ADAPTATION FUND

AFB/PPRC.38/Inf.63
25 September 2026

Adaptation Fund Board
Project and Programme Review Committee
Thirty-eighth Meeting
Bonn, Germany, 19-23 October 2026

PROPOSAL FOR INDONESIA, MALAYSIA, PHILIPPINES AND THAILAND

ADAPTATION FUND

CONCEPT NOTE FOR REGIONAL PROJECT/PROGRAMME

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme:	**Enhancing coastal resilience in the South-East Asia seas**
Countries:	Indonesia, Malaysia, Philippines and Thailand
Thematic Focal Area[1]:	Disaster risk reduction and early warning systems
Type of Implementing Entity:	Multilateral Implementing Entity
Implementing Entity:	UNIDO
Executing Entities:	National Research and Innovation Agency (BRIN, ID), Indonesia Agency for Meteorology Climatology and Geophysics (BMKG, ID), Department of Marine and Coastal Resources (TH), Burapha University (TH), Marine Environment and Resources Foundation, Inc. (MERF) (PH), Malaysia Meteorological Department (MET Malaysia, MY); UNESCO (IOC and its Sub-Commission for the Western Pacific (IOC-WESTPAC)); Euro-Mediterranean Center on Climate Change (CMCC); UNIDO.
Amount of Financing Requested:	29.324.647 (in U.S Dollars Equivalent)
Project Formulation Grant Request:	Yes ☒. No ☐ ☐ I am not sure of that yet
Amount of Requested financing for PFG:	165.000 (in U.S Dollars Equivalent)
Letters of Endorsement (LOE) signed for all countries:	Yes ☒ ☐ No ☐ ☐

Stage of Submission:

☐This proposal has been submitted before including at a different stage (pre-concept, concept)
☒ This is the first submission ever of the proposal at any stage

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Project/Programme Background and Context:

1. Regional Setting: South-East Asia Seas (SEAS)

The South-East Asian Seas (SEAS) span from the Bay of Bengal to the western Pacific, encompassing four sub-basins: the South China Sea, Gulf of Thailand, Sulu-Sulawesi Seas, and Indonesian Seas. This region supports some of the planet's most diverse marine ecosystems while sustaining dense coastal populations and rapid economic growth. Nearly 75% of residents live within 100 km of the coast, heightening dependence on marine resources and vulnerability to sea-level rise, flooding, and storms (Neumann et al., 2015. Its complex geography—thousands of islands, extensive deltas such as the Mekong and Chao Phraya, and major megacities including Jakarta, Manila, and Bangkok—creates acute risks from land subsidence, inundation, and saline intrusion.

The blue economy—encompassing fisheries, aquaculture, tourism, maritime transport, coastal energy, and marine biotechnology—is central to the ASEAN[2] nation's economies. Recent estimates attribute roughly 28% of Indonesia's GDP, 30% of Thailand's, and 23% of Malaysia's to ocean-based sectors. Fisheries and tourism dominate, underpinning food security, employment, and regional economic value.

Coastal and marine-dependent communities face high poverty rates, particularly in Indonesia and the Philippines, where fishing households are disproportionately below national poverty lines. Gender inequities also persist: women play essential roles in post-harvest processing and resource management yet remain underrepresented in governance and decision-making.

Ecologically, SEAS form the core of the Coral Triangle, home to over 500 coral species and more than one-third of global shallow-water reefs. Together with mangroves and seagrasses, these ecosystems support a blue economy valued at over USD 1.2 trillion and livelihoods of 120 million people. Indonesia, Malaysia, and Myanmar contain over one-third of global mangroves, vital for shoreline protection, fisheries, and carbon storage.

Oceanography of the SEAS is shaped by monsoonal reversals and the Indonesian Throughflow, which regulate circulation, nutrient fluxes, and connectivity between the Pacific and Indian Oceans. The region is also the world's most active tropical cyclone basin, generating ~27 storms annually, many of which affect the Philippines Combined, these dynamics underscore SEAS as both a hotspot of biodiversity and a center of compounding climate risks.

[2] ASEAN is an intergovernmental organization of ten Southeast Asian countries: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam.

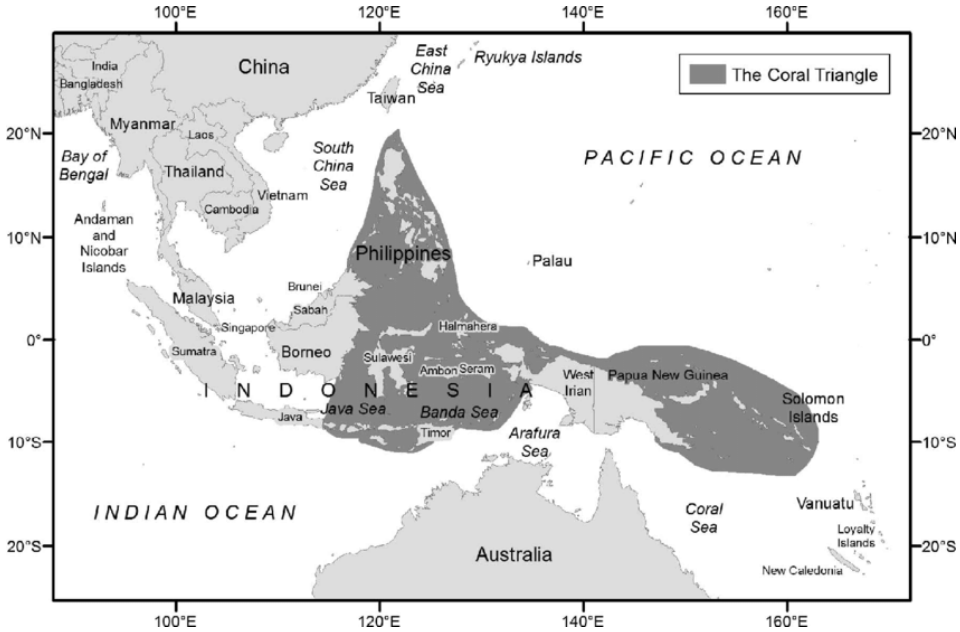


Figure 1. Map of Southeast Asia highlighting the Coral Triangle, with key islands, countries, and marine regions labeled. *Adapted from Heatwole et al. (2017)*.

2. Climate Change Context

In recent decades, the SEAS region has experienced accelerated warming, amplified sea-level rise, more erratic monsoon rainfall, intensified extreme weather events, and increasing ocean heat stress (*see Figures 2-6*).

2.1 Observed Changes (1970–2025)

2.1.1 Sea-Level Rise: Tide gauge and satellite altimetry data confirm that Southeast Asia is experiencing relative sea-level rise exceeding the global mean (~3.4 mm/year since 1993) (Strassburg et al., 2015; Idris et al., 2023). Regional hotspots, such as Manila Bay, the Mekong Delta, and northern Java, report relative rise rates of 5–8 mm/year, driven by both oceanic processes and severe land subsidence. Analysis from over 30 tide gauge stations affirms persistent sea-level rise across the region (Strassburg et al., 2015).

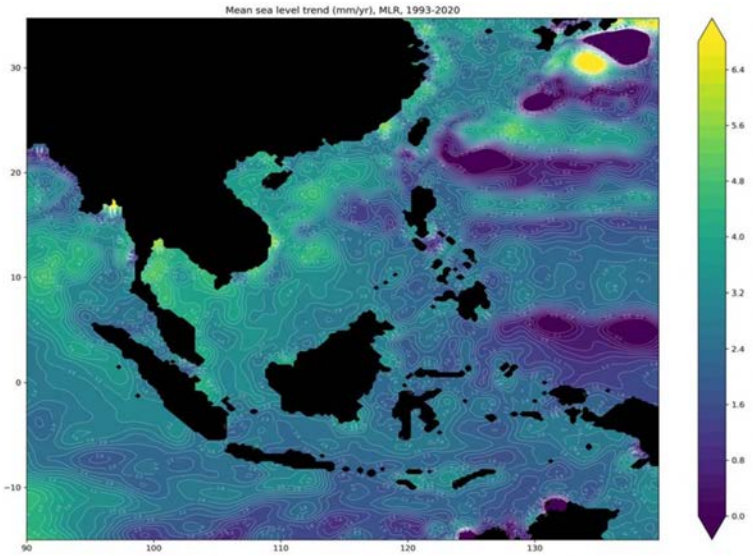


Figure 2. Long-term sea-level rise trends across Southeast Asia derived from AVISO satellite altimetry data (1993–2020), showing regionally elevated trends. *Adapted from Luu & Tkalich (2023).*

2.1.2 Sea Surface Temperature (SST) Trends: There has been a notable increase in SSTs across the region. Satellite observations identify warming around 0.2 °C per decade (*see Figure 3*). WMO's 2025 report notes marine heatwaves encompassing Southeast Asian waters reaching unprecedented spatial extent and intensity in 2024, contributing to elevated SSTs.

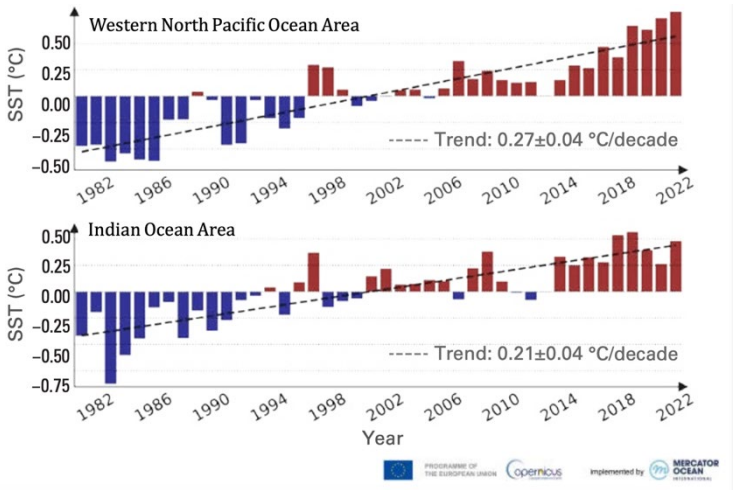


Figure 3. Time series of average sea surface temperature (SST) anomalies (°C) across Asia's ocean regions relative to the 1982–2022 baseline, with dashed line indicating the long-term warming trend. *Adapted from WMO (2024).*

2.1.3 Marine Heatwaves: The 2024–2025 period saw a marine heatwave engulf approximately 40 million km² of ocean around Southeast Asia and the Pacific according to WMO assessments (WMO, 2025). This extensive warming affected over 10 percent of the global ocean surface, unprecedented in its scope. This is linked to mass coral bleaching and widespread ecological stress in the Coral Triangle.

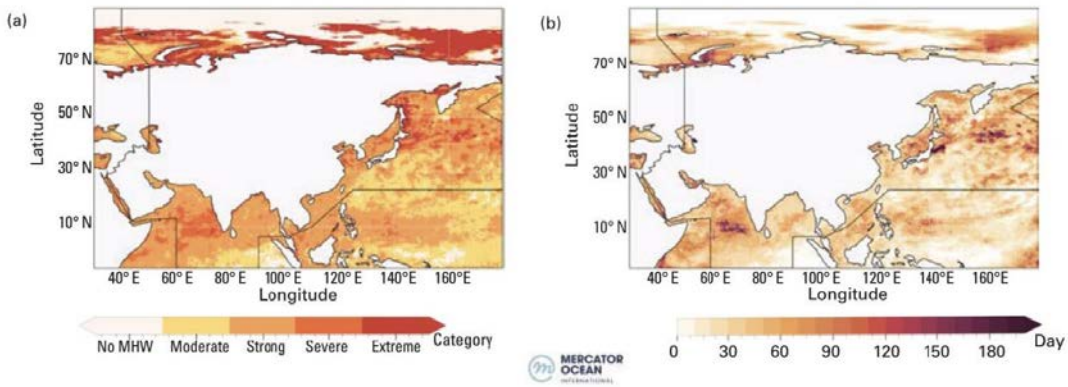


Figure 4. Spatial distribution of marine heatwave (MHW) characteristics in 2023. Panel (a): highest MHW category per grid cell; Panel (b): maximum duration (days). Severe-to-extreme and prolonged events dominate Southeast Asia. *Adapted from Mercator Ocean International (2024*).

2.1.4 Extreme Rainfall & Dry Spells: Southeast Asia has experienced increased frequency of intense rainfall events, particularly linked to monsoon transitions and convective variability related to ENSO and Madden–Julian Oscillation (MJO) patterns (Muhammad et al., 2020). Skliris et al. (2022) report a widespread intensification of rainfall and extreme precipitation across Mainland Southeast Asia. The atmosphere's moisture-holding capacity increases by approximately 7% for every 1 °C rise in temperature (Clausius-Clapeyron relationship). As a result, enhanced atmospheric moisture and its transport in the lower troposphere are expected to intensify global mean precipitation and amplify existing hydrological patterns, making wet regions wetter and dry regions drier, under climate warming scenarios (Held & Soden, 2006, Skliris et al., 2022).

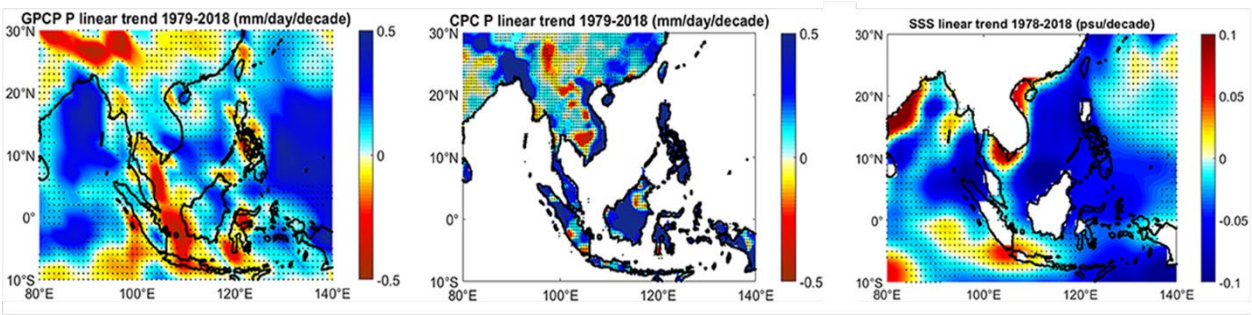


Figure 5. Linear trends (1979–2018) in satellite-derived precipitation and near-surface salinity, showing intensified hydrological conditions marked by increased oceanic precipitation and widespread surface freshening. *Adapted from Skliris et al. (2022).*

2.1.5 Tropical Cyclone Trends

Although region-wide observational studies are fewer, global and Western Pacific basin assessments reveal shifts in cyclone genesis toward higher latitudes and slower translation speeds, with implications for increased storm exposure and coastal flooding over Southeast Asia (*see Figure 6*; Li & Zhou, 2024).

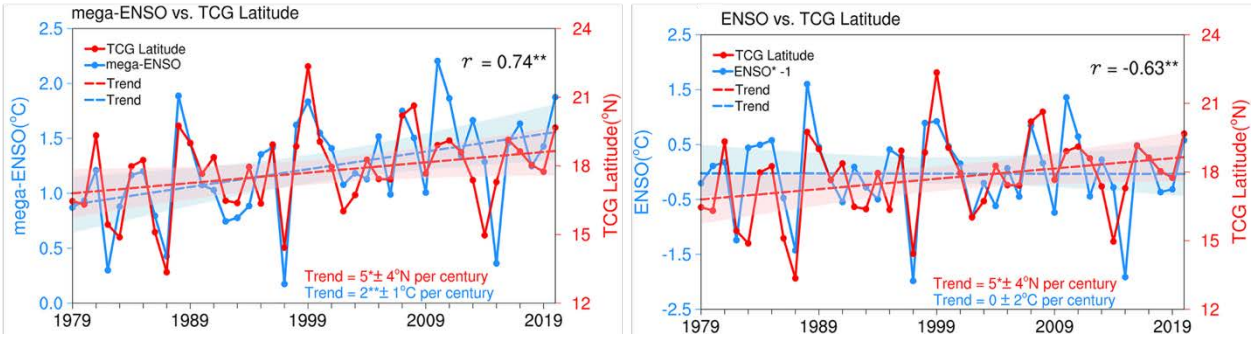


Figure 6. Time series showing northward shift in tropical cyclone genesis latitude in the Western North Pacific (1979–2020), linked to ENSO variability. *Adapted from Li & Zhou (2024).*

2.1.6 Compound Climate–Ocean Stressors

Multi-model diagnostics indicate rising instances where marine heatwaves coincide with heavy rainfall, storm surges, and tidal extremes—amplifying combined stress on both ecosystems and coastal populations (WMO Secretariat, 2024; Idris et al., 2023).Flooding across the region is projected to become more frequent and severe due to the intensification of the hydrological cycle driven by anthropogenic climate change (Held & Soden, 2006).

