

# Funding Proposal

---

## **FP171: Enhancing Early Warning Systems to build greater resilience to hydro-meteorological hazards in Timor-Leste**

Timor-Leste | United Nations Environment Programme (UNEP) | Decision B.30/03

23 November 2021



**GREEN  
CLIMATE  
FUND**

Please submit the completed proposal to:

[fundingproposal@gcfund.org](mailto:fundingproposal@gcfund.org)

Please use the following name convention for the file name:

"FP-[Accredited Entity Short Name]-[Country/Region]-[YYYY/MM/DD]"

## Contents

Section A	<b>PROJECT / PROGRAMME SUMMARY</b>
Section B	<b>PROJECT / PROGRAMME INFORMATION</b>
Section C	<b>FINANCING INFORMATION</b>
Section D	<b>EXPECTED PERFORMANCE AGAINST INVESTMENT CRITERIA</b>
Section E	<b>LOGICAL FRAMEWORK</b>
Section F	<b>RISK ASSESSMENT AND MANAGEMENT</b>
Section G	<b>GCF POLICIES AND STANDARDS</b>
Section H	<b>ANNEXES</b>

### ***Note to Accredited Entities on the use of the funding proposal template***

- Accredited Entities should provide summary information in the proposal with cross-reference to annexes such as feasibility studies, gender action plan, term sheet, etc.
- Accredited Entities should ensure that annexes provided are consistent with the details provided in the funding proposal. Updates to the funding proposal and/or annexes must be reflected in all relevant documents.
- The total number of pages for the funding proposal (excluding annexes) **should not exceed 60**. Proposals exceeding the prescribed length will not be assessed within the usual service standard time.
- The recommended font is Arial, size 11.
- Under the [GCF Information Disclosure Policy](#), project and programme funding proposals will be disclosed on the GCF website, simultaneous with the submission to the Board, subject to the redaction of any information that may not be disclosed pursuant to the IDP. Accredited Entities are asked to fill out information on disclosure in section G.4.

A. PROJECT/PROGRAMME SUMMARY			
<b>A.1. Project or programme</b>	Project	<b>A.2. Public or private sector</b>	Public
<b>A.3. Request for Proposals (RFP)</b>	<p>If the funding proposal is being submitted in response to a specific GCF <a href="#">Request for Proposals</a>, indicate which RFP it is targeted for. Please note that there is a separate template for the Simplified Approval Process and REDD+.</p> <p>Choose an item</p>		
<b>A.4. Result area(s)</b>	<p>Check the applicable <a href="#">GCF result area(s)</a> that the <u>overall</u> proposed project/programme targets. For each checked result area(s), indicate the estimated percentage of <u>GCF budget</u> devoted to it. The total of the percentages when summed should be 100%.</p>		
	<p><b>Mitigation:</b> Reduced emissions from:</p> <p><input type="checkbox"/> Energy access and power generation:</p> <p><input type="checkbox"/> Low-emission transport:</p> <p><input type="checkbox"/> Buildings, cities, industries and appliances:</p> <p><input type="checkbox"/> Forestry and land use:</p> <p><b>Adaptation:</b> Increased resilience of:</p> <p><input checked="" type="checkbox"/> Most vulnerable people, communities and regions:</p> <p><input checked="" type="checkbox"/> Health and well-being, and food and water security:</p> <p><input type="checkbox"/> Infrastructure and built environment:</p> <p><input type="checkbox"/> Ecosystem and ecosystem services:</p>	<p><b>GCF contribution:</b></p> <p><u>Enter number</u>%</p> <p><u>Enter number</u>%</p> <p><u>Enter number</u>%</p> <p><u>Enter number</u>%</p> <p>50%</p> <p>50%</p> <p><u>Enter number</u>%</p> <p><u>Enter number</u>%</p>	
<b>A.5. Expected mitigation impact</b>	N/A	<b>A.6. Expected adaptation impact</b>	<p><b>1,293,119 beneficiaries</b> (including <b>1,034,495 direct beneficiaries</b>)</p> <p>100% of the population of Timor-Leste</p> <p>(including 80% of the population as direct beneficiaries)</p>
<b>A.7. Total financing (GCF + co-finance)</b>	<b>21,729,122 USD</b>	<b>A.9. Project size</b>	Small (Upto USD 50 million)
<b>A.8. Total GCF funding requested</b>	<b>20,980,722 USD</b>		
<b>A.10. Financial instrument(s) requested for the GCF funding</b>	<p>Mark all that apply and provide total amounts. The sum of all total amounts should be consistent with A.8.</p> <p><input checked="" type="checkbox"/> Grant <b>20,980,722 USD</b> <input type="checkbox"/> Equity <u>Enter number</u></p> <p><input type="checkbox"/> Loan <u>Enter number</u> <input type="checkbox"/> Results-based payment <u>Enter number</u></p> <p><input type="checkbox"/> Guarantee <u>Enter number</u></p>		
<b>A.11. Implementation period</b>	5 years	<b>A.12. Total lifespan</b>	10 years
<b>A.13. Expected date of AE internal approval</b>	2/4/2020	<b>A.14. ESS category</b>	C

<b>A.15. Has this FP been submitted as a CN before?</b>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>A.16. Has Readiness or PPF support been used to prepare this FP?</b>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>A.17. Is this FP included in the entity work programme?</b>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>A.18. Is this FP included in the country programme?</b>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>A.19. Complementarity and coherence</b>	<i>Does the project/programme complement other climate finance funding (e.g. GEF, AF, CIF, etc.)? If yes, please elaborate in section B.1.</i> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		
<b>A.20. Executing Entity information</b>	Secretary of State for the Environment (SSE) UN Environment Programme (UNEP)		
<b>A.21. Executive summary (max. 750 words, approximately 1.5 pages)</b>			
<p>Timor-Leste is a Least Developed Country (LDC), a Small Island Developing State (SIDS) and a post-conflict newly independent country whose infrastructure and governmental systems have been devastated by a 25-year war of independence. It is ranked 131 out of 189 countries on the Human Development Index (HDI)<sup>1</sup> and over 70% of the population is classified as living in or vulnerable to multidimensional poverty.<sup>2</sup></p> <p>Climate change presents serious challenges to Timor-Leste's development, including increased climate-related risks to lives, livelihoods, biodiversity, food security, water supply and economic growth. The country is increasingly under threat from climate change impacts common to tropical SIDS – rising mean temperatures, warming and rising seas, ocean acidification<sup>3</sup> and deoxygenation, less predictable and more extreme rainfall, tropical cyclones, flooding, landslides and prolonged droughts. Climate variability and change has direct impacts on the health and well-being of Timor-Leste's population – for example, deaths from extreme weather events, wildfires and emerging infectious diseases<sup>4</sup> – with disproportionate impacts on women and girls.<sup>5</sup> Health and well-being are further affected by climate-related ecosystems degradation, associated biodiversity loss<sup>6</sup> and worsening air quality. In 2019, the World Risk Index identified Timor-Leste as the 15<sup>th</sup> most at risk country in the world to natural disasters, as result of its location, geography and very limited capacity to prepare for and recover from climate impacts.<sup>7</sup></p> <p>As the effects of climate change manifest and the frequency and intensity of climate-related hazards increases, Timor-Leste needs accurate, timely and actionable information and early warnings on local weather, climate and ocean conditions and related risks to human and environmental health. Investments in infrastructure and institutional frameworks must be informed by high quality climate information and science-based advice on planning adaptation to longer term climate impacts. Disaster risk and public health management must integrate impact-based forecasts and warnings and be tailored to location- and sector-specific needs. Without a transformation at scale of Timor-Leste's climate information services, early warning systems and disaster risk reduction mechanisms, climate change will further exacerbate existing vulnerabilities and hamper the country's recovery and future development.</p> <p>The vulnerability of Timor-Leste is evident from the devastating impacts of the recent tropical cyclone, heavy rains, flooding and landslides that occurred between 29<sup>th</sup> March and April 2021, and which affected over</p>			

<sup>1</sup> UNDP, 2019. Human Development Report 2019

<sup>2</sup> UNDP, 2019. Human Development Report 2019 – Based on the Multidimensional Poverty Index, 45.8% of the population are classified as multidimensionally poor and an additional 26.1% are vulnerable to multidimensional poverty.

<sup>3</sup> Matear, R.J and Lenton, A. Biogeosciences, 2018. Carbon-climate feedbacks accelerate ocean acidification. "For the RCP4.5 scenario, by 2100 the carbon-climate feedbacks nearly double the area of surface water undersaturated with respect to aragonite and reduce by 50% the surface water suitable for coral reefs."

