coastal zones, putting their populations at risk. In the TNA project, thirty-one percent of the participating countries prioritized the coastal zones sector, and fourteen percent prioritized the sectors of LULUCF & Forestry and natural disasters. A lesser share of countries prioritized the public health sector (six percent) as a key adaptation sector.

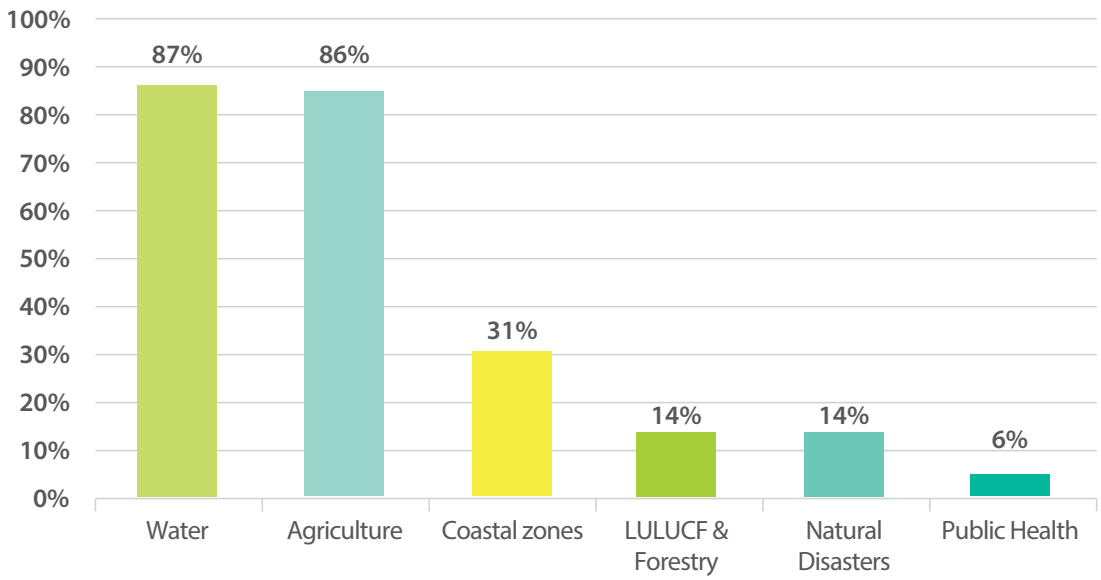


Figure 2: Share of the adaptation sectors prioritized by countries in their TNAs
Source: TNA database

On a worldwide scale, the agriculture sector is strongly impacted by climate change hazards, with increasing crop yield losses, soil degradation and water stresses that severely affect food availability and security, prices and trade. Climate change indeed triggers persistent droughts worldwide, which threaten livelihoods and the food security of countries. The increasing droughts, combined with a desertification phenomenon and poor agricultural and pastoral practices often lead to land degradation in developing countries.

Across all regions, the key technologies and practices identified by TNA countries to increase adaptation to climate change hazards in the agriculture sector are the diversification of crops, with, for example, the introduction of resilient crops varieties and the implementation of climate-resilient farming systems. In addition, countries often identify technologies for the development of salt-, pest- and drought-tolerant crop varieties, drip irrigation systems, precision farming and windbreaker rehabilitation. The development of conservation agriculture and climate-resilient livestock and the implementation of new farming infrastructures constitute additional key technologies and practices identified by TNA countries across all regions.

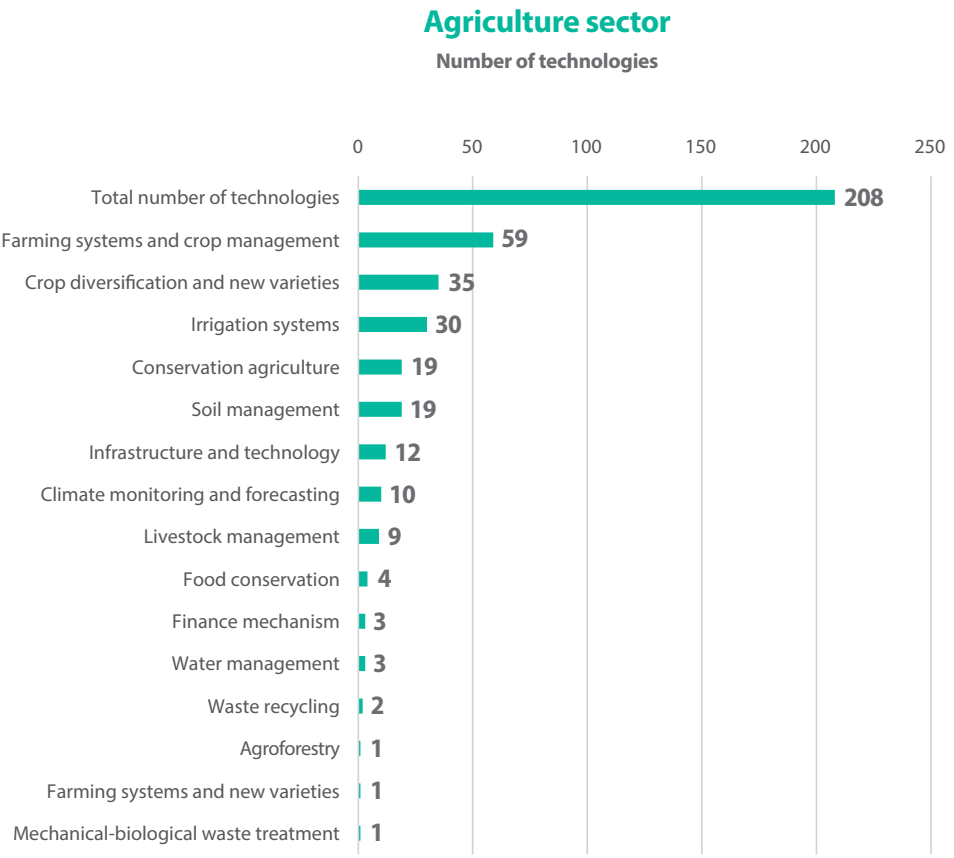


Figure 3: Key adaptation technologies prioritized by countries in the agriculture sector
Source: TNA database

On a global scale, developing countries are increasingly vulnerable to the impacts of climate change, with gradual increases in temperature and reductions in rainfall. The consequence of these changes are a significant reduction in agricultural productivity, as well as an exacerbation of water shortages. In this context, the water sector represents a key adaptation sector for developing countries worldwide.

In the water sector, countries' technology priorities include rainwater-harvesting, storm-water reclamation and reuse, water-quality monitoring, integrated river-basin management, hydropower and the mapping of extreme water events. Furthermore, countries identify technologies and practices related to water monitoring and modelling, saltwater desalinisation and the development of resilient infrastructures as key to build resilience to climate change.

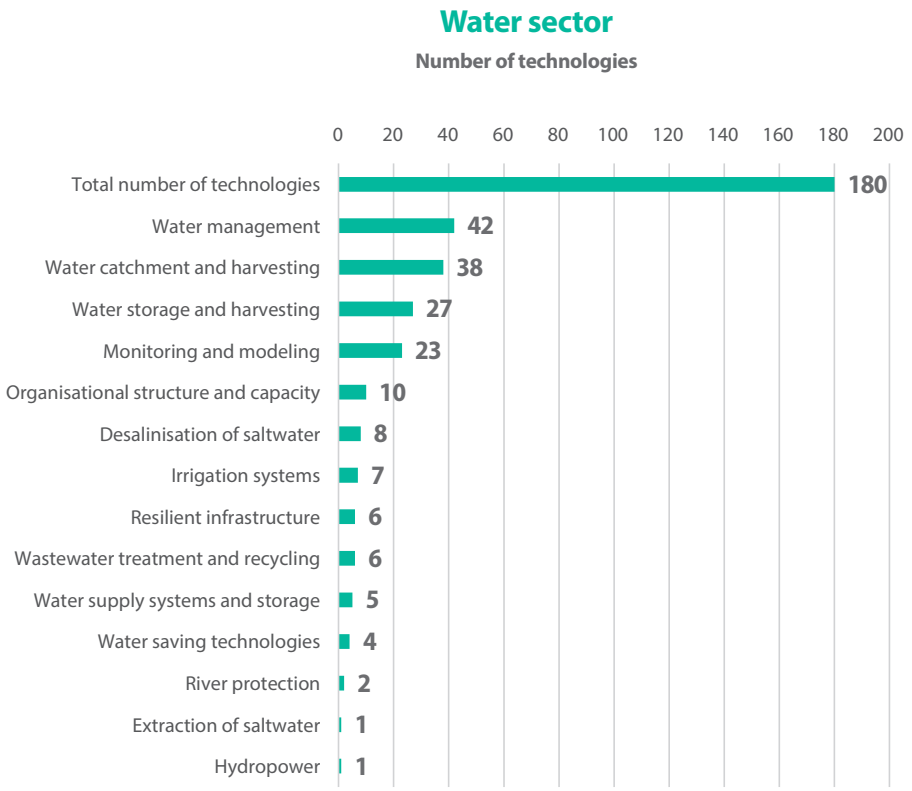


Figure 4: Key adaptation technologies prioritized by countries in the water sector
Source: TNA database

The coastal zones of developing countries, SIDS and LDCs are highly impacted by rising temperatures. As such, sand beaches, mangroves, coral reefs and fish varieties, which are part of coastal zones key resources, suffer greatly from the impacts of climate change. For example, in the case of coral reefs, the rising temperature of the sea is an ultimate threat, which ultimately affects tourism and livelihoods of many local communities. Furthermore, climate change triggers rising sea levels and tides that inundate countries' water sources, severely impacting their infrastructures and threatening their coastal zones.

In the coastal zones sector, the management and restoration of coastal zones, climate monitoring and forecasting, and hard coastal protection are the most commonly prioritized technologies to build costal resilience to climate change hazards. Early warning system also constitute a key

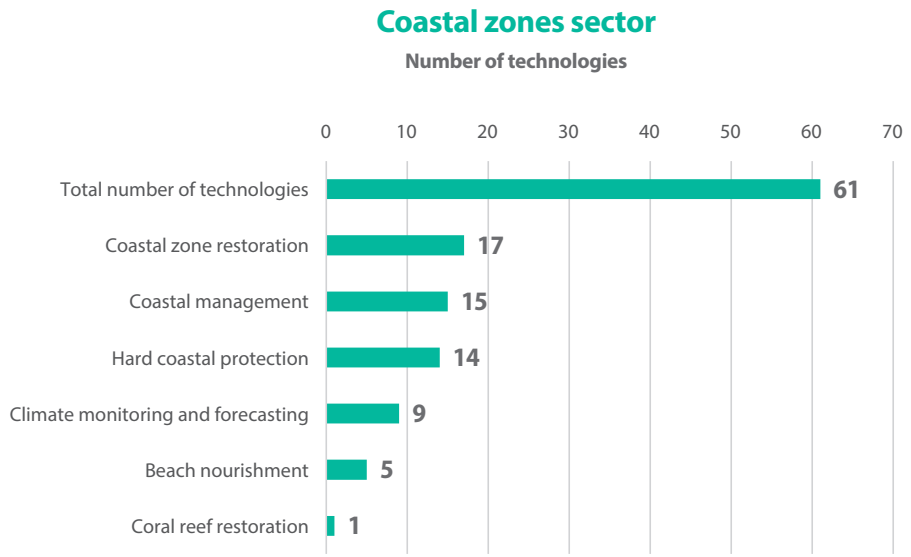


Figure 5: Key adaptation technologies prioritized by countries in the coastal zones sector
Source: TNA database

technology prioritized by countries across all regions, with the need to develop readiness and recovery plans and to minimize the negative impacts that would be caused by extreme flooding events.

Countries worldwide are increasingly impacted by natural disasters, which occurrence increases as a consequence of climate change. Countries increasingly experience cyclones, typhoons, intense rainfall and droughts, and inundations caused by rising sea levels. These hazards, combined with a lack of adequate protection means, severely impact countries' agricultural system and their food security, but also their coastlines, existing infrastructures and the livelihood of populations.

To enhance adaptation to natural disaster threats, countries often prioritize technologies and measures such as early warning systems for flooding and climate monitoring and forecasting tools such as real-time weather stations and weather forecasting. Countries also often identify the development of resilient infrastructures as key to better adapt to these hazards, such as the implementation of climate resilient roads.

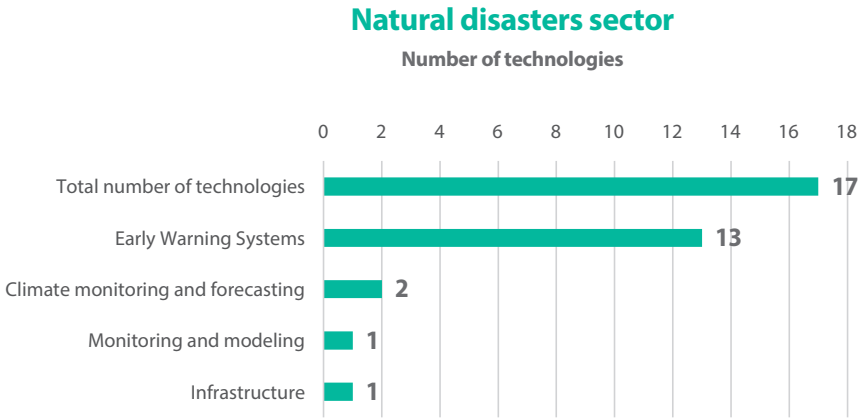


Figure 6: Key adaptation technologies prioritized by countries in the natural disasters sector
Source: TNA database

The increase deforestation worldwide constitutes an urgent issue to tackle. The livelihood of human beings is highly dependent on land and forest ecosystems, which also play a major role in absorbing CO2 from the atmosphere. In the long term, the sustainable management of lands and forests would generate the largest sustained mitigation benefit. As such, it is of crucial importance for countries worldwide to preserve their lands and forests, and to ensure the resilience of these areas to climate change.

In the field of LULUCF & Forestry, countries often prioritized technologies and practices related to forest management and land conservation. Examples of technologies include forest restoration, sustainable forests plantation, sand dune fixation, mangroves forest protection and recovery and integrated pest management in forest plantations through the promotion of mixed-species plantations.

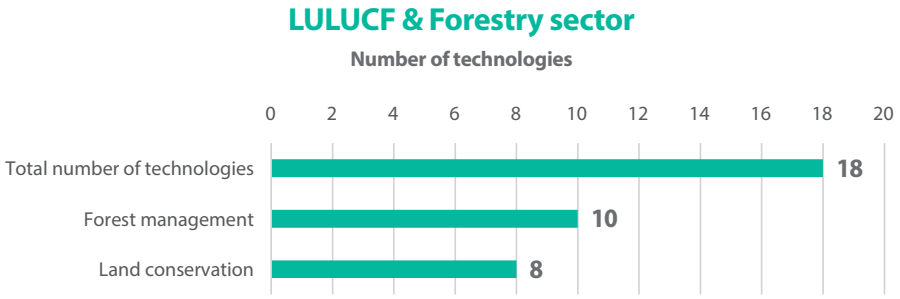


Figure 7 : Key adaptation technologies prioritized by countries in the LULUCF & Forestry sector
Source: TNA database

As a consequence of climate change and the impacts of soil erosion, deforestation, overgrazing, desertification and rising sea levels, countries worldwide increasingly face a loss of biodiversity and soil fertility. Such hazards could lead to an increase of pests and disease apparition, threatening human health, which could in turn lead to increasing rates of urban migration and an exacerbation of conflicts worldwide. In this context, the apparition of pandemics such as the COVID-19 pandemic could increase drastically in the coming decades, hence forging the need to develop resilience in the health sector.

Across all regions, countries mostly prioritized early warning systems, as well as the development of healthcare infrastructure as key technologies priority for adaptation purposes in the health sector. Prioritized measures include the deployment of early warning system for health prevention in case of heat waves, as well as the development of provisional posts of emergency care during critical periods of heat. The transfer of knowledge and skills to health personnel and the management of health care waste are additional measures prioritized by countries in the health sector.

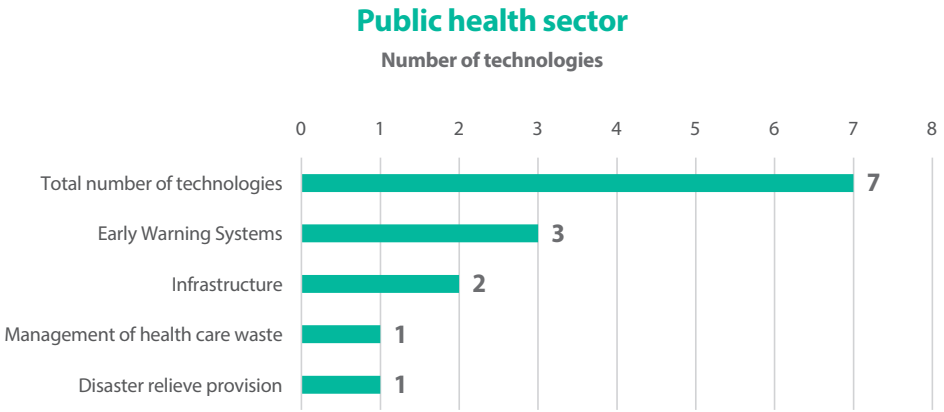


Figure 8: Key adaptation technologies prioritized by countries in the public health sector
Source: TNA database

2.3.
Success Stories

GHANA: STRENGTHENING OF THE CAPACITY FOR A DROUGHT EARLY WARNING AND FORECASTING SYSTEM

In Ghana, the agriculture and water sectors were identified in the climate change Technology Needs Assessment report (TNA), as the main sectors in need for technologies, for climate change adaptation purposes.

Specifically, for both sectors, an "Integrated Climate Monitoring and Early Warning System" was recognized as the top technology priority in Ghana's TNA, on the basis of which Ghana went ahead and prepared a readiness proposal to the Green Climate Fund, which was subsequently approved.

The aim of the readiness activity is to strengthen Ghana's capacity to build an early warning system for droughts based on its existing knowledge and capacity. This will increase the country's ability to adapt to climate change and increased climate variability within the agriculture and water sectors and will have positive impacts on the organizations and stakeholders involved in dry-season management, including local farmers.

ESTAWINI: ADAPTATION MEASURES FOR ITS AGRICULTURE SECTOR

Based on the recommendations from Eswatini's TAPs for mitigation and adaptation, technologies of wetland protection, conservation agriculture, agroforestry and livestock selective breeding were integrated into the Eco-Lubombo Biosphere project under the auspices of UNESCO.

As part of the Lubombo Biosphere project, Eswatini is implementing a National Wetland Policy, free-range chickens as part of a Lubombo Eco-trails program, and an agroforestry program to supply households with fruit and indigenous trees. Eswatini package the different components of the Eco-Lumbo project under a Green Climate Fund proposal for further implementation of these actions. Eswatini also included its TNA results in its Green Climate Fund 'country readiness report', which contributed to the country being given a grant under the Green Climate readiness Fund.

In addition, the country built on its TNA, in a successful application to the Africa Climate Fund for a project with a value of USD 1.35 million. The TNA also provided input into the development of the country's NDC report, and all the technologies prioritized by the TNA were included in the NDC.

2.4. Issues and Challenges

The international community still roughly sets technical areas based on the industrial- and project-level approaches, and most of the technologies are classified without considering the characteristics and purpose of their utilization. In addition, a hierarchical classification structure of the sub-classification system needs to be developed, and the technologies that remain must be divided into large areas of the section unit.

Although the importance of climate technology transfer and the need for technology demands are highlighted in global society, private sector and government stakeholders in donor countries, it is hard to identify and match the technologies due to no common classification system between developing and advanced countries.

To narrow the imbalances for climate technology transfer, UNEP DTU Partnership and the UNFCCC conduct the Technology Needs Assessment (TNA) project to support developing countries in the identification of climate technologies, to build resilience to climate change hazards. Hence, the development of a mutually acceptable technology classification system is essential for providing matching information, both on the demand and supply sides.

In addition, it is difficult to accurately match the technological demand of developing countries, which are centered on adaptation technology needs, due to insufficient classification. As a result, it is highly necessary to prepare a commonly acceptable climate technology classification system that considers the advantages and disadvantages of existing climate technology-related classification. It is also important to consider adaptation technology that is highly connected to projects.

03

TNA Adaptation Taxonomy

3.1. Introduction to Classification

3.2. Objectives and Methodology

3.3. TNA Adaptation Taxonomy

a. Agriculture & Livestock (12)
b. Water (7)
c. Forestry & Land (7)
d. Marine, Fisheries and Coastal Zones (7)
e. Health (4)
f. Climate Change Forecast and Monitoring (5)

3.1.
Introduction to Classification

The Green Technology Center (GTC), a government-funded research institute under the Ministry of Science and ICT Korea, signed a memorandum of understanding (MoU) with the UNEP-DTU Partnership on June 13, 2019, and is jointly conducting research on the development of classification system based on TNA information to support climate change response in developing countries.

To develop a climate technology classification system, the GTC conducted a literature review on existing climate technology related classification system from various organizations like IRENA Resource, IRENA Inspire, Climate Tech Wiki, WIPO Green, OpenEI, Reegle, The Energy and Resources Institute (TERI), Energy Technology Data Exchange (ETDE), Climate-Smart Planning Platform, CTCN, and TNA. It was basically done to set up the scope and type of climate technology for the classification system.

In addition, a survey was conducted with 60 experts in the field of climate technology in Korea to check on 'compatibility' and 'extensivity' of the classification system. The 'Climate Technology Classification (CTC)' was adjusted and integrated based on the experts' feedback and consensus. After integration and adjustment, it was finalized and accredited in 2017 by the Ministry of Science and ICT (MSIT).