2.2 Projected Mid- & End-Century Hazards

By the end of the 21st century, Southeast Asia is projected to face intensifying climate-related hazards under all emissions scenarios. According to the IPCC Sixth Assessment Report (AR6), global mean sea-level rise will likely reach 0.28 to 0.55 meters under an intermediate emissions scenario (SSP2-4.5), and between 0.63 to 1.01 meters under a high emissions pathway (SSP5-8.5) (IPCC, 2024). In Southeast Asia, the effects of rising seas are further amplified by rapid subsidence in urban deltas. For example, Semarang Bay experiences subsidence of up to 100 mm per year, while Jakarta averages around 60 mm per year, dramatically increasing the relative rate of sea-level rise and compounding coastal flood risks (Sofian, 2022; Bott et al., 2021). Projections indicate that extreme sea-level events, those currently classified as “1-in-100-year” coastal floods, may occur annually in several Southeast Asian cities by 2050, even under low to moderate emissions pathways (IPCC, 2024).

Simultaneously, rising sea surface temperatures and changes in monsoon dynamics are projected to increase the intensity and frequency of storm surges, particularly in the South China Sea and Sulu-Sulawesi basins. Multi-model simulations suggest a three- to five-fold increase in storm surge amplitude by 2100, linked to higher ocean heat content and strengthened wind forcing (WMO, 2024). These physical changes are further exacerbated by the growing probability of compound hazards—where coastal storms, extreme rainfall, and high tides coincide. Such compound events pose cascading risks to infrastructure, utilities, and food security across low-lying coastal zones in Southeast Asia (IPCC, 2021; WMO, 2024). Notably, AR6 emphasizes that even under the most aggressive mitigation scenario (SSP1-1.9), sea-level rise will continue for centuries due to the inertia of ice sheet dynamics and thermal expansion, underscoring the urgency of long-term, adaptive planning (IPCC, 2024). Southeast Asia’s coastal megacities and archipelagos will therefore

require flexible, multi-decadal adaptation strategies that combine protection, accommodation, and, in some cases, planned retreat.

3. Vulnerability & Impacts

Ocean stressors, including warming and acidification, and hazards in Southeast Asia are resulting in both ecological degradation and significant human consequences. Coral reefs, mangroves, and seagrass meadows are concurrently losing natural capital, undermining ecosystem services and social resilience. Furthermore, these hazards adversely impact on food security and livelihoods of coastal communities, many of whom depend on the mariculture and wild-capture fisheries for providing livelihoods and employment rendering them highly vulnerable to climate change.

3.1 Natural-Capital Loss

Coral reefs in the Coral Triangle have experienced mass bleaching events linked to marine heatwaves in 2016, 2019, and most recently in May 2023. These bleaching events resulted in extensive coral degradation across Indonesia, the Philippines, and Malaysia, with implications for biodiversity and ecosystem stability (Chou et al., 2023; Lyu et al., 2024). Mangrove forests in Southeast Asia, which serve as direct source of income for many smallholder house which heavily rely on them for fisheries (fish, crabs, shrimp), non-timber products (firewood, thatch), and ecotourism, are declining due to increasing sea surface temperatures, storm frequency, and land use pressures, leading to canopy loss and structural degradation (Richards & Friess, 2016; WMO, 2024). Seagrass ecosystems are also under pressure from warming, sedimentation, and coastal development, contributing to a loss in ecosystem services that are globally valued but under-researched regionally (Waycott et al., 2009). Meanwhile, marine species distributions are shifting poleward due to ocean warming, with evidence of altered catch compositions in the wider Asia-Pacific region (Pecl et al., 2017; Pinsky et al., 2013).

3.2 Societal & Economic Consequences

The degradation of marine ecosystems is having measurable socioeconomic impacts. In tropical Asia and the Pacific, including Southeast Asia, climate change is projected to reduce fisheries catch potential by 65 to 86 percent by the end of the century under high-emissions scenarios, threatening food security and small-scale fishers' livelihoods (Cappa et al., 2024). Major coastal cities such as Jakarta and Manila, are increasingly vulnerable to sea-level rise and storm surge, with mounting concerns about the resilience of critical infrastructure including ports and transport systems. Ongoing coral degradation has raised alarms over future risks to marine tourism, though precise loss estimates remain under investigation.

3.3 Compound & Cascading Risks

Southeast Asia is increasingly affected by compound and cascading climate hazards. In 2020, Super Typhoon Goni brought category 5 winds, torrential rains, and storm surges to the Philippines, displacing over two million people and causing economic losses exceeding US$1 billion (UN OCHA, 2020). During Typhoon Ketsana in 2009, Metro Manila

experienced 450 mm of rain in just 12 hours, severely overwhelming drainage systems and causing nearly US$50 million in infrastructure and agricultural damages (ADB, 2009).These events illustrate the vulnerability of both built and natural systems to compounding hazards—interactions between storm surge, heavy rainfall, and infrastructure failure amplify physical damage and recovery costs.

These examples reflect the layered vulnerability of Southeast Asian coastlines, where the convergence of extreme events, degraded ecosystems, and infrastructure limitations magnify physical damage and socio-economic disruption. Increasingly, such hazards also intersect with the region's expanding blue economy, where marine sectors rely on the stability of coral reefs, mangroves, and seagrass meadows. Climate-induced ecosystem degradation, through bleaching, dieback, retreat, or the spread of harmful algal blooms, compromises vital services such as shoreline protection, water quality regulation, and fishery productivity.

4. Adaptation Gaps & Rationale for a Regional Project

Southeast Asia has made progress in coastal and marine climate adaptation, but persistent gaps in data systems for monitoring of climate and ocean hazards, governance structures, and financing mechanisms impede building resilience of the most vulnerable communities at scale. A regional project is essential to address these interconnected deficits, as national efforts alone are insufficient to manage transboundary ecosystems, shared fisheries, and compound climate risks.

4.1 Fragmented Observing and Early Warning Capacity

Despite expanding coverage since 2015, less than 40 percent of ASEAN's population is currently covered by impact-based multi-hazard early warning systems (MH-EWS), which is below the Sendai Framework's targets for early warning coverage (United Nations Office for Disaster Risk Reduction & World Meteorological Organization, 2024). The regional Global Ocean Observing System (GOOS) and Global Climate Observing System (GCOS) suffer from uneven distribution of stations, which limits the forecasting of compound hazards like storm surges and tidal floods (ESCAP, 2020). National meteorological services often operate in isolation, with varied standards for sensor platforms, data resolution, and dissemination protocols (Pacific Disaster Center, 2024). The ASEAN End-to-End Early Warning System (E2E-EWS) assessment highlights disparities in risk analysis, dissemination, and cross-border data sharing, especially for slow-onset hazards like sea-level rise and salinization (Pacific Disaster Center, 2024). While pilots in countries such as the Philippines exist, they remain underrepresented in rural and peri-urban zones (PAGASA, 2024).

These deficiencies also threaten the viability of Southeast Asia's growing blue economy, which relies on climate-sensitive sectors such as aquaculture, fisheries, marine tourism, and coastal infrastructure. Early warning systems and predictive decision-support tools, when co-designed for ecosystem thresholds and socioeconomic exposure, can help support climate-resilient blue economy investments by anticipating stressors like harmful

algal blooms, seagrass loss, and saline intrusion. Without regionally coordinated systems to monitor and respond to such risks, long-term sustainability of marine economic growth remains compromised.

4.2 Governance and Financial Constraints

Cross-border marine governance is hindered by varying legal frameworks and incompatible data-sharing policies. Although a few ASEAN Member States follow the “Data Free Flow with Trust” model, others employ restrictive data localization requirements, affecting scientific interoperability and delays in regional hazard response (Economic Research Institute for ASEAN and East Asia, 2023). From 2015 to 2022, Southeast Asia received only 8 percent of global adaptation finance, despite being among the most climate vulnerable regions (ADB, 2023; UNFCCC, 2022). Compared to adaptation investments in the Caribbean or Indian Ocean basins, Southeast Asia’s financing levels remain inadequate for nature-based solutions, regional observing systems, and early warning infrastructure (UNFCCC, 2022). Contributing factors include project bankability challenges, lack of regional financial vehicles, and fragmented institutional responsibilities.

4.3 Rationale for a Regional Approach

This project addresses the Adaptation Fund thematic area of Disaster Risk Reduction and early warning system which involves the monitoring and predicting of ocean hazards and assessment of risks. Ocean hazards typically manifest over regional spatial scales and include significant non-local components that preclude effective management at the national level. For instance, coastal sea level variability and extremes can originate from large-scale oceanic processes occurring far from individual coastal sites (Dangendorf et al., 2021). Consequently, the integration of observing and prediction systems must be implemented at the regional scale to adequately capture and forecast these dynamics. Similarly, marine heatwaves (MHWs) exhibit regional coherence, simultaneously affecting multiple coastal zones. Moreover, oxygen dynamics in coastal waters are strongly influenced by cross-shelf exchanges, which modulate and reset local oxygen concentrations and therefore necessitate a regional-scale understanding of coupled physical–biogeochemical processes.

Addressing these interconnected challenges requires a multifaceted regional approach: an Institutional strengthening of the monitoring, predicting and technology infrastructure, and capacity enhancement both at national and regional levels.

This regional adaptation approach offers clear advantages. Shared infrastructure for ocean monitoring, modelling, and early warning systems enhances cost-efficiency and reduces duplication, particularly in data-scarce archipelagic and coastal states (ESCAP, 2020; Pacific Disaster Center, 2024). Harmonization of standards across national agencies fosters interoperability in data collection, modelling, and forecasting (ERIA, 2023c). Transboundary governance platforms can strengthen marine spatial planning and fisheries management, aligning ecosystem-based adaptation across ecological and political borders to support resilience building of vulnerable communities at national and local levels. Anchoring regional financing mechanisms within ASEAN frameworks will further improve

project bankability, attracts concessional capital, and increases access to climate funds (ADB, 2023; UNFCCC, 2022).

Building on the UN Ocean Decade (2021-2030) framework, the proposed regional project aims to **support national and regional adaptation strategies** in beneficiary countries by developing and applying advanced coastal prediction and decision-support tools. These science-based systems will accelerate the implementation of effective **resilience and adaptation solutions** through improved understanding and forecasting of coastal ocean dynamics.

Within this framework, the initiative will focus on four main pillars:

Early Warning Systems and Risk Assessment

Enhancing hazard detection, forecasting, and risk analysis capabilities to support **multi-hazard early warning systems (EWS)** addressing marine heatwaves, tropical storms, storm surges, harmful algal blooms, and ocean deoxygenation. These systems will improve community preparedness and minimize the socio-economic impacts of coastal disasters. In particular, these monitoring capabilities will support management and planning of coastal sustainable businesses, including fisheries and mariculture where information on salinity, currents, waves and pollutant levels can be used to increase sustainable management.

Ecosystem Protection and Restoration

Promoting the conservation and restoration of critical coastal and marine ecosystems—such as **coral reefs, mangroves, seagrasses, and oyster beds**—as natural buffers that enhance biodiversity, carbon sequestration, and coastal protection. Furthermore, identifying where mangrove, seagrass, or oysters restoration will thrive in future climates, will inform planning and investments in business models for blue carbon and ecosystem-based resource exploitation for resilience building.

Sustainable and Resilient Coastal Development

Integrating **science-based evidence** into coastal planning for infrastructure, fisheries, and ecotourism, while fostering private-sector engagement in **climate-smart and nature-based technologies** to ensure long-term sustainability.

Community Resilience and Inclusive Governance

Strengthening **locally led adaptation**, institutional capacity-building, and inclusive governance frameworks to support **risk-informed development** and the establishment of **long-term decision-support systems** that empower vulnerable local communities to act on predictive knowledge.

5 Target Countries & Pilot Sites

The project focuses on four Southeast Asian nations—Indonesia, Malaysia, the Philippines, and Thailand—chosen for their significant exposure to marine climate risks, biodiversity importance, and leadership in marine governance. Together, these countries account for the majority of the Coral Triangle's marine biodiversity, extensive mangrove cover, and vulnerable coastal megacities (Spalding, 2001; Richards & Friess, 2016).

Within these nations, priority pilot sites were identified and proposed by local partner institutions based on climate vulnerabilities, and existing adaptive capacity. Analysis of the data from the CMCCsurvey (see Part II-I), conducted in collaboration with national institutions for oceanography and meteorology has characterized various locations across the archipelagic and deltaic seascapes with respect to the environmental and ecosystem conditions. In collaboration with the lead national institutions, a series of climate hazards identification discussions identified eight locations, the Pilot Sites, representing a spectrum of ecosystem conditions and governance settings. The full proposal development phase will further include more in-depth consultation with the Pilot Site vulnerable communities, stakeholders and marginalized groups to ensure the project will optimize adaptation measures to address the needs of populations on the ground.

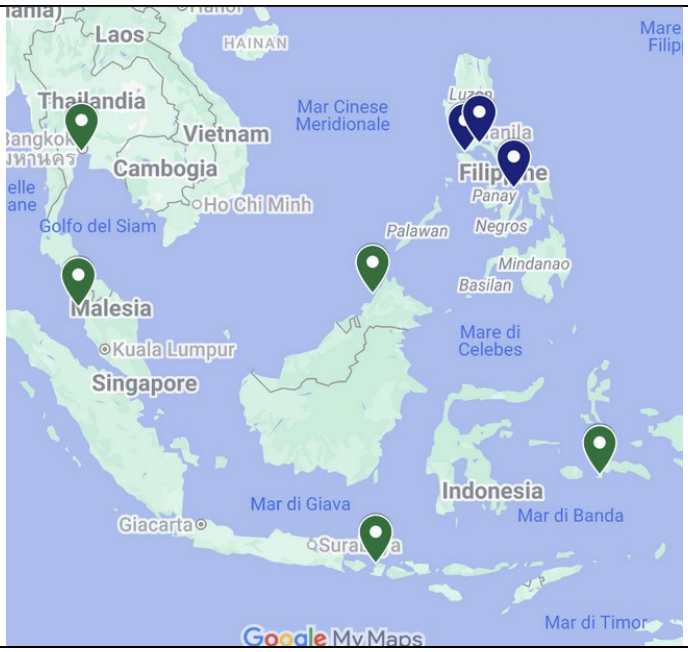
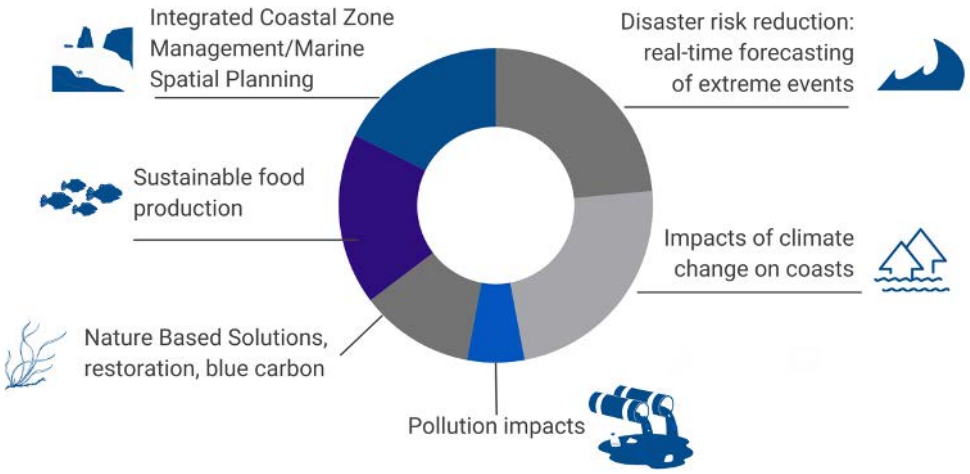


Fig. 7 The project Pilot Sites identified for implementation

Pilot Site consultation identified urgent needs across six thematic adaptation domains:



These thematic domains will inform component development, knowledge exchange, and scalable interventions across all the partner countries. Capacity assessments from the same consultation revealed some observational baselines and very limited operational forecasting capabilities:

6. Problem Statement & Theory-of-Change Snapshot

Core Problem: Southeast Asia's coasts face converging pressures from sea-level rise, ecosystem degradation, fisheries volatility, and infrastructure exposure. These pressures are unfolding in a region with fragmented adaptation systems, insufficient early warning coverage, and uneven technical and financial capacity. While countries have advanced national adaptation plans, current approaches remain largely sectoral and inward-focused, limiting effectiveness against disaster risks reduction and early warning systems for transboundary and compound marine hazards.

Barriers: Multiple systemic barriers constrain adaptation efforts in the region. First, governance remains fragmented across national jurisdictions, with limited cross-border marine spatial planning and divergent legal and institutional frameworks. Second, observational technologies are largely isolated within national systems and lack interoperability, which undermines the regional coherence of climate services, marine monitoring, and early warning capabilities. Third, there are persistent financing bottlenecks. Coastal adaptation and early warning systems receive disproportionately low funding relative to assessed needs, particularly in second-tier cities and rural coastal areas. Finally, technical and institutional capacities vary widely across the region. Many local and national agencies face challenges related to data literacy, risk modeling, and cross-sectoral coordination, limiting their ability to design and deploy effective adaptation strategies.