<sup>4</sup> McMichael A.J. *et al.*, 2006. The Lancet. Climate change and human health: present and future risks

<sup>5</sup> Carbon Brief, 2020. Mapped: How climate change disproportionately affects women's health. Available at: <https://www.carbonbrief.org/mapped-how-climate-change-disproportionately-affects-womens-health>

<sup>6</sup> Peel, G.T. *et al.*, 2017. Science. Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being

<sup>7</sup> Bündnis Entwicklung Hilft, 2019. World Risk Report 2019

30,300 households and caused 48 fatalities.<sup>8</sup> In addition to causing considerable human and economic loss, the flooding and landslides significantly undermined COVID-19 response efforts as Timor-Leste struggled to contain the virus' second wave. Heavy flooding in the National Laboratory and medical storage facility led to the loss of vital medical supplies and a COVID-19 isolation facility had to be temporarily evacuated. Moreover, displaced people sheltered in improvised evacuation centres and in the homes of relatives, which likely exacerbated the spread of the virus.<sup>9, 10</sup> The compounding impacts of weather hazard-induced disasters and the COVID-19 pandemic provide demonstrable evidence of the potential for a repeat of the “unprecedented double disaster” warned of by the UNDRR Asia Pacific COVID-19 Brief in April 2020, following the devastation of large areas of Vanuatu by Tropical Cyclone Harold.<sup>11</sup> In addition, the Brief emphasises “the need for countries to focus on a multi-hazard integrated disaster risk management approach that includes high levels of disaster preparedness and accelerated disaster risk reduction across sectors”.<sup>12</sup> The importance of improving national capacity for early warning systems and community capacity for disaster preparedness and response is also identified in the Timor-Leste Joint Appeal and Flood Response Plan, issued in May 2021.<sup>13</sup>

The dual challenge of climate change and a global pandemic highlights the urgency required to prioritise disaster risk management efforts and enhance multi-hazard early warning systems. The Global Ocean Observing System (GOOS) asserts that “[d]espite its significant impacts on the ocean observing system, the COVID-19 crisis can also be an opportunity for us to look at how to build greater resilience into the system.”<sup>14</sup> The World Bank emphasises strengthening health preparedness as an important precondition for a robust and sustained recovery.<sup>15</sup> Enhancing climate observations in concurrence with health and disaster preparedness capacity building will be a major focus of the Project.

Timor-Leste starts from a low institutional base and lacks climate observation infrastructure and human resources required to generate robust climate data and information and impact-based multi-hazard early warning services (MHEWS) covering the whole country. The main barriers to delivering effective climate and ocean information services and MHEWS include: i) lack of legislative, regulatory and policy frameworks for climate services and disaster risk management; ii) inadequate observation networks and limited sector-specific climate information; iii) limited communication and use of climate hazard and risk information; and iv) limited capacity and funding to prepare for and manage climate risks.

Therefore, this Project will address the urgent need for integrated climate information services, covering oceans, and proactive disaster risk management approaches founded on impact-based forecasting and end-to-end MHEWS. This will be achieved through four inter-related components – the Project Results:

1. Strengthened delivery model and legislation for climate information and multi-hazard early warning services;
2. Strengthened observations, monitoring, analysis and forecasting of climate and its impacts;
3. Improved dissemination and communication of risk information and early warning;

---

<sup>8</sup> UN Resident Coordinator's Office (RCO) Timor-Leste, 2021. Timor-Leste: Floods. Situation Report No. 10 (As of 18 June 2021). Available at: <https://timorleste.un.org/sites/default/files/2021-06/TL%20April%20Flood%20Response%20Situation%20Report%2010%20%2821%20June%2021%29.pdf>

<sup>9</sup> World Bank, 2021. Timor-Leste Economic Report: Charting a New Path

<sup>10</sup> UN News, 2021. 5 April 2021. UN steps up response, as thousands impacted by Timor-Leste floods. Available at: <https://news.un.org/en/story/2021/04/1089012>

<sup>11</sup> UNDRR, 2020. UNDRR Asia Pacific COVID-19 Brief. Combating the Dual Challenge of COVID-19 and Climate-Related Disasters

<sup>12</sup> UNDRR, 2020. UNDRR Asia Pacific COVID-19 Brief. Combating the Dual Challenge of COVID-19 and Climate-Related Disasters

<sup>13</sup> UN RCO Timor-Leste, 2021. Timor-Leste Joint Appeal and Flood Response Plan. Available at:

<https://reliefweb.int/sites/reliefweb.int/files/resources/2021%20TL%20Flood%20Response%20Plan%20FINAL%2010528%20%28rev%29.pdf>

<sup>14</sup> Global Ocean Observing System, 2020. Briefing Note: Covid-19's impact on the ocean observing system and our ability to forecast weather and predict climate change

<sup>15</sup> World Bank, 2020. Timor-Leste Economic Report: Towards a Sustained Recovery

#### 4. Enhanced climate risk management capacity.

The Project will enable a paradigm shift to evidence-based planning and early action for climate resilience through accurate, timely and actionable climate information, impact-based forecasting, people-centred multi-hazard early warning systems (MHEWS) and Forecast-based Financing (FbF). The Project will build the capacity of Timor-Leste to provide the essential high-resolution data and climate information needed to underpin science-based transformational planning and programming, de-risk investments, and facilitate long-term resilience and adaptation to climate change, protecting both human lives as well as the diverse ecosystems that sustain them. The interventions are designed to demonstrate the value of climate data at all levels of Timor-Leste's economy – from government policies to the decision-making of subsistence farmers – and pay particular attention to establishing climate services for health. The Project will also ensure adequate preparedness for climate-related disasters through Forecast-based Financing and Early Warning Early Action (EWEA) for agriculture and food security. This will facilitate that climate-resilient early actions from national to community level are identified and funded before a climate shock and become an integral component of disaster risk management and disaster risk reduction in Timor-Leste.

Cost-Benefit Analysis shows that, assuming a 10-year useful life of proposed interventions at a 10% discount rate, the discounted economic net present value (NPV) is positive (US \$56.01 million). The economic internal rate of return (EIRR) exceeds the discount rate making the proposed investment economically viable<sup>16</sup> by reducing the damage and loss incurred from the increased frequency and intensity of climate-induced disasters. The Project's impact potential is high, with an estimated 1,034,495 direct beneficiaries (80% of the total population) and 1,293,119 indirect beneficiaries (100% of the total population, including direct beneficiaries) of improved climate risk knowledge and effective systems for early warning of extreme events.

The Project Results will strengthen implementation of the WMO Global Framework for Climate Services (GFCS) in Timor-Leste and are designed to align with the four elements of the checklist for Multi-Hazard Early Warning Systems (MHEWS) prepared by the partners of the International Network for MHEWS: i) Disaster Risk Knowledge; ii) Detection, monitoring, analysis and forecasting of hazards and possible consequences; iii) Warning dissemination and communication; iv) Preparedness and response capabilities. Furthermore, the Project will directly contribute to the attainment of selected targets and indicators of the Paris Agreement, Sustainable Development Goal (SDG) 13 on Climate Action, SDG 3 on Good Health and Well-Being and the Sendai Framework for Disaster Risk Reduction.

The Project has been developed at the request of and with the support of the Nationally Designated Authority for Interaction with the GCF (the NDA). All proposed interventions are aligned with and will contribute to the achievement of goals identified in major national strategic and policy documents, including the Nationally Determined Contributions for adaptation and the National Adaptation Program of Action. Continued country ownership will be ensured through strong stakeholder and community engagement. At the request of the NDA of Timor-Leste, the UN Environment Programme (UNEP) will serve as the Accredited Entity (AE) for the Project. The AE will work with the Secretary of State for the Environment (SSE) as the national Executing Entity (EE) alongside a range of technical partners and national service providers, including Timor-Leste Meteorological Service (National Directorate for Meteorology and Geophysics – DNMG), the National Disaster Management Directorate (NDMD), the National Directorate for Water Resource Management (DNGRA), the Ministry of Agriculture and Fisheries (MAF), Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES), the Food and Agriculture Organization (FAO), International Federation and Red Cross and Red Crescent Societies (IFRC) – including its Climate Centre and national society (Cruz Vermelha de Timor-Leste – CVTL), Indonesian Meteorological, Climatological and Geophysical Agency (Badan Meteorologi, Klimatologi dan Geofisika – BMKG), International Centre for Theoretical Physics (ICTP) and the World Meteorological Organization (WMO).

---

<sup>16</sup> See Annex 3 – Economic Analysis

## B. PROJECT/PROGRAMME INFORMATION

### B.1. Climate rationale and context (max. 1000 words, approximately 2 pages)

#### **Background**

Timor-Leste is a Least Developed Country (LDC) and Small Island Developing State (SIDS) situated at the eastern end of the Lesser Sunda Islands of the Indonesian archipelago, about 400 km north west of Australia. It comprises the eastern half of the island of Timor, the Oecusse exclave on the north-western side of Timor, and the islands of Atauro and Jaco. The topography is dominated by a massive central mountainous chain rising up to 3000 metres and dissecting deep valleys. Up to 44% of the area has a slope of 40%.<sup>17</sup>

Timor-Leste has a monsoon climate, which is characterised by a wet season from December to March and a very marked dry season from May to October – except on the south coast and the southern slopes, where the wet season lasts until July.<sup>18</sup> From August to October, rainfall is lower than 50 mm per month on average. Year-to-year variations in Timor-Leste's climate are related to El Niño–Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD). El Niño generally brings drier conditions, whilst La Niña tends to bring above-normal rainfall in the dry season. During a positive phase of the IOD, dry season rainfall is lower than normal.<sup>19</sup> Changes to the IOD as a result of global warming are likely to negatively affect Timor-Leste due to increasing extreme climate events and unpredictability.<sup>20, 21</sup>

#### **Historic climate trends and expected future climate change**

##### **Temperature**

In the period 1901-2005, temperatures in Timor-Leste increased by 0.5 – 0.8 °C. Data from 1979-2005 suggest a decadal increase of 0.1 – 0.3 °C with a mild acceleration over the later decades.<sup>22</sup> There is an increasing trend in hot days, increasing at a rate of 48 days per decade over the 1981-2010 period. This warming is partly attributed to the warming ocean temperatures around Timor-Leste.<sup>23</sup>