The GTC started to conduct a study on establishing a climate technology classification in 2014 and finalized the work in 2017, after dedicating many years to the review and classification of climate technologies, with the support of sectoral experts. The classification system is also planning to improve when is needed to adopt newly identified and prioritized technologies.

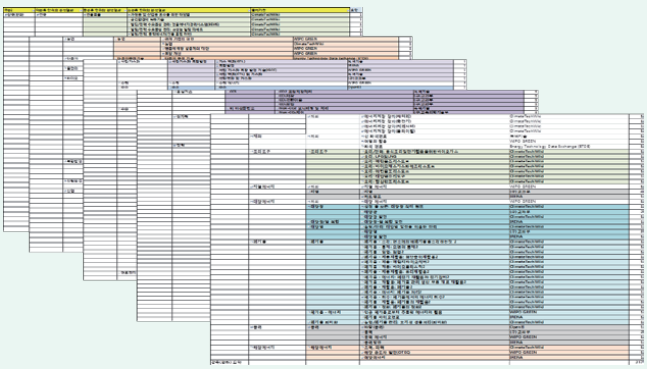


Table 1: Climate technology classification in Korea

Field	Category	Technology Scope
Mitigation	(1) Non-renewable energy	1. Nuclear power 2. Nuclear fusion power 3. Clean thermal power and efficiency
	(2) Renewable energy	4. Hydropower 5. Photovoltaic power 6. Solar thermal power 7. Geothermal power 8. Wind power 9. Marine energy 10. Bioenergy 11. Waste energy
	(3) New energy	12. Hydrogen manufacturing 13. Fuel cell
	(4) Energy storage	14. Power storage 15. Hydrogen storage
	(5) Transmission and distribution, power IT	16. Transmission and distribution system 17. Electric intelligence device
	(6) Energy demand	18. Transport system efficiency 19. Industrial efficiency 20. Building efficiency
	(7) Greenhouse gas fixation	21. CCUS 22. Non-CO_2 reduction
Adaptation	(8) Agriculture and livestock	23. Genetic resources and improvement 24. Crop cultivation · production 25. Livestock disease management 26. Processing · storage · distribution
	(9) Water	27. Water system & water ecosystem 28. Water resource securement and supply 29. Water treatment 30. Waster disaster management
	(10) Climate change forecast and monitoring	31. Climate forecast and modeling 32. Climate information and alarm system
	(11) Marine, fisheries, and coastal	33. Marine ecosystem 34. Fisheries resources 35. Coastal disaster management
	(12) Health	36. Infectious disease management 37. Food safety prevention
	(13) Forest and land	38. Forest production promotion 39. Forest damage reduction 40. Ecological monitoring, and restoration
Conver -gence	(14) Multi-disciplinary convergence	41. Renewable energy hybrid 42. Low power consumption equipment 43. Energy harvesting 44. Artificial photosynthesis 45. Other climate change related technologies not covered in this classification

3.2. Objectives and Methodology

The purpose of categorizing the types of climate technologies by similarities and characteristics to increase the accessibility to matching and funding. To achieve the goal of developing TNA Adaptation Taxonomy, the GTC conducted research to include all the elements of adaptation as possible. The research process of developing the taxonomy is as below.

For the study, the first step was taken to review the current TNA Standardized Technology Classes to improve the classification system, and clear classification criteria were established to develop a taxonomy that encompasses various technologies. Also, the perspective of the 'Study on Climate Adaption-related Industry' by the Korea Environment Institute in 2014 was reviewed to capture more adaptation aspects and to embed to the TNA Adaptation Taxonomy.

After the process, a comparison of adaptation activities using the suggested "Climate Technology Classification (CTC)" was conducted to increase compatibility with adaptation actions.

The adaptation taxonomy, which consider the level of technology demand in developing countries was organized and detailed guidelines were prepared. For this process, about eight matching sessions were performed, and a draft of the Climate Technology Classification (CTC) based on TNA information was suggested and reviewed by 20 technology experts from various national institutes like Rural Development Administration (RDA), Korea Institute of Ocean Science and Technology (KIOST), K-water, and others. The terms from the UDP's TNA Standardized Classes and the Climate Technology Classification(CTC) were merged together. This developed TNA Adaptation Taxonomy will be updated from time to time after new technology needs are identified and prioritized. This is expected to give more clarity to developing countries and technology implementers.

In addition, through the linkage between the demand for adaptation to climate change and the industry and technology point of view, the draft version of the adaptation taxonomy at the division level were formed in comparison with the TNA Standardized Technology Classes, and the final guidelines were completed based on review conducted by experts in each field.

Table 2 : Compatible Table of CTC and TNA Technology Class

Technology Division	CTC Technology Section	TNA Standardized Technology Class
Agriculture & Livestock	Climate-resilient farming measures	Agroforestry
		Conservation agriculture
		Infrastructure and technology
		Management of production system
	Crop management and climate-resilient crops	Crop diversification and new varieties
		Optimisation of fertilizers
	Climate-resilient livestock management	Feedstock improvement
		Livestock management
	Agricultural water management	Drip irrigation
		Water supply system
	Agricultural soil management	Soil management
	Agricultural environment monitoring	Monitoring of agricultural environment
		Early warning system
		Monitoring and modelling
		Risk management and disaster prevention
	Agriculture & Livestock disease management*	-
	Agriculture & Livestock residue and waste management	Composting
		Waste recycling
	Post-harvest/processing/distribution	Food conservation
		Food conservation and grain storage
	Finance mechanisms	Finance mechanism
	Agriculture & Livestock education and consulting	Research & development
		Educational framework
		Information and awareness
Water	Maintaining of sustainable water supply	Desalination of saltwater
		Drip Irrigation
		Extraction of groundwater
		Water catchment and harvesting
		Water saving technologies
		Water supply system and storage
	Monitoring & early warning for water resources	Monitoring and modelling
		Early warning system

Technology Division	CTC Technology Section	TNA Standardized Technology Class
Water	Water quality assurance	Wastewater treatment and recycling
	Integrated water resource management	Land conservation
		Water management
	Water-related disaster risk management	Resilient infrastructure
		River protection
		Risk management and disaster prevention
	Service management of water ecosystem*	-
	Water education and consulting	Organisational structure and capacity
		Educational framework
		Information and awareness
Forestry & Land	Climate-resilient forest resources production	Agroforestry system
		Forest management
		Improved mining exploration
	Forest disaster risk management	Forest conservation
		Land conservation
		Reforestation
		Early warning system
		Risk management and disaster prevention
	Forest carbon sink management	Monitoring of carbon sink
	Forest & Land ecosystem service management*	-
	Forestry & Land ecosystem restoration	Conservation and restoration
		Improved management
		Landscape connectivity
	Forest & Land ecosystem change detectionand prediction	Monitoring and modeling
	Forestry & Land education and consulting	Educational framework
		Information and awareness
Marines, Fisheries and Coastal Zones	Coastal zone risk retention-soft structures	Beach nourishment
		Coastal management
		Coral reef restoration
		Dune restoration
		Wetland restoration
	Coastal zone risk retention-hard structures	Hard coastal protection

Technology Division	CTC Technology Section	TNA Standardized Technology Class
Marines, Fisheries and Coastal Zones	Coastal zone risk retention-hard structures	Early warning system
		Risk management and disaster prevention
	Coastal environment monitoring and risk assessment/ prediction	Climate monitoring and forecasting
		Monitoring and modelling
	Disease management of marine resources*	-
	Marine ecosystem service management*	-
	Production of marine resources and aquaculture	Farming systems and crop management
	Marine, Fisheries and Coastal Zones education and consulting	Educational framework
		Information and awareness
Health	Medical and public health Infrastructure	Early warning system
		Health infrastructure in communities
		Disaster relieve provisions
	Prevention and control of infectious disease	Medical waste management
	Food safety, food security, and nutrition*	-
	Health policy consulting, enabling environment, health education, health system strengthening	Capacity building
Climate Change Forecast and Monitoring	Climate risk analysis, prediction and assessment	Scenario building
	Climate data and information services	Data centre
	Climate disaster prediction and warning	Early warning system
	Climate change monitoring and modeling	Monitoring and modeling
	Climate change education and consulting	Educational framework
		Information and awareness

* Newly added category : technology class is not yet defined but has potentials to be prioritized soon

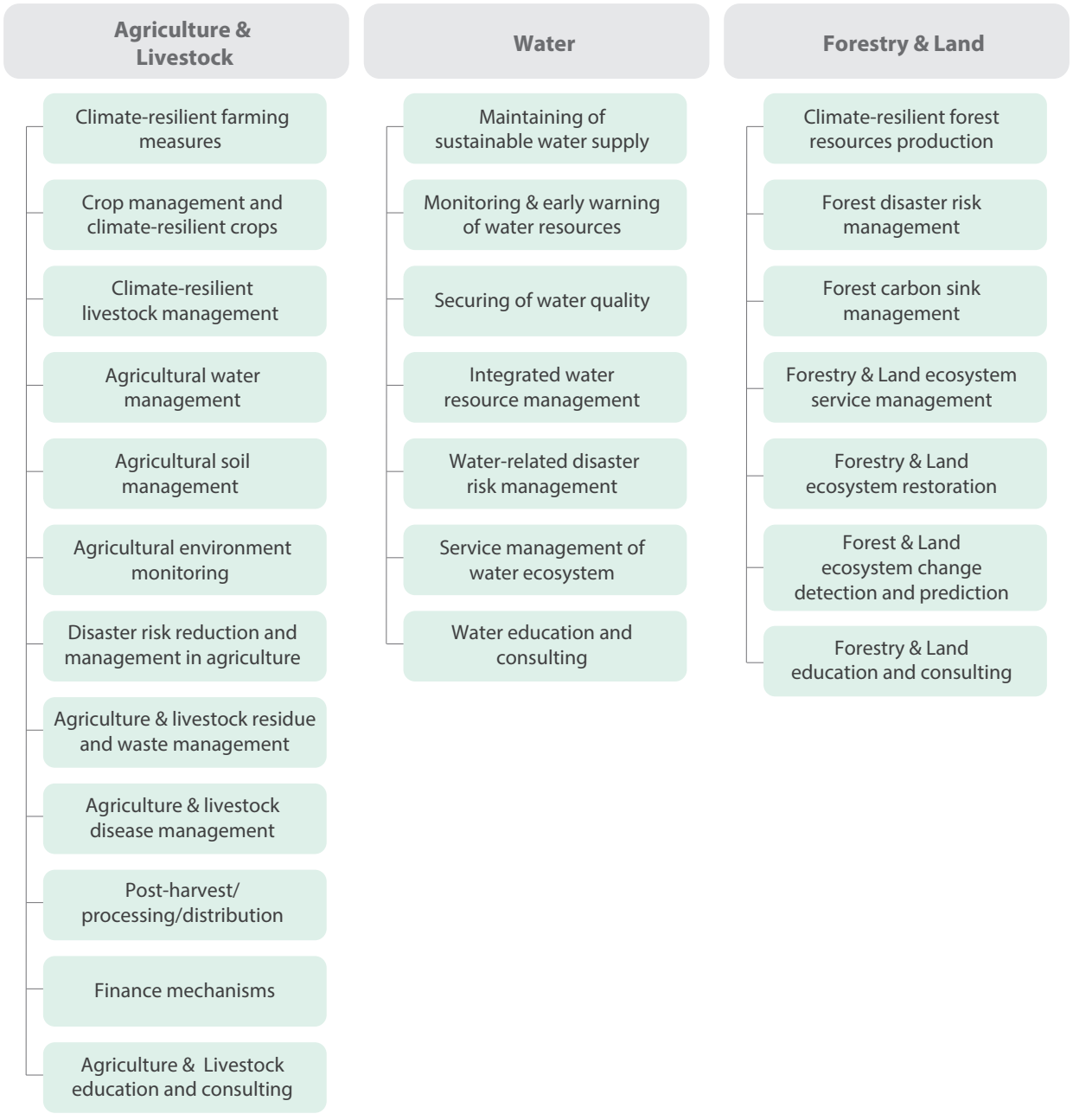
※ Please note that table was based on the TNA data as of 2019. It will be updated time to time with ongoing TNA projects.

3.3.
TNA Adaptation Taxonomy

As for the result of the joint research, the TNA Adaptation Taxonomy was established, as shown on the next page, and is expected to be updated regularly with newly prioritized technology needs from developing countries. Based on the TNA Standardized Technology Classes, it is divided into six sectors: 1) Agriculture & Livestock, 2) Water, 3) Forestry & Land, 4) Marine, Fisheries, and Coastal Zones, 5) Health, and 6) Climate Change Forecast and Monitoring. Each sector is divided further into more categories, which are designed to include all developing countries' prioritized technology needs and give more flexibility to cover a greater scope of technologies. There are some overlapping categories within sectors, but they are carefully designed to be more appropriate for each sector.

After introducing to the TNA Adaptation Taxonomy, the factsheets of each technology that contain various information are also included to help better understanding.

TNA Adaptation Taxonomy



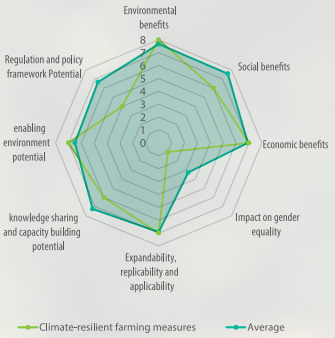
Marine, Fisheries and Coastal Zones	Health	Climate Change Forecast and Monitoring
Coastal zone risk retention-soft structure	Medical and public health infrastructure	Climate risk analysis, prediction and assessment
Coastal zone risk retention-hard structure	Prevention and control of infectious disease	Climate data and information services
Coastal environment monitoring and risk assessment/prediction	Food safety, food security, and nutrition	Climate disaster prediction and warning
Disease management of marine resources	Health policy consulting, enabling environment, health education, health system strengthening	Climate change monitoring and modeling
Marine production promotion		Climate change education and consulting
Marine ecosystem service management		
Marine, fisheries and coastal zones education and consulting		

a. Agriculture & Livestock

Technology Section	Definition
Climate-resilient farming measures	Agroforestry, soil conservation agriculture, improvement of agricultural and livestock production, eco-friendly agriculture, agricultural infrastructure and technology, adaptive infrastructure for climate change for automation and cultivation of production management systems and mechanization techniques
Climate management and climate-resilient crops	Securing genetic resources and improving disease-resistant, and weather-resistant properties for improving crop varieties in response to climate change and extreme weather events.
Climate-resilient livestock management	Production of livestock in response to climate change, including livestock nutrition and feedstock management, livestock disease management, etc.
Agricultural water management	Irrigation is a method of supplying water to plants at regular intervals for farming. It is used to help grow crops, maintain landscapes and cultivate disturbed soil in dry areas and during dry seasons.
Agricultural soil management	Regenerative, or restorative, agriculture can help soil to capture more carbon by encouraging farmers to adopt a mixture of techniques to improve soil health and moisture balance.
Agricultural environment monitoring	Monitoring of ecosystem changes in agriculture and livestock products, assessing effect on agricultural production due to climate change by means of vulnerability assessment.
Disaster risk reduction and management in agriculture	Improving agricultural facilities, improving infrastructure, and reducing crop damage to minimize the harm caused by abnormal weather and disasters. It includes early warning systems and modelling of climate disaster prediction.
Agriculture & Livestock residue and waste management	Management of agricultural and livestock waste, such reuse of agricultural and livestock by-products, eco-friendly treatment, and energy production.
Agriculture & Livestock disease management	With gradual climate change, the inflow of new pests and viruses increases and spreads, and technology is needed to provide products and services to reduce damage. Includes pest diagnosis kits and prevention technologies and product production technologies.
Post-harvest/processing/distribution	Technology that maximizes merchantability for the entire process of screening, pre-cooling, storage, packaging, transportation of harvested agricultural and livestock products.
Finance mechanisms	The generic term for various contracts in which beneficiaries of agricultural livestock environment services pay a certain amount of service costs to suppliers based on private contracts.
Agriculture & Livestock education and consulting	Educational framework, capacity building, expansion of public acceptance, information sharing, tourism, and consulting, etc.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Climate-resilient farming measures
TNA Technology Class	Agroforestry, Conservation agriculture, Infrastructure and technology, Management of production system



Part 2. Information on Technology

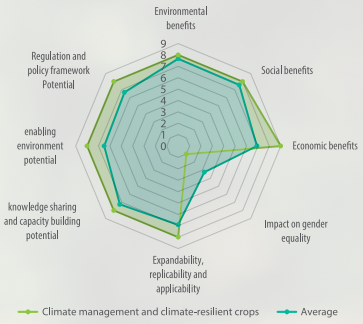
Definition of technology	**Technology Definition** To adapt to changing weather patterns and different crop yields, resource utilization can be maximized by diversifying farming technologies, such as placing crops with trees to increase ecological diversity, improve soil fertility, and reduce soil erosion. This also preserves crop productivity, enabling sustainable economic activities. Through this, climate-adjusted plans per village can be established according to the environment of each region and climate-elastic agriculture can be achieved.
	Examples of detailed technology Crop harvest: mixed agriculture, soil conservation agriculture, increased production of agricultural and livestock products, and eco-resilient agriculture. Agricultural infrastructure and related technologies. Climate-resilient production management system.
Importance and characteristics of technology	This category is divided into agri-silvoculture (trees and crops), mixed-enriched forestry (silvoculture – trees, pasture, and livestock). A mixed farming system can solve the problem of waste disposal caused by the use of fertilizers made from animal excretions for crops. By mixing crops and/or livestock systems, farmers can provide nitrogen to crops by linking grains to soybeans. Or by plant intercropping, farmers can obtain in maximum possible space through plant selection and cultivation methods to make the most of their light, moisture, and soil.
Status of technology	Technology for adapting to climate change through the linkage between technologies in the agricultural and livestock industries is partially empirical, and each country has strong regional specificity in the composition of its agricultural products. This means that it is possible to commercialize such technology by carrying out a consulting process with experts who have an accurate understanding of the local climate.

Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	**Large scale**
Applicable target area	Farms, plantations, etc.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Sustainable environment: Contributing to the creation of a sustainable environment through the installation of facilities for adapting to climate change. Ecosystem conservation: As the biodiversity index increases, biodiversity and ecological value increases.
Social benefits	Social awareness and education: Public awareness of the protection of ecological resources is strengthened, and social acceptability is enhanced by the expansion of educational accessibility.
Economic benefits	Productivity and competitiveness: Climate-resilient farming methods reduce the damage caused by climate change, thus increasing productivity and competitiveness.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: Climate change-resilient facility technology can be replicated for similar climate-specific areas. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: Knowledge sharing is possible through regular technical exchange and education.
Potential for enabling environment to diffuse technology	Climate-resilient facilities that can effectively cope with climate change are likely to spread the technology internationally through performance evaluations.
Potential contribution to establishing regulation and policy framework	Climate-resilient facility technologies will have a moderate impact on the creation of regulatory and policy systems.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Climate management and climate-resilient crops
TNA Technology Class	Crop diversification and new varieties, Optimization of fertilizers



Part 2. Information on Technology

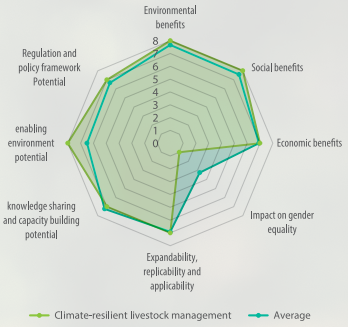
Definition of technology	**Technology Definition** This is a technology that can strengthen national food security against climate change by fostering and disseminating resilient crop varieties (resilient against drought, flood, and salt damage) for long-term factors (such as rising temperatures) and short-term factors (drought, flood, and salt damage) and fostering and distributing new rice varieties that are resilient against environmental stress (drought, flood, and salt).
	Examples of detailed technology Development of disaster-resistant varieties Development of endotrophic variety
Importance and characteristics of technology	The growth of crops may improve due to climate change, but in the long run, the crop production maps are changing greatly, and the socioeconomic problems of farmers are intensifying due to natural disasters and inspect pests. To adapt to warming, crops from other climatic regions are being introduced, and there is a need to evaluate the possibility of potential for the cultivation of such crops. Crops are also particularly vulnerable to natural disasters caused by climate change, so it is necessary to develop disaster-resistant varieties.
Status of technology	To prepare for climate change, crop cultivation and performance evaluation in other climatic regions are being actively carried out, but the infrastructure for technological expansion, such as human resources development, is insufficient. Therefore, it is necessary to overhaul the legal system and lay the foundation for the technology deployment at the national level.

Applicable scale of technology	Technology Assistance	**Portable & Small scale**	**Medium-size application**	Large scale
Applicable target area	Farms, plantations, etc			

Part 3. Influence to Sustainable Development	
Environmental benefits	Reduction of ecological vulnerability: Increasing biodiversity and ecological value, and enabling sustainable agricultural management by protecting biodiversity.
Social benefits	Food safety: Stabilize productivity through the prevention or mitigation of food crop damage caused by weather disasters, and relieve anxiety about the income stability of farmers due to the rapidly changing climate
Economic benefits	Resource supply and productivity improvement: Stabilize farm income and consumer prices by stabilizing production through crop damage reduction and reduce production costs for breeding varieties by increasing the efficiency of breeding technology.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: Climate-resilient crops are similar climate-environmental areas and are highly likely to be replicated. Replicability: Very high
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: Climate-resilient crop technologies are in very high demand in areas where technology levels are insufficient, and knowledge is likely to be shared through various academic societies and workshops, etc.
Potential for enabling environment to diffuse technology	Through support and cooperation, it is possible to provide a foundation for the development of environmental stress-resistant gene search technology, new breeding technology, and climate change-resilient and disaster-resistant crop varieties.
Potential contribution to establishing regulation and policy framework	Climate-resilient crop technology for farms vulnerable to climate change needs support from state agencies and will greatly contribute to the creating of policy and legal systems.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Climate-resilient livestock management
TNA Technology Class	Feedstock improvement, Livestock management



Part 2. Information on Technology

Definition of technology

Technology Definition
This is a technology that responds to climate change by developing specification technologies (improving the breeding environment and supplying feed and nutrients) for the stable production of high-quality livestock products, improving productivity even in adverse weather conditions such as high temperatures in summer, and developing and distributing systematic management systems for each species of livestock.