Theory-of-Change: If Southeast Asian countries jointly invest in shared ocean data systems, regionally harmonized early warning platforms, and scalable ecosystem-based solutions, then they will be better positioned to adapt to climate risks, sustain food systems, and protect marine biodiversity at scale.

This regional strategy is anchored in co-development with national agencies and local stakeholders. It reflects the six adaptation priorities identified by local Pilot Site partners and fills institutional and financial voids where national interventions have fallen short. It is designed to leverage multilateral finance, build capacity for long-term climate risk governance, and deliver inclusive, high-impact solutions for the South-East Asian Seas.

Project/Programme Objectives:

The overarching objective is to strengthen national and regional capacity to monitor, predict, and assess coastal hazards and their risks in both the short and long term, and to deliver knowledge, evidence-based tools and solutions, to build the resilience of vulnerable coastal communities to climate related hazards.

The project Objectives are:

Objective 1. Enhance national infrastructure and capacity for ocean hazard monitoring
This objective includes co-design and implementation of a fit-for-purpose, real-time coastal observing and cloud-based data management systems integrating satellite and in situ data for monitoring key coastal variables.

Objective 2. Reduce risk of exposure to extreme events
This objective entails the development of advanced impact forecasting systems, integrating coastal numerical models and AI-based predictive approaches to address key regional hazards, including storm surges, marine heatwaves, coastal erosion, hypoxic (low-oxygen) conditions, and pollution originating from both land- and sea-based sources.

Objective 3. Generate coastal climate projection information for adaptation planning
The objective entails the co-design and the implementation of high-resolution coastal downscaling and ocean-climate projections for different climate futures, enabling local adaptation planning in relation to sea level rise, temperature and salinity variability, and ecosystem shifts;

Objective 4. Strengthen sustainable coastal economies & resilient communities
The objective considers the co-design and the implementation of tailored information and decision-support services for different user groups, including: 1) Climate-resilient coastal zone planning and marine spatial management for deltas and archipelagos; 2) Digital Twins and Nature-Based Solutions to support restoration and adaptation of mangroves, coral reefs, and seagrasses; 3) Early warning and impact response systems for extreme sea level events, marine heat waves and harmful algal blooms; 4) Climate-smart fisheries and aquaculture management to ensure sustainable livelihoods; 5) Enhanced safety of maritime transport, disaster preparedness, and regional coordination.

Objective 5. Strengthen institutional frameworks and private-sector participation
The objective is to strengthen institutional collaboration and regional governance for long-term sustainability of the new observing and modelling capacity, including co-development

of services and policy dialogues and capacity enhancement programs for coastal stakeholders and decision makers.

Project/Programme Components and Financing:

Project/ Programme Components	Expected Outcomes	Expected Outputs	Countries	Amount (USD)
1. Enhance national infrastructure and capacity for ocean hazard monitoring	1.1. Safer coastal livelihoods by evidence-based information on coastal hazards 1.2. Enhancement of coastal management solutions by digital technologies allowing standardized information sharing	1.1. Real time and delayed mode satellite and in situ data delivery at Pilot sites 1.2. Regional Cloud computing and storage platform for data processing, quality control and exchange in real time and delayed mode	1) Malaysia 2) Indonesia 3) Philippines 4) Thailand	5,699,000
2. Impact forecasting for coastal risk management	2.1. Enhanced preparedness of coastal communities to ocean hazards 2.2. Enhanced capacity to plan adaptive measures to multiple coastal hazards	2.1. Real-Time Impact Forecasting systems tailored to Pilot Site coastal areas. 2.2. Multi-Hazards Mapping (e.g., sea level rise, extremes, pollution, erosion) identifying potential impacts 2.3. Predictive tools leveraging AI to enhance storm surge forecasting accuracy and lead times.	1) Malaysia 2) Indonesia 3) Philippines 4) Thailand	5,030,000
3. Coastal climate downscaling for adaptation planning	3.1. Evidence-based information to inform adaptation planning 3.2. Stakeholder-driven frameworks for adaptation, risk assessment, and management	3.1. Downscaled climate models and scenario-based projections . 3.2. Hazard indicators, risk assessments 3.3. Tools and visualizations to support adaptation plans directed to policy implementations and decision-making.	1) Malaysia 2) Indonesia 3) Philippines 4) Thailand	4,680,000

4.Decision support systems for sustainable coastal economies & resilient communities	4.1.Strengthened institutional and operational capacity for risk-informed coastal management. 4.2. Increased resilience and adaptive capacity of coastal communities and blue-economy sectors	4.1. A complete set of Multi-hazard Early Warning Systems (MH-EWS) dedicated to specific risks 4.2. Assessment and reporting services for adaptation planning. 4.3. Case-specific Digital Twin for the Coastal Ocean (DTCO) 4.4. Decision Support System for Situational Sea Awareness and search and rescue	1) Malaysia 2) Indonesia 3) Philippines 4) Thailand	4,663,000
5. Institutional & private sector engagement for sustainable coastal development.	5.1. Empowered stakeholders and practitioners with skills and knowledge and capacity to apply the solutions locally and maintain them. 5.2. Private sector involvement for sustainable maintenance of the infrastructure 5.3. Regional coordination through Coastal GOOS strategy and enhanced capacity for coastal and ocean monitoring. 5.4. Evidence-based institutional framework in support of coastal resilience	5.1. Workshops with local communities and private sector to train on the new technologies. 5.2.Capacity enhancement through the Coastal Resilience School Courses 5.3. Business models development for system sustainability 5.4. Regional coastal GOOS strategy and guidelines	1) Malaysia 2) Indonesia 3) Philippines 4) Thailand	4,995,000
6. Project/Programme Execution cost				1,591,770
7. Total Project/Programme Cost				26,658,770
8. Project Management Fee charged by the Implementing Entity (10%)				2,665,877
Amount of Financing Requested				29,324,647

The following tables illustrate how the project's outcomes and outputs align with the Adaptation Fund's strategic pillars (Table I.1) and expected results (Table I.2)

Table I.1: Project Outcomes classification by MTS Strategic Pillars

Outcome_Classification_by_Strategic_Pillars

Project Component	Project Outcome	AF Strategic Pillar	Justification
1. Enhance national infrastructure and capacity for ocean hazard monitoring	1.1 Safer coastal livelihoods by evidence-based information on coastal hazards	Action	This outcome supports concrete adaptation action by reducing vulnerability of coastal livelihoods through the provision of actionable, evidence-based hazard information. It contributes to reduced vulnerability, strengthened resilience and enhanced adaptive capacity at the local level by implementing new monitoring networks and advanced data quality control and observational records analysis
	1.2 Enhancement of coastal management solutions by digital technologies allowing standardized information sharing	Innovation	This outcome is central to the Innovation pillar, as it develops and deploys digital cloud technologies, interoperable platforms and standardized data sharing best practices to modernize coastal adaptation practices and enable replication and scaling.
2. Impact forecasting for coastal risk management	2.1 Enhanced preparedness of coastal communities to ocean hazards	Action	This outcome delivers direct, Local Level Adaptation benefits by improving preparedness and reducing risks from ocean hazards, fully aligned with the Action pillar's focus on tangible results for vulnerable communities. The numerical modelling will be deployed at local Institutions focuing on impact and vulenrabilities.
	2.2 Enhanced capacity to plan adaptive measures to multiple coastal hazards	Action	Strengthening planning capacity enables implementation of integrated, multi-hazard adaptation actions, a core objective of the Action pillar. This outcome will support for Locally Based Adaptation by developing tools for modelling the coastal data and deliver impact forecasts.
3. Coastal climate downscaling for adaptation planning	3.1 Evidence-based information to inform adaptation planning	Action	Evidence-based products underpins high-quality and effective adaptation actions, ensuring decisions are robust and risk-informed. This outcome will ensure the provision of local climate downtargeted assessments of needs and possibly expand delivery channels.
	3.2 Stakeholder-driven frameworks for adaptation, risk assessment, and management	Action	Stakeholder-driven frameworks support inclusive, locally based adaptation action, consistent with AF principles on ownership and participation. This outcome wil define the nasis for monitroing climate change impacts and effects of remediation solutions at the Pilots Sites.
4.Decision support systems for sustainable coastal economies & resilient communities	4.1 Strengthened institutional and operational capacity for risk-informed coastal management.	Action	Institutional and operational strengthening directly supports implementation of concrete adaptation actions and long-term sustainability, a core Action pillar objective. This outcome will develop targetedpeople-centered early warning systems and expand delivery channels. by using the cloud infrastructure.
	4.2 Increased resilience and adaptive capacity of coastal communities and blue-economy sectors	Action	This outcome directly corresponds to the ultimate expected result of the Action pillar: enhanced resilience and adaptive capacity of vulnerable communities. It will help to define the potential areas where adaptation soluzions will be successful by a cooperation between public and private national and local Institutions.
5. Institutional & private sector engagement for sustainable coastal development.	5.1 Empowered stakeholders and practitioners with skills and knowledge and capacity to apply the solutions locally and maintain them.	Learning and Sharing	This outcome directly strengthens capacity to capture, apply and disseminate learning, a core Learning & Sharing result. All previous outcomes will be subject to technical training.
	5.2Private sector involvement for sustainable maintenance of the infrastructure	Innovation	Involving the private sector introduces innovative business models, partnerships and service delivery mechanisms for adaptation. This outcome will involve the strategic planning of the scalability of solutions and the leverage of partnerships
	5.3 Regional coordination through Coastal GOOS strategy and enhanced capacity for coastal and ocean monitoring.	Learning and Sharing	This outcome directly advances regional knowledge partnerships, data sharing and south–south learning, central to the Learning & Sharing pillar. This out come will also Increase outreach and visibility of Fund's knowledge products and activities.
	5.4 Evidence-based institutional framework in support of coastal resilience	Action	Strong institutional frameworks are essential for sustained implementation of adaptation actions and policy alignment. This outcome will strengthen long-term capacity of national and regional institutions to implement high quality and local-level adaptation.

Table I.2: Projects expected outputs classified by MTS Expected results

SEAS_Expected_Outputs_to_MTS_Expected_Results

Project Component	Project Expected Output	Strategic Pillar	Expected_Result (MTS_Aligned)
1. Enhance national infrastructure and capacity for ocean hazard monitoring	1.1 Real time and delayed mode satellite and in situ data delivery at Pilot sites	Action	A1 – Vulnerability reduced & resilience strengthened
	1.2 Regional Cloud computing and storage platform for data processing, quality control and exchange in real time and delayed mode	Innovation	I3 – Access and capacities enhanced for innovation
2. Impact forecasting for coastal risk management	2.1 Real-Time Impact Forecasting systems tailored to Pilot Site coastal areas.	Action	A1 – Vulnerability reduced & resilience strengthened
	2.2 Multi-Hazards Mapping (e.g., sea level rise, extremes, pollution, erosion) identifying potential impacts	Action	A1 – Vulnerability reduced & resilience strengthened
	2.3 Predictive tools leveraging AI to enhance storm surge forecasting accuracy and lead	Action	A3 – Evidence generated & results scaled
3. Coastal climate downscaling for adaptation planning	3.1 Downscaled climate models and scenario-based projections .	Action	A3 – Evidence generated & results scaled
	3.2 Hazard indicators, risk assessments	Action	A1 – Vulnerability reduced & resilience strengthened
	3.3 Tools and visualizations to support adaptation plans directed to policy implementations and decision-making.	Action	A2 – Access & institutional capacity enhanced
4.Decision support systems for sustainable coastal economies & resilient communities	4.1 A complete set of Multi-hazard Early Warning Systems (MH-EWS) dedicated to specific risks	Action	A1 – Vulnerability reduced & resilience strengthened
	4.2 Assessment and reporting services for adaptation planning.	Action	A3 – Evidence generated & results scaled
	4.3 Case-specific Digital Twin for the Coastal Ocean (DTCO)	Action	A3 – Evidence generated & results scaled
	4.4 Decision Support System for Situational Sea Awareness and search and rescue	Action	A1 – Vulnerability reduced & resilience strengthened
5. Institutional & private sector engagement for sustainable coastal development.	5.1 Workshops with local communities and private sector to train on the new technologies.	Learning and Sharing	L2 – Capacity to capture & disseminate learning strengthened
	5.2 Capacity enhancement through the Coastal Resilience School Courses	Action	A2 – Institutional capacity enhanced
	5.3 Business model development for eCORE-SEAS system sustainability	Innovation	I2 – Successful innovations replicated & scaled
	5.4 Regional coastal GOOS strategy and guidelines	Learning and Sharing	L1 – Knowledge generation & dissemination

Legend:
Strategic Pillar 1 Action: A1 – Vulnerability reduced, resilience strengthened, and adaptive capacity enhance; A2 – Access to finance and institutional capacities enhance.
A3 – Evidence for effective action generated and results replicated and scaled up
Strategic Pillar 2 Innovation: I1 – New innovations and risk-taking encouraged and accelerated; I2 – Successful innovations replicated and scaled up; I3 – Access and capacities enhanced for designing and implementing innovation; I4 – Evidence base generated and shared.
Strategic Pillar 3 Learning & Sharing: L1 – Knowledge generation and dissemination on effective and innovative local adaptation increased; L2 – Capacity to capture and disseminate learning strengthened; L3 – Knowledge partnerships expanded and outreach increased.

Projected Calendar:

Milestones	Expected Dates
Start of Project/Programme Implementation	01/01/2027
Mid-term Review (if planned)	31/11/2029
Project/Programme Closing	31/12/2032
Terminal Evaluation	30/09/2032

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Describe the project/programme components, particularly focusing on the concrete adaptation activities, how these activities would contribute to climate resilience, and how they would build added value through the regional approach, compared to implementing similar activities in each country individually. For the case of a programme, show how the combination of individual projects would contribute to the overall increase in resilience.

This project will improve beneficiary country communities' capacity to assess and predict coastal multi-hazards and risks from ocean weather extremes and climate change trends in the SEAS. The methodology is based on coordinated risk identification and community-embedded adaptation measures.

More broadly, the project will build societal awareness and thereby resilience to the several weather and climate coastal threats, developing EWS and digital coastal services, as promoted by the Sendai Framework for Disaster Risk Reduction 2015-2030, to which the South East Asia nations are committed.

According to the United Nations Office for Disaster Risk Reduction (UNISDR), the following are four key elements of EWS: I. risk knowledge; II. Monitoring and warning service; III. dissemination and communication; and IV. response capability. The project will advance the first 3 while putting the basis for the response capabilities. The project will enhance risk knowledge and response capability with activities that map potential threats and implement low-cost adaptation measures to reduce community risk. Capacity strengthening, highlighted in the 2030 Agenda under SDG 13 Target 13.1, will also be addressed in all project components through training, institutional twinning, participatory planning, and knowledge exchange.

A core strength of this project is the regional approach and the Pilot area implementation strategy for MH-EWS and solutions. Deploying solutions across these varied Pilot Sites will facilitate the integration of coastal heterogeneity, regional connectivity, and solution scalability. Standardized data collection and modeling efforts within the Pilot Sites will provide a foundation for identifying and validating transferable solutions applicable across diverse coastal systems. The project emphasizes from the beginning a cloud digital infrastructure for data management and service deployment

that will enhance sustainability of the science-based solutions and allow public private partnerships to grow in the future.

The sustainability of the regional approach is ensured by the presence of the executing entity being the UNESCO Intergovernmental Oceanographic Commission's Sub-Commission WESTPAC, residing in the region, which ensures the direct contact with national policy makers and research Institutions in the single nations.

The project is directly aligned with four Adaptation Fund outcomes: Outcome 1 (Reduced exposure to climate change hazards and threats); Outcome 2 (Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses); Outcome 3 (Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level); and Outcome 4 (Improved policies and regulations that promote and enforce resilience)

Tables I-1 and I-2 illustrate how the project's Outcomes and Outputs align with the Adaptation Fund Medium-Term Strategy Pillars and Expected Results, offering readers a structured overview of these linkages.

Component 1: Enhance national infrastructure and capacity for ocean hazard monitoring

This core component underpins all others—especially Components 2, 3, and 4—by strengthening infrastructure, capacity, and human resources. It encompasses the enhancement of observation platforms (both conventional and low-cost) at the eight Pilot Sites, the improvement of data management and exchange systems, and the development of a regional cloud platform for processing real-time and delayed data. Additionally, it builds local institutional capacity in coastal ocean monitoring and promotes sustainability through training in data utilization, management, and cloud-based computing. These monitoring capabilities are critical because the real time information about the temperature, salinity, currents and waves and pollutant levels can be used to increase the viability of coastal businesses, including fisheries, farms and ecotourism, which ensures the livelihood and resilience capacities of vulnerable coastal communities.