Surface air temperature and sea surface temperature are projected to continue to increase. Under all RCPs, projected warming is up to 1.1 °C by 2030 (relative to 1995), but after 2030 there is a growing difference in warming between each RCP scenario. For example, by 2090 a warming of 2.4 – 4.2 °C is projected for RCP8.5, while a warming of 0.5 – 1.2 °C is projected for RCP2.6.<sup>24</sup> The rate of warming is also projected to increase.<sup>25</sup>

Increasing temperatures on a global scale are projected to result in an increase in extreme ENSO events.<sup>26</sup> The frequency of extreme El Niño events is projected to double to one event every 10 years under global warming in the period 1991 – 2090.<sup>27</sup> Extreme ENSO events are associated with more extreme temperatures.<sup>28</sup> This indicates a positive (reinforcing) feedback mechanism between ENSO and climate change.<sup>29</sup>

<sup>17</sup> Barnett, J. et al. 2007. Vulnerability to climate variability and change in East Timor

<sup>18</sup> World Bank, 2021. Climate Knowledge Portal – Timor-Leste. Available at: <https://climateknowledgeportal.worldbank.org/country/timor-leste/climate-data-historical>

<sup>19</sup> Australian BoM and CSIRO, 2014. Current and future climate of Timor-Leste

<sup>20</sup> Huang, P. American Meteorological Society. 2019. Disentangling the Changes in the Indian Ocean Dipole-Related SST and Rainfall Variability under Global Warming in CMIP5 Models. Available at: <https://doi.org/10.1175/JCLI-D-18-0847.1>

<sup>21</sup> Cai, W. et al., 2020. Nature Climate Change. Opposite response of strong and moderate positive Indian Ocean Dipole to global warming

<sup>22</sup> World Bank, 2021. Climate Knowledge Portal – Timor-Leste. Available at: <https://climateknowledgeportal.worldbank.org/country/timor-leste/climate-data-historical>

<sup>23</sup> Australian BoM and CSIRO, 2014. Current and future climate of Timor-Leste

<sup>24</sup> BoM (Australian Bureau of Meteorology) and CSIRO, 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: Updated Country Reports

<sup>25</sup> World Bank, 2021. Climate Change Knowledge Portal – Timor-Leste. Available at: <https://climateknowledgeportal.worldbank.org/country/timor-leste/climate-data-projections>

<sup>26</sup> Yang, S. et al., 2018. National Science Review. El Niño-Southern Oscillation and its impact in the changing climate

<sup>27</sup> Cai, W. et al. 2014. Nature Climate Change. Increasing frequency of extreme El Niño events due to greenhouse warming

<sup>28</sup> Fasullo, J.T., et al., 2018. Geophysical Research Letters. ENSO's Changing Influence on Temperature, Precipitation, and Wildfire in a Warming Climate

<sup>29</sup> Koutavas, A., 2012. Nature Education Knowledge. El Niño's Grip on Climate

Key climate hazards related to increasing temperatures are outlined below:

- **Heatwaves** are projected to increase in frequency.<sup>30</sup> More extreme temperatures could result in increased incidence of heat stress and death in local communities, which will particularly affect the young, elderly and infirm. The incidence of vector-borne diseases such as malaria and dengue fever is also likely to increase.<sup>31</sup>
- **Wildfire** hazard levels are classified as ‘high’ in almost all of Timor-Leste, meaning that there is more than 50% chance of encountering weather that could support a significant wildfire that is likely to result in both loss of life and property in any given year.<sup>32</sup> During the dry season, the vegetation dries, leaving significant highly combustible biomass. Rugged terrain and steep topography and a contrasting bimodal rainfall pattern has resulted in a high land vulnerability to wildfire. The fire season is from June to December, with fire events peaking towards the end of the dry season in October and November. VIIRS imagery shows an increasing trend in fire events between 2012 and 2019.<sup>33</sup> Future projections indicate an increase in the frequency and severity of wildfire events.<sup>34</sup> This is on account of increasing temperatures with more hot days, lower soil moisture, greater variance in rainfall and a doubling of extreme El Niño frequency.<sup>35</sup> Wildfires are a major source of fine particulate matter (PM<sub>2.5</sub>), which is a significant concern for public health.<sup>36</sup>
- **Increased air pollution:** Air quality is strongly dependent on weather and is therefore sensitive to climate change.<sup>37</sup> Increasing temperatures and extreme heat can increase the concentration of fine particulate matter (PM<sub>2.5</sub>) and ground-level ozone (O<sub>3</sub>).<sup>38</sup> Coupled GCM–CTM<sup>39</sup> studies find that climate change alone will increase summertime surface ozone in polluted regions by 1–10 ppb over the coming decades, with the largest effects in urban areas and during pollution episodes.<sup>40</sup> As highlighted above, the projected increase in frequency and severity of wildfires is also expected to lead to increased concentrations of particulate matter.

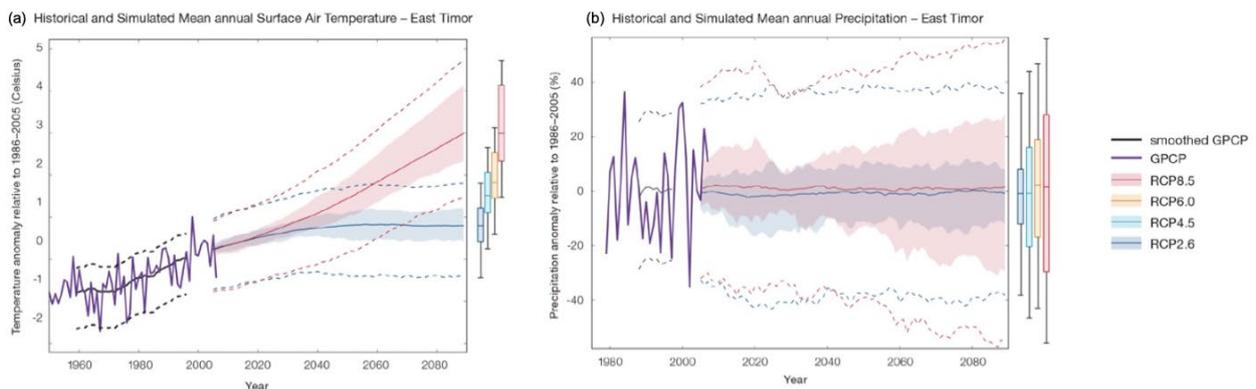


Figure 1. Historical and simulated (a) mean surface air temperature and (b) mean annual precipitation time series for Timor-Leste (Source: Australian BoM and CSIRO, 2014)

<sup>30</sup> World Bank, 2021. Climate Change Knowledge Portal – Timor-Leste. Available at:

<https://climateknowledgeportal.worldbank.org/country/timor-leste/climate-data-projections>

<sup>31</sup> CSIRO, Australian BoM and SPREP, 2015. Climate in the Pacific: A regional summary of new science and management tools

<sup>32</sup> GFDRR, 2021. ThinkHazard! Timor-Leste – Wildfire. Available at: <https://thinkhazard.org/en/report/242-timor-leste/WF>

<sup>33</sup> FAO, 2019. Rapid remote sensing analysis conducted in Timor-Leste

<sup>34</sup> GFDRR, 2021. ThinkHazard! Timor-Leste – Wildfire. Available at: <https://thinkhazard.org/en/report/242-timor-leste/WF>

<sup>35</sup> Cai, W. *et al.* 2014. Nature Climate Change. Increasing frequency of extreme El Niño events due to greenhouse warming

<sup>36</sup> Aguilere, R. *et al.*, 2021. Nature Communications. Wildfire smoke impacts respiratory health more than fine particles from other sources: observational evidence from Southern California

<sup>37</sup> Jacob, D.J. and Winner, D.A., 2009. Atmospheric Environment. Effect of climate change on air quality

<sup>38</sup> Exhaustion.eu., 2020. The feedbacks between climate change and air pollution. Available at: <https://www.exhaustion.eu/resources/the-link-and-feedbacks-between-climate-change-and-air-pollution>

<sup>39</sup> <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/general-circulation-model>

<sup>40</sup> Jacob, D.J. and Winner, D.A., 2009. Atmospheric Environment. Effect of climate change on air quality

## Rainfall

In the period 1961-1990, mean annual rainfall in Timor-Leste decreased (relative to 1931-1960).<sup>41</sup> Long-term seasonal analysis shows a consistently increasing trend in rainfall during the rainy season (7.6 mm/decade in December – February over the period 1901-2009). Long-term downward trends in rainfall are shown during the dry season, with a particular dominant decrease in rainfall observed over the last two decades.<sup>42</sup> These long-term trends are indicative of climate change.<sup>43</sup>

Strong inter-annual variability is observed and is associated with annual increase or decreases in rainfall that lead to possible extreme climate events, such as drought and floods. The onset of the wet and dry seasons also shows strong inter-annual variability.<sup>44</sup> Short-term inter-annual variability is linked to climate drivers such as ENSO and IOD.<sup>45</sup> However, climate change is projected to alter inter-annual ENSO-driven precipitation variability,<sup>46</sup> particularly with regard to changes in intensity or location of rainfall during El Niño.<sup>47</sup>

Long-term average rainfall is expected to remain similar in Timor-Leste, but extreme rainfall events are projected to increase.<sup>48</sup> In addition, wet season onset may be delayed by about 20 days from the current climate pattern, while dry season onset may be delayed by as much as 11 days.<sup>49</sup> Projected changes in the spatial patterns of rainfall indicate that there will be decreases in the total area of generally wetter regions (western and central) of Timor-Leste, with consequent increases in the total area of generally drier regions (north and south-west).<sup>50</sup> This suggests that heavy rainfall will be concentrated over smaller total land areas in the future. These changes in both spatial and temporal rainfall distribution will have significant impacts on the water balance.