Examples of detailed technology
Technology for measuring and reducing greenhouse gases in antifreeze
Optimum thermal environment management technology for livestock barns
Construction and management technology for preventing high temperatures in livestock facilities

Importance and characteristics of technology	Global warming is causing damage such as reduced livestock productivity due to abnormal weather, including temperature increases, heat waves, and tropical night increased mortality rates and increased disease rates. Livestock that affected by the high temperature stress reduce are reduced due to decreased feed intake, which leads to decreased productivity and decreased farm household income. In addition, the need to develop livestock technologies that specialized in adaptation to cope with climate change by breed is increasing in order to establish a stable livestock production base.
Status of technology	Increasing temperatures continue to impact the productivity of livestock and environmental control technologies such as the distribution of feeding and management manuals and barns for breeds at hot temperature are used in developed countries, which are capable of commercialization and technology transfer independently of other technologies.

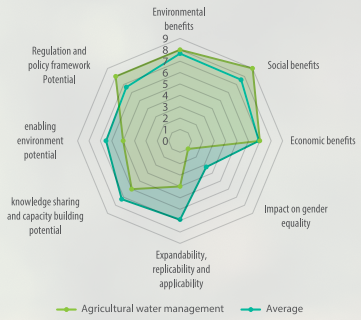
Applicable scale of technology	Technology Assistance	**Portable & Small scale**	**Medium-size application**	Large scale

Applicable target area	barns

Part 3. Influence to Sustainable Development	
Environmental benefits	Greenhouse gas (GHG) reduction: By efficiently managing the methane gas produced by ruminant livestock farms, it contributes to reducing GHG emissions.
Social benefits	Food safety: Contribute to increasing the income of livestock farmers and the stable development of the industry by creating the foundation for the diversification of income generation in the livestock industry and enhancing consumer confidence through the production of safe, high-quality meat.
Economic benefits	Resource supply and productivity improvement: Improving the self-sufficiency rate for livestock feed and establishing a stable supply system for improving meat consumption. In addition, stable national competitiveness of livestock products is improved through the introduction of optimal specification technology for each type of livestock.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: Climate-resilient livestock technology is a livestock environment in a similar environment and is highly likely to be replicated. Replicability: Very high
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: Knowledge on climate-adapted livestock technology is likely to be shared through various academic societies and workshops, depending on related R&D performance.
Potential for enabling environment to diffuse technology	It is highly likely that ICT technology will be expanded by upgrading stock keeping technologies and securing technologies for improving the productivity of each breed, as well as improving technology for developing livestock feed, nutrients, and additives.
Potential contribution to establishing regulation and policy framework	Climate-resilient livestock technology needs to be sufficiently prompted at the national level to prepare for regulation and is likely to contribute to the creation of a policy system.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Agricultural water management
TNA Technology Class	Drip irrigation, Water supply system



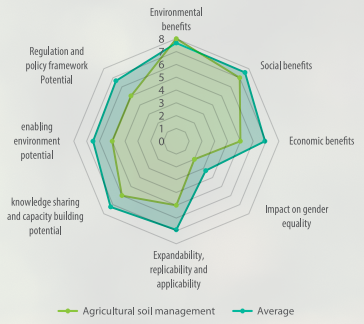
Part 2. Information on Technology

Definition of technology	**Technology Definition** This includes technologies for responding to water resource vulnerabilities caused by abnormal weather conditions due to climate change, such as installing reservoirs and pumping stations, installing water drainage channels in drought-prone areas, repairing old facilities in preparation for natural disasters, repairing old reservoirs, saving water through the distribution of cultivation facilities, and supporting the dissemination of rainwater-harvesting technologies to horticulture areas for drought response.			
	Examples of detailed technology Evaluation of future water capacity Drought and flood vulnerability assessment Construction and management technology for water resources facilities to water supply.			
Importance and characteristics of technology	Regional and seasonal variation in precipitation due to climate change is growing, more problems are expected in terms of providing sufficient water supply for growing crops, and the need to secure agricultural water resources to prepare for future water shortages caused by climate change and meet various water-related needs is increasing. In preparation for water shortages caused by abnormal weather conditions, the systematic management of agricultural water for water conservation and development of water-saving technologies are required, and the dissemination of resource technology for rainwater is needed to secure water resources in agricultural facilities for drought preparation.			
Status of technology	Technologies for the construction of water and water supply facilities in rural area are sufficiently disseminated around the world, and technologies for accurately assessing vulnerability to drought and flooding are currently being actively studied in response to future global scenarios of climate change.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	**Large scale**
Applicable target area	Reservoirs, streams, channels, etc.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Water resources environment: Improving and preserving the water resources environment through river maintenance and management of water use and control facilities to prepare for climate change.
Social benefits	Water use and control: Prepare for disasters and provide a stable supply of agricultural water by expanding water use and control facilities in preparation for extreme rainfall and drought caused by climate change.
Economic benefits	Productivity improvement: By securing water resources infrastructure in preparation for sudden droughts and floods, the stability of crop production can be ensured.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: Agricultural resources technologies for responding to climate change are not likely to be replicated because of their strong regional specificity. Replicability: Low
Potential for knowledge sharing and capacity building	Knowledge sharing workshops: In response to future scenarios of local climate change, the framework for agricultural water resource management can be shared through relevant academic conferences and workshops, etc.
Potential for enabling environment to diffuse technology	Agricultural water resource technology in response to climate change is an area that must be studied and supplemented in accordance with the actual conditions of the basin, where the technology is implemented. If the framework used in the process is standardized, it can create a technology diffusion environment.
Potential contribution to establishing regulation and policy framework	Climate-resilient agricultural water resource technology corresponds to the design of infrastructure and is likely to contribute to the development of legal system, design standards, etc. because it requires national policy support in order for its application to be expanded beyond the test bed.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Agricultural soil management
TNA Technology Class	Soil management



Part 2. Information on Technology

Definition of technology	**Technology Definition** This technology can prevent carbon-rich soil loss and reduce soil-derived greenhouse gas emissions by injecting appropriate agricultural materials to preserve soil carbon, while enhancing the soil fertility and environment soil conservation value.
	Examples of detailed technology Prevention of loss of farmland topsoil: Stairline transfer, water supply formation, conservation tillage, contour cultivation, minimum tillage Increase in soil carbon: bio-dioxide, compost, organic trials, minimum tillage Reduced greenhouse gas emissions: water management, nitrogen fertilizer input, lime input Promoting Agricultural Land Fertility: green manure crop cultivation, fertilizer input
Importance and characteristics of technology	The carbon absorption-discharge flow of soil is 6 to 10 times that of carbon dioxide emissions derived from human activity, and if the balance is broken and carbon emissions of soil are 1% higher than absorption, 10% of carbon emissions from humans are additionally released into the atmosphere. Therefore, it is critical to prevent the conversion of soil carbon into atmospheric carbon dioxide to prevent global warming, which is an elemental technology of soil absorption source and soil management, to reduce the emissions of carbon dioxide from agricultural land, to prevent salt concentration and greenhouse gas emissions by overusing fertilizer, to reduce muddy water and dust caused by heavy rain and drought, and to manage soil fertility that can produce farm products stably.
Status of technology	Elemental technologies related to soil absorption sources and soil management have been developed, but it is necessary to establish a measurement-reporting-verification (MRV) system for individual technologies for commercialization.

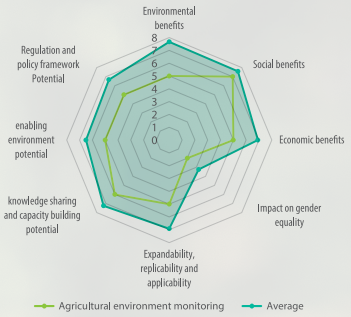
Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	Large scale

Applicable target area	Rice paddies and fields (sloping, flatland, rice paddy plant horticulture plantation), orchards, grasslands, and forests.

Part 3. Influence to Sustainable Development	
Environmental benefits	Improvement of crop production environment: soil health is improved by fertile topsoil conservation, soil organic matter enhancement and correct fertilizer use. Environmental conservation: It contributes to soil, air and water environment conservation by reducing muddy water and dust. Global warming prevention: Soil carbon isolation is increased and soil-derived carbon dioxide emissions are reduced.
Social benefits	Health: Contributes to the promotion of national health by improving air quality by reducing dust. Safety: Reducing muddy water contributes to preventing landslides and soil inflow. Education accessibility: implement visible education projects such as soil dust and muddy water reduction.
Economic benefits	Job creation effect: The measurement of soil absorption source and soil management technical project performance and job creation in the monitoring-reporting-verification field. Poverty Mitigation Effect: The income of residents of agricultural and fishing villages in connection with the soil absorption source and soil management technology project is improved with the direct payment system for the public interest. Productivity and competitiveness increase: Agricultural productivity and competitiveness are improved by enhancing soil fertility.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability of technology: It is highly likely to be expanded to the agricultural environment conservation program, topsoil conservation project, and public-interest direct payment system business. Replicability : Very high
Potential for knowledge sharing and capacity building	Knowledge sharing: Education projects for farmers, forestry workers and landscaping can be implemented. Strengthening the capacity of the relevant management agencies: The Agricultural Technology Practicalization Foundation, Forestry Promotion Agency, and others may be strengthened.
Potential for enabling environment to diffuse technology	Great ripple effect is expected when linked to the Ministry of Agriculture, Food and Rural Affairs' direct payment system for the public interest, agricultural environment conservation program, and the Ministry of Environment's surface conservation project.
Potential contribution to establishing regulation and policy framework	The Ministry of Agriculture, Food and Rural Affairs' direct payment system for the public interest and the agricultural environment conservation program can cut subsidies for those who fail to implement the plan.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Agricultural environment monitoring
TNA Technology Class	Monitoring of agricultural environment



Part 2. Information on Technology

Definition of technology	**Technology Definition** Technology to mitigate damage caused by weather, such as temperature disturbance, lack of sunlight, lack of precipitation, strong solar radiation, strong winds, and typhoons, to produce agricultural and livestock products stably, and includes technologies such as early warning and monitoring of weather disasters and risk management for extreme weather disasters.
	Examples of detailed technology Early Warning: Establishment and utilization of peripheral information, big data, and a real-time analysis system Monitoring and Modeling: Representability, effectiveness monitoring, real-time analysis and prediction system establishment. Risk management: abnormal temperature, lack of sunlight, drought, heavy rain
Importance and characteristics of technology	Agricultural climate change has a close relationship with the growth of disease and insect pests as well as weather disasters, such as weather damage, frost damage, high temperature disturbance, low temperature damage, drought, heavy rain, and lack of sunlight, which greatly affect the stable production of crops. Mitigating agricultural weather disasters ensures production activities for farmers. It is essential to systematize technologies that predict weather disasters and minimize damage through monitoring the changes in the weather environment and provide useful services to farming sites.
Status of technology	Due to the difference between the observation points of the Meteorological Administration and the location of the farm, it is urgent to expand the disaster warning service project to reduce damage from weather disasters on the farms.

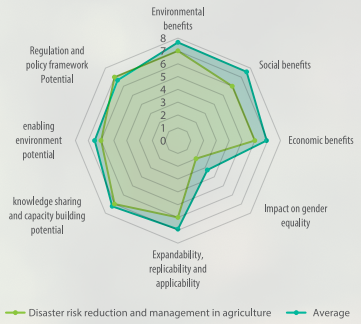
Applicable scale of technology	Technology Assistance	**Portable & Small scale**	Medium-size application	Large scale

Applicable target area	Rice paddies and fields (sloping, flatland, rice paddy plant horticulture plantation), orchards, grasslands, and forests.

Part 3. Influence to Sustainable Development	
Environmental benefits	Forecast of weather disasters: Yellow dust, fine dust, wind damage, frost damage, heavy rain, drought, lack of sunlight, high temperature disturbance, low temperature damage, and others are predicted.
Social benefits	Educational accessibility: The education project on the crisis of climate change is implemented, and the education on the EAP (Emergency Action Plan) for residents in areas vulnerable to weather disasters is implemented.
Economic benefits	Job Creation Effect: Jobs in the field of agricultural weather accident analysis and forecasting services are created. Reduced farm management costs: Agricultural facilities and crop damage from weather disasters are mitigated. Increased productivity and competitiveness: Produce agricultural products stably, and produce locally specialized agricultural products utilizing meteorological resources.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: The expansion of agricultural accident insurance is highly likely to be used as a basis for damage assessments. Replicability: The weather disaster mitigation technology can be duplicated in areas with similar weather conditions and regional characteristics.
Potential for knowledge sharing and capacity building	Knowledge sharing: Education projects for farmers, forestry workers and landscaping can be implemented. Strengthening the capacity of the relevant management institutions: The capacity of the Rural Development Administration, the Provincial Agricultural Research and Extension Services, the Agricultural Technology Center, and others may be strengthened.
Potential for enabling environment to diffuse technology	Linking the technology to the ministry's agricultural accident insurance project will maximize the impact
Potential contribution to establishing regulation and policy framework	Agricultural accident insurance may be used as the basis for damage assessment.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Disaster risk reduction and management in agriculture
TNA Technology Class	Early warning system, Monitoring and modelling, Risk management and disaster prevention



Part 2. Information on Technology

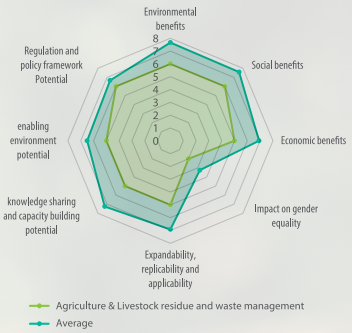
Definition of technology	**Technology Definition** Technology to mitigate damage caused by weather, such as temperature disturbance, lack of sunlight, lack of precipitation, strong solar radiation, strong winds, and typhoons, to produce agricultural and livestock products stably, and includes technologies such as early warning and monitoring of weather disasters and risk management for extreme weather disasters.
	Examples of detailed technology Early Warning: Establishment and utilization of peripheral information, big data, and a real-time analysis system. Monitoring and Modeling: Representability, effectiveness monitoring, and real-time analysis and prediction system establishment Risk management: Abnormal temperature, lack of sunlight, drought, heavy rain
Importance and characteristics of technology	Agricultural climate change has a close relationship with the growth of disease and insect pests as well as weather disasters, such as weather damage, frost damage, high temperature disturbance, low temperature damage, drought, heavy rain and lack of sunlight, which greatly affect the stable production of crops. Mitigating agricultural weather disasters ensures the production activities for farmers. It is essential to systematize the technologies that predict weather disasters and minimize damage through monitoring the changes in the weather environment and provide useful services to farming sites.
Status of technology	Due to the difference between the observation points of the Meteorological Administration and the location of the farm, it is urgent to expand the government's disaster warning service project to reduce damage from weather disasters on the farms.

Applicable scale of technology	Technology Assistance	**Portable & Small scale**	Medium-size application	Large scale
Applicable target area	Rice paddies and fields (sloping, flatland, rice paddy plant horticulture plantation), orchards, grasslands, and forests.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Forecast of weather disasters: Yellow dust, fine dust, wind damage, frost damage, heavy rain, drought, lack of sunlight, high temperature disturbance, low temperature damage, and others are predicted.
Social benefits	Educational accessibility: The education project on the crisis of climate change is implemented, and the education on the EAP (Emergency Action Plan) for residents in areas that are vulnerable to weather disasters is implemented.
Economic benefits	Job Creation Effect: Jobs in the field of agricultural weather accident analysis and forecasting services are created. Reduced farm management costs: Agricultural facilities and crop damage due to weather disasters are mitigated. Increased productivity and competitiveness: Produce agricultural products stably, and produce locally specialized agricultural products utilizing meteorological resources.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: The expansion of agricultural accident insurance is highly likely to be used as a basis for damage assessment. Replicability: The weather disaster mitigation technology can be duplicated in areas with similar weather conditions and regional characteristics.
Potential for knowledge sharing and capacity building	Knowledge sharing: Education projects for farmers, forestry workers and landscaping can be implemented. Strengthening the capacity of the relevant management institutions: The capacity of the Rural Development Administration, the Provincial Agricultural Research and Extension Services, the Agricultural Technology Center, and others may be strengthened.
Potential for enabling environment to diffuse technology	Linking the technology to the ministry's agricultural accident insurance project will maximize the impact
Potential contribution to establishing regulation and policy framework	Agricultural accident insurance may be used as the basis for damage assessment.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Agriculture & Livestock residue and waste management
TNA Technology Class	Composting, Waste recycling



Part 2. Information on Technology

Definition of technology	**Technology Definition** The treatment of agricultural residue includes consumptive treatments, such as purification and incineration, and productive processing, such as composting and renewable energy production, and includes appropriate recycling technologies according to the byproduct characteristics.
	Examples of detailed technology Management of agricultural residue: Rice straw and other agricultural side products such as rice bran and whey. Livestock manure treatment: composting, liquidating, incineration, and purification Renewable energy production: bioenergy production and by-product processing
Importance and characteristics of technology	Globally, the recognition and management system of waste is shifting to a sustainable environment and a society of agriculture and resource circulation, with various efforts being made, including the readjustment of laws and systems to implement the processes. At a time when carbon dioxide emissions are likely to increase due to the excessive use of fossil energy and fossil energy depletion, resource circulation processes, such as composting and renewable energy production rather than purification or incineration of agricultural byproducts, are technologies that reduce carbon emissions and the cost of processing by-products fully. The circular utilization of by-products is a necessary skill for building a sustainable society.
Status of technology	Various renewable energy production methods, composting technologies, and liquid ratio production technologies have been developed according to the characteristics of carbon, nutrient content, and other qualities of the by-products, and this is the stage where commercialization begins and is connected to industrial property rights.

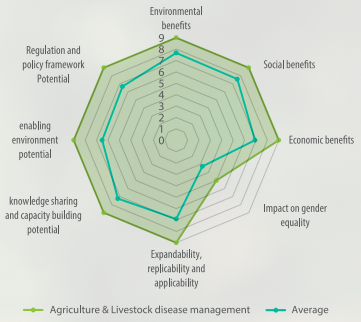
Applicable scale of technology	Technology Assistance	**Portable & Small scale**	Medium-size application	Large scale

Applicable target area	Livestock excrement public treatment plants, food waste collection centers, and agricultural processing plants.

Part 3. Influence to Sustainable Development	
Environmental benefits	Reduction of organic waste resources: Decrease reclamation volume and produce renewable energy. Production of organic fertilizer resources: Reduce the use of chemical fertilizers by composting and utilizing liquid fertilizer.
Social benefits	Health and hygiene: Reduce odors, fine dust, hygiene insects and leachate. Educational Accessibility: Implement educational projects on the production and utilization of renewable energy.
Economic benefits	Job Creation Effect: Jobs in organic waste disposal and renewable energy production and utilization are created. Increase productivity and competitiveness: Increase the added value of by-products.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: The carbon emissions trading system, the carbon reduction policy to comply with the Paris Convention, is readily available. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing: Education projects for composters, renewable energy producers and liquid fertilizer businesses can be implemented. Strengthening the capacity of the relevant management agencies: The Agricultural Technology Practicalization Foundation, Forestry Promotion Agency, and other agencies may be strengthened.
Potential for enabling environment to diffuse technology	Significant impact is expected with the establishment and implementation of government policies to implement the Paris Convention goals. The ripple effect will increase with the revitalization of the livestock circulation agriculture.
Potential contribution to establishing regulation and policy framework	Carbon credits and renewable energy sales will be activated. Policies to support incentives for cyclical farming can be established.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Agriculture & Livestock disease management
TNA Technology Class	-



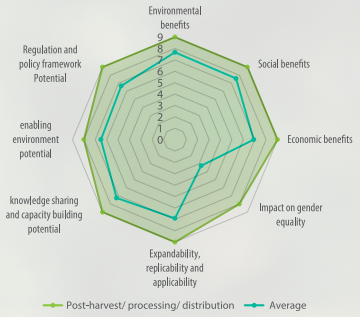
Part 2. Information on Technology

Definition of technology	**Technology Definition** The agricultural sector of this technology class includes technologies to minimize crop diseases caused by germs, viruses, fungi, and protozoans to enhance crop yields or quality. The livestock sector of this technology class includes prevention (biological safety) measures against diseases within vulnerable livestock groups and control technologies taken after an outbreak of livestock infection. **Examples of detailed technology** Agriculture: disease prevention and crop protection, crop disease sympathy and diagnosis, chemical and biological control and treatment, and integrated disease management. Livestock industry: controlled breeding, farm access control and quarantine of diseased livestock, development and improvement of antibiotic, vaccines, and diagnostic tools, evaluation of ethical-treatment options, and vector (pathogen) control technologies			
Importance and characteristics of technology	As climate change increases the incidence of various extreme phenomena, such as cold weather, heat waves, droughts, and monsoon rains, the growth of crops and the occurrence of pathogenic organisms ultimately cause crop diseases, which cause problems such as reduced imports and food shortages on farms, so managing crop diseases is critical. Livestock diseases cause substantial problems in the livestock production system, such as animal welfare, productivity, uncertain food security, income loss, and other negative effects on human health.			
Status of technology	The management of diseases in the agricultural and livestock sectors should continue to develop new technologies when there are signs of a recurrence of existing diseases, new infectious diseases, or a resistive medium.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Crop-growing farm and livestock farm			

Part 3. Influence to Sustainable Development	
Environmental benefits	Health of crops and livestock: The prevention and relief response technologies that can be generated by climate change contribute to the health of crops and livestock. These technologies can provide health and safety not only for agricultural products, but also for living organisms.
Social benefits	Health and safety: Because diseases in the agricultural and livestock sectors can be transmitted to people as well as crops and livestock, the response technology contributes not only to animal welfare but also to human health and safety. Food security: Contributes to food security through the yield and quality of agricultural products, stable production of livestock products, and other factors.
Economic benefits	Poverty-relief effect: Poverty-relief effect by eliminating uncertainty in food security due to diseases in agricultural and livestock products. Increased productivity and competitiveness: Increase productivity and competitiveness in related fields through the stable production of agricultural and livestock products.
Impact on gender	Moderate level of gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: It can be utilized in areas suffering from the same epidemic or in a similar epidemic resolution. Replicability : Very high.
Potential for knowledge sharing and capacity building	Knowledge sharing: The sharing of knowledge will occur actively because the workers involved in agricultural and livestock industries must have a sufficient understanding of this technology, and the relevant management agencies must also know exactly how to deal with disinfection and aid.
Potential for enabling environment to diffuse technology	It is highly likely that a technology diffusion environment will be created because of the need to create an environment in which the technology can be propagated against similar infectious diseases.
Potential contribution to establishing regulation and policy framework	Because the spread of information, knowledge, and technologies through various communication systems is vital, it is highly likely to contribute to the creation of a policy system that can assist it.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Post-harvest/ processing/ distribution
TNA Technology Class	Food conservation, Food conservation and grain storage



Part 2. Information on Technology

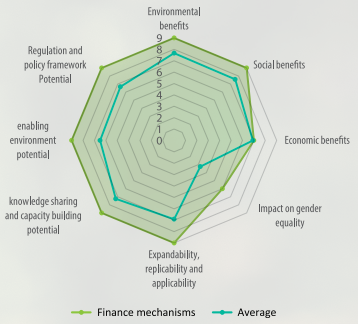
Definition of technology	**Technology Definition** This technology includes post-harvest management and storage, transportation and distribution to necessary areas, food processing, and technology that greatly affects human health after securing food security and food quality. **Examples of detailed technology** Food preservation technology: utilization of natural substances and drying, among others. Food storage: bio-packaging and refrigeration, among others. Food processing: Water consumption reduction technology, renewable energy use, and other technologies.
Importance and characteristics of technology	The agri-food storage, distribution, and processing industries are energy-intensive and highly related to human life. They play a critical role in reducing greenhouse gas generation by reducing the energy consumption needed for storage, drying, refrigeration, and processing and replacing fossil fuels with renewable energy. This technology determines food security, food quality, and the economic feasibility of food.
Status of technology	Although technologies for storing, distributing, and processing agricultural and livestock products have been developed and commercialized for a long time, processing and renewable energy utilization are areas where technological development should be continuously studied in the future.

Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Agricultural and livestock farmers, food industries, food researchers (government, private sector, schools).			

Part 3. Influence to Sustainable Development	
Environmental benefits	Greenhouse Gas Reduction: It greatly contributes to improving the efficiency of energy needed for storing, drying, refrigeration, and processing and reducing greenhouse gas generation through energy conversion.
Social benefits	Health and safety: The safe processing/storage/distribution system of agricultural and livestock products contributes to the improvement of food quality, which contributes to the health and safety of the people. Food security: Effective food storage and preservation technologies contribute to the food security of each country.
Economic benefits	Poverty Mitigation Effect: The technology of storage and preservation of agricultural and livestock products contributes to the stable long-term supply and demand of food and is effective in alleviating poverty in developing countries. Income generation in related fields: New jobs can be created through the paradigm of energy conversion in the process of food processing, storage and distribution, and contribute to the income generation of the related workers.
Impact on gender	Because the workers in food processing factories are predominantly women, the development of this technology significantly affects gender.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: It is likely to spread to similar industries, such as fisheries. Replicability : Very high
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building: The capacity can be enhanced through various exchanges in related government agencies, farms, food industries, and others.
Potential for enabling environment to diffuse technology	Support for the spread of renewable energy utilization in the fields of food storage, distribution, and processing will be needed.
Potential contribution to establishing regulation and policy framework	It may be necessary to create regulations on the spread of renewable energy utilization in the fields of food storage, distribution, and processing.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Finance mechanisms
TNA Technology Class	Finance mechanism



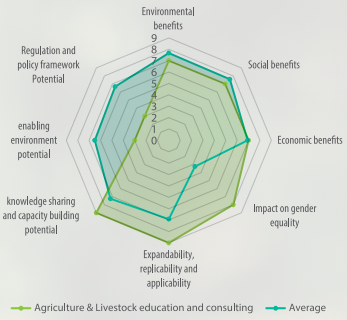
Part 2. Information on Technology

Definition of technology	**Technology Definition** Ecosystem services refer to various benefits from the natural environment and are classified as supply, control, culture, and support services. In addition, the management of ecosystem services includes the consideration of these ecosystem services in various plans to manage ecosystem services in an integrated manner or to include financial payments for ecosystem services through market-based measures.			
	Examples of detailed technology Supply Service: Food, water, and timber supply Control Service: Control over air quality, climate, and flood hazards. Cultural services: Providing recreational, tourist and educational opportunities and training Support Services: Essential basic functions such as soil formation and nutrient circulation Integrated ecosystem service management and market-based measures, among others.			
Importance and characteristics of technology	The destruction of the ecosystem and the consequent degradation of ecosystem services are caused by factors such as population growth, urbanization, and climate change. This ultimately affects the welfare and survival of the present and future of humankind. This requires efforts on the management of integrated ecological services linking ecological services, economic services, and social-cultural services with human welfare and the consideration and practice of market-based measures, including macroeconomic perspectives and financial support for ecological services.			
Status of technology	Integrated management of ecosystem services and market-based measures are areas that have long been discussed and have novelty and originality, and it is necessary to develop new technologies.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Applicable to all areas associated with the ecosystem, relevant policy ministries, local communities			

Part 3. Influence to Sustainable Development	
Environmental benefits	Ecosystem preservation: Contributes to the conservation of the ecosystem by investing in the creation and maintenance of various ecosystems in the natural environment. Conservation of the global environment: Conservation of the ecosystem and management of integrated ecosystem services globally contribute to the conservation of the global environment.
Social benefits	Quality of human life: Stable ecological service management contributes to the quality of human life by promoting tangible and intangible factors such as human health and rest, and by preserving the natural environment.
Economic benefits	Resource Supply: Ecosystem conservation has a positive effect on the structure of agricultural and livestock resources and contributes to an increase in these products. Recreational Industry: Recreational fields included in the agricultural industry ecosystem service create new jobs.
Impact on gender	Improving the vulnerability to climate change through the conservation of the natural environment and the development of the related technology is positive for women's adaptation to climate change.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: It is highly likely that the technology will be applied to areas with similar environments. Replicability : Very high
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: Related knowledge can be shared through holding workshops related to ecosystem services. Empowerment of relevant management agencies (government departments): Because it is a public service, government departments can take the initiative and strengthen their capabilities in related fields.
Potential for enabling environment to diffuse technology	New guidelines or systems for introducing new integrated management methods and market-based measures should be created through technologies for managing ecosystem services in the agricultural and livestock industries.
Potential contribution to establishing regulation and policy framework	Improvements to regulatory frameworks will be necessary, including revisions to regulations on new financial payments.

Part 1. General Information

Sector	Agriculture & Livestock
Category	Agriculture & Livestock education and consulting
TNA Technology Class	Research & development



Part 2. Information on Technology

Definition of technology	**Technology Definition** By conducting education, knowledge dissemination and advisory roles for farmers and livestock farmers on various topics of agricultural and livestock technology, advice is given on how to improve agricultural and livestock work, such as farm management, crop circulation, soil conservation, livestock breeding and feed supply, new machine use and marketing, and education on adapting to climate change for agricultural and livestock farmers.
	Examples of detailed technology Technical advice on the field of agricultural and livestock products Technical training in the field of agricultural and livestock products
Importance and characteristics of technology	As agricultural and livestock farmers must quickly recognize and cope with various changes such as climate change and the consequent variations in the environment, the occurrence of new diseases, new methods of farming and livestock, and the development of new varieties, the dissemination of knowledge is vital and can provide various benefits such as increased production, increased income, and prevention of damage.
Status of technology	Although consulting and training on agricultural, livestock, and livestock sectors are actively conducted primarily by government departments, the degree of system deployment varies greatly depending on the country.

Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Agro-farmers, government agencies related to agro-farmers			

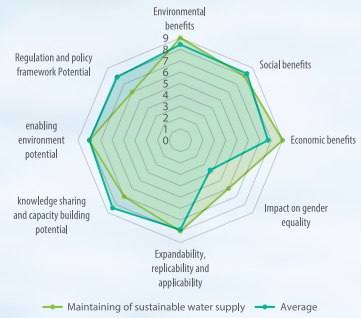
Part 3. Influence to Sustainable Development	
Environmental benefits	Sustainable agricultural and livestock technology: Disseminate sustainable agricultural and livestock technologies and improve technological level.
Social benefits	Health and safety: Promote the technical level of agricultural and livestock workers through relevant technical education and consulting. Food security: Securing food security in accordance with the promotion of agricultural and livestock technology levels.
Economic benefits	Expand Industry-Academic Cooperation: Jobs are created for academic professionals through consulting. Income-generating capacity in the relevant sector: Increased productivity by enhancing the technological level of agricultural and livestock workers.
Impact on gender	Increasing the spread of agricultural and livestock technology increases benefits to women.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: It is likely that the technology will be expanded only in similar fields among the agricultural and livestock industries. Replicability : Very high
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: Education and consulting cases can be shared periodically, and workshops can be held. Empowerment of relevant management agencies (government ministries): Government agencies can strengthen their knowledge of related work by sharing educational and consulting cases.
Potential for enabling environment to diffuse technology	Potential for enabling the environment seems weak because the technology expansion is extremely repetitive.
Potential contribution to establishing regulation and policy framework	Because technology expansion is extremely repetitive, its contribution to the creation of regulatory frameworks, such as laws and systems, for activating the technology seems weak.

b. Water (7)

Technology Section	Definition
Maintaining of sustainable water supply	Technology to maintain and increase the capacity of water to enhance the safety of water facilities from various threats such as abnormal rainfall, earthquakes, and deterioration of facilities, and to manage the entire water supply process from the supply source to the faucet.
Monitoring & early warning for water resources	Technology that includes quantitative rain forecasting and decision-making techniques for efficient water management amid extreme floods, frequent abnormal droughts and severe regional seasonal changes in precipitation including water level and flow observation (monitoring). e.g. Monitoring and early warning system for flood damage reduction, dam condition observation, etc.
Water quality assurance	Establishing a preventive water quality safety management system, minimizing the ecological impact of changes in water quality, and applying various water quality ecological restoration technologies to enhance the sustainable development and utility value of water resources facilities. e.g. Sewage treatment and management, water purification system, water quality management, etc.
Integrated water resource management	Integrated management of water quality, quantity, water ecology, environment, etc., which has been managed individually in consideration of all matters affecting water management in the region. e.g. Water demand and supply management, watershed management
Water-related disaster risk management	Pre-emptive drought and flood response, urban flooding and damage reduction technologies through monitoring of flood-stricken areas and drought-prone areas and establishment of an operational plan for the flood-watershed season also including water level and rainfall data monitoring systems and water resource management infrastructure. e.g. Disaster prevention and disaster mitigation infrastructure, etc.
Service management of water ecosystem	Policy design that includes upstream water source management funding for the protection of water resources ecosystems and a system for levying environmental charges on water users, etc. e.g. Watershed management contract, water quality credit, land purchase/rental limit, watershed environment-friendly certificated product, tax for watershed conservation and protected areas.
Water education and consulting	Educational framework, building competencies, expanding public acceptance, sharing information, tourism, policy consulting, etc.

Part 1. General Information

Sector	Water
Category	Maintaining of sustainable water supply
TNA Technology Class	Desalination of saltwater, Drip Irrigation, Extraction of groundwater, Water catchment and harvesting, Water saving technologies, Water supply system and storage



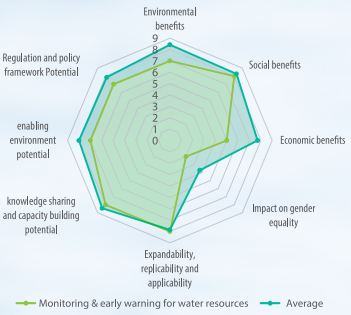
Part 2. Information on Technology

Definition of technology	**Technology Definition** This includes technologies to increase the sustainability of the water supply by applying technologies for the development and management of water resources, including those related to the use of water resources in the basin, the development of alternative water resources, and the diversification of water sources, to ensure the stability of water supply, such as domestic water, agricultural water, and industrial water.			
	Examples of detailed technology Seawater desalination Irrigation Water Supply System			
Importance and characteristics of technology	Water shortages act as a negative factor for not only basic human life but also the development of the country's industry, so it is important to stabilize the water supply by securing a system and technology that can continuously supply water. Therefore, a technology that increases the efficiency of water use and secures alternative water resources is needed.			
Status of technology	Advanced countries are applying smart water grids that combine various target technologies to increase water supply efficiency, and developing countries should prioritize technology advancement that improves water resources development and water efficiency.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Country, city, stream.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Biodiversity: The technology benefits biodiversity by securing water resources.
Social benefits	Health and safety: Securing the water supply benefits health and safety. Securing public confidence: Improves people's quality of life and the reliability of the water supply through securing the stability of water supply and sharing information.
Economic benefits	Increase in productivity and economic power: A stable water supply contributes to an increase in people's productivity and competitiveness.
Impact on gender	In some developing countries, the technology can reduce the risk to women and children when collecting water.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: It is likely to expand from unit scale to national scale. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building: There is a high possibility of capacity building through knowledge sharing, as many technologies of observations and early forecasting are already being shared.
Potential for enabling environment to diffuse technology	These technologies are highly likely to be linked to smart water grid technologies in the future.
Potential contribution to establishing regulation and policy framework	It is possible to improve the legal system through cooperation with specialized institutions in advanced countries.

Part 1. General Information

Sector	Water
Category	Monitoring & early warning for water resources
TNA Technology Class	Monitoring and modelling, Early warning system



Part 2. Information on Technology

Definition of technology	**Technology Definition** It includes technologies that can collect and manage water resources data and use climate change scenarios to predict future floodgate/water use/water quality changes through models, secure stable water resources, and enhance the ability to prevent and respond to water disasters.
	Examples of detailed technology Observation sensor Image analysis Geographic Information System
Importance and characteristics of technology	Various inputs are needed to predict future changes in water resources using physical models, which require observations. The basic data generally required for water resource modeling include weather, terrain, soil, and land use data. Weather data are based on ground observations, and recently, using satellites or radar. Topographic data and land use data generally require technologies that use satellite images, and soil data should be investigated directly on the ground and built as numerical data using GIS. Technologies that use sensors or CCTVs are generally used as early warning equipment.
Status of technology	Through real-time monitoring, the level of dams and beams classified by water systems, floodgate discharge, and the power generation status of dams can be identified, and advanced countries operate water management systems that focus on IT-based flow measurement monitoring technology.

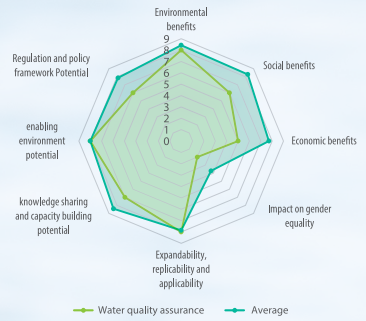
Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	Large scale

Applicable target area	Streams, city, farmhouse, waterfront areas

Part 3. Influence to Sustainable Development	
Environmental benefits	Hydrological Circulation Response: Allows for a smooth response to hydrologic cycles through water resource forecasting for future climate change.
Social benefits	Policy aspects: Contributes to water resource policy stably by analyzing the trend of water resources through continuous water resource observations.
Economic benefits	Damage Reduction: Utilizing the early warning system for natural disasters to minimize the damage to the national infrastructure and economic loss.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: It is likely to expand from the regional scale to the national scale. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building: There is a high possibility of capacity building through knowledge sharing, as many technologies of observation and early forecasting have already been shared.
Potential for enabling environment to diffuse technology	Although the initial costs are somewhat high to apply ground observation technology, using satellite images from developed countries may lead to a significant reduction in investment costs.
Potential contribution to establishing regulation and policy framework	It is possible to improve the legal system through cooperation with specialized institutions in advanced countries.

Part 1. General Information

Sector	Water
Category	Water quality assurance
TNA Technology Class	Wastewater treatment and recycling



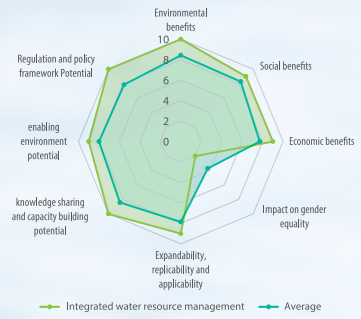
Part 2. Information on Technology

Definition of technology	**Technology Definition** This technology is designed to prevent adverse effects on water quality and water ecosystems due to increased volatility in temperature and precipitation patterns caused by climate change, including those related to water supply and sewage management, operations management of water purification plants and sewage treatment facilities, and wastewater treatment.			
	Examples of detailed technology Intelligent Water and Sewage Pipe Network Control Operation and management of water purification plants and sewage treatment facilities Elevation of wastewater treatment			
Importance and characteristics of technology	Because changes in water quality can increase the vulnerability to water use, it is necessary to develop technologies that can respond to changes in water quality caused by climate change in the future. Therefore, it is necessary to expand the water supply rate by expanding facilities in farming and fishing areas, build eco-friendly dams, expand underground water observation networks, explore measures to reduce green algae and minimize its damage, and establish measures to manage water quality in rivers and appeals.			
Status of technology	Studies predicting changes in the water temperature and floodgate environment due to the temperature changes of climate change have been fully carried out, and technologies for upgrading operations management methods and wastewater treatment methods for water treatment facilities have been fully completed.			
Applicable scale of technology	Technology Assistance	**Portable & Small scale**	Medium-size application	Large scale
Applicable target area	Industrial complex, small area			

Part 3. Influence to Sustainable Development	
Environmental benefits	Water environment: It contributes to the overall improvement of the quality of water resources, such as monitoring water quality and streamlining water treatment.
Social benefits	Diversification of water sources: Realize diversification of water sources through elemental technologies. Water resource value: We can promote the safe awareness of water resources, and contribute to the psychological stability of the people.
Economic benefits	Change in resource supply and sector productivity: Increase efficiency for water treatment facilities and supply stable water quality.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: It is likely to expand from the unit scale to the regional scale. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building: Many technologies are already being shared, so there is a high possibility of capacity building through knowledge sharing.
Potential for enabling environment to diffuse technology	In the future, these technologies are highly likely to be linked to improved water efficiency and seawater desalination technologies.
Potential contribution to establishing regulation and policy framework	It is possible to improve the legal system through cooperation with specialized institutions in advanced countries.

Part 1. General Information

Sector	Water
Category	Integrated water resource management
TNA Technology Class	Land conservation, Water management



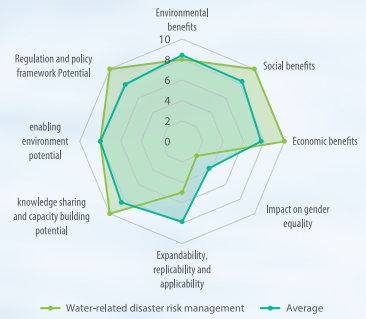
Part 2. Information on Technology

Definition of technology	**Technology Definition** This technology manages water in a basin unit to maximize synergy in terms of efficiency, fairness, and sustainability by integrating the entire basin into a single organism, considering all human and natural activities affecting the water in the basin.			
	Examples of detailed technology Integrated Management of water use and control environment ecology Development of waterfront/waterfront (City Water Circulation Evaluation Technology, River Amenity Space Technology). The establishment of integrated governance.			
Importance and characteristics of technology	Although the existing water management directions were operated separately for each function and purpose, such as quantity and water quality, the need for integrated water management is widespread as the risk of water management is expected to increase significantly due to the continued impact of climate change. For sustainable water use, technology for integrated management is needed to maximize the efficiency while considering the quantity, water quality, ecology, and culture. First, the production of additional water-related information and active sharing of data by water management agencies should consider the overall water circulation.			
Status of technology	Korea is included in countries where integrated water management is well implemented but is low among countries with poor water management conditions, such as the Netherlands and Japan.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	**Large scale**
Applicable target area	City, river basin, and others.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Water environment: To create a healthy water environment balancing quantity and water quality, ecology, energy and culture. Water culture: Realize a cooperative water culture based on efficiency, fairness, and persistence.
Social benefits	Social conflict: It resolves conflicts between water resource-related conflict areas in the basin.
Economic benefits	Budget efficiency: Reduce new facility development and recovery costs (prevent duplicate overinvestments).
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: It is highly likely to expand its scalability to include water use and control, the environment, ecology, water supply, and energy. Replicability: Very High
Potential for knowledge sharing and capacity building	Capacity Enhancement of Related Institutions: There is a high possibility of sharing knowledge among governments, local governments, and public institutions to establish an integrated governance.
Potential for enabling environment to diffuse technology	It is necessary to establish a legal and institutional basis for the performance of water management.
Potential contribution to establishing regulation and policy framework	The national government, local governments, institutions and the people all need to improve their consistent communication systems.