Output 1.1. Real time and delayed mode satellite and in situ data delivery at Pilot sites

These solutions are intended in support of modelling (both numerical and AI/ML), improving the accuracy and trustability of both short- and long-term predictions/projections and Digital Twins at the identified for the project Pilot Sites (Fig. 7). The implementation will consider with high priority:

1. High-resolution remote sensing data at the Pilot Sites delivery and analysis, considering the atmosphere-land-river-sea interfaces and subcomponents;
2. Cost-efficient coastal observing networks, implemented and operational, including Citizen Science
3. Upgraded traditional coastal stations and novel technology at selected Pilot Sites

4. Engagement of local industrial and business sensor/platform providers for sustained and maintained observing system.

Output 1.2 Regional Cloud computing and storage platform for data processing, quality control and exchange in real time and delayed mode

This infrastructure is designed to support data sharing and computational activities at project's Pilot Sites, initially with a regional scope and subsequently enabling interoperability across regions. The main outcomes/outputs are:

1. Tailored Regional Cloud resources for accessible and usable observational and model data collected at Pilot Sites
2. Cloud-based numerical modelling and AI/ML models
3. Hubs for Web-based DSS, Digital Twins and other applications
4. Interoperable cloud platforms across the Pilot Sites

Component 2: Impact forecasting for coastal risk management

This component enhances local capabilities to generate real-time and short-term (up to a few weeks) forecasts of ocean conditions, such as storm surge, waves, inundation, marine ecosystem behavior, and marine heatwaves in advance of extreme events. It also develops expertise in analyzing and predicting compound events with innovative AI-based methods, including coastal flooding and pollution. Hazard mapping will aid climate-resilient planning by delivering accurate and timely assessments for preparedness and risk management. The project intervention will support AI-enhanced predictive tools for forecasting of temperature, salinity, currents, waves and pollution dispersion models, for managing climate and ocean risks that threaten livelihoods along the coast.

Output 2.1 Real time impact forecasting systems tailored to Pilot sites

Real time forecasting numerical models and operational chains, following international best practices, will be established or improved, calibrated and validated at each project Pilot Sites. The models will include:

1. High resolution river-coast-ocean numerical models nested into global forecasting models and forced at the air-sea interface by global or regionally limited area atmospheric forecasts;
2. High resolution numerical wave models, both coupled and uncoupled to ocean current models (point 1 above) to forecast, including but not limited to, significant wave height, wave direction.
3. Coastal biogeochemical numerical models coupled to the river-coast-ocean numerical models outlined above forecasting oxygen, PH, phytoplankton biomass, etc.
4. Different complexity coupled sediment-waves-currents and inundation models for coastal erosion

Output 2.2 Multi-Hazards Mapping (e.g., sea level rise, extremes, pollution, erosion) identifying potential impacts

Using the Output 2.1 models, ensemble simulations will be carried out to sample the variability and quantify the uncertainty. Mapping of hazard will follow the best practices in oceanography that are:

1. Mapping of sea level rise trends based upon long time series of downscaled sea level from global models for the past 30 years, compared with satellite altimetry data available for the same period.
2.Pollution mapping: generic source
3. Mapping of extremes based upon innovative statistical analysis tools applied to observation and numerical model output classifying the highest hazard coastal areas at each Pilot site
4.Coastal erosion mapping from satellite visible imagery for the past 30 years and concomitant in situ data from existing and new high efficiency stations implemented in Component 1
All products will be made available on interactive Atlas-like space on the cloud.

Output 2.3. Predictive tools leveraging AI to enhance storm surge forecasting accuracy and lead times.

AI forecasting will be implemented at selected sites allowing to optimize computing resources and allowing for simplified operational chains and timely information to be produced. The project will implement experimental forecasting for waves and sea level following international best practices. This component of the project supports business intelligence for coastal business value chains, facilitate investments in these sectors.

Component 3: Coastal climate downscaling for adaptation planning

This component develops and provides high-resolution climate projections to inform coastal adaptation planning and risk evaluation. It supports evidence-based decision-making by using stakeholder-informed frameworks, climate hazard analyses, and tools designed to guide adaptation strategies and policy development.

Output 3.1 Downscaled climate models and scenario-based projections

This output will be delivered after careful examination of the HPC and data management resources needed to carry out the projects. Shared Socioeconomic Pathways (SSPs) – used in IPCC AR6 –will be discussed with local stakeholders to find how many and which ones are the most desirable for coastal climate downscaling. Pilot sites coastal downscaling with models delivered in component 2 will be done for 100 years on acquired HPC resources in the region. Validation for the historical period will be carried out with observations collected in Component 1

Output 3.2 Hazard indicators, risk assessments

Climate downscaling for the coastal ocean is still in its early stages. Therefore, new downscaling frameworks and initiatives should prioritize accessibility, transferability of methodologies and outputs, and effective knowledge exchange. Following best practices, the design of regional climate downscaling frameworks, whether using numerical modelling or AI, should aim to support long-term development and build relocatable capabilities. From the available downscaling models, encompassing both waves, currents and biogeochemistry, hazard indices will be extracted, among others sea level rise along the coasts and in the bays, temperature anomalies and heat wave events, oxygen and PH projections.

Output 3.3 Tools and visualizations to support adaptation plans directed to policy implementations and decision-making.

The climate model downscaling projections produced previously will be stored following international, cloud-based standards on the regional Cloud system of Output 1.2. A software analysis package for visualization will be developed that will be interactive and designed with local policy makers and coastal managers.

Component 4: Decision support systems for sustainable coastal economies & resilient communities

This component provides decision support tools specifically tailored to local contexts, aimed at fostering sustainable coastal economies and communities. Building on the outputs of Components 1, 2, and 3, it includes customized, people-centered early warning systems, pollution and hazard mapping, and validated Digital Twins to support sustainable ocean planning and nature-based solutions.

Output 4.1 A complete set of Multi-hazard Early Warning Systems (MH-EWS) dedicated to specific risks

MHEWS comprise: (a) **risk knowledge** through systematic data collection and assessment (Components 1–3); (b) hazard detection and forecasting, emphasizing impact-based predictions for storm surge, inundation, erosion, marine heatwaves, pollution, and ecosystem stressors such as algal blooms, acidification, and hypoxia. While storm surge and heatwaves will be derived from Building Blocks 1–2, specific models of pollutant transport and debris drift will be added here for pollution forecasting; (c) preparedness and response capacity (Component 5); and (d) risk communication and early warning, via multi-platform, multi-channel dissemination.

All these services will be implemented at the Pilot Sites.

Output 4.2 . Assessment and reporting service for adaptation planning.

In parallel to the IPCC process, we aim to build capacity to produce assessment and special reports tailored to Pilot Sites and their regional contexts. Following IPCC working methods, Task Groups will use climate data from cloud repositories and downscaling products of this project to analyze coastal hazards. Their work will include: (1) defining requirements and protocols for climate datasets; (2) developing user-friendly interfaces, similar to the IPCC Interactive Atlas; (3) engaging scientific experts to evaluate content and establish quality indicators; and (4) delivering reports in line with IPCC best practices.

Output 4.3 Case-specific Digital Twin for the Coastal Ocean (DTCO)

To manage priority risks at Pilot Sites, the Digital Twin for the Coastal Ocean (DTCO) will be employed. A DTCO is a digital replica of coastal systems, integrating models and observations to reproduce current and historical conditions. This tool enables governments and stakeholders to test management options—such as Nature-Based Solutions for erosion and flooding, habitat improvements, before real-world implementation. By providing scenario-based evidence, DTCOs strengthen decision-making, support effective adaptation planning, and advance coastal resilience and sustainable development. This will include DCTO to identify where mangrove, seagrass

and oyster beds restoration will thrive in future climates, informing business and investment models for blue carbon, and ecosystem-based production systems.

Output 4.4 Decision Support System for Situational Sea Awareness and search and rescue

Situational awareness, in the project context, entails the continuous comprehension and projection of the maritime environment. Specifically, it involves: real-time acquisition of environmental and operational data (Component 1 and 2) contextual analysis and correlation of this data to infer the current operational situation; the evolution of maritime conditions that may affect ongoing or planned activities at sea. SSA decision support system will use data fusion techniques and decision-support frameworks that can transform raw data into actionable information. A particularly critical application of SSA is in Search and Rescue (SAR) operations. The foundational Components 1 and 2 play a pivotal role in enabling SAR authorities, such as coast guards and maritime safety agencies, to deploy optimized, data-driven response strategies.

Component 5: Institutional & private sector engagement for sustainable coastal development.

This component supports long-term sustainability by fostering private sector participation and providing stakeholder training in the use of innovative monitoring and forecasting tools. It reinforces national institutional frameworks, enhances regional coordination through WESTPAC, and contributes to the development of a coastal GOOS strategy and sustainable business models. Additionally, it promotes knowledge sharing across pilot sites to refine and scale effective solutions.

Output 5.1 Workshops with local communities and private sector to train on the new technologies

The activities here will strengthen local capacity through tailored training and workshops with communities and the private sector. Activities will begin with needs assessments to ensure relevance, followed by the delivery of practical training supported by demonstrations and pilot applications. Dialogue and co-design processes will align community priorities with private sector opportunities, while train-the-trainer approaches will create local champions for sustained knowledge transfer. Post-training support, combined with monitoring and evaluation, will ensure adoption and generate evidence of impact. Lessons learned will guide scaling and replication to other communities and sectors, fostering long-term technology uptake and resilience.

Output 5.2 Capacity enhancement through the Coastal Resilience School Courses.

Capacity building will be built on previous experience and tested formats, such as the Coastal Resilience School and regionally tailored training programs such as COMPASS, which integrate science, practice, and innovation for coastal resilience. Training will expand to governmental institutions and sustainable ocean planning, while participatory approaches—through citizen science, industry collaboration, and Ocean Literacy initiatives—will broaden stakeholder engagement across the national Pilot Sites of the region.

Output 5.3 Business model development for system sustainability

Business models for use of EWS and Decision Support System technologies will be developed through private sector engagement to generate new revenue opportunities to secure long-term sustainability and resilient coastal businesses, in alignment with national disaster risk management priorities. It will demonstrate the cost-benefit advantages of the use of such tools for planning and managing coastal businesses. The specific approaches and models to be tested will be defined based on the existing local context and would include i) financing strategies - including blended finance, public-private partnerships, and subscription-based services. Local enterprises and institutions will be capacitated to operate and maintain the systems, supported by clear data-sharing and IP frameworks. Pilot models will be implemented and evaluated at selected sites, providing evidence for scaling and replication.

Output 5.4 Coastal GOOS strategy for the region

The UNESCO-IOC GOOS program will oversee the implementation of coastal observing with international standards to ensure the long-term sustainability, fostering a structured and collaborative framework under GOOS Regional alliances and WMO regional associations. This solution will consider the implementation of the Coastal Resilience Requirement Review process and the extraction of best practices for observing and modelling for coastal risk assessment and management.

B. Describe how the project /programme would promote new and innovative solutions to climate change adaptation, such as new approaches, technologies and mechanisms.

The project promotes innovation in climate change adaptation by establishing a transformative regional system for monitoring, predicting, and managing coastal risks. Its foundation is a cloud-based digital infrastructure that integrates real-time satellite data, in-situ observations, and advanced modeling tools. This regional backbone not only standardizes and harmonizes data across the partner countries but also ensures that information is accessible to both national agencies and coastal communities. By addressing the persistent fragmentation of climate services in Southeast Asia, the project represents a major step towards scalable and science-based coastal adaptation.

The project further advances innovation through the deployment of Digital Twin technologies, which enable decision-makers to simulate “what-if” scenarios and assess the cost-effectiveness of nature-based and hybrid grey–green solutions, such as mangrove buffers, living shorelines, and coastal green corridors. This allows for transparent, evidence-based planning of adaptation measures before large-scale investment is committed. A strong emphasis is also placed on community-driven innovation, through citizen science networks and low-cost sensors that empower coastal populations to monitor variables such as sea surface temperature, salinity, dissolved oxygen, and algal blooms. These locally generated data will feed into national and regional systems, enhancing both early warnings and public ownership of adaptation strategies.

Country-specific pathways illustrate the diversity and adaptability of this innovative framework. In Indonesia, the project expands on national initiatives for Community Preparedness, combining operational forecasting capacities of BMKG with research from BRIN to strengthen resilience in Lombok and Ambon, where tectonic and climatic hazards converge. In Malaysia, the innovation lies in integrating Digital Twin tools into marine spatial planning and urban coastal management, enabling the testing of adaptation options for ports, aquaculture, and mangrove-based shoreline protection. In Thailand, the emphasis is on confronting unique ecological stressors in the Upper Gulf of Thailand, where eutrophication, hypoxia, and marine heatwaves have severely degraded ecosystems. Meanwhile, the Philippines continues to build on its strong disaster risk management systems by embedding community-based monitoring and ecosystem-based adaptation into multi-hazard forecasting. Together, these country-level innovations strengthen the regional fabric of the project, demonstrating how cutting-edge technologies can be applied in context-specific ways while serving broader regional adaptation goals.

C. Describe how the project/programme would provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project/programme would avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

The project is designed to generate tangible economic, social, and environmental benefits for Southeast Asia's most vulnerable coastal populations.

Economically, the project reduces the recurring losses associated with extreme weather and climate hazards by providing early warnings and predictive tools that enable proactive decision-making. This is particularly important in sectors such as fisheries, aquaculture, and tourism, which are central to the livelihoods of millions in the region. For example, in Indonesia, enhanced forecasting is expected to reduce disruption to small-island economies that rely heavily on fisheries, while in Malaysia, safeguarding critical port infrastructure and aquaculture assets will protect jobs and revenues in the blue economy. In Thailand, protecting Bangkok and the Upper Gulf from sea-level rise, hypoxia, and marine heatwaves secures both fisheries productivity and a substantial share of national GDP.

Socially, the project places strong emphasis on inclusion and equity. By integrating gender-responsive approaches and community-based participation into the design of early warning systems, the project ensures that women, youth, Indigenous peoples, and the elderly are not only beneficiaries but also co-designers of adaptation solutions. The integration of citizen science empowers marginalized groups to contribute actively to climate monitoring and resilience planning, while training and capacity development will ensure that local communities have the knowledge and skills to act upon forecasts and adaptation options.

Environmentally, the project prioritizes ecosystem-based adaptation measures, recognizing the role of mangroves, seagrasses, and coral reefs as natural defenses

against hazards. These ecosystems not only buffer storm surges and reduce erosion but also provide vital co-benefits in terms of biodiversity conservation, carbon sequestration, and food security. In Thailand's Upper Gulf, for example, monitoring and mitigating eutrophication and hypoxia will help restore marine biodiversity and fisheries stocks. The project's safeguards framework ensures that all interventions are consistent with national environmental standards and the Adaptation Fund's Environmental and Social Policy, thereby avoiding negative impacts and ensuring that adaptation actions are environmentally restorative and socially equitable.

D. Describe or provide an analysis of the cost-effectiveness of the proposed project/programme and explain how the regional approach would support cost-effectiveness.

The regional design of the project maximizes cost-effectiveness by pooling resources, sharing infrastructure, and promoting replication of solutions across national boundaries. By establishing a common digital backbone for hazard monitoring, forecasting, and decision support, the project avoids costly duplication of national systems. Shared access to satellite data, ocean sensors, and modeling tools ensures that economies of scale are achieved, with each participating country benefiting from regional investments at a fraction of the cost of independent implementation.

The cost-effectiveness of this approach is particularly evident at the national level. In Indonesia, where monitoring for multiple marine hazards is highly resource-intensive, integrating into a shared regional system significantly reduces costs. Malaysia, with its dual coastlines in Peninsular and Bornean regions, avoids duplicating investments by linking national systems into the regional cloud. Thailand demonstrates cost-effectiveness by protecting high-value economic zones, particularly Bangkok and the Central Plain, through preventive measures rather than costly post-disaster recovery. In the Philippines, embedding ecosystem-based approaches into local disaster risk reduction strategies ensures that adaptation measures are both affordable and scalable. By focusing on prevention, regional cooperation, and replication, the project ensures that donor investments generate long-term, sustainable returns.

E. Describe how the project/programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist. If applicable, please refer to relevant regional plans and strategies where they exist.

The project is firmly anchored in both regional and national policy **frameworks**, ensuring coherence, complementarity, and long-term uptake of results. At the regional level, the project directly supports the ASEAN Climate Change Strategic Action Plan (2025) and the ASEAN State of Climate Change Report (2021), which highlight the need for enhanced early warning systems, data interoperability, and financing for adaptation. It also contributes to the implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030, particularly Target G on access to multi-hazard early warning systems and aligns with the UN Decade of Ocean Science for Sustainable Development (2021-2030).

These linkages ensure that the project is not only nationally relevant but also regionally and globally strategic.