Key climate hazards related to rainfall are outlined below:

- **Floods** are one of the most frequently occurring extreme events in Timor-Leste, resulting from a combination of climate change and non-climatic drivers – heavy monsoon rainfall, steep topography and widespread deforestation.<sup>51</sup> Natural climatic drivers (i.e., ENSO) also affect floods. La Niña years are associated with above-normal rainfall leading to increased flooding.<sup>52</sup> Future projections indicate that the frequency and intensity of extreme rainfall events will increase.<sup>53</sup> More extreme rainfall is expected to cause increased risk of flooding and associated impacts for infrastructure, food, health, tourism and biodiversity.<sup>54</sup>
- **Landslides** induced by flooding are reported to be one of the most common disasters in Timor-Leste, with the eastern half of the country particularly highly prone to landslide. A combination of climatic (extreme rainfall events) and geographic (steep slopes, high weathering rates and slope material with low shear resistance or high clay content) factors are the main preconditions for landslides.<sup>55</sup>

<sup>41</sup> World Bank, 2021. Climate Knowledge Portal – Timor-Leste. Available at: <https://climateknowledgeportal.worldbank.org/country/timor-leste/climate-data-historical>

<sup>42</sup> Timor-Leste, 2014. Timor-Leste's Initial National Communication under the UNFCCC

<sup>43</sup> Pacific Climate Futures, 2021. Understanding Climate Variability and Change. Available at: <https://www.pacificclimatefutures.net/en/help/climate-projections/understanding-climate-variability-and-change/>

<sup>44</sup> Timor-Leste, 2014. Timor-Leste's Initial National Communication under the UNFCCC

<sup>45</sup> Faqih, A., 2010. Rainfall variability in the Austral-Indonesian Region and the role of Indo-Pacific climate drivers

<sup>46</sup> Power, S. *et al.* 2013. Nature. Robust twenty-first-century projections of El Niño and related precipitation variability

<sup>47</sup> Collins, M. 2014. NOAA Climate.gov News & Features. Climate Change and ENSO: Take 2. Available at: <https://www.climate.gov/news-features/blogs/enso/climate-change-and-enso-take-2>

<sup>48</sup> Australian BoM and CSIRO, 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: Updated Country Reports. Pacific-Australia Climate Change Science and Adaptation Planning Program Technical Report

<sup>49</sup> CSIRO, 2010. Climate change in Timor-Leste – A brief overview on future climate projections

<sup>50</sup> Timor-Leste, 2014. Timor-Leste's Initial National Communication under the UNFCCC

<sup>51</sup> Timor-Leste, 2014. Timor-Leste's Initial National Communication under the UNFCCC

<sup>52</sup> BoM (Australian Bureau of Meteorology) and CSIRO, 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: Updated Country Reports

<sup>53</sup> Australian BoM and CSIRO, 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: Updated Country Reports. Pacific-Australia Climate Change Science and Adaptation Planning Program Technical Report

<sup>54</sup> CSIRO, Australian BoM and SPREP, 2015. Climate in the Pacific: A regional summary of new science and management tools

<sup>55</sup> UNDP, 2016. Timor-Leste: Stay Connected – Reducing Climate Risks, Building the Future

**Drought:** Timor-Leste experiences periodic extreme drought events associated with El Niño. Future projections indicate that the overall proportion of time spent in drought is expected to decrease slightly under RCP8.5 and stay approximately the same under all other scenarios, although there is low confidence in the projections in drought frequency and duration.<sup>56</sup> However, based on the projected increase in extreme El Niño events under global warming,<sup>57</sup> an increase in the number of *extreme* drought events could be expected.<sup>58</sup> Drought has devastating impacts on agricultural productivity and water availability,<sup>59</sup> and increases environmental stress on coastal and inland ecosystems.<sup>60</sup>

### Tropical cyclones and storms

Seven tropical cyclones developed within or passed through the Timor-Leste EEZ in the period 1969 – 2010, all of which were less than Category 3. Tropical storms (wind speed of 36 – 117 km/hour) affect Timor-Leste annually and can be as devastating as cyclonic activity due to the deposition of extremely high amounts of rainfall in a short time period.<sup>61</sup> An increase in the average maximum wind speed of cyclones by 2 – 11% and an increase in rainfall rates of about 20% within 100 km of the cyclone centre are projected in the future.<sup>62</sup> Infrastructure damage increases exponentially with wind speed, therefore an increase in the proportion of severe cyclones is expected to lead to increased loss and damage. Increased incidence of extreme storm-related loss of critical habitats is also anticipated.<sup>63</sup>

### Sea level rise

Sea level has risen near Timor-Leste by about 9mm per year since 1993. This rate is two to three times faster than the global average. Mean sea level is projected to continue to rise over the course of the 21st century. CMIP5 models simulate a rise of between approximately 8–18 cm by 2030, with increases of 20–60 cm indicated by 2090 under the higher emissions scenarios.<sup>64</sup> Sea-level rise is predominantly due to ocean thermal expansion and glacier mass loss due to warming.<sup>65</sup> Impacts of rising sea levels include the increased risks of coastal inundation that damages critical infrastructure and degrades coastal habitats; loss and damage to arable land due to saline intrusion; and salinisation of freshwater sources.<sup>66</sup>

### Ocean acidification and deoxygenation

Ocean acidification has been increasing in Timor-Leste's waters and is project to continue to increase throughout the 21<sup>st</sup> century.<sup>67</sup> The rate of ocean acidification is driven primarily by increased oceanic uptake of carbon dioxide, in response to rising atmospheric carbon dioxide concentrations. In parallel to acidification, deoxygenation of oceans has occurred due to the decreased capacity of warmer waters to dissolve oxygen.<sup>68</sup> Deoxygenation of sea water as surface temperatures rise will negatively impact corals and other marine organisms.<sup>69</sup> Rising ocean temperatures, increasing acidification and reduced oxygenation of sea water will reduce the availability of fish for inshore fishermen.

<sup>56</sup> BoM and CSIRO, 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: Updated Country Reports. PACCSAP Program Technical Report

<sup>57</sup> Cai, W. *et al.* 2014. Nature Climate Change. Increasing frequency of extreme El Niño events due to greenhouse warming

<sup>58</sup> Yale Environment 360, 2019. Climate Change is Making El Niños More Intense, Study Finds. Available at:

<https://e360.yale.edu/digest/climate-change-is-making-el-ninos-more-intense-study-finds>

<sup>59</sup> USAID, 2017. Fact Sheet – Climate Risk Profile Timor-Leste

<sup>60</sup> CSIRO, Australian BoM and SPREP, 2015. Climate in the Pacific: A regional summary of new science and management tools

<sup>61</sup> BoM and CSIRO, 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: Updated Country Reports. PACCSAP Program Technical Report

<sup>62</sup> Australian BoM and CSIRO, 2014. Current and future climate of Timor-Leste

<sup>63</sup> CSIRO, Australian BoM and SPREP, 2015. Climate in the Pacific: A regional summary of new science and management tools

<sup>64</sup> BoM (Australian Bureau of Meteorology) and CSIRO, 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: Updated Country Reports

<sup>65</sup> IPCC, 2013. Climate Change 2013: The Physical Science Basis

<sup>66</sup> CSIRO, Australian BoM and SPREP, 2015. Climate in the Pacific: A regional summary of new science and management tools

<sup>67</sup> Australian BoM and CSIRO, 2014. Current and future climate of Timor-Leste

<sup>68</sup> IPCC, 2013. Climate Change 2013: The Physical Science Basis

<sup>69</sup> IPCC, 2019. Special Report on the Ocean and Cryosphere in a Changing Climate

### **Vulnerability of Timor-Leste to climate hazards and climate change**

Timor-Leste is highly vulnerable to climate change and climate-induced hazards, and experiences recurrent disasters associated with droughts, floods and landslides, resulting from climate drivers such as extreme rainfall, precipitation variability and sea-level rise. Factors such as steep topography, geographic isolation and widespread deforestation increase climate risks. Socio-economic development is limited by the inability to respond appropriately to climate hazards, which in turn increases vulnerability.