Part 1. General Information

Sector	Water
Category	Water-related disaster risk management
TNA Technology Class	Resilient infrastructure, River protection, Risk management and disaster prevention



Part 2. Information on Technology

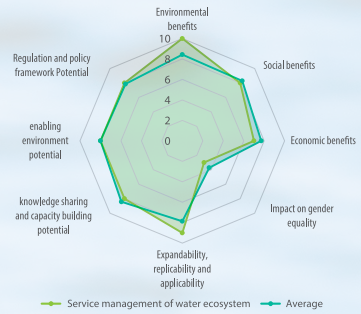
Definition of technology	**Technology Definition** The technology is designed to establish a safe and preventive adaptation and defense system for disasters caused by climate change, such as floods and droughts, for urban and river watersheds with preemptive drought and flood response and damage reduction technologies through the monitoring of flood-damaged and drought-prone areas.
	Examples of detailed technology Flood survey/measurement/modeling, Urban flood disaster planning and design Operation of water control facilities (preventive flood warning) Remodeling of deteriorated facilities Drought prediction and response.
Importance and characteristics of technology	Due to climate change, the possibility of flood damage is increasing rapidly as the occurrence of torrential rain and the intensity of rainfall increase compared with the past, and local drought is intensifying due to the increase in drought frequency and intensity. As a result, demands for the crisis and disaster-response management of water resources are increasing in preparation for severe water disasters and water shortages such as floods and droughts. In order to ensure the safety of the people in response to the threat of such disasters and to improve the ability of the entire society to adapt to climate change, advanced measures in rivers and watersheds and artificial intelligence analysis tools are needed to cope with the need for composite disaster response technology in the entire cycle of flood control.
Status of technology	Although the preparation measures for coping with flood damage have been well established according to the existing flood design strength, the technology for predicting flood damage in advance is still developing, and the linkage of flood disasters is insufficient for integrated water management.

Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	**Large scale**
Applicable target area	City, river basin, river facilities and others.			

Part 3. Influence to Sustainable Development	
Environmental benefits	River Environment: It secures the sustainable soundness of streams and prevents the streams from drying.
Social benefits	Social safety: Ensure the safety of the people (reducing human life damage), and secure the water control stability of repair facilities.
Economic benefits	Natural disaster damage: It reduces property damage caused by water disasters.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: The scalability of a business will be normal because it seeks social values that are in the public interest rather than projects for economic benefits. Replicability: Moderate
Potential for knowledge sharing and capacity building	Empowerment of Related Institutions: There is a high possibility of sharing knowledge among governments, local governments and public institutions seeking social values in line with the public interest rather than projects for pursuing economic benefits.
Potential for enabling environment to diffuse technology	It is necessary that required technology conforms to public values and is linked to the relevant laws and institutions.
Potential contribution to establishing regulation and policy framework	The government, local governments, institutions, and the public all need to improve their consistent communication systems to respond to disasters.

Part 1. General Information

Sector	Water
Category	Service management of water ecosystem
TNA Technology Class	Finance mechanism



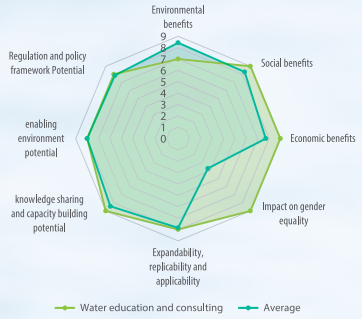
Part 2. Information on Technology

Definition of technology	**Technology Definition** This includes various benefits from the water resources ecosystem, and it manages various benefits that humans receive from the ecosystem, such as greenhouse gas reduction, water purification, food chain maintenance, and natural experience.			
	Examples of detailed technology Control service: CO2 absorption, pollutant removal, and soil fertility Cultural service: Reduction of heat waves and recreation.			
Importance and characteristics of technology	As the ecological environment changes, directly or indirectly, due to climate change, the environment suitable for growth may change, and wetland areas are expected to decrease. This can lead to a decrease in habitat area and a decrease in species diversity. As such, the benefits of humans through the water ecosystem are gradually decreasing, it is necessary to manage water ecosystem services using technologies capable of conserving and restoring the water ecosystem.			
Status of technology	This technology is considered novel and original because it has not been long since discussions on the integrated management of water resources ecosystem services and market-based measures began. In addition, ecosystem services are applicable in other areas, so there is a good chance of expansion.			
Applicable scale of technology	**Technology Assistance**	Portable & Small scale	Medium-size application	Large scale
Applicable target area	Area subject to management of aquatic ecosystem services, such as upstream and downstream watersheds and sources of rivers.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Biodiversity: Conservation of water ecosystems and protection of biodiversity in water ecosystems through the application of water ecosystem service management technology.
Social benefits	Water quality and culture: Through water ecosystem service management technology, humans enjoy various benefits, such as water purification and nature experiences, among others.
Economic benefits	Ecosystem value: The management of aquatic ecosystem services increases incomes, productivity, and competitiveness.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: There is a possibility of expanding into similar projects through the application of the technology. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and workshop: It is possible to share such knowledge through a workshop on ecosystem services. Empowerment of relevant management agencies (government ministries): Because it is a public service, government departments can take the initiative and strengthen their capabilities in related fields.
Potential for enabling environment to diffuse technology	Water ecosystem services are likely to create a technology diffusion environment for climate change response technologies, which must be managed not only in coastal areas but also in inland areas worldwide.
Potential contribution to establishing regulation and policy framework	It is necessary to improve regulatory frameworks, such as amending regulations on new financial payments, and establish and introduce new guidelines or systems following the introduction of new integrated management methods and market-based measures through aquatic ecosystem service management technology.

Part 1. General Information

Sector	Water
Category	Water education and consulting
TNA Technology Class	Organisational structure and capacity, Educational framework, Information and awareness



Part 2. Information on Technology

Definition of technology	**Technology Definition** It includes consulting and education programs on the technologies needed throughout the water sector, including education frameworks, capacity building, expansion of public acceptance, information sharing, tourism, and policy consulting.				
	Examples of detailed technology Advisory on technologies for water resources and aquatic ecology Education on technologies related to water resources and aquatic ecology.				
Importance and characteristics of technology	There is still a limit to solving the problems that technology transfer faces and education programs for capacity building are important to help developing countries internally strengthen their capabilities for sustainable development. To realize technology transfers, policies and infrastructure need to be implemented as well, so do activities are needed to derive the necessary elements.				
Status of technology	It is necessary to establish the conditions for infrastructure deployment so that target technologies can be successfully transferred. Consulting and education should be promoted through assessment of the level of knowledge and social acceptability in the region and country to which the target technology is transferred. Since education, information-sharing, and social availability are important factors in other areas, there is a high possibility that they will be extended to other technology fields.				
Applicable scale of technology	**Technology Assistance**	**Portable & Small scale**	**Medium-size application**	**Large scale**	
Applicable target area	A village, district, country, etc.				

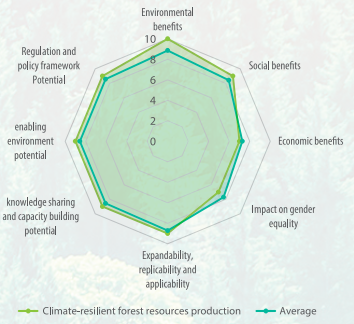
Part 3. Influence to Sustainable Development	
Environmental benefits	General water resources environment: This is not a technology that rather than directly contributing to protecting the environment, indirectly contributes to the protection of the general water environment by disseminating sustainable water technology and increasing the level of technological advancement.
Social benefits	Sustainable development: Through education and training in the water sector and capacity-building, it contributes greatly to the sustainable development of the relevant region and society. The education and consulting supports the smooth operation and management of the technology after it is transferred.
Economic benefits	Competitiveness enhancement: The capacity of water-related workers is strengthened, contributing to the improvement of their capacity to earn income.
Impact on gender	In underdeveloped areas, women have fewer opportunities to receive education, so they can reduce their climate vulnerability by gaining expertise through capacity-building. It is expected to contribute to women's social advancement and economic independence.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: It is highly likely that the project will be expanded to other areas by discovering, implementing, and implementing capacity-building projects. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: A continuous network can be built through regular international workshops and demand for capacity-building can be jointly identified and systematically implemented through the workshops as well. Reinforcement of institutional competency: It is possible to contribute to the development of the relevant country through consulting, feedback, etc. in the relevant field continuously during the implementation of the project.
Potential for enabling environment to diffuse technology	The base of the overall knowledge environment will be expanded in each country through capacity-building projects, and additional projects linked to the results of the competency education or links with other projects are expected.
Potential contribution to establishing regulation and policy framework	In the course of carrying out this project, a consulting is required to improve regulations and governance of the relevant country, it is possible to contribute to the creation of a foundation for technology transfer.

C. Forestry & Land (7)

Technology Section	Definition
Climate-resilient forest resources production	Technology to raise the value of forestry and land ecosystem management for utilization of resources and to efficiently create forest resources through climate-adaptable genetic variety and species management.
Forest disaster risk management	Technology to minimize soil erosion, disaster forecasting and management, and pest response technology. e.g. early detection of forest fire and landslide, forest pest prediction and management.
Forest carbon sink management	Management of soil nutrition and moisture in forest and land ecosystems, monitoring of carbon conservation in forest flatlands.
Forestry & Land ecosystem service management	Design of an environmental payment service for the protection of livestock, genetic conservation and ecosystems in forest areas. e.g. taxes on ecotourism, exploration rights on biological resources, biodiversity-friendly products, biodiversity credit, tax on conservation areas, biodiversity resource management, forest logging rights purchase.
Forestry & Land ecosystem restoration	Promoting biodiversity of damaged forests and land to help vegetation restoration, combined with landscape conservation, management of deterioration by related disasters and ecological stability.
Forest & Land ecosystem change detection and prediction	Prediction of environmental changes in forests and land due to climate change
Forestry & Land education and consulting	Education framework, building competencies, expanding public acceptance, sharing information, tourism, consulting, etc.

Part 1. General Information

Sector	Forestry & Land
Category	Climate-resilient forest resources production
TNA Technology Class	Agroforestry system, Forest management, Improved mining exploration



Part 2. Information on Technology

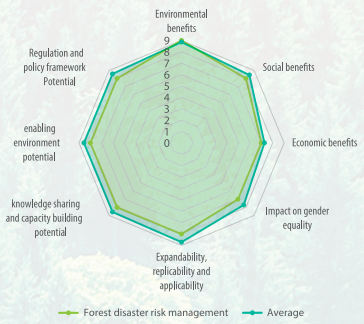
Definition of technology	**Technology Definition** Technologies that enhance carbon dioxide absorption by forests by promoting forest production in response to climate change include the renewal of forests using high-quality varieties, creation of double-decker forests through selective cutting forest management, expansion of new carbon sinks through the creation of urban forests, and expansion of the use of wood products.
	Examples of detailed technology Forest management/information: seedlings/forestry/forest treatment/harvesting, forest growth/harvesting models, forest GIS/RS Forest seed/genetic species: forest seeds/seed physiology/wood physiology ecology, forest genetic breeding/introduction/improvement/development, special use/honey source/loss/landscape tree improvement fostering Forest biotech: forest genetics, forest molecular biology
Importance and characteristics of technology	To enhance forest carbon absorption and adapt to climate change, due to the large-scale examination of alpine coniferous species due to abnormal weather condition, such as high temperature and drought, installation of wind power plants, and reduction of absorbent sources due to the increases in acid use such as solar energy development, it is necessary to update species and enhance forest production functions through proper forest management by improving forest density.
Status of technology	There is a growing need to develop forest management technology, and the development of technology for superior breeding is being pursued worldwide. With the aim of implementing international agreements, international policies for the legalization of greenhouse gas reduction technology using forest carbon trading is being developed.

Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	forests, mountainous areas			

Part 3. Influence to Sustainable Development	
Environmental benefits	Sustainable forests: Conserves sustainable forest ecosystems and promotes technology development to create sustainable utilization space.
Social benefits	Energy safety: Contributes to climate change adaptation elasticity by providing measures for reducing greenhouse gases, which cause climate change.
Economic benefits	Productivity enhancement: Responds to climate change contributing to productivity in agriculture, forestry, and civil engineering Job creation: Contributes to job creation in the forest sector
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: This technology is likely to spread to areas with similar climate conditions. Replicability: Moderate
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: This technology for promoting forest production is likely to be shared through various academic societies and workshops depending on R&D performance.
Potential for enabling environment to diffuse technology	Production promotion and carbon absorption technology for the forest environment is a technological field with very high demand, and it is highly likely that an environment for technology expansion will be created.
Potential contribution to establishing regulation and policy framework	Carbon emission rights will be active in regulatory and policy systems in each country as they are traded through international agreements.

Part 1. General Information

Sector	Forestry & Land
Category	Forest disaster risk management
TNA Technology Class	Forest conservation, Land conservation, Reforestation, Early warning system, Risk management and disaster prevention



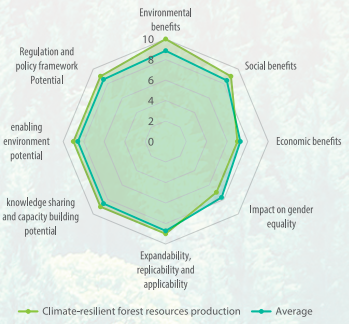
Part 2. Information on Technology

Definition of technology	**Technology Definition** This is a technology that establishes and controls preventive forest management technologies and early warning systems to monitor damage caused by forest fires, landslides, insect pests, tree pests, and forest degradation caused by abnormal weather and weather changes due to climate change and predict and analyze damage risks and vulnerabilities associated with future climate conditions.			
	Examples of detailed technology Forest fires: fire prevention/monitoring/recovery/restoration Landslides: landslide/storm-caused forest disaster prevention/monitoring/recovery/restoration, erosion control engineering, coastal forests Forest pests: forest microorganisms (fungi, bacteria, nematode), forest (arbor) pathology, forest pests (pine wilt nematode), Forest pests forecast/control.			
Importance and characteristics of technology	The increase in dry weather, earthquakes, soil creep, torrential rain, and insect pests is increasing forest disasters such as forest fires, landslides, and forest pest and disease. In particular, the accumulation of fuel materials in forests is raising the risk of forest fires, meaning that protection from forest disasters is urgently needed. In addition, it is necessary to protect areas vulnerable to soil disasters and provide ecofriendly prevention technologies.			
Status of technology	Advanced countries are starting to pursue climate change-adaptive forest management methods and pilot research. In particular, the United States is testing various forest management methods through the ASCC project, including strengthening forest ecosystem resilience and setting goals for the adaptation of forest ecosystems to future environments.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	forests, mountainous areas			

Part 3. Influence to Sustainable Development	
Environmental benefits	Forest environment: Promotes the conservation and diversity of forest ecology and improves the function of water cultivation of surface soil Carbon storage: In response to global warming, maintains the carbon emission reduction and carbon absorption functions of forests.
Social benefits	Health: Reduces heat damage by creating urban forests.
Economic benefits	Strengthening of productivity and competitiveness: Creates value through plant resources and contributes to forest disaster prevention and recovery.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: This technology is likely to spread to areas with similar climate conditions. Replicability: Moderate
Potential for knowledge sharing and capacity building	Knowledge sharing: Developed countries will respond actively with a sense of responsibility for countries suffering from deforestation and desertification.
Potential for enabling environment to diffuse technology	It is highly likely that the Green ODA will be expanded through support from developing countries and that and environment for the diffusion of technology among OECD DAC countries will be created.
Potential contribution to establishing regulation and policy framework	There is a possibility for contributing to the regulatory and policy framework as there is a need to reduce disasters caused by climate change.

Part 1. General Information

Sector	Forestry & Land
Category	Forest carbon sink management
TNA Technology Class	Monitoring of carbon sink



Part 2. Information on Technology

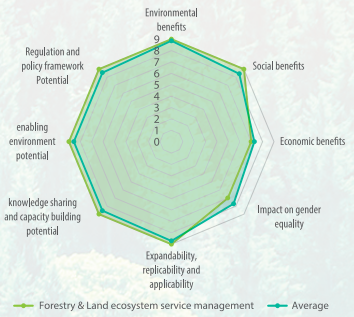
Definition of technology	**Technology Definition** This technology includes diagnostic evaluation due to the changes in soil by the climate change, improvement of polluted environment, collection of contrasting ecological information, and restoration planning, monitoring, and adaptation management technology combining the all the mentioned information above, including technologies for improving contaminated substrate, introducing bio selection and placement, and monitoring and adaptation management,
	Examples of detailed technology Forest ecology: forest (animal/plant/insect/microorganism) ecology, forest meteorology, physiology ecology for adapting to climate change, city ecology/landscape/green belt effects Conservation of forest, water, and soil: forest soil, material cycling, conservation of damaged land ecology/ restoration Policy for forest carbon: forest carbon offsetting policies/systems, carbon credits
Importance and characteristics of technology	It is necessary to analyze tree growth, improve soil, and prepare management measures according to soil conditions caused by deforestation: review changes in land use by MRV systems (measuring, reporting and verifying) and spatial information-based statistical techniques in the forest sector: and develop technologies that can improve sustainable and cost-effective land use.
Status of technology	Basic studies have been carried out for the establishment of a forest carbon accounting system. Recently, studies have been conducted on carbon accounting for entire forests, in addition to international conventions, development and upgrading of forest carbon models, and carbon accounting of wood products. In addition, efforts such as the establishment of forest activity data and commercialization of MRV are continuously needed to successfully commercialize the technology.

Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Forests, mountainous areas			

Part 3. Influence to Sustainable Development	
Environmental benefits	Greenhouse gas reduction: Reduces greenhouse gases through wood substitution effect, biomass use, forest fire behavior adjustment, forest conversion prevention, etc.
Social benefits	Provision of recreational space: Efficiently maintain forests to provide social benefits, such as clean water and habitats for wild animals and plants, and recreational spaces.
Economic benefits	Carbon emissions trading: Enables carbon trading through the offset market by promoting regional carbon absorption efforts based on afforestation.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: This technology is likely to spread to areas with similar climate conditions. Replicability: Moderate
Potential for knowledge sharing and capacity building	Knowledge sharing: Considering that about 25% of carbon dioxide emissions are absorbed by plants, the demand for related technology is high, and such technology is likely to be shared through related academic societies, national institutions, workshops, etc.
Potential for enabling environment to diffuse technology	Although the international market has yet to fully grasp the potential of the forest sector, this technology is likely to spread to countries that are favorable to forestry.
Potential contribution to establishing regulation and policy framework	Across society, policymakers agree on the need for relevant policies on sustainable forest management to be formulated, and there is a possibility that a related regulatory and policy system will be created.

Part 1. General Information

Sector	Forestry & Land
Category	Forestry & Land ecosystem service management
TNA Technology Class	



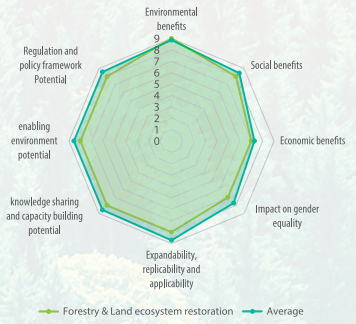
Part 2. Information on Technology

Definition of technology	**Technology Definition** The entire life-cycle management system, ranging from the primary resources obtained in forests and on land to complex services, such as climate, welfare, and education, can be established and various technologies can be applied to enhance the utility value of sustainable forest land ecosystem services.			
	Examples of detailed technology Life-cycle service management Convergence service system Supply-demand-based services.			
Importance and characteristics of technology	The forest land ecosystem, which is recognized as a carbon absorber, is an essential element for responding to climate change, and resources for daily life and economic activities are supplied through the management of the entire process of forest land ecosystem. A substantial amount of carbon is stored in biology and soil, so it has a high rate of exchange with the atmosphere and is directly linked to greenhouse gas emissions. Measures to minimize the impact of climate change and a service management system to improve adaptability are needed throughout the process, such as soil erosion, water shortages, salt growth in groundwater, food problems caused by reduced resource productivity, and carbon absorption, which can occur in the event of forest land ecosystem destruction.			
Status of technology	The management of forest land ecosystem services can be created considering climate change by utilizing the existing specialized technologies in each completed field and has unique independent technology factors in convergence with other areas, such as health, food, and welfare			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Applicable to all areas, such as forest land ecosystems and social cultures			

Part 3. Influence to Sustainable Development	
Environmental benefits	Conservation of biodiversity (including human survival), improvement of air quality, protection of water quality, and securing carbon sinks, among others.
Social benefits	It can ensure residential safety and food security.
Economic benefits	It provides a resource supply, job creation, and poverty alleviation.
Impact on gender	It reduces the physical burden on women due to increased productivity and expands economic activities and educational opportunities for women through the application of various technologies.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	It is possible to apply technology to forest land ecosystems with similar climates and terrain and to expand its convergence into related projects, such as agriculture.
Potential for knowledge sharing and capacity building	On/off-line case-study workshops. Operation of local training programs by similar climates or terrains Maximize knowledge sharing by establishing a cross-country colloquium.
Potential for enabling environment to diffuse technology	It is necessary to establish a protection system for the original technology for service management and follow-up business links across the ecosystem.
Potential contribution to establishing regulation and policy framework	It is necessary to establish a fiscal injection plan considering the impact of sustainable forest land use on food security, the economy, human rights, and society.