ASEAN Alignment: The project directly supports the ASEAN Climate Change Strategic Plan (2025–2030), which prioritizes cross-border collaboration, integrated risk reduction, and enhanced adaptation finance across Member States. It embodies objectives from the ASEAN State of Climate Change Report, particularly resilience of coastal-marine ecosystems and climate-smart adaptation of marine-coastal livelihoods (ASEAN Secretariat, 2021). The initiative also operationalizes recommendations of the ASEAN Working Group on Climate Change, which advocates for strengthened data-sharing, monitoring, and regional climate action.

Vision 2050 Synergies: Under ASEAN Vision 2050, reaffirmed in the ASEAN Community Blueprint 2023, Southeast Asia sets a trajectory toward an inclusive, adaptive, and climate-resilient future. The project promotes this vision by reinforcing early warning systems, nature-based solutions, and institutional capacity across the South-East Asian Seas region.

National Alignment & Global Frameworks: The initiative aligns with Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) in partner countries - more detail is outlined for each country below. Regional cooperation enables these countries to meet national goals through shared infrastructure, harmonized standards, and transboundary ecosystem management, offering greater cost-effectiveness and scale.

The project advances Sendai Framework Target G, which seeks to substantially increase access to multi-hazard early warning systems and risk information (UNDRR, 2022). It also aligns with the UN Decade of Ocean Science for Sustainable Development (2021–2030), by enhancing ocean observation, data equity, and transboundary marine governance (IOC, 2022).

Biodiversity Frameworks: The project supports commitments under the Kunming-Montreal Global Biodiversity Framework (GBF), particularly Target 2 (ecosystem restoration) and Target 8 (minimizing climate impacts on biodiversity). By integrating ecosystem-based adaptation and marine habitat monitoring, the project contributes to national implementation of the GBF across Southeast Asia. At the national level, the initiative complements biodiversity targets embedded within national adaptation strategies and NDCs. Countries such as the Philippines, Malaysia, and Indonesia have committed to protecting and restoring coastal ecosystems - mangroves, seagrass, and coral reefs—as nature-based climate solutions. Through regionally harmonized monitoring, risk mapping, and data-sharing, the project strengthens the science-policy interface essential for biodiversity and climate co-benefits.

Indonesia

Indonesia’s National Adaptation Plan (2025) highlights coastal and ocean hazards - such as sea-level rise, coastal flooding, storm surges, and ocean warming - as critical national

risks for an archipelagic country, with direct implications for livelihoods, infrastructure, and development. There is an emphasise ecosystem-based and hybrid coastal protection (e.g. mangroves, coral reefs, and engineered measures) as priority adaptation strategies to reduce exposure, protect fisheries, and strengthen long-term resilience. The National Action Plan for Climate Change Adaptation (RAN-API, 2014) prioritizes ecosystem-based coastal and fisheries adaptation, and the project supports this by integrating downscaled climate models with ecosystem restoration planning. The country's updated NDC (2021) emphasizes enhancing resilience in archipelagic and coastal zones, particularly through early warning and strengthened institutional capacity. The project aligns with and operationalizes these priorities by embedding BMKG's operational hazard forecasting into a regional cloud platform and extending BRIN's research mandate to support downscaled projections and Digital Twin applications. Furthermore, the project is consistent with the Medium-Term National Development Plans (Rencana Pembangunan Jangka Menengah Nasional, RPJMN 2020–2024 and draft RPJMN 2025–2029), which identify climate resilience, disaster preparedness, and sustainable blue economy development as cross-cutting priorities. Sub-nationally, pilot activities in Lombok and Ambon address multi-hazard risks, community preparedness, and fisheries resilience, reinforcing Indonesia's commitments under the Disaster Risk Reduction Master Plan (Rencana Induk Penanggulangan Bencana) and the Ocean Policy framework. This project will give the science-based evidence for marine-based adaptation solutions, contributing to the national development agenda.

Malaysia

Malaysia's National Climate Change Policy 2.0 (no formalised National Adaptation Plan published) underscores the vulnerability of coastal communities and coastal and marine ecosystems, fisheries, and biodiversity to climate hazards, and calls for improved institutional coordination and data-driven adaptation. The policy's strategic thrusts include an emphasis on adaptation and resilience so that climate impacts are managed in ways that support socio-economic and development objectives. Strategies for this include risk-based analysis (of climate hazards, vulnerabilities) to inform planning, so adaptation becomes a routine element of planning; an emphasis on evidence-based and science/data-driven decision-making; and intensified research and innovation for preparedness. The project will support such strategies by developing interoperable climate information systems, embedding forecasting into local decision-making, and supporting nature-based adaptation in mangroves and coral reefs. Malaysia's updated NDC (2021) prioritizes coastal resilience, climate-smart agriculture, and blue economy adaptation, which the proposed project advances through its Digital Twin tools and marine spatial planning applications. Furthermore, at the sub-national level, the project aligns with the Penang State Climate Action Plan, which highlights coastal inundation, urban flood risk, and mangrove loss as urgent priorities. By piloting ecosystem-based and digital solutions that can be scaled across Peninsular Malaysia and Sabah/Sarawak, the project supports both national and state-level strategies. The project also reinforces Malaysia's Integrated Shoreline Management Plans (ISMPs) and the National Policy on Biological Diversity (2016–2025), ensuring that coastal adaptation contributes directly to biodiversity conservation and sustainable development goals.

Thailand

Thailand's National Adaptation Plan (NAP 2018, updated in 2023–2037) highlights sectoral adaptation priorities, with a focus on ecosystem-based adaptation, climate-resilient communities, and enhanced climate information systems. By developing data driven climate data at national and regional levels this project will ensure access to comprehensible, open, and shared climate information for planning and design of interventions and support some of the specific measures and guidelines under six specific sectors - Water Resources Management, Agriculture and Food Security, Tourism, Public Health, Natural Resources Management and Human Settlements and Security. Thailand's Climate Change Master Plan (2010–2050) sets out long-term strategic goals to reduce greenhouse gas emissions, strengthen climate resilience, and enhance institutional capacity. Thailand's 2nd Updated NDC (2022) also highlights coastal adaptation, water resources management, and resilient urban development. The project is strongly aligned with these priorities, particularly in addressing the vulnerabilities of the Upper Gulf, where eutrophication, hypoxia, marine heatwaves, and sea-level rise threaten fisheries, aquaculture, and Bangkok's economic core. By providing real-time forecasting, water quality monitoring, and participatory early warning tailored to local needs, the project strengthens Thailand's capacity to implement its national and sub-national strategies. It also supports the Policy and Plan for Enhancement and Conservation of National Environmental Quality (2017–2036), which calls for integrated databases and technological innovation to advance adaptation planning. In addition, the project reinforces implementation of Thailand's 20-Year National Strategy (2018–2037), which identifies climate resilience and sustainable natural resource management as key pillars of long-term national development.

Philippines

The project will contribute to key strategies under sectoral priority outcomes outlined in the Philippines NAP and will align across the plan's identified enablers including Governance and institutions, Stakeholder engagement, Skills and capacity building, Data and knowledge infrastructure, Technology and innovation and Adaptation financing. Specific This alignment will include development of localized and inclusive early warning systems, delivery of data for vulnerability assessment and monitoring programs and data-driven tools for disaster response and urban planning.

The Philippines' National Climate Change Action Plan (NCCAP 2011–2028) prioritizes food security, water sufficiency, ecosystem stability, climate knowledge, and capacity development. A 2024 performance audit of the NCCAP acknowledged improvements in mainstreaming adaptation into planning but highlighted ongoing gaps in inter-agency coordination and scientific capacity, which this project directly addresses by strengthening interoperable observing systems and impact-based forecasting. Ambisyon Natin 2040, the Philippines' long-term vision, explicitly frames resilience as a pillar of prosperity, and the proposed project aligns by enhancing disaster risk governance and coastal protection. The country's Updated NDC (2021) identifies priority adaptation measures, including multi-hazard forecasting and early warning, coastal zone management, and improved climate information networks. By embedding these into a regional digital backbone, the proposed project advances the Philippines' commitments while delivering co-benefits in local capacity-building, gender-responsive adaptation, and ecosystem-based resilience at its

pilot sites in the Verde Island Passage, Tayabas Bay, and the Visayan Seas. The project also complements the Philippine Development Plan (2023–2028) and the National Disaster Risk Reduction and Management Plan (2020–2030), ensuring integration with national development and disaster resilience priorities.

Taken together, these country-specific alignments demonstrate how the regional project would build directly on existing national strategies while enhancing regional coherence. By embedding advanced climate services, interoperable digital infrastructure, and participatory governance across four countries, the project operationalizes ASEAN priorities and global adaptation frameworks. Its regional approach ensures that national investments are considered, cross-border ecosystems are jointly managed, and knowledge generated in one country benefits all, thereby transforming fragmented efforts into a coherent regional adaptation strategy.

F. Describe how the project/programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.

The project has been designed to comply fully with the national technical standards and environmental regulations of all four participating countries, while aligning with the Adaptation Fund's Environmental and Social Policy.

In Indonesia, all project interventions will adhere to the Environmental Protection and Management Law (Law No. 32/2009, amended by Law No. 11/2020), which mandates environmental impact assessments (AMDAL) for coastal and marine projects. The project also aligns with the Medium-Term National Development Plan (RPJMN), which emphasizes climate-proofing of critical infrastructure and ecosystem-based adaptation. In addition, the operational standards of BMKG for multi-hazard monitoring will be integrated, ensuring that observation and warning infrastructure meets established national protocols, particularly for small-island and archipelagic contexts. The pilot sites in Lombok and Ambon will follow national protocols for community preparedness, while BRIN will provide scientific oversight to ensure that downscaled models and Digital Twin applications comply with established research and technical standards.

In Malaysia, compliance will be ensured through the Environmental Quality Act (1974, amended 1985, Section 34A), which requires EIAs for prescribed projects, and the Environmental Impact Assessment Order (2015), which defines coastal infrastructure categories subject to environmental review. The project will also adhere to the National Physical Plan for Coastal Zone Management and the Second National Coastal Zone Physical Plan, which set standards for shoreline protection, ecosystem management, and urban coastal development. At the sub-national level, pilot activities in Penang will follow the state's climate and environmental guidelines, particularly those addressing urban flood risk and mangrove management. Institutional oversight will be provided by the Department of Environment (DOE) and the Ministry of Natural Resources, Environment, and Climate Change (NRECC), which are the responsible authorities for compliance. In addition, the pilots in Penang and Sabah/Sarawak will comply with state-level environmental and coastal planning frameworks, ensuring that locally specific standards for mangrove rehabilitation, aquaculture development, and shoreline protection are met.

In Thailand, project activities will conform to the Enhancement and Conservation of National Environmental Quality Act (1992), which governs EIAs, coastal land-use standards, and marine resource protection. Complementary policy frameworks, such as the Climate Change Master Plan (2010–2050) and the National Adaptation Plan (2023–2037), provide additional guidance by calling for integrated databases, ecosystem-based management, and strengthened climate information systems to support infrastructure and development decisions. These standards will guide the implementation of forecasting systems, Digital Twin applications, and ecosystem restoration activities, ensuring they meet both environmental requirements and long-term climate-resilience objectives. The Upper Gulf pilots will specifically apply DMCR's standards for water quality monitoring and fisheries management, ensuring that early warning tools and ecosystem-based measures are technically compliant with national coastal regulations.

In the Philippines, the project will comply with Presidential Decree No. 1586 establishing the Environmental Impact Statement System, as well as the Climate Change Act (2009), which requires climate risk screening of development activities. Project interventions will also follow national building codes and climate-proofing standards issued by relevant agencies, ensuring that coastal infrastructure such as monitoring stations and community facilities are designed to withstand climate extremes. This is complemented by compliance with Department of Environment and Natural Resources (DENR) guidelines on ecosystem restoration and biodiversity protection. In addition, Local Government Units (LGUs), which are mandated under the Local Government Code to enforce environmental safeguards, will be engaged to ensure that community-level interventions meet locally applicable standards and contribute to long-term institutional sustainability.

Safeguard assessments will be embedded into the project implementation process. Across all four countries, safeguard screening will be systematically applied to identify and mitigate potential risks, including those related to equity, gender, biodiversity, Indigenous peoples, and involuntary resettlement. Regional oversight through IOC-WESTPAC, working with national implementing entities, will ensure consistent application of safeguards and technical standards. By harmonizing national and regional frameworks, the project sets a precedent for climate-resilient infrastructure and ecosystem management that is both nationally compliant and regionally coherent.

G. Describe if there is duplication of project/programme with other funding sources, if any.

The project has been structured to ensure complementarity with, rather than duplication of, existing initiatives. Across the region, national governments and partners have launched important climate and disaster risk management projects, but these remain largely country-specific, sectoral, and disconnected. The project provides the regional integration and interoperability that these efforts currently lack, ensuring that national investments yield broader cross-border impact.

In Indonesia, the project builds on BMKG's multi-hazard early warning system and BRIN's hazard research, extending their application beyond single-hazard contexts into a multi-

hazard, regional framework. This ensures that national investments are leveraged for broader climate adaptation outcomes. In Malaysia, the project complements the National Adaptation Plan and Penang State Climate Action Plan by connecting ecosystem-based measures with interoperable risk data and decision-support systems. Existing projects focus on rehabilitation and sectoral resilience but lack the integrated forecasting and planning capacities that the project provides.

In Thailand, the project complements ongoing implementation of the Climate Change Master Plan (2010–2050) and the National Adaptation Plan by filling gaps in water quality and ecosystem monitoring in the Upper Gulf. National agencies already collect data, but without the predictive integration and regional sharing that the project will deliver. Meanwhile, In the Philippines, the project complements several government efforts such as PAGASA's storm surge early warning, the DENR's Ocean and Environment Task Force's Ocean observation and modeling development, and the Climate Change Commission's knowledge networks, as well as projects in the academe to develop early warning and marine spatial planning systems. The project would link these to a regional digital backbone and embed citizen science, thereby enhancing their scope and reach.

At the regional level, the project strengthens ASEAN and IOC-WESTPAC climate initiatives by embedding them within a shared digital infrastructure, avoiding duplication while ensuring interoperability and transfer of lessons. The project design also incorporates insights from another project in the Caribbean, demonstrating how multi-country Adaptation Fund projects can achieve both efficiency and complementarity.

H. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

Knowledge management is embedded in the project as a mechanism to ensure that lessons learned in one country can be applied and scaled across the region. Each participating country has emphasized that adaptation efforts must be accompanied by systematic learning, replication, and continuous improvement.

At the community level, citizen science networks and participatory monitoring will not only provide data to national and regional systems but also create pathways for experiential learning and empowerment. In the Philippines, community-based monitoring of water quality, and storm surges and coastal erosion will inform coastal ecosystem risk management systems, and PAGASA's multi-hazard forecasting, respectively, while in Indonesia, community preparedness in Lombok and Ambon will generate lessons on preparedness and fisheries resilience. In Malaysia, pilots in Penang and Sabah/Sarawak will integrate mangrove monitoring and aquaculture adaptation into local knowledge systems. In Thailand, citizen-led water quality monitoring in the Upper Gulf will provide vital information on eutrophication, hypoxia, and marine heatwaves, while also training communities in interpretation and response.

At the national level, line agencies will receive capacity-building support to integrate new forecasting models, Digital Twin tools, and cloud-based data systems into planning and regulatory functions. This includes strengthening the operational and research capacities

of BMKG and BRIN in Indonesia, supporting DOE and NRECC in Malaysia to embed climate data into environmental regulation, and enabling ONEP and DMCR in Thailand to mainstream coastal ecosystem monitoring into national adaptation planning. In the Philippines, capacity building for various government agencies and research institutions will ensure that hazard responses and marine resource management are anchored on science. National pilots are designed as demonstration hubs, generating replicable practices and standard operating procedures that can be applied in other provinces and scaled nationwide.

By combining these efforts, the project creates a framework where pilot sites act as laboratories for innovation, and where lessons are systematically documented and transferred between countries through their institutional anchors. This ensures that knowledge gained in one context informs action in others, and that regional cooperation produces cumulative learning for climate-resilient coastal management.