About 70% of Timor-Leste's population live in poorly serviced rural areas and rely on climate sensitive rain-fed agriculture as their main source of income, with very limited access to financial services.<sup>70</sup> Over 40% of the population lives below the national poverty line.<sup>71</sup> Low agricultural production combined with a lack of access to markets, inputs and basic services contributes to high food insecurity, particularly in rural areas. 74% of the rural population suffers moderate and severe food insecurity,<sup>72</sup> which is exacerbated by extreme climate events such as drought. Annual food deficits also contribute to malnutrition rates, especially for children and women, which have been among the highest in the world. In 2019, Timor-Leste was ranked 110<sup>th</sup> out of 117 countries on the Global Hunger Index (GHI), with the GHI score indicating a "serious level of hunger".<sup>73</sup>

Climate change threatens to exacerbate existing health problems (e.g., deaths from extreme weather events, cardiovascular and respiratory diseases, infectious and vector-borne diseases and malnutrition) as well as undermine water and food supplies, infrastructure, health systems and social protection systems.<sup>74</sup> Air pollution poses further health risks. The annual mean concentration of PM<sub>2.5</sub> in Timor-Leste is 19 µg/m<sup>3</sup>, which exceeds the "safe" maximum of 10 µg/m<sup>3</sup> recommended by the World Health Organization.<sup>75</sup> Climate change can affect air pollution both physically and chemically in a manner that reduces air quality. In particular, increasing temperatures and extreme heat can increase the concentration of fine particulate matter (PM<sub>2.5</sub>) and ground-level ozone (O<sub>3</sub>).<sup>76</sup> Wildfires, which are projected to increase in frequency and severity with climate change,<sup>77</sup> also contribute to increased levels of PM<sub>2.5</sub>. Both of these pollutants are detrimental to human health – increasing the risk of all-cause and/or cardiovascular and respiratory mortality – which increases the burden of climate change on the health sector.<sup>78</sup>

The majority of climate-related disasters in Timor-Leste are localised and periodic, with resultant significant impacts on local communities and sectors. A *suco* (village) level vulnerability assessment found that 61 of the 442 *sucos* in Timor-Leste can be categorised as being vulnerable or very vulnerable to climate change. Less than one-fifth of the *sucos* can be categorised as less or not vulnerable.<sup>79</sup> Around 80 percent of the population has already experienced the impacts of a natural disaster during their lifetime,<sup>80</sup> with the most affected communities being those isolated in terms of accessibility and communications, and those with low capacity to prepare for and respond to climate risks.<sup>81</sup> Table 1 summarises the main impacts of climate change on the five priority sectors of the WMO Global Framework for Climate Services (GFCS) as well as on infrastructure and coastal zones, which were identified as a high vulnerability sector by Timorese citizens during the NAPA process.<sup>82</sup>

<sup>70</sup> Bündnis Entwicklung Hilft, 2017. World Risk Report – Analysis and Prospects 2017

<sup>71</sup> World Bank, 2020. The World Bank in Timor-Leste - Overview. Available at: <https://www.worldbank.org/en/country/timor-leste/overview>

<sup>72</sup> Food and Nutrition Security Task Force. Ministry of Agriculture and Forests Agis Map. Dili, January 2012.

<sup>73</sup> Concern Worldwide and Welthungerhilfe, 2019. Global Hunger Index 2019 – Timor-Leste

<sup>74</sup> World Health Organization, 2015. Climate and Health Country Profile – Timor-Leste

<sup>75</sup> IAMAT, 2021. Timor-Leste General Health Risks: Air Pollution. Available at: <https://www.iamat.org/country/timor-leste/risk/air-pollution>

<sup>76</sup> Exhaustion.eu., 2020. The feedbacks between climate change and air pollution. Available at: <https://www.exhaustion.eu/resources/the-link-and-feedbacks-between-climate-change-and-air-pollution>

<sup>77</sup> GFDRR, 2021. ThinkHazard! Timor-Leste – Wildfire. Available at: <https://thinkhazard.org/en/report/242-timor-leste/WF>

<sup>78</sup> Orellano, P. *et al.*, 2020. Environment International. Short-term exposure to particulate matter (PM<sub>10</sub> and Pm<sub>2.5</sub>), nitrogen dioxide (NO<sub>2</sub>), and ozone (O<sub>3</sub>) and all-cause and cause-specific mortality: Systematic review and meta-analysis

<sup>79</sup> Government of the Democratic Republic of Timor-Leste, 2014. Timor-Leste's Initial National Communication under UNFCCC

<sup>80</sup> UNDP, 2018. Strengthening Disaster Risk Management Project Fact Sheet

<sup>81</sup> Government of Timor-Leste, 2010. National Adaptation Programme of Action (NAPA) to Climate Change

<sup>82</sup> Government of Timor-Leste, 2010. National Adaptation Programme of Action (NAPA) to Climate Change

Table 1. Climate stressors and risks for vulnerable sectors in Timor-Leste

Sector	Stressors	Risks
Agriculture and food security	Increased temperatures; increased rainfall variability; flooding; drought; increased frequency and intensity of wildfires; sea-level rise	<ul style="list-style-type: none"> <li>• Reduced crop yields and/or crop failure</li> <li>• Increased evaporation of groundwater leading to increased salt concentration in plant rooting zones and reduced plant growth and productivity</li> <li>• Increased incidence of damaging pest populations</li> <li>• Reduced livestock productivity, fertility and reproduction leading to decreased incomes for farmers</li> <li>• Increased erosion and loss of agricultural land</li> <li>• Decreased agricultural productivity due to storm damages to seeds and changing patterns of crop pests and diseases</li> <li>• Reduced dry season affecting inland fisheries</li> <li>• Coastal flooding and soil salination threaten the viability of low-lying fields</li> </ul>
Biodiversity	Increased frequency and intensity of wildfires; increased temperatures; increased rainfall variability; storms; sea-level rise; ocean acidification	<ul style="list-style-type: none"> <li>• Reduced surface water and de-oxygenation leading to loss of aquatic ecosystems and increased stress or local extinction of species</li> <li>• Reduced health, diversity and productivity of forest ecosystems and species</li> <li>• Increased numbers of some species, including pests, weeds and pathogens</li> <li>• Migration or displacement to locations with more suitable environmental conditions</li> <li>• Increased contamination and pollution by runoff from human settlements, industry and roads impacting on aquatic biodiversity</li> <li>• Direct physical damage to forest and terrestrial ecosystems</li> <li>• Salinisation of soil, freshwater, coastal lands, infrastructure and agriculture due to seawater intrusion</li> </ul>
Disaster risk reduction	Increased frequency and/or intensity of extreme climate events, such as flooding, drought and wildfires	<ul style="list-style-type: none"> <li>• Increased incidence of injury and deaths</li> <li>• Displacement due to flooding</li> <li>• Reduced water and food security, resulting in impacts to hygiene and health</li> <li>• Increased damage to natural resources</li> </ul>
Energy	Increased temperatures; increased frequency and/or intensity of extreme rainfall; drought	<ul style="list-style-type: none"> <li>• Reduced energy supply due to disrupted operations and distribution</li> <li>• Increased electricity consumption due to increased demand for cooling and refrigeration</li> </ul>
Health	Increased temperatures; increased frequency and/or intensity of extreme climate events such as flooding, drought and wildfires; increased air pollution	<ul style="list-style-type: none"> <li>• Increased incidence of injury and deaths</li> <li>• Increased risk of malnutrition, hunger and water shortages</li> <li>• Increased incidence of heat stroke, dehydration, heat exhaustion and sun stroke</li> <li>• Increased risk of severe respiratory infections</li> <li>• Increased spread of vector-borne diseases, particularly dengue and malaria</li> <li>• Increased incidence of water-borne diseases and infections</li> </ul>
Water resources	Increased frequency and intensity of wildfires; increased temperatures; increased rainfall variability; flooding; drought; sea-level rise	<ul style="list-style-type: none"> <li>• Increased evaporation from water storage (e.g. reservoirs and tanks)</li> <li>• Reduced availability and quality of water for irrigation and domestic use</li> <li>• Limited water infiltration to the soil due to steep terrain, shallow and thin soils and sparse vegetation</li> <li>• Increased groundwater contamination by saltwater intrusion</li> <li>• Landslides and flooding damage water resources and infrastructure</li> </ul>
Infrastructure	Increased frequency and/or intensity of extreme climate events; strong winds; flooding; wildfires	<ul style="list-style-type: none"> <li>• Increased damage to infrastructure including homes, schools, business facilities, health facilities, roads, power infrastructure, agricultural facilities and water supply</li> <li>• Isolation of communities for long durations due to disrupted road networks</li> </ul>

Coastal zones	Increased temperatures; increased frequency and/or intensity of extreme rainfall events; ocean acidification and deoxygenation	<ul style="list-style-type: none"> <li>• Loss or destruction of coastal vegetation, species and habitats</li> <li>• Reduced health, diversity and productivity of marine ecosystems and fisheries</li> <li>• Increased coral reef bleaching and damage due to storm surge</li> <li>• Flooding and destruction of coastal settlements and coastal protection measures</li> <li>• Damaged coastal saline habitats – including wetlands and mangroves – due to flooding</li> <li>• Increased erosion of beaches, shorelines and coastal land leading to loss of breeding and nesting habitats</li> </ul>
---------------	--	---