Part 1. General Information

Sector	Forestry & Land
Category	Forestry & Land ecosystem restoration
TNA Technology Class	Conservation and restoration, Improved management, Landscape connectivity



Part 2. Information on Technology

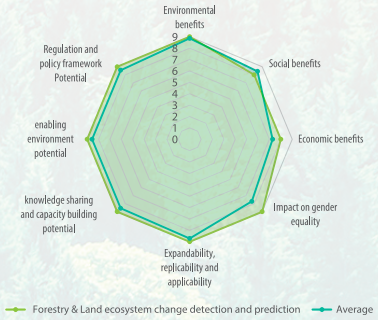
Definition of technology	**Technology Definition** The future value of a sustainable forest land ecosystem can be enhanced by evaluating the impact of climate change on the forest land ecosystem and applying various restoration technologies.
	Examples of detailed technology Improvement of biodiversity Restoration technologies for reforestation Comprehensive management of forest diseases/pests
Importance and characteristics of technology	It is necessary to verify effective alternatives through diagnostic evaluations, improvement of the pollution environment, collection and restoration plan of ecological characteristics information, development, and the application of modeling and adaptation management technology to utilize forest land ecosystem as a means of responding to the climate crisis.
Status of technology	The forest land ecosystem restoration field has novelty and originality by observing global changes and can be expanded to other areas.

Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	Large scale
Applicable target area	Species, clusters, ecosystems, progress, and others			

Part 3. Influence to Sustainable Development	
Environmental benefits	It has environmental effects such as the conservation of biodiversity, enhancement of ecosystem functions, and production of primary resources.
Social benefits	It is expected to improve health, safety, and food security, among other benefits.
Economic benefits	We can expect such economic effects as securing quality jobs, alleviating poverty, generating income, and supplying resources.
Impact on gender	Various technologies for the restoration of the forest land ecosystem can be applied to provide economic activities (job, income generation) and educational opportunities.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	It is possible to observe global changes and expand into similar projects in areas that require the application of various technologies.
Potential for knowledge sharing and capacity building	There will be a knowledge network platform for global cooperation. A knowledge-sharing system will be established for the common use of the database.
Potential for enabling environment to diffuse technology	It is necessary to establish a communication channel of various global technology groups and a system for joint utilization of the databases among ministries and to provide funding.
Potential contribution to establishing regulation and policy framework	Long-term fiscal input and ongoing monitoring are required to be used in response to climate change

Part 1. General Information

Sector	Forestry & Land
Category	Forestry & Land ecosystem change detection and prediction
TNA Technology Class	Monitoring and modeling



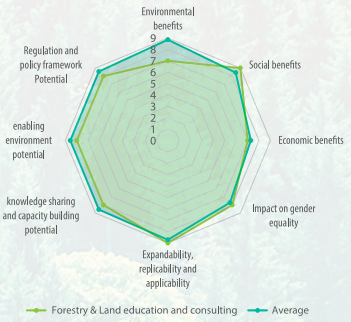
Part 2. Information on Technology

Definition of technology	**Technology Definition** Long-term monitoring of the variations in the forest land ecosystem and an integrated interpretation of the ecological information can diagnose changes and promote the health of forest land environment.			
	Examples of detailed technology Monitoring of forest climate Impact forecasting Disaster prediction Risk assessment.			
Importance and characteristics of technology	Various technologies need to be developed and applied to assess vulnerabilities and cope with the climate crisis by monitoring micro, macro, short, and long-term forest land environments and establishing a forecasting system.			
Status of technology	It is possible to create new markets by monitoring the characteristics and changes in the forest land ecosystem, making long-term predictions, and applying convergence to other areas.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Mountain weather, disaster prediction, risk assessment.			

Part 3. Influence to Sustainable Development	
Environmental benefits	It is possible to reduce the risk of destroying the forest land ecosystem, preserve biodiversity, and secure the health of the forest land ecosystem.
Social benefits	Environmental policies will be improved and established, health and safety will be secured regarding climate change, and social costs due to damage to the forest ecosystem will be reduced.
Economic benefits	It is expected to reduce poverty, increase environmental competitiveness by securing resources, expand jobs, and generate income.
Impact on gender	It is expected that access to technology will be improved and economic activities will be expanded through knowledge sharing using the predicted results.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Based on the establishment of a long-term cooperative system, chances are high that it will be expanded and applied to similar fields.
Potential for knowledge sharing and capacity building	Workshops can be operated on discovering cooperative policies between countries by sharing knowledge on forecasting environmental changes. A shared system for applicable technologies using predictive results can be provided.
Potential for enabling environment to diffuse technology	It is necessary to monitor the development of technology through long-term financial inputs and to expand the scope of cooperation between countries.
Potential contribution to establishing regulation and policy framework	It is necessary to create a cooperative framework by utilizing the communication system between countries and to apply and monitor technologies simultaneously.

Part 1. General Information

Sector	Forestry & Land
Category	Forestry & Land education and consulting
TNA Technology Class	Educational framework, Information and awareness



Part 2. Information on Technology

Definition of technology	**Technology Definition** By acquiring the right knowledge of the forest land and forming values, we can improve sensitivity and enhance sustainable conservation and utilization. **Examples of detailed technology** Forest experience Ecotourism Tree doctor			
Importance and characteristics of technology	It is necessary to develop and apply various strategic technologies to improve the sensitivity of sustainable conservation and utilization of forest land ecosystems by raising awareness through quality education and experience of the life cycle.			
Status of technology	Various convergence programs can be applied to enhance awareness and sensitivity of the life cycle, and they have creativity in terms of utilizing forest land ecosystems.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Urban forests, ecological parks, natural forest areas, and others.			

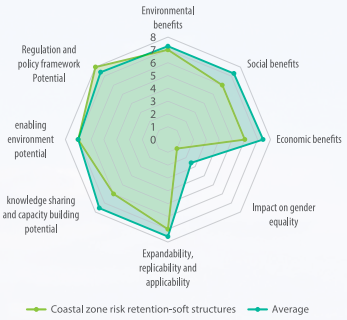
Part 3. Influence to Sustainable Development	
Environmental benefits	It has the effect of preserving biodiversity by promoting environmental sensitivity and securing resources by using sustainable forest ecosystems.
Social benefits	We can expect to improve access to education by utilizing forest land ecosystems and improve health by improving immunity.
Economic benefits	It is expected that the expansion of jobs will generate income and increase private investments in consulting/tourism.
Impact on gender	The expansion of educational opportunities regarding the forest land ecosystem will reduce the accident/death rate of women and expand the scope of women's economic activities due to the expansion of educational opportunities.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	By introducing the original technology, it can be expanded to similar fields and applied with optimization that reflects regional characteristics.
Potential for knowledge sharing and capacity building	Education programs and workshops considering regional characteristics will be conducted. Knowledge sharing is possible, such as continuous monitoring results according to life cycle or industrial cycle.
Potential for enabling environment to diffuse technology	It is necessary to design a program considering the linkage of follow-up projects and to link various technologies.
Potential contribution to establishing regulation and policy framework	A monitoring system for the results of application should be prepared in consideration of the differences in policy conditions for each community.

d. Marine, Fisheries and Coastal Zones (7)

Technology Section	Definition
Coastal zone risk retention-soft structures	Restoration of natural functions of coastal wetlands, construction of land/ embankment to prevent erosion, prevention of inflow/leakage of groundwater or surface or sea water, transplanting healthy alternative trees, responding to flood control, etc.
Coastal zone risk retention-hard structures	Establishing safe and flexible infrastructure to cope with coastal disasters caused by abnormal phenomena such as (coastal) flooding, typhoons, heavy rains, and high water temperatures due to rising sea levels.
Coastal environment monitoring and risk assessment/prediction	Prediction of changes in the marine coastal environment due to climate change (increase in sea level, change in ocean currents/side, increase in sea temperature, etc.) and environmental impact assessment, etc.
Disease management of marine resources	With growing interest in the safety of the marine environment and marine ecosystem, the response to diseases arising from fisheries resources, safety surveys, rapid diagnosis kits and related management technologies are necessary technologies.
Production of marine resources and aquaculture	To enhance the productivity of marine and coastal ecosystems by protecting coastal environments, marine life habitats, protected species, etc. e.g. Genetic breeding, strengthening of aquaculture facilities.
Marine ecosystem service management	Response management of climate change to ensure that various services, such as marine resources, tourism and leisure, are sustainable by the marine ecosystem.
Marine, Fisheries and Coastal Zones education and consulting	Education framework, building competencies, expanding public acceptance, sharing information, tourism, consulting, etc.

Part 1. General Information

Sector	Marine, Fisheries and Coastal Zones
Category	Coastal zone risk retention-soft structures
TNA Technology Class	Beach nourishment, Coastal management, Coral reef restoration, Dune restoration, Wetland restoration



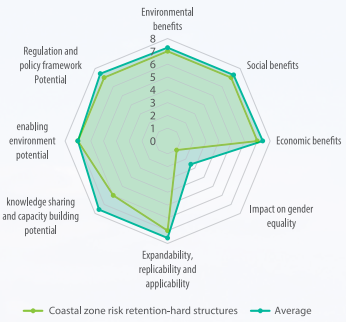
Part 2. Information on Technology

Definition of technology	**Technology Definition** Marine ecosystem maintenance is carried out through the restoration of the raw land of the primary producer, which is the basis of the marine ecosystem, including the use of restoration technology such as artificial reefs.			
	Examples of detailed technology Beach creation and coastal management Coral reef recovery Restoration of dunes and wetlands			
Importance and characteristics of technology	Due to climate change, sea levels are rising, and coastal erosion and swelling waves are occurring amid reckless development. Coastal erosion creates sand cliffs and collapses shafts, posing significant risks. The coast plays a role in protecting the land from storms and tsunamis, but due to erosion, coastal waters have become deeper, weakening their land protection function. To respond to this, marine and coastal restoration technologies are needed. Wetlands are important as natural breakwaters that reduce the damages caused by disasters such as typhoons and tsunamis and have high ecological value as habitats for animals and plants.			
Status of technology	Efforts to restore marine life from harm species diversity, discharge to restore populations, and removal of harmful organisms have been made steadily across developed countries. In addition, efforts are being made to strengthen the international network of marine reserves and manage maritime coastal areas in a long-term manner around the world.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	**Large scale**
Applicable target area	coasts, coastal areas			

Part 3. Influence to Sustainable Development	
Environmental benefits	Marine ecosystem: Protects the food chain by increasing biodiversity and preserving marine ecology through marine and coastal restoration. Marine coastal environment: Prevents marine erosion and increases carbon storage.
Social benefits	Environmental restoration: Promotes sustainable marine coastal management by expanding the social acceptability of the technology in question, thereby ensuring environmental safety.
Economic benefits	Jobs and fisheries resources: The technology can create jobs and increase the productivity and competitiveness of fisheries resources.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: Similarities in land management allow for application of technology to relevant areas. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: Knowledge sharing can be conducted through specialized knowledge sharing workshops on the technology concerned.
Potential for enabling environment to diffuse technology	There is a possibility that technology transfer will create and environment for the diffusion of the technology to other areas, such as marine ecosystem restoration.
Potential contribution to establishing regulation and policy framework	Basic policy structures should be well-established for the transfer and dissemination of the relevant technology, and regulatory and policy systems should be created through the introduction of environmental taxes, such as environmental payments.

Part 1. General Information

Sector	Marine, Fisheries and Coastal Zones
Category	Coastal zone risk retention-hard structures
TNA Technology Class	Hard coastal protection, Early warning system, Risk management and disaster prevention



Part 2. Information on Technology

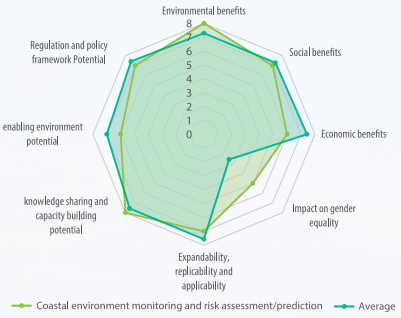
Definition of technology	**Technology Definition** The technologies for observing, alerting, evaluating, responding to, and managing coastal disasters caused by climate change include the real-time observation of coastal disaster phenomena such as blue and tidal waves, numerical modeling analysis, correlation analysis, statistical analysis-based forecasting, alarm technology, and risk assessment techniques for disaster factors.
	Examples of detailed technology Early warning system Establishment of breakwaters, seawalls, and emitters.
Importance and characteristics of technology	According to the IPCC special report, sea level rise could reach up to 1.1 meters by 2100. Disaster response is the most important area of proactive preparedness and is an area in which government departments and related agencies around the world should respond organically. In addition to how to cope structurally, the government should simultaneously prepare to support the vulnerable, strengthen health damage prevention and management, and enhance disaster management system to ensure safety and a stable social foundation.
Status of technology	The Sendai Framework (2015-2030) for the Reduction of Disaster Risk provides a global framework with which policymakers can flexibly cope with disasters. Coastal areas vulnerable to maritime disasters are steadily installing buffers that reduce the impact of disasters. However, analyses of abnormalities under possible future scenarios of climate change are still in the research stage, and sufficient time is still needed for the results to be reflected in legislation.

Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	**Large scale**
Applicable target area	coasts, coastal areas			

Part 3. Influence to Sustainable Development	
Environmental benefits	Environmental conservation: Mitigates impact on the environment by reducing the damage caused by disasters.
Social benefits	Social safety: It is possible to enhance safety through the establishment of disaster base, enhance capacity through education, and expand social demand.
Economic benefits	Disaster damage reduction: Reduces the costs of damage recovery due to disasters, i.e. annual marine coastal disaster insurance payments. Fishery resources: Enhances the productivity of fishery resources through the conservation of marine ecosystems.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: The technology is necessary in any field to reduce damage from disaster. It is therefore expected that similar technologies will be expanded to other areas. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: Knowledge sharing can be conducted through specialized knowledge sharing workshops on the technology concerned.
Potential for enabling environment to diffuse technology	A marine coastal disaster has large fragility deviations by country and region, and there is a possibility that an environment will be created to enable the dissemination of this technology to areas where it requires.
Potential contribution to establishing regulation and policy framework	This technology can contribute to the creation of early warning systems in various ways, such as the establishment of a disaster alert system.

Part 1. General Information

Sector	Marine, Fisheries and Coastal Zones
Category	Coastal environment monitoring and risk assessment/ prediction
TNA Technology Class	Climate monitoring and forecasting, Monitoring and modeling



Part 2. Information on Technology

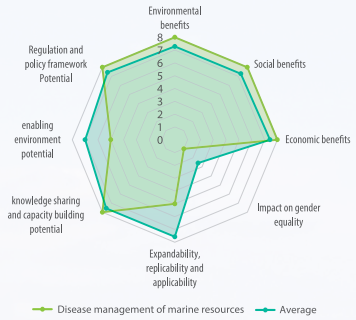
Definition of technology	**Technology Definition** The technology enables monitoring changes in the marine environment along the coast and interpret their variability to assess the effects of climate change and predict future changes to establish appropriate countermeasures.
	Examples of detailed technology Marine environment monitoring technology Marine environment variability evaluation technology Marine environment prediction Technology.
Importance and characteristics of technology	The coastal waters are a place where people engage in leisure and relaxation activities as well as active economic activities such as fisheries and shipping. Climate change will inevitably lead to changes in the marine environment and it is necessary to predict and establish effective response/management measures against the expected threats. Observation and analysis to identify and understand the characteristics of changes in the marine environment caused by climate change is the most basic technology that can predict changes in the marine environment along the coast. The expected changes in the marine environment occur through various processes, and each process is linked to each other and should be analyzed comprehensively. The coastal marine environment is dependent on changes in the external or global scale and should be linked to forecasts of variability in the global, regional sea scale.
Status of technology	This technology enables long-term monitoring, analyses, and reproduction of the effects of climate change for an evaluation and prediction of future changes. It is possible to predict changes in the marine environment due to regional climate change in connection with changes in the marine environment on a global scale.

Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	**Large scale**
Applicable target area	Coast, coastal sea, regional sea.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Marine Environment: It is possible to improve, preserve, and manage the marine environment more efficiently.
Social benefits	Health and safety: It can prevent or effectively respond to disasters and safety accidents in coastal waters, and social infrastructure is improved. Social awareness: People's awareness of coastal waters improves.
Economic benefits	Job Creation Effect: New industries related to the long-term monitoring of the ocean coast are created, and jobs are increased. Expanding Industry-Academic Cooperation: Currently, research and development is actively carried out, which will cooperate with the industry that wants to enter or enter the marine industry.
Impact on gender	More women will participate in the study.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: It will contribute to the improvement of relevant technologies (response to climate change) through the application of technology. Replicability: Technical application is possible for areas near the coast.
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building: Knowledge sharing and capacity building for big data processing analysis will be strengthened, and active knowledge sharing will be made between researchers and related institutions. In addition, international joint cooperation research will become more active.
Potential for enabling environment to diffuse technology	The relevant government ministries will actively work to develop follow-up projects to improve predictive accuracy, and will work harder to resolve legal and institutional barrier factors that hinder further climate change research.
Potential contribution to establishing regulation and policy framework	We will create a framework, including laws and systems, for the maintenance of long-term monitoring, and may organize and operate a public-private consultative body that includes the community to predict and respond to changes in the coastal environment.

Part 1. General Information

Sector	Marine, Fisheries and Coastal Zones
Category	Disease management of marine resources
TNA Technology Class	Biosecurity



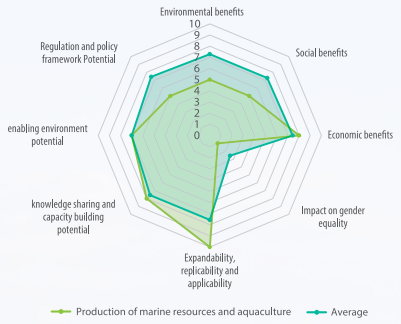
Part 2. Information on Technology

Definition of technology	**Technology Definition** It includes technologies that can cope with the emergence of new diseases in various marine products due to changes in marine sulfur caused by climate change, and the timing of existing diseases changes.			
	Examples of detailed technology Prevention of new diseases Diagnosis and countermeasures Development of prediction technology for fisheries and biological diseases Disease blocking and quarantine system			
Importance and characteristics of technology	It is also necessary to enhance strategies for responding to marine life diseases caused by climate change, including new types of marine life diseases such as Lake Virus disease, Salmon Alpha Virus disease, and leg lobster disease, and those that have been occurring only at certain times at high temperatures or at certain times throughout the year due to changes in marine sulfur caused by climate change.			
Status of technology	Although the risk of waterborne diseases is increasing due to climate change, there is a lack of measures to defend against infectious diseases and minimize losses, and basic data on physiological changes and adaptability due to marine acidification by marine life are insufficient.			
Applicable scale of technology	**Technology Assistance**	Portable & Small scale	Medium-size application	Large scale
Applicable target area	Fish farms, coasts, inland water.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Aquatic Ecology Protection: The marine life disease response technology protects the aquatic ecosystem, thereby providing the marine hydrophilic space and protecting the inland water ecosystem.
Social benefits	Food safety: Contributes to national fisheries policy by applying this technology, to high quality safety of fishery food.
Economic benefits	Poverty Mitigation Effect: By coping with marine life disease, the productivity of marine biological resources increases, which leads to food resources and has the effect of poverty alleviation.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: The application of this will not likely expand to agricultural and livestock. Replicability: There is a high possibility of technical use that can be applied to neighboring countries.
Potential for knowledge sharing and capacity building	Knowledge sharing and workshop holding: Through domestic and international cooperative systems such as academic conferences and workshops, it is possible to share the disease response system in the field of aquatic life, and a system can be established to share the data of each researcher.
Potential for enabling environment to diffuse technology	The degree of ripple effect to create an environment where technology can spread will be normal.
Potential contribution to establishing regulation and policy framework	The contribution to the creation of regulatory frameworks, such as legal systems for boosting technology, will be high.

Part 1. General Information

Sector	Marine, Fisheries and Coastal Zones
Category	Production of marine resources and aquaculture
TNA Technology Class	Crop and fisheries management



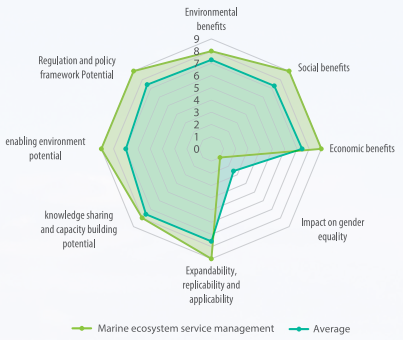
Part 2. Information on Technology

Definition of technology	**Technology Definition** By preventing overfishing of resources, reducing the mix of immature and protected species, productivity inventory and sustainable fishing are realized, and the development of aquaculture industry enables the supply of certain quality aquatic products.				
	Examples of detailed technology Adaptive fish breeding Establishment of fishery resource farming facilities in response to environmental changes Formation of sea forest				
Importance and characteristics of technology	Climate change directly affects changes in sea temperature, causing changes in the marine ecosystem. In the case of fish directly, there are many cases where they are moving to the proper formable waters or changing populations, and the marine environment where the fish live is also changing. Therefore, it is crucial to observe the ecological and physiological changes of the fish, investigate resource fluctuations, and develop appropriate fishing methods in order to adapt to these changes to secure sustained fishery production and further increase production through resource management.				
Status of technology	Methods for evaluating and managing fishery resources have long been studied, and there are many studies on the correlations with climate change. The areas of predicting and managing changes in resources still require substantial research. However, there are many technologies that can be independently applied to overfishing and catching immature fish that have a significant impact on resources. These technologies can be expanded to include the reduction of marine mammals living with marine resources.				
Applicable scale of technology	**Technology Assistance**	**Portable & Small scale**	**Medium-size application**	**Large scale**	
Applicable target area	Areas where fishing is carried out, such as the ocean and inland water.				