I. Describe the consultative process, including the list of stakeholders consulted, undertaken during project/programme preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

In July 2023, CMCC initiated a survey to identify national partners interested in strengthening their Disaster Risk Reduction and Early Warning Systems through the development of Pilot Sites in their coastal zones. The survey helped highlight key priorities for enhancing coastal resilience, which now serve as the key basis for this CoastPredictproject. In addition, the following consultation meetings have been organized:

- May 2024, Workshop at the 2nd UN Ocean Decade Regional Conference for the Western Pacific & 11th IOC/WESTPAC International Marine Science Conference. The workshop (https://www.iocwestpac2024.com/workshops/) was done to consult with WESTPAC representatives and interested scientific/technical Partners on the structure of the project and the main objectives.
- June 2024, Side meeting at 57th Session of the IOC Executive Council. Delegates from UNESCO-IOC Member States manifested general support for the concept and the regional approach of the AF project.
- July 2024 – Sept 2025. Monthly on-line consultations with Pilot Sites' Partner Institutions and the Office of IOC WESTPAC Sub-commission -see Table below.
- 11-13 March 2025. At the Fifteenth Intergovernmental Session of the IOC Sub-Commission for the Western Pacific (WESTPAC-XV) in Tokyo, Japan, CoastPredict was listed as one of the UN Decade programs to be engaged with by Member States.
- 26 June 2025: At the 33rd IOC Assembly, the side event *"CoastPredict and Sustainable Blue Economy Partnership"* featured the presentation of the concept note and received explicit support from government representatives to advance the project's full proposal

Online Consultation with Pilot Site partner institutions for Concept Note content

Date	Meeting / Notes	Organisations represented
Friday, 26 July 2024	National institutes consultation	University of Malaysia, BRIN (Indonesia), University of Burapha (Thailand), University of the Philippines, WESTPAC, CMCC, Decade Collaborative Centre for Coastal Resilience (DCC-CR)
Thursday, 19 September 2024	National institutes consultation	University of Malaysia, BMKG (Indonesia), University of Burapha (Thailand), CMCC, Decade Collaborative Centre for Coastal Resilience (DCC-CR)
Tuesday, 15 October 2024	Philippines key stakeholder consultation - PAGASA	University of the Philippines, PAGASA Philippines (meteorological service), University of Malaysia, WESTPAC, CMCC, Decade Collaborative Centre for Coastal Resilience (DCC-CR)
Thursday, 14 November 2024	Malaysia key stakeholder consultation - Met Malaysia	University of Malaysia, Met Malaysia (meteorological service) WESTPAC, CMCC, Decade Collaborative Centre for Coastal Resilience (DCC-CR)
Tuesday, 10 December 2024	Malaysia institute consultation	University of Malaysia, CMCC
Tuesday, 4 March 2025	WESTPAC consultation on structure	University of the Philippines, WESTPAC, CMCC, Decade Collaborative Centre for Coastal Resilience (DCC-CR)
Tuesday, 25 March 2025	National institutes consultation	WESTPAC, University of the Philippines, University of Malaysia, CMCC, Thailand Dept. Marine & Coastal Resources, DCC-CR
Wednesday, 23 April 2025	National institutes consultation	WESTPAC, University of the Philippines, University of Malaysia, CMCC, Thailand Dept. Marine & Coastal Resources, DCC-CR
Wednesday, 28 May 2025	WESTPAC consultation on structure	WESTPAC, CMCC
Friday, 6 June 2025	WESTPAC consultation on structure	WESTPAC, CMCC
Tuesday, 8 July 2025	National institutes consultation	WESTPAC, University of the Philippines, University of Malaysia, BMKG - Indonesia, BRIN-Indonesia, Burapha University - Thailand, CMCC, Thailand Dept. Marine & Coastal Resources, DCC-CR

Thursday, 24 July 2025	National institutes consultation	WESTPAC, University of the Philippines, University of Malaysia, BMKG - Indonesia, BRIN-Indonesia, Burapha University - Thailand, CMCC, Thailand Dept. Marine & Coastal Resources, DCC-CR
Friday, 10 September 2025	National institutes consultation	WESTPAC, University of the Philippines, University of Malaysia, BMKG - Indonesia, BRIN-Indonesia, Burapha University - Thailand, CMCC, Thailand Dept. Marine & Coastal Resources, DCC-CR
Wednesday, 27 August 2025	National institutes consultation	WESTPAC, University of the Philippines, University of Malaysia, BMKG - Indonesia, BRIN-Indonesia, Burapha University - Thailand, CMCC, Thailand Dept. Marine & Coastal Resources, DCC-CR

During the full proposal development phase, detailed assessments and consultations at the Pilot Site community level and with vulnerable groups and women, will take place to further select specific adaptation activities and to identify specific needs and possible concerns. This will be done in cooperation with the national government, the technical Institutions involved in the project and local authorities, and other relevant stakeholders. As part of the assessment, the Pilot Site detailed target area stakeholder mapping will be done, including the identification of economic activities present at the Pilot sites. The consultations will be with heads of communities but also through women and youth focus groups and other any relevant groups. The planned consultations are the following:
- Pilot site municipalities representatives
- Pilot site management public Institutions
- Coast Guards and Port Authorities
- Pilot site economic activities consortia or groups (fishery consortia, tourism agencies/associations, local commercial associations, surfing/sport associations, etc.)
- Pilot site communities' representatives
- Pilot site NGO representatives
- Women representatives
- Youth representatives
- Any other relevant groups representative (disabled, elderly, etc.).
- Coastal / water user association representatives
- Actors implementing projects at Pilot sites (or in other nearby coastal areas).

J. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

All activities are structured to deliver measurable adaptation outcomes independently, without reliance on additional external financing. Targeting specific groups and locations will further ensure clear verification of results.
The regional project approach is essential for building resilient communities that share knowledge and determine best practices for data exchange at both regional and global levels. This approach ensures that prototypes developed locally achieve broad impact and that the associated business models are sustainable.

The following are the scenarios with and without project for each project component.

Component 1: Enhance national infrastructure and capacity for ocean hazard monitoring

Baseline: Although basin sea level monitoring systems exists in particular for tsunami, missing wave and temperature monitoring is of relevance at all Pilot Sites. Furthermore, the absence of a reliable high resolution remote sensing data sets for the coastal regions is an important limitation that does not allow the calibration and validation of numerical and AI models for forecasting and climate projections. Nor is there a robust record of hydrometeorological variables covering the land connected to the coasts at Pilot Sites. Furthermore, there is no regional exchange of data management practices as well as a lack of infrastructure to share the data in an interoperable way between the Pilot Sites.

With AF funds: The project will increase dramatically the number of coastal observations and remote sensing high resolution imagery for the effective implementation of forecasting and climate change adaptation aspects. The cloud system will host the observational and modelling/forecasting data sets allowing for

Component 2: Impact forecasting for coastal risk management

Baseline: There is a lack of numerical modelling in the region coastal areas The recent availability of large scale ocean forecast and meteorological open and free forcing fields makes it possible to use the technology of limited area numerical modelling and the innovative AI models for few weeks forecasts of extreme events in sea level, inundation and marine heat waves among the others.

With AF funds: The project will dramatically improve the numerical modelling and few weeks ocean forecasting capacity at the Pilot Sites with calibration and validation procedures to assess the quality.

Component 3: Coastal climate downscaling for adaptation planning

Baseline: Climate change scenario projections at the resolution required for coastal management (less than 1 km) are not existent in the region and at Pilot Sites. There is a lack of a comprehensive understanding of climate change and its risks and of adaptation measures among most of the actors that have an impact on the coastal territory, from high-level politicians to the coastal inhabitants. In addition, there are few instances of knowledge sharing.

With AF funds: New climate change scenario will be produced for the specific Pilot site areas and intercompared, as well as the data exchanged with best practice protocols.

Component 4: Decision support systems for sustainable coastal economies & resilient communities

Baseline: Multi-Hazard EWS are totally lacking at Pilot Sites and there is no operational ocean forecasting system in any site of the region

With AF funds: Leveraging project outputs from Component 1,2 and 3, it provides people-centered multi-hazard early warning systems, pollution and hazard mapping, and Digital Twins of coastal environments to test adaptation and nature-based solutions before real-

world implementation. It also supports site-specific assessment and reporting aligned with IPCC best practices, offering policymakers actionable, evidence-based guidance. Real-time situational sea awareness tools further enhance operational decision-making, including optimized search-and-rescue responses. Collectively, these tools enable governments and stakeholders to anticipate, plan for, and respond to environmental, climatic, and socio-economic risks, fostering sustainable coastal economies and resilient communities.

Component 5: Institutional & private sector engagement for sustainable coastal development.

Baseline: There is and overall lack of training for coastal stakeholders on topics of operational oceanography, real time monitoring, ocean forecasting best practices and science based coastal management solutions.

With AF funds: This component strengthens coastal resilience by fostering long-term sustainability through private sector participation, institutional capacity building, and stakeholder training. It delivers tailored workshops, regional training programs, and knowledge-sharing initiatives to empower communities, governments, and businesses in using innovative monitoring, forecasting, and decision-support tools. Complementary efforts develop sustainable business models for early warning and digital coastal systems, align operations with national disaster risk priorities, and secure financing through public–private partnerships. Coordinated under GOOS and WESTPAC frameworks, these activities ensure regional collaboration, evidence-based planning, and scalable, resilient solutions for sustainable coastal development.

The activities outlined in this proposal are designed to establish and strengthen the infrastructure necessary for evidence-based coastal risk assessment and management. By their nature, these activities require significant capital investment, specialized technical expertise, sustained long-term operation and maintenance, and robust, continuous data processing capabilities. Accordingly, this project prioritizes the following interventions and associated costs:

i. Establishment and upgrading of observing systems and coastal monitoring infrastructure. An approximate total budget of 6,000,000 USD spread among the 5 different components, is allocated for the procurement of equipment and related personnel training, particularly during the first two years of the project. All procurement activities for this task will be centralized and managed by UNIDO.
The planned procurement includes, for all the eight Pilot Sites:

- Low-cost bathymetric survey systems
- Citizen science–based sea-level and atmospheric monitoring stations
- Drifting buoys for wave and pressure measurements
- Moored buoys for wave, physical, and biogeochemical observations
- Fishery Voluntary Observing Network sensors
- High-efficiency coastal video monitoring systems

All equipment costs will account for the necessary data transmission capabilities.

ii. Development of a regional cloud platform with interoperable data management, high-resolution modelling capacity, and AI/ML forecasting. The Cloud platform costs have been split between a procurement by UNIDO for general software acquisition for cloud services/training and hardware procurement by each country. This federated system will constitute the backbone of the regional cloud system. The total amount of procurement will amount to approximately 3,000,000 USD distributed between UNIDO and the EEs. Such strategy will empower the local infrastructure building, enhance capacity to locally manage the information collected and produced, maintaining however an adequate level of data sharing in the region. Procurement costs have been also split between the 5 years to ensure the continuous monitoring and improvement of the activities.

iii. Tailored multi-hazard early warning systems. EE personnel costs and travel for dedicated workshops make up the primary expenditures in this component of the project. In addition, the budget includes UNIDO-managed procurement of consultancy services for high- to very-high-resolution satellite data for coastal areas, as well as consultancy for calibration of satellite data with real-time observational data. Consultancy costs in this component may reach up to 1,000,000 USD.

iv. Tailored coastal climate scenario information. This component covers costs associated with procuring HPC resources and securing consultancy services to conduct the required climate downscaling scenarios for the Pilot Sites. All procurement activities will be fully managed by UNIDO during the central 2–3 years of the project. It is estimated around 2,000,000 USD.

v. Digital Twins and decision-support tools. This component will primarily cover EE personnel costs and training activities, including travel by local experts across the Pilot Sites. It also includes the organization of various co-design meetings led by UNESCO-IOC and UNIDO to determine the specific features of the Decision Support System—such as visualization options, indicators, and interactive tools—that will enable local authorities to effectively use the products generated by the integrated monitoring and prediction systems.

vi. A comprehensive capacity-building and regional governance package. This part currently represents a significant share of expenditures, primarily due to personnel time and event-related costs linked to the Component 5 outputs. It covers the design and delivery of capacity-building courses for a wide range of stakeholders in the coastal management sector, including local private companies interested in coastal management consultancy services. Additionally, activities carried out by various EE personnel will focus on fostering public–private partnerships to support the maintenance of local infrastructure components. The Project Management Unit will meet virtually every three months, and in person every six months at a host country in the South-East Asia. Technical committee meetings will be held primarily online, although a limited number may take place in person, which would involve travel and related EE personnel costs.

K. Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project/programme.

The project has been designed from the outset with sustainability as a guiding principle, ensuring that outcomes endure well beyond the project's implementation period. Rather than functioning as a stand-alone intervention, the project establishes the foundations for replication and transformation in how South-East Asia countries develop technical capacity and generate science-based services to manage coastal climate and anthropogenic risks.

The project will transform the evidence-based assessment and management of coastal risks by addressing the necessary technical advancements with the following community-level adaptation benefits.

1. Direct Transmission of Climate Information to Local Decision-Makers
The proposed new observing, modelling and digital systems are designed to directly improve the accuracy, timeliness, and accessibility of climate risk information for local coastal communities, and municipal authorities. By developing fit-for-purpose and high-resolution observing, modelling and cloud computing, communities will receive actionable early-warning alerts, risk maps tailored to settlement and infrastructure planning and local climate change impact assessments. This enables households and local institutions to make earlier, safer, and better-informed decisions—reducing climate-related losses before they occur.

2. Community-Embedded Delivery Mechanisms
The project's Pilot Site strategy ensures that local communities, managers, policymakers, and researchers work together to identify the most pressing coastal resilience challenges and co-design practical solutions. Building on priorities highlighted through the Pilot Site survey, the project will develop user-friendly information tools that help integrate climate insights into key policy areas such as marine planning, disaster preparedness, and coastal protection.

At the regional level, the project will establish an open-access cloud system that draws from trusted local data sources and makes this information available across countries. This approach helps overcome technological limitations faced by many local authorities and ensures that accurate, relevant information can be used where it is needed most.

3. Institutional Empowerment at the Local Level
By strengthening observation and prediction data governance and coordination, local governments gain the capacity to integrate climate risk information into planning, budgeting, and public-service delivery. This institutional strengthening is directly linked to **enhanced adaptive capacity**, because it ensures that local actors are not only recipients but **active managers** of climate information.

4. Monitoring and Evaluation Focused on Outcomes
The project will explicitly track how improved digital and institutional systems lead to behavioral change and risk reduction at the community level. Indicators will assess uptake and use of climate information, changes in adaptation behavior, and increased livelihood stability. This ensures that community-level adaptation benefits are not implicit but central and measurable.

Institutional sustainability is achieved by embedding the project within the existing policy frameworks and operational mandates of national agencies. In Indonesia, Malaysia, Thailand, and the Philippines, the designated EE will integrate project outputs directly into their statutory responsibilities. This alignment ensures that early warning systems,

monitoring tools, and decision-support services become part of ongoing national operations rather than temporary project activities.

Finally, financial sustainability is ensured by embedding project functions into the budgeted operational services of national institutions. Each country has committed to integrating project-developed tools into their regular programming, with the regional governance framework under ASEAN and IOC-WESTPAC providing additional continuity. This mainstreaming approach guarantees that the benefits of the project will persist as integral components of national adaptation systems and regional cooperation platforms.

L. Provide an overview of the environmental and social impacts and risks identified as being relevant to the project/programme.

During the full proposal development phase, particular attention will be devoted to identifying potential risk areas that may affect both the execution of project activities and the achievement of intended results. This process will include measures to ensure the meaningful participation of coastal communities in all assessment and planning stages.
Under **Component 1**, activities will focus on upgrading existing coastal monitoring infrastructure and enhancing associated data management systems within the Cloud environment. The project will guarantee equitable representation and benefits for all relevant actors and beneficiary groups. Consultations regarding monitoring platforms and sensors will be conducted with the appropriate national and local providers, and all station installations will undergo Environmental Impact Assessments in full compliance with the respective national regulations.
Components 2 and 3 will encompass the design, implementation, and evaluation of multi-hazard early warning systems for pilot coastal sites, as well as the development of adaptation strategies to address the adverse impacts of climate change. Given the nature and scope of these interventions, direct environmental and social risks are expected to be minimal; however, potential indirect impacts will be thoroughly assessed during the full proposal development phase.
Under **Component 4**, the project will support the development of tailored services by public and private stakeholders engaged in coastal risk assessment and management. These activities aim to deliver positive economic, social, and environmental outcomes in targeted coastal communities, drawing upon best practices promoted by the Global Ocean Observing System (GOOS).