### Vulnerability due to COVID-19 and interconnectivity with climate change

As of 24 May 2021, COVID-19 cases continued to increase daily, particularly in Dili, with 5,637 confirmed cases of COVID-19. The risk of further spread of COVID-19 remained high, particularly amongst the temporarily displaced.<sup>83</sup> In response to the COVID-19 pandemic, a State of Emergency was declared on 28 March 2020, which enabled the Government of Timor-Leste to rapidly implement several public health measures to prevent an outbreak.<sup>84</sup> However, “the country’s dependence on agricultural production, high levels of multidimensional poverty, unemployment and chronic malnutrition, lack of basic infrastructure, dependence on exports, and unequal access to essential services mean the ongoing socio-economic impact of the pandemic could be severe”.<sup>85</sup> The impact of COVID-19 is forecast to contribute to the sharpest fall in gross domestic product (GDP) in Timor-Leste since independence in 2002.<sup>86</sup> Moreover, despite initial relative success in containing the virus, May 2021 has seen Timor-Leste report its highest daily rate of infections since the pandemic began<sup>87</sup> and the capital Dili entered its first lockdown due to concern that it could be facing its first local outbreak.<sup>88</sup> Recent severe floods in Timor-Leste in April 2021 have killed 48 people<sup>89</sup> and more than 10,000 people were displaced.<sup>90</sup> The impact on COVID-19 prevention and response efforts could be severe; the national medical storage facility has been heavily flooded, and many medical supplies have been damaged or washed away. In addition, a COVID-19 isolation facility had to be temporarily evacuated and the national laboratory was also affected.<sup>91</sup>

UNDRR has asserted that as countries in the Asia-Pacific region enter their cyclone, drought, heatwaves or monsoon seasons, the potential for an “**unprecedented double disaster**” is increasing.<sup>92</sup> The COVID-19 pandemic highlights how risks rise significantly with compounding extreme events, with social and economic impacts escalating across all areas of life. Despite the decrease in greenhouse gas emissions as a result of the pandemic, SIDS continue to be affected by existing climate change impacts and must address these simultaneously to recovering from the pandemic.<sup>93</sup> There is an urgent need to “focus on a multi-hazard integrated disaster risk management approach that includes high levels of disaster preparedness and accelerated disaster

<sup>83</sup> WHO, 2021. 6 April 2021. COVID-19 Timor-Leste Situation. Available at: <https://covid19.who.int/region/searo/country/tl>

<sup>84</sup> World Bank, 2020. Timor-Leste Economic Report: Towards a Sustained Recovery

<sup>85</sup> UNDP, 2020. Socio-Economic Impact Assessment of COVID-19 in Timor-Leste

<sup>86</sup> World Bank, 2020. Timor-Leste Economic Report: Towards a Sustained Recovery

<sup>87</sup> Reuters, 2021. Covid-19 Tracker – Timor-Leste. Available at: <https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/timor-leste/>

<sup>88</sup> ABC News, 2021. 8 March 2021. Papua New Guinea COVID cases surge, Timor-Leste imposes first lockdown over outbreak fears.

Available at: <https://www.abc.net.au/news/2021-03-09/png-timor-leste-face-growing-outbreaks,-concern-in-australia/13229098>

<sup>89</sup> UN Resident Coordinator’s Office (RCO) Timor-Leste, 2021. Timor-Leste: Floods. Situation Report No. 10 (As of 18 June 2021).

Available at: <https://timorleste.un.org/sites/default/files/2021-06/TL%20April%20Flood%20Response%20Situation%20Report%2010%202821%20June%2021%29.pdf>

<sup>90</sup> The Guardian, 2021. 6 April 2021. Death toll in Indonesia and Timor-Leste from catastrophic floods rises to 157. Available at:

<https://www.theguardian.com/world/2021/apr/06/death-toll-in-indonesia-and-timor-leste-from-catastrophic-floods-rises-to-157>

<sup>91</sup> UN News, 2021. 5 April 2021. UN steps up response, as thousands impacted by Timor-Leste floods. Available at:

<https://news.un.org/en/story/2021/04/1089012>

<sup>92</sup> UNDRR, 2020. UNDRR Asia Pacific COVID-19 Brief. Combating the dual challenge of COVID-19 and climate-related disasters

<sup>93</sup> Climate Analytics, 2020. Coronavirus crisis underscores small islands’ climate vulnerability. Available at:

<https://www.climatechangenews.com/2020/04/17/coronavirus-crisis-underscores-small-islands-climate-vulnerability/>

risk reduction across sectors” as a priority action to enhance resilience to the dual challenge of pandemics and climate-related hazards.<sup>94</sup>

### **Exposure to climate hazards and climate-related loss and damage**

Timor-Leste’s geographical location, topography and lack of coping and adaptive capacity and strategies makes it the 15th most disaster-prone country in the world according to the World Risk Index 2019.<sup>95</sup> About 80% of Timorese have experienced the effects of a natural disaster in their lifetime, and climate-related hazards have caused over 80% of all disaster-related deaths since 1992.<sup>96</sup> Timor-Leste estimates its total estimated value of exposure to climate hazards at more than US\$570 million, where residential exposure is 42.5%, transport 38.2%, commercial 10.9%, education 3.7%, industrial 1.6%, health 0.8% and crops 0.7%.<sup>97</sup>

The Government of Timor-Leste has identified climate change and natural disasters as a major source of risk for the country’s population and assets are identified in its Strategic Development Plan 2011 – 2030. In addition, the National Disaster Risk Management Policy (2008) elevated Disaster Risk Management to national priority.

Using official government data, the UNDRR DesInventar platform<sup>98</sup> reports 87 deaths due to meteorological events in the period 1992 – 2017. The deaths are recorded from 2009 onwards, which gives an average annual mortality rate of 9 deaths per year. However, casualties are likely to be underestimated because not all deaths may have been reported in the aftermath of a disaster. Precipitation-related disasters have clearly been causing most of the fatalities (86%). Based on the the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI)<sup>99</sup> modelling, Average Annual Losses (AAL) for Timor-Leste are estimated at US\$51.3 million including direct and emergency losses. However, it is suggested that the AAL value is severely underestimated. Overall, a potential loss equivalent to 6.7% of combined gross domestic product (GDP) per year by mid-century due to climate change impacts is expected.<sup>100</sup> The damage costs of climate change are therefore significant for Timor-Leste.

### **Current status of climate information and early warning systems**

Basic weather and climate services are currently provided by the Timor-Leste Direção Nacional Meteorologia e Geofísica (National Directorate of Meteorology and Geophysics—DNMG) as a public good, funded from very limited public sector resources and with the assistance of the neighbouring countries of Indonesia and Australia, and other external agencies. DNMG is a WMO Category 1<sup>101</sup> – basic level meteorological service. It is poorly resourced—it has 23 staff, a small budget (USD 299,000 in 2019)<sup>102</sup> and limited equipment—and provides only basic weather services, which many communities are currently unable to access. As a result, Timor-Leste’s observation network and resulting data availability is rudimentary:<sup>103</sup>

- There are currently ten stations in the national meteorological observation network, all of which require calibration and maintenance. None of the stations are currently reporting to the WMO Integrated Global Observing System (WIGOS) and none are compliant with the WMO Global Basic Observing Network

<sup>94</sup> UNDRR, 2020. UNDRR Asia Pacific COVID-19 Brief. Combating the dual challenge of COVID-19 and climate-related disasters

<sup>95</sup> Bündnis Entwicklung Hilft, 2019. World Risk Report 2019

<sup>96</sup> UNDRR. Desinventar Country Profile – Timor-Leste. Available at:

<https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=tis&continue=y>

<sup>97</sup> RMSI, 2015. Building Climate and Disaster Resilience in Communities along Dili-Ainaro and Linked Road Corridors Project. Component 1: Natural Hazard Risk Assessment. Available at: <http://documents.worldbank.org/curated/en/466781468299341781/pdf/97119-WP-P133265-PUBLIC-Box391470B-ACS.pdf>

<sup>98</sup> <https://www.desinventar.net/>

<sup>99</sup> <http://pcrafi.spc.int/> downloaded 31<sup>st</sup> October 2019.

<sup>100</sup> UNDP, 2019. GCF UNDP Project Funding Proposal – Safeguarding rural communities and their physical assets from climate induced disasters in Timor-Leste

<sup>101</sup> WMO, 2015. WMO Capacity Development Strategy and Implementation Plan. Annex 5 – Categorization of National Meteorological and Hydrological Services. Available at: [https://library.wmo.int/doc\\_num.php?explnum\\_id=7871](https://library.wmo.int/doc_num.php?explnum_id=7871)

<sup>102</sup> Timor-Leste, 2019. State Budget 2019

<sup>103</sup> Reported during in-country consultations, 22-24 November 2017.

(GBON) draft technical requirements.<sup>104</sup> The Dili airport weather station is operated with the assistance of the Australian Bureau of Meteorology (BoM), which collects, processes and analyses the data for forecasting and for airport operational purposes. ConocoPhillips, an American multinational energy corporation, is also supporting the DNMG through the provision of automatic weather stations, which provide forecasting information for commercial aviation.

- The hydrometeorological network consists predominantly of agrometeorological stations operated by the Agriculture and Land-use Geographic Information System (ALGIS) within the Ministry of Agriculture and Fisheries (MAF) and various development partners, and rain gauges operated by the National Directorate for Water Resources Management (DNGRA). Whilst DNGRA collects hydrological data, it is not analysed.<sup>105</sup> The features of the stations and their condition vary widely. The recent severe flooding in April 2021 has caused significant damage to infrastructure in Timor-Leste,<sup>106</sup> which is likely to have also impacted on the hydrometeorological observation network.
- Cyclone tracking and early warning information is available from the Australian Bureau of Meteorology (BoM) and other international bodies calculating the frequencies of cyclonic events.
- Local ocean data is not currently collected and what information exists is derived from low resolution satellite sources, unverified by sea surface observations. Given that there is no tide gauge data available for Timor-Leste, the Wyndham (Western Australia, since 1984) record is used as the closest available gauge. Long-term locally monitored sea-surface temperature data are also unavailable.<sup>107</sup>
- Maintaining adequate observation networks is very challenging, both financially and physically. Whilst DNMG is responsible for collecting all the information from the country's weather stations in a database,<sup>108</sup> it has no ownership over the stations operated by other entities. Although satellite data can provide broad scale weather information, if verification at ground level is impossible then timely and reliable local forecasts cannot be developed.