Part 3. Influence to Sustainable Development	
Environmental benefits	Marine Ecosystem: Managing fishery resources has a net function throughout the marine ecosystem, which not only increases productivity but also improves the health of the marine ecosystem. Furthermore, because the ocean is open to the public, resource management in certain areas does not only function in the area, but also affects the health of the entire ecosystem of the ocean.
Social benefits	Sustainable Fisheries Resources: Keep fishery resources available continuously. Conservation of the marine environment: Internationally, it preserves the marine environment as well as the protection and management of resources.
Economic benefits	Poverty Mitigation Effect: Especially in countries with low economic power, poverty is alleviated by using the protein in fishery products. Job Creation Effect: In many developing countries, the development of fisheries creates jobs and income.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: Fishery resource management technology can be applied in various ways in all areas where fishing (with fishing vessel) is carried out. Replicability: Very High
Potential for knowledge sharing and capacity building	Knowledge-sharing network: The possibility of knowledge-sharing and capacity-building is high, as it has long been striving to spread the technology of fisheries resource management in various international organizations, and most countries agree on its purpose and direction. There are also national organizations in place to share knowledge and strengthen capabilities.
Potential for enabling environment to diffuse technology	Fisheries resource management technology can be realized through the implementation of the national or institutional system. However, due to the nature of the area in which the technology is realized, it is necessary to agree and cooperate with fishers. Therefore, in order to apply the fishery resource management technology, the education of those involved in the area (public officials, fishers, fishery cooperatives) will be essential.
Potential contribution to establishing regulation and policy framework	The purpose of fishery resource management technology is to protect and manage resources and to continuously utilize them, which must be recognized as regulation by the subjects of the site, so it is necessary to provide a more convenient, safe and efficient means of using fishery resources to obtain agreement on the regulation.

Part 1. General Information

Sector	Marine, Fisheries and Coastal Zones
Category	Marine ecosystem service management
TNA Technology Class	



Part 2. Information on Technology

Definition of technology	**Technology Definition** The technologies produce the benefits that can be obtained through the marine ecosystem in the social and economic activities of mankind. Ecosystem services are classified into four types of services: supply, control, support, and culture. These are actively used in the management and development of the environment, resources, space, and energy.
	Examples of detailed technology Supply: aquatic products, water resources (fresh and sea water), genetic resources Control: water control and purification, climate adaptation and mitigation, etc. Support: soil formation, primary production Culture: spiritual, cultural value, ecotourism
Importance and characteristics of technology	Due to climate change, marine and marine coastal ecosystems are being destroyed, and the protection of biodiversity, including preservation of the food chain, is becoming impossible due to related threats. Demand for the use and development of the ocean is increasing for various reasons, such as climate change, the energy crisis, and overpopulation, and basic marine and coastal ecosystem protection and service management need to be carried out using this technology.
Status of technology	Integrated management of ecosystem services, market-based measures, etc. are areas that have not been discussed for very long. These area are also novel and original and require the development of new technologies.

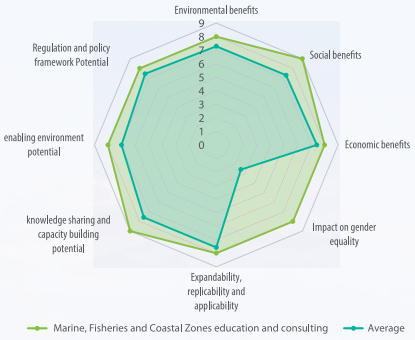
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**

Applicable target area	Applicable to all areas related to marine and coastal ecosystems.

Part 3. Influence to Sustainable Development	
Environmental benefits	Ecosystem conservation: Contributes to ecosystem conservation by investing in the creation and maintenance of various ecosystems of maritime and fisheries coastal areas.
Social benefits	Health and quality of life: Through the stable management of marine and coastal ecosystem services, we can help people stay healthy and improve quality of life.
Economic benefits	Conservation and supply of resources: Marine and coastal ecosystems has a huge impact in terms of resources supplying food resources and contributes to increasing marine resources, thus increasing the production of food resources. Job creation effect: Increases the production of fishery resources through the preservation of the coastal ecosystem food chain, thereby creating related jobs.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability and applicability	Expandability: There is a high possibility for this technology to be applied in areas with similar environments. Replicability: Very high
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: Knowledge sharing can be conducted through professional knowledge sharing workshops on the relevant technology.
Potential for enabling environment to diffuse technology	New guidelines or systems for introducing new management methods and market-based measures will have to be created through technologies for marine ecosystem service management.
Potential contribution to establishing regulation and policy framework	Laws, regulations, and frameworks will be improved so that technologies for marine ecosystem service management and fisheries can be transferred well.

Part 1. General Information

Sector	Marine, Fisheries and Coastal Zones
Category	Marine, Fisheries and Coastal Zones education and consulting
TNA Technology Class	Capacity building



Part 2. Information on Technology

Definition of technology	**Technology Definition** This technology can contribute to achieving other SDGs as well as sustainable development goals SDGs No. 14 marine products, and contribute to sustainable development and improvement of local communities through education, training and capacity building in various fields of marine fisheries.				
	Examples of detailed technology Response to IUU Fishing Coastal Management Fishery Value Chain Rise Sustainable Development of Fishing Villages and Fishing Ports Economic Development through the Improvement of Fisheries Distribution System Fish Farm Capacity Building				
Importance and characteristics of technology	Among the competency-building programs in various fields, education and training are systematically conducted in consideration of the priority demand of the relevant countries, but for sustainable development, it is important to establish a cooperative channel with demand countries, multidisciplinary cooperation with international organizations, and to cooperate with program donor countries in connection with their special features. After that, systematically and consistently implementing comprehensive programs based on priorities is a vital factor in capacity building.				
Status of technology	Developing countries often have legislation systems in the maritime and fisheries sectors, and even if they are not institutionalized, international trends are often complete with knowledge, However, there are many difficulties in implementing and applying them domestically, so technical support is needed to support the norms, technologies, knowledge sharing, education and the feasibility of local fishers.				
Applicable scale of technology	**Technology Assistance**	**Portable & Small scale**	Medium-size application	Large scale	
Applicable target area	Groups of experts, such as fishing villages, fishing port areas, central and local maritime officials, and youth students at the maritime and fishery university.				

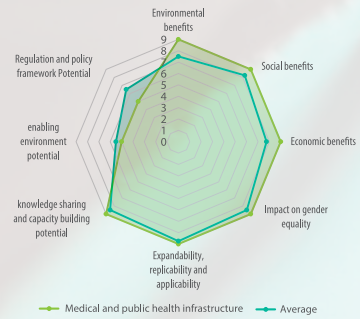
Part 3. Influence to Sustainable Development	
Environmental benefits	Sustainable Marine Fisheries: It makes sustainable marine fisheries possible and contributes to environmental and climate change response by enhancing convergent capabilities such as coastal management linked to climate change, support for fishing port management technology, support for improving fisheries distribution processing, response to the IUU (Illegal Unreported And Unregulated) fishing industry, and support for aquaculture technology.
Social benefits	Sustainable Development: Contribute to the sustainable development of the society in question through education and training in the marine fishery field and capacity building. Pan-national cooperation: Improving the ability of workers in the field through education is one of the most effective ways for the development of the society of the countries subject to cooperation, including the relevant field.
Economic benefits	Enhancement of Competitiveness: Strengthens capacity for marine fisheries, contributing greatly to the improvement of income generating capacity of workers in the field.
Impact on gender	Because female fishers are mostly engaged in fishing, post-land fishery processing, and distribution, they contribute to gender equality in the countries concerned along with responding to climate change through the convergence capacity building program above.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: Although it is highly likely to expand to other areas by drawing excellent cases through the discovery, and implementation of capacity building projects, it is important to systematically employ areas that require priority and secondary capacity building from the stage of excavation of the project. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building: A continuous network can be established, and regular international workshop activities will be required. Knowledge sharing and workshops: The priority of capacity building demand should be jointly identified and systematically implemented through workshops. Strengthening the capacity of national institutions: It is possible to contribute to the development of the relevant country through consulting and feedback in the relevant field continuously during the implementation of the project.
Potential for enabling environment to diffuse technology	As a result of the capacity building project, it is expected that the overall knowledge environment related to the relevant country will be expanded, and that additional projects linked to the results of the competency education will be discovered or linked to other existing projects, which will spread the environmental base for sustainable development of the maritime and fisheries sectors in the country concerned. It will also contribute to creating an environment for eliminating institutional and technological barriers that hinder this development.
Potential contribution to establishing regulation and policy framework	It is possible to contribute to the creation of a foundation for improvement of regulations and governance in the relevant country through consulting during the implementation of this project. Through continuous communication, accurate results on the necessary improvements, such as in the legal system and governance of the country, can be derived through discussions with the countries concerned. In addition to experts in the relevant countries, improvements can be made through continuous communication with local communities such as fishing villages and fishing port areas.

e. Health (4)

Technology Section	Definition
Medical and public health infrastructure	Management of health infrastructure with extreme events ari sing from climate change. e.g. after extreme events, water pollution prevention, exposure to harmful environments, indoor air quality management, etc.
Prevention and control of infectious disease	Strengthening control and related multi-sector activities that enable disease control in the early stages. e.g. vector-borne and water-borne disease prevention technology, medical waste management
Food safety, food security, and nutrition	Monitoring and preventing food hazards and rapid detection of food poisoning bacteria to reduce unintended environmental pollutants contaminated by the production environment and transferred to food. e.g. Evaluation model for predicting occurrence of foodborne diseases, risk factors, detection of addiction, safety diagnosis, food sanitation system
Health policy consulting, enabling environment, health education, health system strengthening	Policy consulting, strengthening local health capabilities, enhancing sanitation and medical publicness, etc.

Part 1. General Information

Sector	Health
Category	Medical and public health infrastructure
TNA Technology Class	Early warning system, Health infrastructure in communities



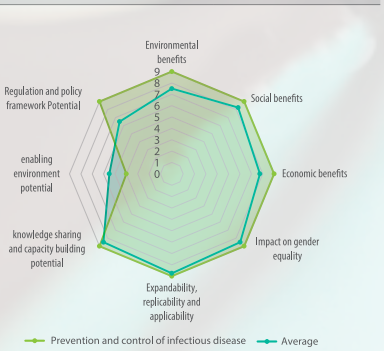
Part 2. Information on Technology

Definition of technology	**Technology Definition** It is a technology to quickly recover from the consequences of poor health derived from climate change, minimize damage caused by climate change, and to establish a health and medical infrastructure to prevent it in advance.			
	Examples of detailed technology Establishment and improvement of community health care facilities centered on health centers/health branches Establishment of medical information system using information technology such as mobile health Technologies for outsourcing to local residents and purchasing/supplying medicines.			
Importance and characteristics of technology	Climate change can directly or indirectly affect people's health. Emergency disasters such as tsunamis and conflicts caused by climate change can cause various kinds of injuries or mental illnesses. In addition, natural environmental pollution and air pollution caused by climate change can cause various kinds of non-inflammatory diseases. In addition to the need for recovery technologies to respond quickly and return the population to a healthy state after these health problems occur, technology as a preventive response that does not significantly affect the health of the population is necessary.			
Status of technology	The establishment and improvement of community health and medical facilities centered on health centers/health branches, medical information systems using information technology such as mobile health, outlining, and drug purchase and procurement systems are mainly completed technologies, but they are not used well especially in vulnerable areas of developing countries for various reasons, so access to services is low. Therefore, technology development needs to find a solution in terms of completion or its application.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Underdeveloped areas and areas subject to conflict due to climate change are not prepared to take medical emergency measures in the event of a disaster caused by climate change. .			

Part 3. Influence to Sustainable Development	
Environmental benefits	Forest conservation: Reduce the use of firewood in developing countries, reducing forest losses and lung diseases in children and women. Water and Soil Pollution: Nearly 700 million people worldwide would reduce environmental pollution caused by defecation.
Social benefits	Safety: Preventing disputes in advance, or taking quick action in case of disputes, it can prevent the outbreak or spread of disputes, so it has a substantial impact in terms of peace and safety. Social Integration Aspects: According to the United Nations report, the major problems related to climate change are people living in conflict-prone areas and have a great impact on social integration.
Economic benefits	Poverty eradication and economic benefits: It has the effect of poverty eradication, which is the ultimate goal of development cooperation. Many studies have also shown that these projects bring huge economic benefits.
Impact on gender	Those who benefit the most from these technologies will have the greatest impact on gender, especially on women and children (especially girls) who are currently relatively unrecognized in many vulnerable areas of the developing world.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: These problems worldwide kill more than 5 million children under the age of five, and more than 300,000 women, more than 90 percent of the deaths occurring in 81 developing countries, especially underdeveloped areas, so there is a high possibility of technology expansion. Replicability: Very High
Potential for knowledge sharing and capacity building	Knowledge sharing: Because it is already a technology field that has been developed in high-income countries, it is highly likely that this technology will be shared in underdeveloped areas of developing countries.
Potential for enabling environment to diffuse technology	It is estimated that there are not many legal and institutional barriers in the 81 countries listed above in this field that would hinder the dissemination and diffusion of the technology, except in very exceptional cases.
Potential contribution to establishing regulation and policy framework	The potential for this technology to contribute to the creation of regulatory and policy frameworks is moderate.

Part 1. General Information

Sector	Health
Category	Prevention and control of infectious disease
TNA Technology Class	Medical waste management



Part 2. Information on Technology

Definition of technology	**Technology Definition** It is the technology of detecting, preventing, diagnosing, and treating diseases caused directly or indirectly by climate change or environmental pollution at an early stage.
	Examples of detailed technology Rapid diagnosis of disease Tracking of infected persons, tracking path of disease propagation, predicting path of disease propagation, predicting trend of disease occurrence Treatment of diseases, prevention of disease transmission, equipment technology for preventing infection, and information management technology for infected persons.
Importance and characteristics of technology	Many of the new infectious diseases have been caused by climate change, and other existing infectious diseases, other than new infectious diseases, are also greatly affected by climate change. For example, highly lethal malaria may spread to southern Europe, and infectious diseases traditionally thought of as the "endemic" region are expanding their reach. Therefore, technology is needed to prevent these diseases from occurring early and spreading them to communities, countries, and around the world at an early stage.
Status of technology	Technology should also continue to be newly discovered as new cases of new infections continue to occur. Thus, in this case, technology development and commercialization should not be completed, but should be a new, original technology. However, infectious diseases related to climate change or environmental pollution are not limited to new infectious diseases. In the case of lung diseases caused by air pollution, waterborne diseases caused by water pollution, and many offsite tropical diseases, technology development and commercialization are often already carried out.

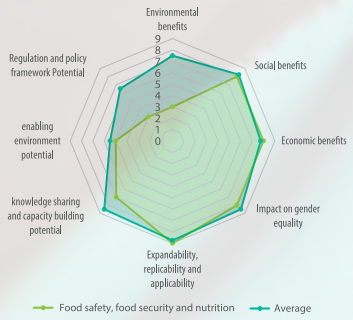
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**

Applicable target area	Underdeveloped areas that are difficult to access within developing countries, areas with refugee camps, and areas where migrants live due to civil wars or disasters.

Part 3. Influence to Sustainable Development	
Environmental benefits	In order to fundamentally solve new and other infectious diseases, the key is to develop technologies to prevent environmental pollution, including climate change. As mentioned above, related technologies themselves, such as developing more environmentally friendly and sustainable technologies in firewood, have a direct effect on the environment, as energy sources for heating and cooking in underdeveloped areas of developing countries are developed.
Social benefits	World Security and Safety: Major infectious diseases, including new infectious diseases, have enormous impacts worldwide beyond the borders of certain countries. This, among other things, affects the safety and security of individual countries and around the world, which also has a ripple effect on the education sector and society as a whole. Therefore, the technology to prevent it, and the technology to quickly diagnose it, track and block the propagation pathways, and treat it, even in the event of new infectious diseases and major infectious diseases, have enormous social effects.
Economic benefits	Job creation effects: The technology to prevent and treat infectious diseases plays a role in creating or at least preserving jobs. Increased productivity and competitiveness: Minimize adverse effects on productivity and competitiveness that can be caused by infectious diseases.
Impact on gender	Low-income people are most affected by new infectious diseases and major infectious diseases caused by climate change. Women and girls, especially in developing countries, are one of the most affected groups by these infectious diseases, as they are often socially, culturally and economically vulnerable. Therefore, the technology to prevent and diagnose and treat these diseases early has a great effect on genders.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: It is highly likely that the technology will be expanded to similar projects. Replicability: Very High
Potential for knowledge sharing and capacity building	Knowledge sharing: Because it is already a technology field that has been developed in high-income countries, it is highly likely that this technology will be shared in the underdeveloped areas of developing countries.
Potential for enabling environment to diffuse technology	Active diagnosis, treatment technology, quarantine technology, infectious tracking technology, and epidemiological investigation technology are also linked to personal information protection, and there is a high possibility that the technology will spread in connection with information system technology in the country or region.
Potential contribution to establishing regulation and policy framework	Because the prevention of infectious diseases is an area where the state should intervene and control throughout society, it is highly likely that this technology will contribute to the creation of silos and policy systems.

Part 1. General Information

Sector	Health
Category	Food safety, food security and nutrition
TNA Technology Class	



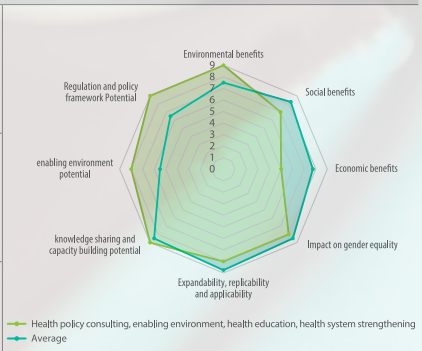
Part 2. Information on Technology

Definition of technology	**Technology Definition** It is a technology that predicts the situation where food insecurity, food pollution, and malnutrition can occur on a large scale due to climate change and the consequent environmental pollution, immediately discovers and reports problems at the beginning of the occurrence, and responds early and treats them so as not to spread on a large scale.			
	Examples of detailed technology Prediction of food safety in response to climate change Chemical, biological, and physical hazard effects analysis Establishment of Food Management System			
Importance and characteristics of technology	In order to minimize the impact of climate change, a predictive model should be developed to assess the overall impact and vulnerability of climate change on food safety and long-term monitoring of possible risk factors caused by climate change should be ensured. Therefore, the technology that can manage the risk factors that occur should be applied, and efficient education-promotion is needed for the expansion of food safety risk information exchange, and for the call of industry and public awareness.			
Status of technology	Although the level of technology for the prevention of general food safety is sufficiently developed and applied throughout society, there is a lack of response to the external environment caused by climate change. Research on food hazards caused by climate change and minimization of social and economic losses are needed. International cooperation to ensure food safety is required through the international network.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Food production facilities, food storage and distribution network			

Part 3. Influence to Sustainable Development	
Environmental benefits	Because the technology is limited to health, the environmental impact of the technology is not expected to be significant.
Social benefits	Health and safety: In the case of technology for food pollution prevention and early response, it has a relatively large impact on health and safety.
Economic benefits	Poverty Mitigation Effect: Food safety prevention technology is a problem directly linked to poverty, and the technology that solves it has a great effect on poverty eradication.
Impact on gender	Because food security and malnutrition have the greatest impact on women, the technology greatly contributes to their nutrition and health.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: It is highly likely that technologies can be applied to similar projects and similar areas. Replicability: Very High
Potential for knowledge sharing and capacity building	Climate change is linked to various ministries as the entire production, storage, and distribution of food are involved, but there is no foundation for inter-ministerial linkage, and various data are not being used efficiently. Research cooperation among agencies and the establishment of a system to share relevant data will have to be prioritized.
Potential for enabling environment to diffuse technology	It is likely to create a technology diffusion environment through international networks such as GIFSA, established by WHO/FAO. In addition, it is highly likely that continued cooperation will be maintained as joint research between pan-ministerial and multidisciplinary organizations is required.
Potential contribution to establishing regulation and policy framework	The need for a regulatory and policy framework is high, but the possibility of contributing to the creation of a unified legal system and policy system will be moderate, as it is a technology that spans the production, processing and distribution of food.

Part 1. General Information

Sector	Health
Category	Health policy consulting, enabling environment, health education, health system strengthening
TNA Technology Class	Capacity building



Part 2. Information on Technology

Definition of technology	**Technology Definition** Health issues are so multi-layered that it is necessary to consider all the social factors, policy factors, and individual behaviors that determine the health of the population, and this category is a technology that contributes to promoting health by addressing these multilayered health determinants directly related to climate change and environmental issues.			
	Examples of detailed technology Health Education Program to Respond to Climate Change Health Consulting to Respond to Climate Change			
Importance and characteristics of technology	In order to minimize health and health damage caused by climate change, people's understanding and awareness of climate change should be enhanced. Therefore, it is necessary to publish the results of the research produced by various R&D to the public and carry out them through effective publicity, especially intensive education and support for the vulnerable in health is essential.			
Status of technology	There are technologies already developed and commercialized (e.g., health information system platforms, platforms for health education) as well as many areas that need to be newly developed.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	All regions			

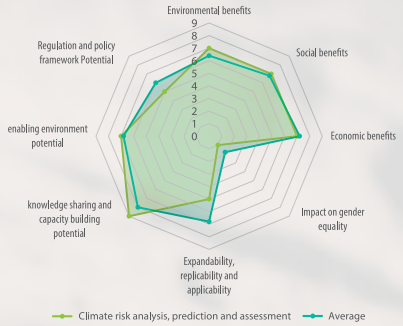
Part 3. Influence to Sustainable Development	
Environmental benefits	Although it varies greatly depending on the case to induce changes in policy, social, and behavioral factors to prevent health problems caused by climate change and environmental pollution in advance, there are many factors that have great environmental effects (e.g., technologies used to educate, promote, and improve policies for early prevention of road and food pollution are estimated to have a significant environmental impact).
Social benefits	Health: Prohibition of hazardous behavior, such as on-road defecation, and development of preventive approaches to food pollution are essential to build a supporting environment that enables behavior change, so they are involved in building a support environment and behavior change.
Economic benefits	Revitalizing the local economy: It contributes in part to the revitalization of the local economy, such as village health personnel in underdeveloped areas of developing countries, local skilled workers and sanitary goods companies for toilet improvement and food safety-related companies.
Impact on gender	Such policy, social and individual behavior changes are still unfavorable to women and girls in many developing countries. In addition, as women are the main drivers of this behavior change, the related businesses will have a significant impact on women's empowerment.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: The technology shows very high expandability to other similar projects Replicability: Very High
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building: The education and consulting regarding health factors arising from climate change will increase the opportunities for knowledge sharing and improve the ability to respond to climate change.
Potential for enabling environment to diffuse technology	The consulting, education, and public relations technologies in the health sector due to climate change will have the effect of technological expansion, and the same educational programs and consulting materials will be available to various related agencies.
Potential contribution to establishing regulation and policy framework	Health issues are highly likely to contribute to the creation of policy systems such as compulsory education, as they can only be implemented by pre-emptive regulatory and policy systems throughout our society.

f. Climate Change Forecast and Monitoring (5)

Technology Section	Definition
Climate risk analysis, prediction and assessment	Technology includes the variability of climate systems, abnormal climate analysis and detection techniques, seasonal weather forecasting and evaluation by the effects of climate change.
Climate data and information services	Establishment of an information production system for the purpose of producing customized information on climate change.
Climate disaster prediction and warning	Prediction and monitoring of extreme climatic changes, such as heat waves and cold waves, and drought trends.
Climate change monitoring and modeling	Monitoring climate change at national and regional levels and developing standardized climate change scenarios, observing and monitoring greenhouse gases.
Climate change education and consulting	Building capabilities, expanding public awareness of climate change, sharing information, etc.