Finally, **Component 5** will focus on strengthening capacities through training of diverse actors and active participation of stakeholders in assessing the fitness-for-purpose of the services developed across the preceding components, thereby fostering inclusivity, ownership, and long-term sustainability.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law		**Medium risk:** Environmental Impact Assessments will be carried out in accordance with Adaptation Fund (AF) requirements and

		relevant national laws for all coastal monitoring platform installations. This approach ensures full legal compliance for these installations.
Access and Equity		**Low risk:** At the earliest stages, the project will implement web interfaces and multi-channel (including mobile) systems to ensure broad access to information about risks and hazards at pilot sites. This ensures that critical risk information is accessible to all relevant stakeholders from the outset.
Marginalized and Vulnerable Groups		**Medium risk:** Participation by vulnerable groups (e.g., the elderly, persons with disabilities, women, and youth) may be limited. To address this, the project will identify all stakeholders and ensure these groups are actively included in project design and the validation of project outcomes.
Human Rights		**Medium risk:** The project will proactively identify and address any potential risks of non-compliance with human rights standards. This approach will ensure adherence to international human rights norms throughout all project activities.
Gender Equity and Women's Empowerment		**Low risk:** Potential risks related to insufficient gender equity and women's empowerment will be addressed by developing a comprehensive gender plan during the full project planning phase. This plan will be started from the project outset to ensure that gender considerations are addressed throughout the project lifecycle.
Core Labour Rights		**Medium risk:** The project will identify and mitigate any potential risks of non-compliance with international labor standards. These measures uphold ethical labor practices throughout the project.
Indigenous Peoples		**Low risk:** Each project component will include detailed stakeholder mapping to ensure that indigenous communities are identified and included in the validation of project outputs. This will ensure that indigenous perspectives and needs are respected and integrated into project outcomes.
Involuntary Resettlement	X	
Protection of Natural Habitats		**Low risk, with high potential positive impact:** The project will aim to improve and safeguard coastal natural habitats, prioritizing their protection through collaborative planning with local stakeholders at pilot sites. Through this collaboration, both immediate and long-term solutions will be developed to protect these habitats.
Conservation of Biological Diversity		**Low-risk, high positive potential impacts-** The project is fundamentally designed to enhance the conservation of coastal biological diversity. Implementation will involve continuous consultation with local stakeholders at the pilot sites.
Climate Change		**Low risk:** The project has a net-positive climate impact, as material transport and construction activities are minimal. The monitoring platforms are designed to be low-emission and energy-efficient.
Pollution Prevention and Resource Efficiency		**Low-risk, high positive potential impacts-** Prevention of marine pollution is a cornerstone of the project's services. Implementation will be carried out in collaboration with pilot-site stakeholders and national institutions responsible for emergency response (such as coast guards and port authorities). All project infrastructure will consist of low-cost, low-maintenance monitoring platforms with minimal energy consumption. Additionally, the

		cloud infrastructure will be climate-resilient, with operational costs aligned to actual usage.
Public Health		**Low risk, with high potential positive impacts-** Preventing the impact of marine pollution, monitoring harmful algal blooms, and preparing for their occurrence will have significant positive effects on public health. The project will establish effective standards early in the implementation phase and document these measures in the full project proposal.
Physical and Cultural Heritage		**Low risk, with high potential positive impacts-** The project recognizes that coastal socio-economic activities (such as fisheries, tourism, and marine recreation) are integral to the cultural heritage of pilot site communities. To preserve this heritage, the project will engage local communities in consultation throughout all program components, beginning with the preparation of the full proposal.
Lands and Soil Conservation		**Low risk, with high potential positive impacts-**Although the project is primarily marine-focused, it acknowledges the importance of benthic ecosystems. Consequently, all feasible measures will be taken to conserve land and soil quality and functioning in any impacted areas. These measures will protect the integrity of land and benthic ecosystems that could be affected by the project.

PART III: IMPLEMENTATION ARRANGEMENTS

A. Project Alignment with the Results Framework of the Adaptation Fund

Project Objective(s)	Project Objective Indicator(s)	Adaptation Fund Outcome	Adaptation Fund Outcome Indicator	Grant Amount (USD)
Objective 1. Enhance national infrastructure and capacity for ocean hazard monitoring This objective includes co-design and implementation of a fit-for-purpose, real-time coastal observing and cloud-based data management systems integrating satellite and in situ data for monitoring key coastal variables.	1.1.1 # of integrated coastal early warning systems implemented 1.1.2 # of people covered by early warning systems implemented	Outcome 1: Reduced exposure to climate-related hazards and threats	Indicator 1: People using improved climate-related threat and hazard information	3,000,000
	1.2.1# of data management best practices developed for different coastal observations 1.2.2 # of cloud servers interfaced and operational	Outcome 8: Innovation for effective, long-term adaptation to climate change accelerated, encouraged, and enabled to scale up	Indicator 8.1: Innovations successfully reaching scale up that demonstrate local innovation participation and/or local innovation benefit	2,699,000
Objective 2. Reduce risk of exposure to extreme events This objective entails the development of advanced impact forecasting systems, integrating coastal numerical models and AI-based predictive approaches to address key regional hazards, including storm surges, marine heatwaves, coastal erosion, hypoxic (low-oxygen) conditions, and pollution originating from both land- and sea-based sources.	2.1.1 # of people using improved real-time impact forecasting systems tailored for local communities including AI-based systems for storm surge forecasting	Outcome 1: Reduced exposure to climate-related hazards and threats	Indicator 1: People using improved climate-related threat and hazard information	3,800,000
	2.2.1 # of improved protocols for hazard mapping adopted for local communities	Outcome 7: Improved policies and regulations that promote and enforce resilience measures	Indicator 7: Policies, strategies, and/or plans adopted, implemented, and/or enforced that integrate climate risk and resilience considerations	1,230,000

Objective 3. Generate coastal climate projection information for adaptation planning The objective entails the co-design and the implementation of high-resolution coastal downscaling and ocean-climate projections for different climate futures, enabling local adaptation planning in relation to sea level rise, temperature and salinity variability, and ecosystem shifts.	3.1.1 # people informed by downscaled climate projections validated against local observations 3.1.2 # people informed by climate risk assessment reports produced and disseminated	Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes	Indicator 3.1: People with strengthened awareness of climate change risks and how to better address them	3,000,000
	3.2.1 # of coastal adaptation plans integrating validated projections 3.2.2 # of stakeholder consultations/participatory events conducted	Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses	Indicator 2: Institutions with strengthened capacity to understand and better address climate risks and resilience	1,680,000
Objective 4. Strengthen sustainable coastal economies & resilient communities The objective considers the co-design and the implementation of tailored information and decision-support services for different user groups, including: 1) Climate-resilient coastal zone planning and marine spatial management for deltas and archipelagos; 2) Digital Twins and Nature-Based Solutions to support restoration and adaptation of mangroves, coral reefs, and seagrasses; 3) Early warning and impact response systems for extreme sea level events, marine heat waves and harmful algal blooms; 4) Climate-smart fisheries and aquaculture management to ensure sustainable livelihoods; 5) Enhanced safety of maritime transport, disaster preparedness, and regional coordination.		Outcome 5: Increased ecosystem resilience in response to climate change and variability-induced stress	Indicator 5: Ecosystems and natural resources brought under protection, restoration, or improved management in response to climate variability and change	1,663,000
	4.1.1 # of institutional partners using project services 4.1.2 # of scenarios inserted in adaptation plans	Outcome 6: Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas	Indicator 6.1: People adopting improved and/or new climate resilient livelihood practices	3,000,000

Objective 5. Strengthen institutional frameworks and private-sector participation The objective is to strengthen institutional collaboration and regional governance for long-term sustainability of the new observing and modelling capacity, including co-development of services and policy dialogues and capacity enhancement programs for coastal stakeholders and decision makers.	5.1.1 % of trained stakeholders reporting improved ability to apply/maintain solutions 5.2.1 # of private sector partnerships formalized (MoUs, PPPs, business models) 5.3.1 # of joint regional coastal observing or modelling protocols established under coastal GOOS strategy 5.4.1 # of institutional agreements/strategies integrating project outputs into national strategies	Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes	Indicator 3.2: People implementing new or improved adaptation actions	1,500,000
		Outcome 7: Improved policies and regulations that promote and enforce resilience measures	Indicator 7: Policies, strategies, and/or plans adopted, implemented, and/or enforced that integrate climate risk and resilience considerations	2,495,000
		Outcome 8: Innovation for effective, long-term adaptation to climate change accelerated, encouraged, and enabled to scale up	Indicator 8.1: Innovations successfully reaching scale up that demonstrate local participation and/or local innovation benefit	1,000,000
Total outcome level grant amount.				**25,067,000**

Project Outcome(s)	**Project Outcome Indicator(s)**	**Adaptation Fund Output**	**Adaptation Fund Output Indicator**	**Grant amount (USD)**
1.1 Safer coastal livelihoods through evidence-based information on coastal hazards	1.1.1 # of integrated coastal monitoring systems implemented	Output 1.2 Targeted population groups covered by warning and advisory services for climate-related hazards and threats	Indicator: 1.2.1 Early warning systems established or improved	3,000,000
1.2 Enhancement of coastal management solutions by digital technologies, allowing standardized information sharing	1.2.1 # of data management, cloud and other best practices and innovations co-designed and operational to address local community needs.	Output 8.1: Innovations identified and piloted which collectively enhance local innovation capacity & contribute to the development of local, national, and regional adaptation innovation ecosystems	Indicator 8.1.2: Innovations piloted that demonstrate local participation and/or local innovation benefit.	2,699,000
2.1 Enhanced preparedness of coastal communities to ocean hazards	2.1.1 # of Real-Time Impact Forecasting systems tailored to community needs including AI-based forecasting for storm surge	Output 1.1: Risk and vulnerability assessments conducted and updated	Indicator 1.1.1: Risk and vulnerability assessments conducted or updated	3,800,000
2.2 Enhanced capacity to plan adaptive measures to multiple coastal hazards	2.2.1 # of improved protocols for hazard mapping adapted for coastal communities	Output 7.1: Improved integration of climate-resilience strategies into country development plans	Indicator 7.1.1: Policies, strategies, and/or plans developed or adjusted to integrate climate risk considerations	1,230,000
3.1 Evidence-based information to inform adaptation planning	3.1.1 # of downscaled climate projections validated against local observations	Output 3.2: Strengthened the capacity of national and subnational stakeholders and entities to capture and disseminate knowledge and learning	Indicator 3.2.1: Climate resilience knowledge products and/or tools developed	3,000,000

	3.1.2 # of climate risk assessment reports produced and disseminated		and shared with stakeholders	
3.2 Stakeholder-driven frameworks for adaptation, risk assessment, and management	3.2.1 # of coastal adaptation plans integrating validated projections 3.2.2 # of stakeholder consultations/participatory events conducted	Output 2.1: Strengthened capacity of institutions to understand and better address climate risks	Indicator 2.1.1: Institutions supported to strengthen capacity to understand and address climate risks and resilience	1,680,000
4.1 Strengthened institutional and operational capacity for risk-informed coastal management.	4.1.1 # of institutional partners using project services 4.2.1 # of strategies/plans endorsed/adopted by local or national authorities	Output 6 Targeted individual and community livelihood strategies strengthened in relation to climate change impacts, including variability	Indicator 6.1: People adopting improved and/or new climate resilient livelihood practices	3,000,000
4.2 Increased resilience and adaptive capacity of coastal communities and blue-economy sectors	4.2.1 # of institutions and private operators using services 4.2.2 # of strategies/plans endorsed/adopted by local or national authorities for coastal adaptation and management	Output 5: Vulnerable ecosystem services and natural resource assets strengthened in response to climate change impacts, including variability	Indicator 5.1.1: Ecosystems and natural resources targeted by activities to improve protection, restoration, and/or management	1,663,000
5.1 Empowered stakeholders and practitioners with skills and knowledge and capacity to apply the solutions locally and maintain them.	5.1.1 % of trained stakeholders reporting improved ability to apply/maintain solutions	Output 3.3: Increased ownership of adaptation and climate risk reduction processes	Indicator 3.3.1: Number of local institutions and/or communities responsible for decision-making over how adaptation solutions are defined, prioritized, designed, and/or implemented	2,000,000
5.2 Private sector involvement for sustainable maintenance of the infrastructure	5.2.1 # of private sector partnerships formalized (MoUs, PPPs, business models) 5.2.2 # of private enterprises trained/engaged for Sargassum exploitation	Output 8.1: Innovations identified and piloted that collectively enhance local innovation capacity and contribute to the development of local, national and regional adaptation innovation ecosystems	Indicator 8.1.2: Innovations piloted that demonstrate local innovation participation and/or local innovation benefit	1,000,000

5.3 Regional coordination through Coastal GOOS strategy and enhanced capacity for coastal and ocean monitoring.	5.3.1 # of joint regional coastal observing or modelling protocols established under coastal GOOS strategy	Output 7.1: Improved integration of climate-resilience strategies into country development plans	Indicator 7.1.1: Policies, strategies, and/or plans developed or adjusted to integrate climate risk considerations	1,995,000
5.4 Evidence-based institutional framework in support of coastal resilience	5.4.1 # of institutional agreements/strategies integrating project outputs into national strategies	Output 8.2: Innovations identified and piloted which build the adaptation innovation evidence-base and institutional capacity	Indicator 8.2.1: Innovation-focused knowledge products disseminated and/or learning events facilitated that support and enable innovation capacity at a local, national, and/or regional level	1,500,000
Total output level grant amount				**25,067,000**

B. Implementation Arrangements

The project will be implemented by the United Nations Industrial Development Organization (UNIDO), which will serve as the Implementing Entity. UNIDO will be responsible for several key aspects of the project, including overall project coordination and oversight to ensure alignment with the Adaptation Fund's objectives and national adaptation priorities. It will also manage financial aspects, ensuring transparency and accountability in the utilization of funds. As an implementing agency, it will provide technical support and capacity building, offering guidance on resilient coastal businesses, facilitating knowledge exchange, and strengthening institutional capacities. Moreover, UNIDO will oversee monitoring, evaluation, and learning (MEL) processes to assess project progress, identify challenges, and incorporate adaptive management strategies.

National execution

At national level, the project will be executed by national entities in each of the eight partner countries who will be responsible for the day-to-day execution of the project. They would be responsible for the project activities related to observing predicting, services, stakeholder engagement at national and local levels and ensure that the interventions are locally driven and aligned with national policies. Four key stakeholder groups will be engaged in each country: civil society; coastal managers and practitioners in the public and private sectors; policymakers at local and national levels. Further details of national and local level execution for each country and national executing entity will be defined in project design stage.

Regional execution and knowledge sharing

UNESCO (IOC and its Sub-Commission for the Western Pacific (WESTPAC)), will coordinate regional stakeholder engagement and support community involvement in the co-design process. It will be responsible for the project outputs on coastal GOOS strategy and guidelines. UNESCO-IOC has led regional and intergovernmental consultations with policymakers and integrated science-based coastal resilience principles into the Global

Ocean Observing System. UNESCO-IOC will also be responsible for sharing knowledge among the partner countries.

CMCC will be partly responsible for different outputs in all components including: cloud development, observing system network design, early warning systems and numerical modelling, climate downscaling and Digital Twins. Drawing on its extensive experience in observing systems to develop Multi-Hazard Early Warning Systems (MH-EWS) for complex regional seas such as the Mediterranean, CMCC will ensure best practices for coastal resilience in the project implementation.

As part of the project execution function (not under the fee for IE acting as part of the EE) UNIDO will lead the execution of the project mid –term and a final independent evaluation which will be conducted as per UNIDO and the AF requirements and standards. The independent project evaluation will support learning, continuous improvement and accountability, and provide information about results and practices. UNIDO will also be responsible for one (1) output under component 5: “Institutional & private sector engagement for sustainability”. It will oversee the development of business models for use of EWS and Decision Support Systems for resilient coastal businesses. Furthermore, UNIDO will be responsible for the procurement of international goods and services.

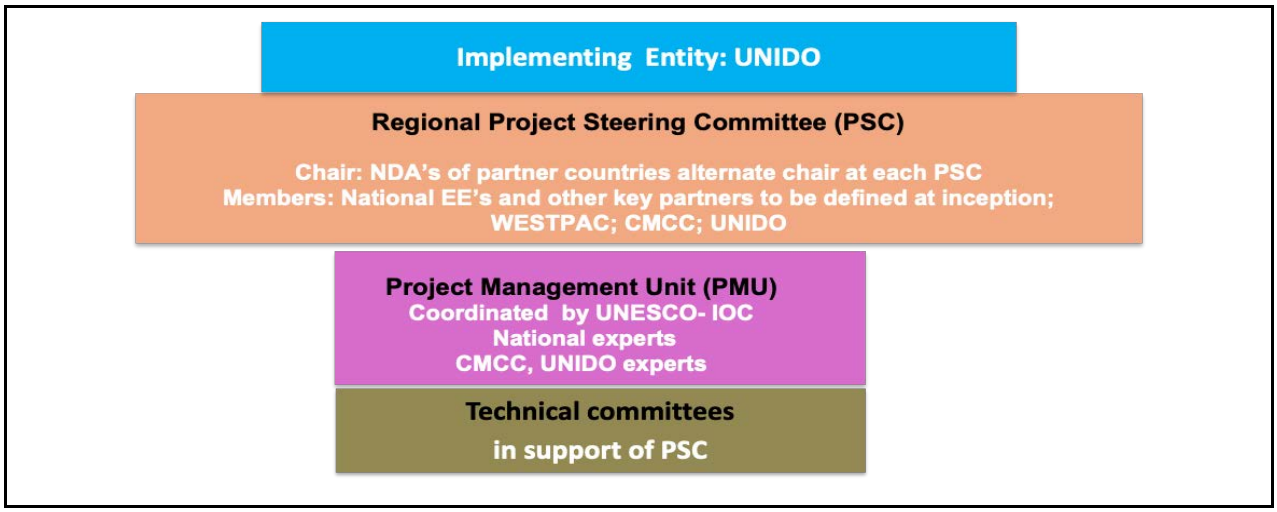
Governance and Oversight: Project Steering Committee (PSC)

A Project Steering Committee (PSC) will be set up at the regional level to provide strategic oversight, risk adaptation, and performance monitoring throughout the project. The PSC will ensure that the project aligns with national policies and regional adaptation frameworks, facilitating coordination among the eight countries to avoid duplication of efforts. It will also address implementation challenges, ensuring effective resource allocation. The PSC will also support regional cooperation by engaging with other initiatives in the region fostering collaboration and sharing of knowledge and resources.