There is no end-to-end early warning system (EWS) in place in Timor-Leste and disaster risk management is fragmented. Lack of ocean data and sparse land-based data add to these difficulties. While informal coordination around early warning takes place and there is a Government EWS working group, coherent approaches and understanding about EWS are lacking in Timor-Leste amongst disaster risk reduction (DRR) actors working in Community Based Disaster Risk Reduction. In the absence of a functional end-to-end early warning system in Timor-Leste, organisations have included ad-hoc early warning related work at the community level, but these efforts have not been coordinated or integrated into a broader national system. Therefore, Timor-Leste's Strategic Development Plan 2011–2030 under the Section Civil Protection and Protection of State Assets states that "The important functions of civil protection, along with the protection of State assets, will be prioritised according to a management plan. This function will involve establishing, where possible, an early warning system for natural disasters, as well as coordinated response plans to protect our people".

A detailed assessment of the baseline, needs, completed and existing projects, and priorities is provided in the Feasibility Study (Annex 2).

### **Current status of disaster risk management**

<sup>104</sup> WMO, 2020. The gaps in the Global Basic Observing Network (GBON)

<sup>105</sup> DNMG, 2017. First Steering Committee Meeting SAOFFG System. Timor-Leste Country Report. Available at: <https://www.wmo.int/pages/prog/hwrp/flood/ffgs/saoffg/presentations/scm1/Countries/TimorLeste.pdf>

<sup>106</sup> UN RCO Timor-Leste, 2021. Timor-Leste: Floods. Situation Report No. 6 (As of 21 April 2021) <https://reliefweb.int/sites/reliefweb.int/files/resources/TL%20April%20Flood%20Response%20Situation%20Report%206%20%20%2821%20Apr%2021%29%20%28final%29.pdf>

<sup>107</sup> CSIRO. 2010. Climate change in Timor-Leste – a brief overview on future climate projections. Available at: <http://www.cdu.edu.au/itl/documents/East-Timor-review-for%20submission%20to%20DCCCE.pdf>

<sup>108</sup> UNDP, 2019. FP109: Safeguarding rural communities and their physical assets from climate induced disasters in Timor-Leste. Annex 2 – Feasibility Study

The National Disaster Management Directorate (NDMD) is responsible for providing disaster risk management coordination and technical support to the government and communities in Timor-Leste, including responsibility for preparedness and early warnings. The NDMD is composed of the National Disaster Operation Centre (NDOC), the Departments of Preparedness and Formation, Prevention and Mitigation, Response and Recovery, and disaster management committees at district, sub-district and village (*suco*) levels. It works in support of the National Disaster Coordinator (NDC) to: i) act as Timor-Leste's centre for disaster risk reduction activities and knowledge; ii) develop strategies in disaster risk reduction including preparedness, response plans and procedures; iii) establish and sustain links to risk assessment and monitoring in the region and interpret and provide warning and strategic planning; and iv) act as the contact point for initial reports of emergencies and disasters in conjunction with the NDOC. Within each village, the Suco Chief and village leaders are responsible for emergency and disaster risk reduction activities.<sup>109</sup>

### **Current financing for climate services and disaster risk management**

The National Directorate of Meteorology and Geophysics (DNMG), under the Ministry of Transport and Communication, is responsible for the provision of climate services in Timor-Leste. In 2019, the annual state budget for DNMG was USD 299,000 – of which USD 232,000 was allocated to goods and services; and USD 67,000 on salaries and wages.<sup>110</sup> In 2018, the total annual state budget for DNMG was USD 165,000. As with the national budget for climate services, the budget for disaster risk management varies from year to year. In 2018, the National Disaster Management Directorate (NDMD) was allocated USD 920,000.<sup>111</sup> In 2017, NDMD received USD 1.5 million from the annual state budget; the majority of which (USD 847,000) was allocated to goods and services. In addition, funding for disaster management is allocated directly to each of the 12 municipalities.<sup>112</sup> Timor-Leste also allocates funding for disaster relief and response to other sectoral ministries, namely environment, health, education and public works.<sup>113</sup>

External finance is critical to Timor-Leste for climate change programming and disaster risk management, on account of its highly limited financial capacity as a newly independent country, Least Developed Country and Small Island Developing State – as well as to compensate for its declining oil and gas revenues. National ownership over climate funding is limited as most financial flow is 'off-budget' via development partners and NGOs. A 2018 study by WaterAid highlighted that there is a "lack of clarity and transparency in climate finance disbursement. Ministries do not have standardised procedures for expenditure, and there is still some ambiguity around the roles of ministries and working groups in coordinating climate change responses across government." Despite this, the "process of GCF accreditation, including readiness support, is triggering important discussions about procedural changes that might facilitate climate-related fund disbursement through the national budget."<sup>114</sup>

### **Barriers to the delivery of effective climate information and early warnings**

Timor-Leste starts from a low institutional base and lacks the weather and climate observation infrastructure and human resources required to generate robust climate data and information and impact-based multi-hazard early warnings that cover the entire population. The effective delivery of weather, water and climate information and early warnings is essential to support evidence-based policy, planning and early actions, and enable sectors (including health, agriculture, disaster risk reduction, water, and environmental management) and communities to reduce their vulnerability to climate change and climate-related disasters. The main barriers to be overcome are as follows:

---

<sup>109</sup> Government of Timor-Leste, 2019. Disaster Management Reference Handbook 2019

<sup>110</sup> Government of Timor-Leste, 2020. Annual State Budget 2019

<sup>111</sup> Government of Timor-Leste, 2019. Annual State Budget 2018

<sup>112</sup> Government of Timor-Leste, 2018. Annual State Budget 2017

<sup>113</sup> National Disaster Management Directorate, 2010. National progress report on the implementation of the Hyogo Framework for Action (2009-2011) - Interim

<sup>114</sup> WaterAid, 2018. Accessing climate finance for sustainable water, sanitation and hygiene services in Timor-Leste

- i) Lack of legislative, regulatory and policy frameworks for climate services and disaster risk management;
- ii) Inadequate observation networks and sector-specific climate information (e.g., health, agriculture, disaster risk reduction, environmental management);
- iii) Limited communication and use of climate hazard and risk information, including related health risks;
- iv) Limited capacity and funding to prepare for and manage climate risks.

### **Problem statement**

The national economy and most people's livelihoods in Timor-Leste depend heavily on climate-sensitive sectors such as agriculture and fisheries. Changes in precipitation patterns are already having devastating effects on the availability of fresh water, agricultural yields and access to arable land. Fisheries are under threat from the loss of coral reef, mangrove and sea grass habitats as a result of destructive climate-related events and warming of the sea. Lives, livelihoods, assets and infrastructure are threatened by climate-related hazards, particularly drought, floods and landslides, but also coastal inundation. Air pollution, which is expected to worsen with climate change, poses a further threat to both human and environmental health.

Climate information and early warning services are essential to Timor-Leste's economic growth and sustainable development, but they cannot be consistently provided. Weather, climate, water and ocean information services are critical to the health, well-being and livelihoods of communities, but communication of the information is not reliably reaching the people who need it. These services are crucial to enhancing resilience and reducing the vulnerability of Timor-Leste's people to climate-related hazards and the effects of climate change. However, the Government needs support in integrating climate information into its planning and management processes.

The staff of the DNMG are constrained by a lack of human, financial and technical resources in their capacity to develop and deliver weather, water and climate services. Geographical coverage of the country with observation and monitoring equipment is inadequate; a value chain from data collection to delivery of services and response by users is lacking; communication and outreach systems, especially to remote inland communities, are patchy and unreliable, particularly during extreme weather events and emergencies; and comprehensive early warning systems do not yet exist. Timor-Leste's capacity to protect its population from climate-related hazards is correspondingly limited, as is its ability to plan for mitigation of the long-term impacts of climate change.

### **"Without the Project" Scenario**

Without the proposed Project, the DNMG will continue to provide basic weather forecasts with the help of external partners, but its information will be based on incomplete data for large areas of the country and for ocean areas, and it will not always reach its intended audiences in good time or in a useful form. The roles of agencies responsible for disaster preparation and warnings will remain often unclear and their response actions reactive with delayed financing. Data critical to adaptation planning, early action and public health management will not be collected, or not stored accessibly, and maladaptation may result. Communities' knowledge of traditional forecasting systems has been disrupted by decades of conflict and it is already less reliable, as climate change affects weather patterns. Communities, Government agencies and private sector entities will continue to find the DNMG's technically worded information difficult to understand and apply, and many communities will not reliably receive any usable information.

The DNMG's traditional development partners will continue their support, addressing some of the obstacles to effective adaptation, but underlying barriers will remain, undermining the sustainability of efforts. Severe hardship and loss of lives, assets and livelihoods will escalate as extreme events become more common and less predictable and response measures will be reactive and underfunded.