Part 1. General Information

Sector	Climate Change Forecast and Monitoring
Category	Climate risk analysis, prediction and assessment
TNA Technology Class	Scenario building



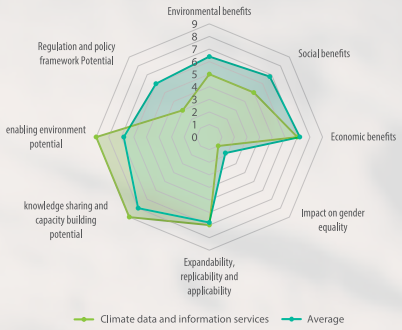
Part 2. Information on Technology

Definition of technology	**Technology Definition** It includes the establishment of information production systems aimed at producing customized information on climate change and services that enable users to easily access information or data on climate change.			
	Examples of detailed technology Technology for producing and storing climate change data on climate change Climate Change Data DBMS Establishing a climate change portal system			
Importance and characteristics of technology	In order to assess, adapt, and respond to climate change, customized climate change information production is necessary. However, most of the countries that suffer from abnormal weather conditions due to climate change are developing countries with relatively poor capacity for climate change-related infrastructure. To overcome this, we desperately need a system to produce climate change data and a climate change information service that can be easily accessed.			
Status of technology	Climate change-related information services are well-established by international organizations, such as UNEP and UNDP, and CMIP climate change scenarios are also readily available through the U.S.-led database of ECGFs. However, as climate change has strong regional characteristics, customized data services for each river region are also needed, but this is a huge technology gap for each country.			
Applicable scale of technology	**Technology Assistance**	Portable & Small scale	Medium-size application	Large scale
Applicable target area	By country/regional unit, area of interest (water resources, agriculture, health, ecosystem, forest, architecture).			

Part 3. Influence to Sustainable Development	
Environmental benefits	Regional environment: Based on climate change data produced through the technology developed or provided through information services, it is effective in preserving the environment through raising awareness of the environment in the region (or target areas and sectors).
Social benefits	Improving the national system: The national system for the regulation and prevention of climate change is improved through the evaluation of the impact on climate change and adaptation research.
Economic benefits	Reducing economic damage: Climate change damage is reduced through the assessment of the impact on climate change and adaptation research.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: Customized climate change information production systems in certain countries (or areas) can be applied to and utilized in other countries. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and workshops: Workshops for knowledge sharing on climate change and technology transfer on information production systems for capacity building in developing countries can be held, and utilized workshops of developed climate information services can be held.
Potential for enabling environment to diffuse technology	Workshop experience for technology transfer and diffusion to developing countries and the environment in which tasks can be continuously managed to improve systems and climate information services by reflecting user feedback.
Potential contribution to establishing regulation and policy framework	It is expected to prepare a communication system that can well utilize and manage the system and climate information services developed as part of the capacity building of developing countries, and to prepare institutional improvements and measures for continuous communication.

Part 1. General Information

Sector	Climate Change Forecast and Monitoring
Category	Climate data and information services
TNA Technology Class	Data center



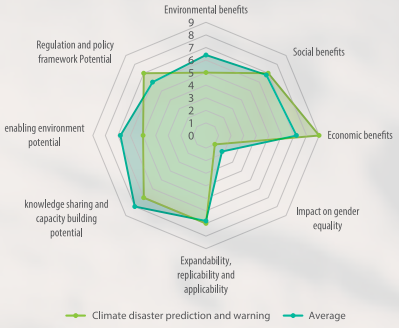
Part 2. Information on Technology

Definition of technology	**Technology Definition** It is a technology that predicts the characteristics of changes in weather/climate disasters such as heat waves, cold waves, droughts, and floods according to climate change scenarios, and the intensity, frequency, and space size of the disasters, and predicts and monitors extreme weather/climate phenomena based on the predicted data.				
	Examples of detailed technology Long-term climate change scenario analysis technology Disaster prediction technology based on big data forewarning decision system				
Importance and characteristics of technology	The impact and damage of climate change, represented by global warming, are directly related to changes in the occurrence characteristics of climate disasters such as heat waves, droughts, typhoons, and rising sea levels, and the process of producing reliable predictive information on them and delivering them to users in advance is critical. Pre-response to extreme weather/climate phenomena that have sensitive effects on human health and ecological sustainability is becoming more important, and because climate disaster phenomena occur rarely and in small areas spatially, uncertainty is great and predictions taking into account these uncertainties are required.				
Status of technology	Climate disaster and disaster forecasting technology is in a leap forward phase, with great uncertainty due to a lack of long-term accurate observation and monitoring data and limitations in forecasting technologies based on climate modeling, and efforts are underway to reduce it.				
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**	
Applicable target area	continental, national, wide-area, administrative units				

Part 3. Influence to Sustainable Development	
Environmental benefits	Drought response: Through the prediction of droughts occurring on a long time scale, appropriate water resource utilization measures are derived.
Social benefits	Health and safety: If early warning and prediction are possible through continuous and immediate monitoring of extreme weather/climate, it is effective for safety (such as heavy snow, torrential rain) and health (high-risk elderly people in the heat wave).
Economic benefits	Reducing economic damage: If early warning and prediction are possible through continuous and immediate monitoring of extreme weather/climate, the resulting economic damage (such as property) is reduced through proactive preparedness.
Impact on gender	No significant gender impact is expected.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: The climate disaster prediction and early warning system built for specific phenomena and regions is highly likely to be extended and applied to other phenomena and regions. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building: It is possible to strengthen the ability to cope with climate change by sector, regional impact and damage, and related knowledge sharing to reflect the opinions of users necessary for the establishment of early warning systems.
Potential for enabling environment to diffuse technology	The establishment of a climate disaster prediction and early warning system will help the development of related follow-up technologies with great environmental and socioeconomic ripple effects.
Potential contribution to establishing regulation and policy framework	Measures are required for the establishment of relevant laws and systems for systematic weather disaster prediction and efficient early warning, and for the improvement of actual communication with the public, and a system for the communication of national units for the improvement of national manuals through early warning information can be formed.

Part 1. General Information

Sector	Climate Change Forecast and Monitoring
Category	Climate disaster prediction and warning
TNA Technology Class	Early warning system



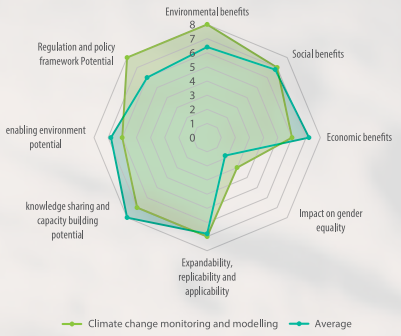
Part 2. Information on Technology

Definition of technology	**Technology Definition** It is a technology to quickly recover from the consequences of poor health derived from climate change, or to minimize damage caused by climate change, and to establish health and medical infrastructure to prevent it in advance..			
	Examples of detailed technology Establishment and improvement of community health care facilities centered on health centers/health branches Establishment of medical information system using information technology such as mobile health Technologies for outsourcing to local residents and purchasing/supplying medicines.			
Importance and characteristics of technology	Climate change can directly or indirectly affect people's health. Emergency disasters such as tsunamis and conflicts caused by climate change can cause various kinds of injuries or mental illnesses. In addition, natural environmental pollution and air pollution caused by climate change can cause various kinds of non-inflammatory diseases. In addition to the need for recovery technologies to respond quickly and return the population to a healthy state after these health problems occur, technology as a preventive response that does not significantly affect the health of the population is needed.			
Status of technology	The establishment and improvement of community health and medical facilities centered on health centers/health branches, medical information systems using information technology, such as mobile health, outlining, and drug purchasing and procurement systems, are mainly completed technologies, but they are not used well especially in areas vulnerable to developing countries for various reasons, so access to services is low. Therefore, technology development needs to find a solution in terms of completion or its application.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Underdeveloped areas, areas subject to conflict due to climate change, areas not prepared to take medical emergency measures in the event of a disaster caused by climate change.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Forest conservation: Reduce the use of firewood in developing countries, reducing forest losses and lung diseases in children and women. Water and Soil Pollution: Nearly 700 million people worldwide reduce environmental pollution caused by defecation.
Social benefits	Safety: Preventing disputes in advance, or taking quick action in case of disputes, can prevent the outbreak or spread of disputes, so it has a very great impact in terms of peace and safety. Social Integration Aspects: According to the United Nations report, the major problems related to climate change are people living in conflict-prone areas and have a great impact on social integration.
Economic benefits	Poverty eradication and economic benefits: It has the effect of poverty eradication, which is the ultimate goal of development cooperation. Many studies have also shown that these projects bring huge economic benefits.
Impact on gender	Those who benefit the most from these technologies will have the greatest impact on gender, especially on women and children (especially girls) who are currently relatively unrecognized in many vulnerable areas of the developing world.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: These problems worldwide kill more than 5 million children under the age of five, and more than 300,000 women, with more than 90 percent of these deaths occurring in 81 developing countries, especially underdeveloped areas, so there is a high possibility of technology expansion. Replicability: Very High
Potential for knowledge sharing and capacity building	Knowledge sharing: Because it is already a technology field that has been developed in high-income countries, it is highly likely that this technology will be shared in underdeveloped areas of developing countries.
Potential for enabling environment to diffuse technology	It is estimated that there are not many legal and institutional barriers in the 81 countries listed above in this field that would hinder the dissemination and diffusion of the technology, except in very exceptional cases.
Potential contribution to establishing regulation and policy framework	The potential for this technology to contribute to the creation of regulatory and policy frameworks is moderate.

Part 1. General Information

Sector	Climate Change Forecast and Monitoring
Category	Climate change monitoring and modelling
TNA Technology Class	Monitoring and modeling



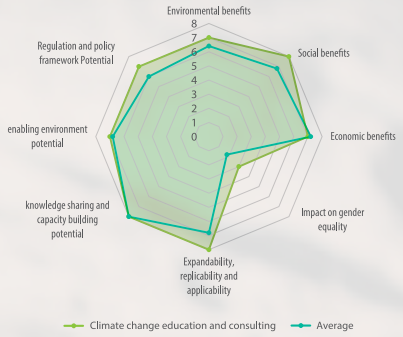
Part 2. Information on Technology

Definition of technology	**Technology Definition** It is a technology that systematically monitors and analyzes the long-term temporal and spatial variation characteristics of climate change and sectoral impacts appearing in observations and develops statistical and dynamic modeling technologies to understand the causes of changes in observations.			
	Examples of detailed technology Deep Learning-Based Prediction Model Smart Sensors and IoT Instrumentation Equipment Time-space abstract downscaling			
Importance and characteristics of technology	In order to accurately predict future climate change and impact, the analysis of actual observations to verify this is essential, especially the technology to systematically monitor whether the effects of climate change are real. In addition, modeling technologies are essential to identify the causes of changes in observations and to predict future climate change based on them. In particular, it is essential to identify the causes of changes in climate disasters that cause enormous damage to human society and ecosystems and to improve modeling technology for future prospects.			
Status of technology	Climate change monitoring technology requires the development of long-term homogeneous and systematic monitoring technologies in the growth stage, and efforts are underway to incorporate more detailed scale and actual impact in the application stage.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	**Medium-size application**	**Large scale**
Applicable target area	Global level, continents, countries, cities, affected areas			

Part 3. Influence to Sustainable Development	
Environmental benefits	Ecosystem conservation: The systematic monitoring technology of climate change is an important basis for reducing the associated damage, such as ecosystem destruction, by giving an accurate grasp of the changes in environmental factors.
Social benefits	Social Information Network: The technology of monitoring and modeling the effects of climate change contributes to the production and utilization of information essential to identifying damage situations in different sectors of society.
Economic benefits	Reducing economic damage: Systematic monitoring of climate change and sectoral impacts can reduce associated climate disasters and thus bring about economic effects.
Impact on gender	An increase in women's educational opportunities is expected in areas related to the technology and the resulting vulnerability exchange effect.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: Data produced from climate change monitoring and modeling can be shared and expanded to other regions, areas through joint analysis, or other areas. Replicability: High
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building of related institutions: It is required to reflect public opinion for efficient monitoring of climate change and sectoral impact, and it is possible to share the related knowledge and strengthen the capacity of management institutions through workshops.
Potential for enabling environment to diffuse technology	The development of climate change monitoring and modeling technologies will result in socioeconomic benefits and the spread to subsequent technologies using the data is expected.
Potential contribution to establishing regulation and policy framework	In order to efficiently understand the impact of climate change by sector, the relevant systems will be supplemented and ways of communicating with the public will be improved.

Part 1. General Information

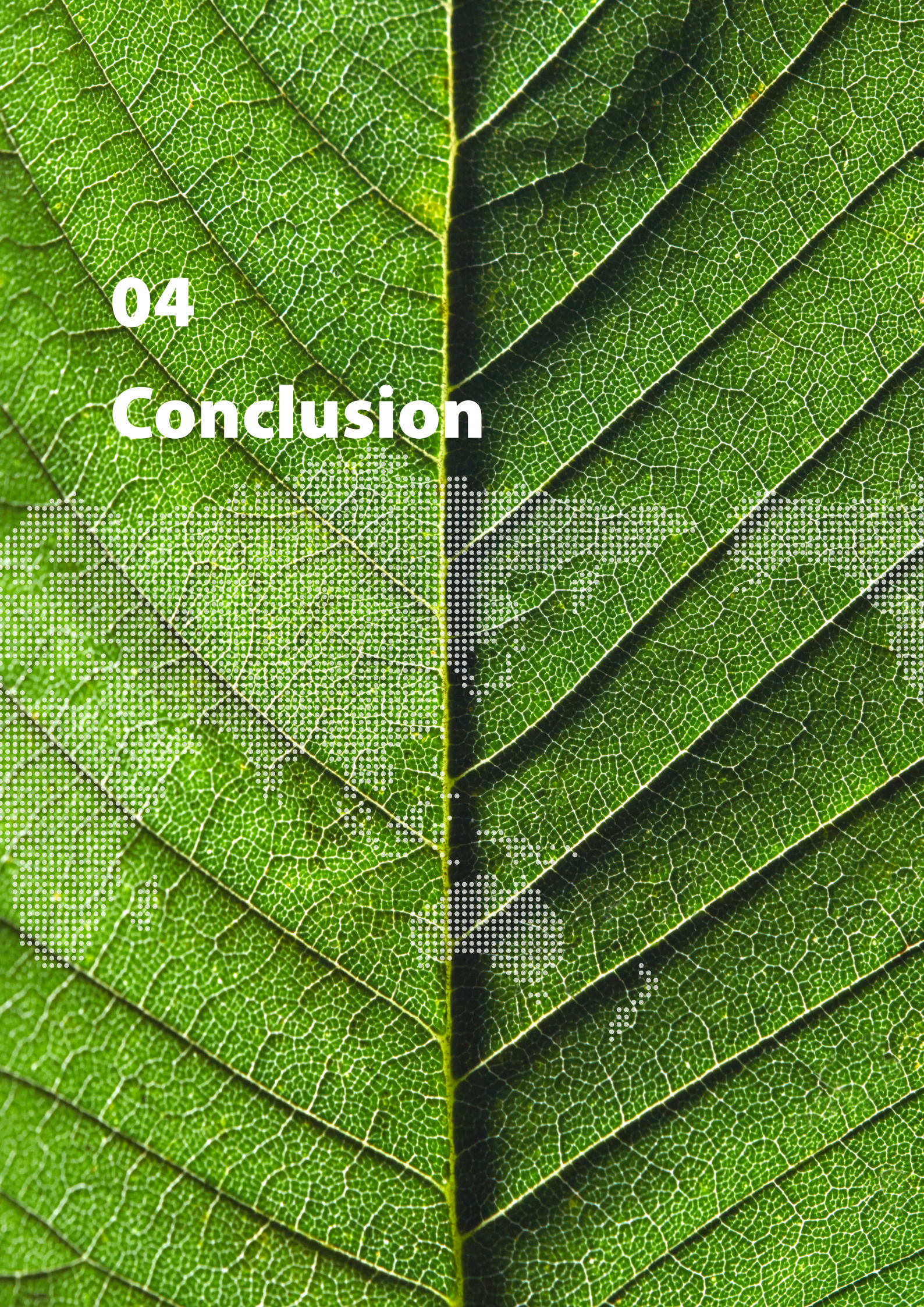
Sector	Climate Change Forecast and Monitoring
Category	Climate change education and consulting
TNA Technology Class	Educational framework, Information and awareness



Part 2. Information on Technology

Definition of technology	**Technology Definition** It includes technologies for improving public awareness as well as providing users with information about future climate change prospects and sectoral impacts, adaptations and responses based on the extent of human activity and sectoral damage associated with the current state of climate change occurring.			
	Examples of detailed technology Operation of Climate Change Prediction and Monitoring Education Program Climate Change Forecasting and Monitoring Consulting			
Importance and characteristics of technology	In order to minimize damage in each area of future climate disasters and disasters, it is essential to come up with efficient adaptation and response measures, especially based on the understanding and recognition of users. Accurate understanding of the causes and effects of climate change, as well as policy makers, is an important starting point for developing countermeasures against climate change, and therefore education and advice on climate change and related technologies are essential.			
Status of technology	Climate change consulting and capacity building technologies are now in the beginning stage, requiring the collection and processing of systematic and comprehensive information in the long run, and should also presuppose an understanding of the environmental and socioeconomic conditions and perceptions of climate change in the subjects.			
Applicable scale of technology	Technology Assistance	Portable & Small scale	Medium-size application	**Large scale**
Applicable target area	Continental, national, wide-area, administrative region.			

Part 3. Influence to Sustainable Development	
Environmental benefits	Ecosystem preservation: Climate change education and improvement of awareness help environmental preservation, including air, water quality, and soil.
Social benefits	Society: The climate change awareness Hyangxiang is an important basis for reducing the impact and damage caused by climate disasters in all sectors of the social economy, including energy, safety and health.
Economic benefits	Reducing economic damage: Through active climate change education and capacity building, economic damage from climate disasters is expected.
Impact on gender	The application of the technology is expected to have the effect of expanding educational opportunities for women' regarding climate change and increasing economic activity.
Part 4. Paradigm Shift Potential	
Expandability, replicability, and applicability	Expandability: Regional and sector-specific climate change consulting and capacity building technologies are highly likely to be extended to other regions and areas. Replicability: Very High
Potential for knowledge sharing and capacity building	Knowledge sharing and capacity building: Through climate change education and consulting, we will increase opportunities for knowledge sharing on the impact and damage of each field of climate disaster, thereby improving our ability to respond to climate change.
Potential for enabling environment to diffuse technology	Improving awareness of climate change will have an indirect economic and social ripple effect and will help develop the relevant technologies for climate change response
Potential contribution to establishing regulation and policy framework	A drastic improvement of the systems involved and ways to improve communication with the public will be devised for efficient climate change education and capacity building.



04 Conclusion

> The phase IV of the project will support seventeen Least Developed Countries (LDCs) and Small Island Developing States (SIDS) in carrying out new or improved Technology Needs Assessments.

The TNA project has recently entered its fourth phase. The phase IV of the project will support seventeen Least Developed Countries (LDCs) and Small Island Developing States (SIDS) in carrying out new or improved Technology Needs Assessments, from 2020 to 2023.

The fourth phase of the TNA project will support 17 countries in three regions as below:

- **Africa** (Comoros Union; Ethiopia; Guinea Bissau; Lesotho; Somalia; South Soudan);
- **Asia-Pacific** (Kiribati; Maldives; Niue; Papa New Guinea; Solomon Islands; Timor-Leste; Tonga; Tuvalu; Yemen)
- **The Caribbean** (Bahamas; St Kitts and Nevis).

The Phase IV countries might have different characteristics from the existing TNA countries due to regional differences, so it may not be possible to cover the new area with the current taxonomy. The newly identified and prioritized technology needs from Phase IV will be added to the exiting taxonomy time to time.

This enhanced TNA Adaptation Taxonomy is divided into 6 sectors and 42 technology sections, considering all the aspects that have never been considered such as capacity building, finance mechanism, consulting and other relevant matters.

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Taxonomy of Climate Change Adaptation Technology

A guidebook for countries conducting
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