The PSC will include representatives from: UNIDO (Implementing Entity); National Designated Authorities of the partner countries (Alternating Chairs); National Execution Entities of the partner countries (National Execution Lead; UNESCO IOC (Regional EE); CMCC (Technical EE).

A Project Management Unit (PMU) will be set up under UNESCO-IOC, to serve as the operational backbone, coordinating day-to-day implementation across all pilot countries, consolidating technical and financial reporting, managing the regional delivery schedule, and ensuring that national EE activities remain synchronized and mutually reinforcing. It will facilitate regular (virtual quarterly and in-person semi-annually) among the national and international EEs.

Technical Committees composed of technical leads from the national EEs and the project’s scientific/operational partners will be established to facilitate maintaining common technical standards (observations, modelling, cloud/data governance, EWS), validate methods and quality assurance, and drive peer-learning so that each pilot’s solutions are interoperable, scalable, and readily transferable across the region.



Project governance structure

Legal Context

It is expected that each set of activities to be implemented in the target countries will be governed by the provisions of the Standard Basic Cooperation Agreement concluded between the Government of the recipient country concerned and UNIDO or – in the absence of such an agreement – by one of the following: (i) the Standard Basic Assistance Agreement concluded between the recipient country and UNDP, (ii) the Technical Assistance Agreements concluded between the recipient country and the United Nations and specialized agencies, or (iii) the Basic Terms and Conditions Governing UNIDO Projects.

PART IV: ENDORSEMENT BY GOVERNMENTS AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[3]

Mr. Ary Sudijanto *Deputy Minister, Climate Change and Carbon Governance,* *Ministry of Environment/Environmental Protection Agency, Indonesia*	November, 2025
Mr. Phirun Saiyasitpanich *Director General* *Department of Climate Change and Environment* *Ministry of Natural Resources and Environment,* *Thailand*	November 14, 2025
Atty. Analiza Rebuelta-Teh *Undersecretary Finance, Information Systems and Climate Change* *Department of Environment and Natural Resources (DENR)*	January 15, 2026

3. Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

Philippines *Appointed as Officer-in-Charge by Primary contact (letter attached)* *Mr. Raphael P.M. Lotilla* *Secretary* *Finance, Information Systems and Climate Change* *Department of Environment and Natural Resources (DENR)*	
Mr. Datuk Nor Yahati Binti Awang *Deputy Secretary General* *Environmental Sustainability,* *Ministry of Natural Resources and Environmental Sustainability, Malaysia*	January 29, 2026

B. Implementing Entity certification

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (**INDONESIA:** NAP (2025); National Action Plan for Climate Change Adaptation (RAN-API, 2014); NDC (2021); Medium-Term National Development Plans (Rencana Pembangunan Jangka Menengah Nasional, RPJMN 2020–2024 and draft RPJMN 2025–2029); Disaster Risk Reduction Master Plan (Rencana Induk Penanggulangan Bencana) and Ocean Policy framework. **MALAYSIA:** National Climate Change Policy 2.0; NDC (2021); Integrated Shoreline Management Plans (ISMPs); National Policy on Biological Diversity (2016–2025). **THAILAND:** NAP 2023 (2023–2037); Climate Change Master Plan (2010–2050); 2nd Updated NDC (2022); Policy and Plan for Enhancement and Conservation of National Environmental Quality (2017-2036); Thailand's 20-Year National Strategy (2018–2037). **PHILIPPINES**: NAP (2023-2050); National Climate Change Action Plan (NCCAP 2011–2028); Ambisyon Natin 2040; Updated NDC (2021); Philippine Development Plan (2023–2028); National Disaster Risk Reduction and Management Plan (2020–2030)).
and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.

Name & Signature
Ganna Onysko
Ms. Ganna Onysko
Senior GEF, GCF, AF Coordinator
Division of Funding Partner Relations
Directorate of Global Partnerships and External Relations
United Nations Industrial Development Organization - UNIDO
Implementing Entity Coordinator

Date: *February 6, 2026*	Tel. and email: +43 1 26026 3708 g.onysko@unido.org

Project Contact Person: Yvonne Lokko

Tel. And Email: +43 1 260263737 / y.lokko@unido.org

Annex 1: Letters of Endorsement

Annex 1.1 Indonesia Letter of Endorsement

MINISTRY OF ENVIRONMENT/
ENVIRONMENTAL PROTECTION AGENCY

DEPUTY OF CLIMATE CHANGE AND CARBON GOVERNANCE

Plaza Kuningan, South Tower 3rd floor, H. R. Rasuna Said St., Karet Kuningan, South Jakarta 12920
website : https://kemenlh.go.id/ e-mail : tudirektoratadaptasi@gmail.com

Our Ref. : B.257/H/PPI.4.1./11/2025 Jakarta, November 2025

Subject : Endorsement to concept note of the Coast Predict Regional Project "Enhancing Coastal Resilience in the South-East Asia Seas" -eCORE-SEAS-

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

In my capacity as the national designated authority for the Adaptation Fund in Indonesia, I am writing to you in conjunction with the Concept Note "**Enhancing Coastal Resilience in the South-East Asia Seas" -eCORE-SEAS-**" The pre-concept note has been reviewed and I confirm that the above Concept Note is in accordance with the government of Indonesia's national priorities to strengthen risk-informed planning, promote climate-resilient development, and support ocean-based sustainable economies. The programme is in collaboration with UNESCO-IOC's Sub-Commission for the Western Pacific (WESTPAC) and the UNESCO/IOC-led Global Ocean Observing System (GOOS).

Accordingly, I am pleased to endorse the above Concept Note with support from the Adaptation Fund. If approved, the project/programme will be implemented by United Nations Industrial Development Organization (UNIDO) and executed by BRIN and BMKG and partial execution by international Executing Entities: UNESCO IOC, Euro-Mediterranean Centre on Climate Change (CMCC) and UNIDO.

Thank you for your attention and further cooperation.

Sincerely yours,

Ary Sudijanto
Deputy Minister for Climate Change and Carbon Governance
As National Designated Authority
for Adaptation Fund Indonesia

Annex 1.2 Malaysia Letter of Endorsement

KEMENTERIAN SUMBER ASLI DAN KELESTARIAN ALAM
(Ministry of Natural Resources and Environmental Sustainability)
Parcel F, Blok F11, Kompleks F
Lebuh Perdana Timur, Presint 1
Pusat Pentadbiran Kerajaan Persekutuan
62000 PUTRAJAYA
MALAYSIA

Tel : +603-8000 8000
Portal Rasmi : www.nres.gov.my

Our Reference : NRES.700-7/1/7 (15)(S)
Date : 29 January 2026

The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

ENDORSEMENT FOR "ENHANCING COASTAL RESILIENCE IN THE SOUTH-EAST ASIA SEAS (eCORE-SEAS)"

With reference to the above matter.

2. In my capacity as designated authority for the Adaptation Fund in Malaysia, I confirm that the above proposed regional project/ programme aligns with Malaysia's national priorities in implementing climate change adaptation activities to reduce adverse impacts and risks associated with climate change on our coastal and marine areas.

3. Accordingly, I am pleased to endorse the above project/programme proposal with support from the Adaptation Fund. If approved, the project/ programme will be implemented by United Nations Industrial Development Organization (UNIDO) with the Malaysian Meteorological Department (MET Malaysia) as the national executing entity. The above proposed project will also involve partial execution by international Executing Entities namely UNESCO-OIC, Euro-Mediterranean Centre on Climate Change (CMCC) and UNIDO.

4. MET Malaysia as the national executing agency will be supported by other relevant agencies, and not limited to, as listed in Annex A.

5. This endorsement is subject to the following conditions:

(i) all project-related data are the property of the Government of Malaysia;
(ii) data security must comply with the Government's data classification requirements, including mandatory verification and approval processes prior to any use;
(iii) use of, or access to, monitoring systems and technologies shall remain restricted and governed by the F.A.I.R principles;

(iv) the proposed project sites will be identified and mutually agreed upon during the consultation process; and

(v) for the avoidance of doubt, this endorsement does not create any obligation on the part of the Government of Malaysia with respect to legal or financial actions.

Sincerely,

(DATUK NOR YAHATI BINTI AWANG)
Deputy Secretary General (Environmental Sustainability)
Ministry of Natural Resources and Environmental Sustainability
Malaysia

Official Use Only

Annex 1.3.1 Philippines Letter of Endorsement*

*also see Annex 1.3.2 – letter from the Philippines noting that the secondary contact is Officer-in-Charge (OIC)

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
KAGAWARAN NG KAPALIGIRAN AT LIKAS NA YAMAN

BAGONG PILIPINAS

JAN 15 2026

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: afbsec@adaptation-fund.org
Fax: 202 522 3240/5

Subject: Endorsement for **Enhancing COastal REsilience in the South-East AsiaSeas (eCORE-SEAS)**

In my capacity as the Secondary Contact Point of the Department of Environment and Natural Resources (DENR) of the Philippines, acting as the Designated Authority for the Adaptation Fund, I confirm that the above regional project proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks posed by, climate change in the Philippines.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. If approved, the project will be implemented by the United Nations Industrial Development Organization (UNIDO) and executed by the Marine Environment and Resources Foundation, Inc. (MERF) and partial execution by international Executing Entities: United Nations Educational, Scientific and Cultural Organization Intergovernmental Oceanographic Commission (UNESCO-IOC), Euro-Mediterranean Centre on Climate Change (CMCC) and UNIDO.

Thank you.

Very truly yours,

ATTY. ANALIZA REBUELTA-TEH
Officer-In-Charge, DENR
Secondary Contact Point of the Philippines
as National Designated Authority -Adaptation Fund

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
SENR070331

PH16/1341

ISO 9001
SOCOTEC

Visayas Avenue, Diliman, Quezon City 1100, Philippines
www.denr.gov.ph

Annex 1.3.2 OIC letter

Philippines letter noting secondary contact as Officer-in-Charge (OIC)

Office of the President
Malacañang

JAN 08 2026

Secretary **RAPHAEL PERPETUO M. LOTILLA**
Department of Environment and Natural Resources
Quezon City

Sir:

Upon representations made with this Office, and in view of your trips to Abu Dhabi, United Arab Emirates on 11 – 13 January 2026 and to Riyadh, Kingdom of Saudi Arabia on 13 – 16 January 2026 (all dates inclusive of travel time), please be advised of the designation of Undersecretary **ANALIZA REBUELTA-TEH** as Officer-in-Charge of the Department of Environment and Natural Resources on 11 – 16 January 2026.

Very truly yours,

RALPH G. RECTO
Acting Executive Secretary

cf: Undersecretary **Analiza Rebuelta-Teh**
Department of Environment and Natural Resources

BAGONG PILIPINAS

Annex 1.4 Thailand Letter of Endorsement

No. 0804/ 2941

Ministry of Natural Resources
and Environment
92 Soi Phahon Yothin 7
Phahon Yothin Road
Bangkok 10400 Thailand
Tel./Fax. (+66) 2 298 5646

14 November B.E. 2568 (2025)

To: The Adaptation Fund Board

Subject: Endorsement for Enhancing COastal REsilience in the South-East Asia Seas (eCORE-SEAS)

In my capacity as Designated Authority for the Adaptation Fund in Thailand, I confirm that the above regional project proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Thailand.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. If approved, the project will be implemented by United Nations Industrial Development Organization (UNIDO) and executed by Thailand's Department of Marine and Coastal Resources together with Burapha University, and partial execution by international Executing Entities: UNESCO IOC, Euro-Mediterranean Centre on Climate Change (CMCC) and UNIDO.

Yours sincerely,

(Mrs. Chayanan Pakdeejit)
Permanent Secretary
Ministry of Natural Resources and Environment

I hereby endorse and validate this Letter of Endorsement (LOE)

P. Saiyasitpanich
(Mr. Phirun Saiyasitpanich)
Director General
Department of Climate Change and Environment
Primary Contact Point of the Designated Authority
to the Adaptation Fund

Adaptation Fund Board Secretariat
c/o Global Environmental Facility,
Mail stop: N 6-600
1818 H Street NW
Washington D.C.
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Revised PFG Submission Form[1]

Project Formulation Grant (PFG)

Submission Date: 06 February 2026

Adaptation Fund Project ID:

Country/ies: Indonesia, Malaysia, Philippines, Thailand
Title of Project/ Programme: Enhancing coastal resilience in the South-East Asia seas
Type of IE (NIE/RIE/MIE): MIE
Implementing Entity: United Nations Industrial Development Organization (UNIDO),
Executing Entity/ies: UNIDO, UNESCO (IOC and its Sub-Commission for the Western Pacific (IOC-WESTPAC)), Euro-Mediterranean Center on Climate Change (CMCC)

A. Project Preparation Timeframe

Start date of PFG	01 June 2026
Completion date of PFG	31 December 2026

B. Proposed Project Preparation Activities ($)

List of Proposed Project Preparation Activities	Output of the PFG Activities	US$ Amount	Budget note[2] (Based on Lead Organization)
Consultation, Data Collection, and Technical Assessments	**Deliverable 1:** workshops with target communities and stakeholders' engagement, **Deliverable 2**: prepare a baseline report, documenting national/regional priorities, projects, roadmap for implementation, and indicators/targets aimed	79,000	1) International and National support staff: US$ 15,000 (UNESCO 5000, CMCC 5000; UNIDO 5000) 2) International and National travel: US$ 10,000 (UNESCO 4000 UNIDO 6000) 3) Meetings and workshop expenses: US$ 40,000 (UNESCO 40000) 4) Technical Report: US$ 14,000 (UNESCO 6000, CMCC 8000)

[1] As presented in AFB/PPRC.33/40 Annex 1.
[2] The proposal should include a detailed budget with budget notes indicating the break- down of costs at the activity level. It should also include a budget on the Implementing Entity management fee use.

	Deliverable 3: database information of hazards and vulnerabilities for target coastal areas;		
Preparation of specific assessment reports for the full proposal	**Deliverable 4:** Environmental & social risk assessment (ESS) report **Deliverable 5:** Proposed adaptation solutions' environmental sustainability & financial feasibility analysis	22,000	4) Contracted Reports: US$ 22,000 (UNIDO 22000)
Preparation of the AF Submission Package and Revision Process	**Deliverable 6:** Undertake a due diligence assessment of target national Ees-HACT (Harmonized approach to cash transfer - one per country) **Deliverable 7:** Full proposal drafting **Deliverable 8:** Regional validation workshop (virtual)	34,000	1) International and National support staff: US$ 5,000 (UNIDO 5000) 2) Technical Report: US$ 29,000 (UNESCO 4000; CMCC 5000, UNIDO 20000)
Implementing-Entity management fee (Agency fee)	10%	15,000	Technical and admin support services.
Total Project Formulation Grant		150,000	

Please describe below each of the PFG activities and provide justifications for their need and for the funding required:

Description of the required activity	Justification for the need and for the amount
Consultation, Data Collection, and Technical Assessments	Need to consult with the Pilot Site communities as well as the national stakeholders. Additionally, we need to start collection evidence-based climate information as well as vulnerability at target sites. Workshop and ESS reports should be prepared to support the full proposal. This will entail organizing maximum of 4 regional meetings, with national partners and regional stakeholders to co-design the national project components, within an overall regional and scientific operational framework, and initiates the co-design of these with key stakeholders for delivery. Cost will cover travel to the workshop sites for international and national experts and meeting expenditures, as well as expert report writing
Preparation of specific assessment reports	Need to create specific assessment reports to do due diligence, inform and support the preparation of the full proposal
Preparation of the AF Submission Package and Revision Process	This activity will gather the results of all the assessments conducted during the preparation of the full fledge project proposal, following the template of the Adaptation fund and the requirements of UNIDO. The full-fledge proposal will be presented to all key stakeholders for validation during a regional virtual workshop. The drafting and compiling of the project proposal will be conducted by the EE and national adaptation experts.

For LLA Projects only:

If requesting additional funding for LLA projects to enable devolving decision making to the local level, please specify the activities that would directly serve to enable devolving decision making to the lowest appropriate level and enable local actors to make informed decisions on how adaptation actions are defined, prioritized, designed, and implemented:

Please provide justifications for their need and for additional funding required:

C. Implementing Entity

This request has been prepared in accordance with the Adaptation Fund Board's procedures and meets the Adaptation Fund's criteria for project identification and formulation.

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