### **Proposed actions for reducing vulnerability**

The Project will enable a paradigm shift to evidence-based planning and early action through timely and actionable climate information, impact-based forecasting, people-centred multi-hazard early warning systems

(MHEWS) and Forecast-based Financing. This will result in a transformation to increased resilience to climate change threats, improved human health, enhanced livelihoods, and a reduction in the damage and losses incurred due to the increased frequency or intensity of climate-induced disasters, such as flooding and extreme drought. Avoided economic losses will result from better preparedness to extreme events due to the use of improved forecasts, early warning and early action. Social benefits will include improved public safety due to early warning (less fatalities and injuries), better healthcare services supported by enhanced coordination, collaboration and knowledge sharing between the climate and health communities, and improved access to food and freshwater from evidence-informed climate resilient agriculture.

The Project will address the aforementioned barriers by facilitating that accurate, timely and actionable climate information is used in policy, planning and response actions, and sectors and communities in Timor-Leste are enabled to adapt and reduce their vulnerability to increasing climate variability and change. This will be achieved through four inter-related Project Results:

- **Result 1** will provide an enabling environment for adaptation and reduced vulnerability by developing legislative, regulatory and policy frameworks for climate services and disaster risk management, including a financial framework and business model for long-term sustainability. By enhancing inter-sectoral collaboration and multistakeholder partnerships for climate action, the Project will reduce the risk of maladaptation resulting from failure to account for multiple interactions and feedbacks between different groups and sectors.
- **Result 2** addresses the need for observation networks that provide the critical data underpinning weather and climate forecasts, which in turn facilitate timely warning of climate risks and hazards that enable vulnerable communities to take early action. Simultaneously, this Result will build capacity to translate data into sector-specific climate information for use by climate-sensitive sectors (e.g., health, agriculture and disaster risk reduction) to inform appropriate preparedness and response actions that reduce vulnerability and increase resilience.
- **Result 3** addresses the need to enhance communication and dissemination of climate hazard and risk information, including related health risks, by establishing end-to-end people-centred MHEWS that are targeted to the differential vulnerabilities of specific population groups. The Project will employ a socially inclusive and gender-responsive approach by integrating local social characteristics and cultural values about risk and environmental dynamics.
- **Result 4** addresses the need to increase the capacity of Timor-Leste – from national to community level – to better prepare for and manage climate risks, which in turn will reduce the impact of climate-related hazards and support long-term resilience. An emphasis on awareness-raising and the integration and development of local skills and knowledge related to climate-related hazards and the environment will be a key element of the robust knowledge management approach. This Result also addresses the need for reliable and sustainable funding for climate and disaster risk management through Forecast-based Financing, which will facilitate climate-resilient early action based on prior analysis of vulnerability, exposure and risk.

The proposed interventions are designed to address the key barriers to delivering sustainable climate services and MHEWS that provide the information and knowledge exchange underpinning effective risk reduction and resilience, which in turn reduces climate vulnerability. The Project will create an enabling environment for long-term climate resilience through the integration of climate services and MHEWS into key policies, strategies, plans and budgets. This will provide a foundation for uptake of climate information in decision-making and planning in key sectors, such as health, agriculture, water and disaster risk reduction.

The integration of hydrology and hydraulics information is an important element of the impact-based forecasting and early warning systems to be developed in Timor-Leste. The approach taken to integrate hydrology and hydraulics throughout the Project takes into account the low baseline capacity in Timor-Leste and has been carefully designed to complement the existing GCF-funded UNDP-led project “Safeguarding communities and

their physical assets from climate-induced disasters in Timor-Leste” (FP109). Critical elements of hydrology and hydraulics are already covered in FP109, which includes flood risk mapping, flood modelling and forecasting for major river basins. The Project will build on these outputs and address the critical gap of integrating the observational data from monitoring stations (including hydrometric and hydrological) maintained by various agencies including, but not limited to, the National Directorate for Meteorology and Geophysics (DNMG), the National Directorate for Water Resources Management (DNGRA), the Agriculture and Land-use Geographic Information System (ALGIS) and the Ministry of Agriculture and Fisheries (MAF). The proposed Climate Data Informatics System (CDIS) for DNMG will host all hydrological data along with weather and climate data in a single platform.

Moreover, a sustainable delivery model for climate services will be established based on a value chain approach. This will include identification of opportunities to develop value-added climate products and services and facilitate private sector engagement. Sustainability will be further ensured through targeted activities for capacity building, knowledge management and learning. In this regard, the Project will specifically focus on maintaining climate resilience at the last mile through an emphasis on community engagement, local capacity building and targeted multi-channel communications to reach the most vulnerable populations.

## B.2. Theory of change (max. 1000 words, approximately 2 pages plus diagram)

The Project interventions aim to shift away from the current paradigm, characterised by lack of national capacity to systematically monitor and issue warnings for hydrometeorological hazards, and to implement proactive and effective climate risk management and responses. In the **new paradigm**, the Timor-Leste Meteorological Service (National Directorate for Meteorology and Geophysics - DNMG) will provide accurate, timely and actionable climate information and impact-based multi-hazard early warnings for use in policy, planning and early actions, and enable sectors (including health, agriculture, disaster risk reduction, water and environmental management) and communities in Timor-Leste to minimise the impact of climate change and extreme climate-related disasters. In order to effect this transformation, the following key barriers will have to be overcome:

- i) Lack of legislative, regulatory and policy frameworks for climate services and disaster risk management, as also highlighted in the 2030 Agenda for Sustainable Development and its Sustainable Development Goal (SDG) 13, target 13.b, which aims to “*Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States*”.
- ii) Inadequate observation networks and sector-specific climate information (e.g., for health, agriculture, disaster risk reduction, environmental management), as also recognised under the Paris Agreement Article 7, 7c, which stresses the need for “*Strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making*”.
- iii) Limited communication and use of climate hazard and risk information, including related health risks, as also recognised by the Sendai Framework on Disaster Risk Reduction, which highlights in I, 14 that “*there is a need to address existing challenges and prepare for future ones by focusing on monitoring, assessing and understanding disaster risk and sharing such information...and enhancing multi-hazard early warning systems...*”, in III, 19g that “*Disaster risk reduction requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data...*”, and in SDG 3, target 3.d, which aims to “*Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.*”
- iv) Limited capacity and funding to prepare for and manage climate risks, as also recognised in the Paris Agreement Article 11, 1, which emphasises the need to “*enhance the capacity and ability of developing country Parties*” and facilitate “*access to climate finance, relevant aspects of education,*

*training and public awareness, and the transparent, timely and accurate communication of information”.*

To address these barriers, the proposed Project will establish integrated climate information services covering oceans and impact-based MHEWS for sectors (including health, agriculture, disaster risk reduction, water and environmental management) and communities in Timor-Leste. This will be achieved through four inter-related

**Project Results:**

- 1) **Strengthened delivery model and legislation for integrated climate information and multi-hazard early warning services.** The Project will develop a National Framework for Climate Services (NFCS) based on the GFCS to coordinate, facilitate and strengthen collaboration among national institutions for enhanced use of climate information and provision of climate services, and to facilitate a sustainable long-term business model of the national meteorological and hydrological service (DNMG). Moreover, it will instigate a best practice approach to data governance and advance the integration of climate, health, agriculture, hydrology/hydraulics and other data for improved forecasting and early warning.
- 2) **Strengthened observations, monitoring, analysis and forecasting of climate and its impacts,** mainly by the national meteorological and hydrological service (DNMG). Amongst others, the Project will establish a national Forecasting Centre and upgrade the meteorological observation network in Timor-Leste to ensure compliance with the WMO Global Basic Observing Network (GBON). Impact-based forecasting will be established in conjunction with decision-support systems (DSS) for key climate-sensitive sectors to facilitate science-based decision making and de-risking of investments. Climate services for health will be established as a critical priority to address increasing climate-related health risks – including enhanced multidisciplinary coordination and collaboration through a national Climate and Health Working Group, establishment of a hybrid ambient air quality monitoring system and impact advisory, and tailored forecasting and DSS for the health sector. In addition, the Project will advance Timor-Leste in establishing Internet of Things (IoT) for innovative climate applications.
- 3) **Improved dissemination and communication of risk information and early warning.** The Project will deliver end-to-end early warning systems based on the priorities for Multi-Hazard Early Warning Systems (MHEWS) and Disaster Risk Reduction, as set out in the Paris Agreement, Sendai Framework and SDGs – further elaborated in section B.5. Amongst others, the Project will ensure the effective and coordinated delivery of early warning systems through strengthened organisational and decision-making processes of DNMG, NDMD, civil society organisations, communities and other key actors. This will contribute to the outcomes of the 2019 UN Climate Action Summit, in particular targets 3 and 4 of the Risk-informed Early Action Partnership (REAP) on investment in “*early warning infrastructure and institutions to target early action in ‘last/first mile’ communities*” and “*more people are covered by new or improved early warning systems...*”.
- 4) **Enhanced climate risk management capacity.** The Project will build capacities at all levels (from the national government services to the communities at the last mile) to prepare for and respond to climate risks and hazards, and related health impacts. This will include scaling up community-based disaster preparedness, delivering targeted and gender-responsive public awareness and education campaigns, and the establishment of a Roadmap for Forecast-based Financing (FbF).

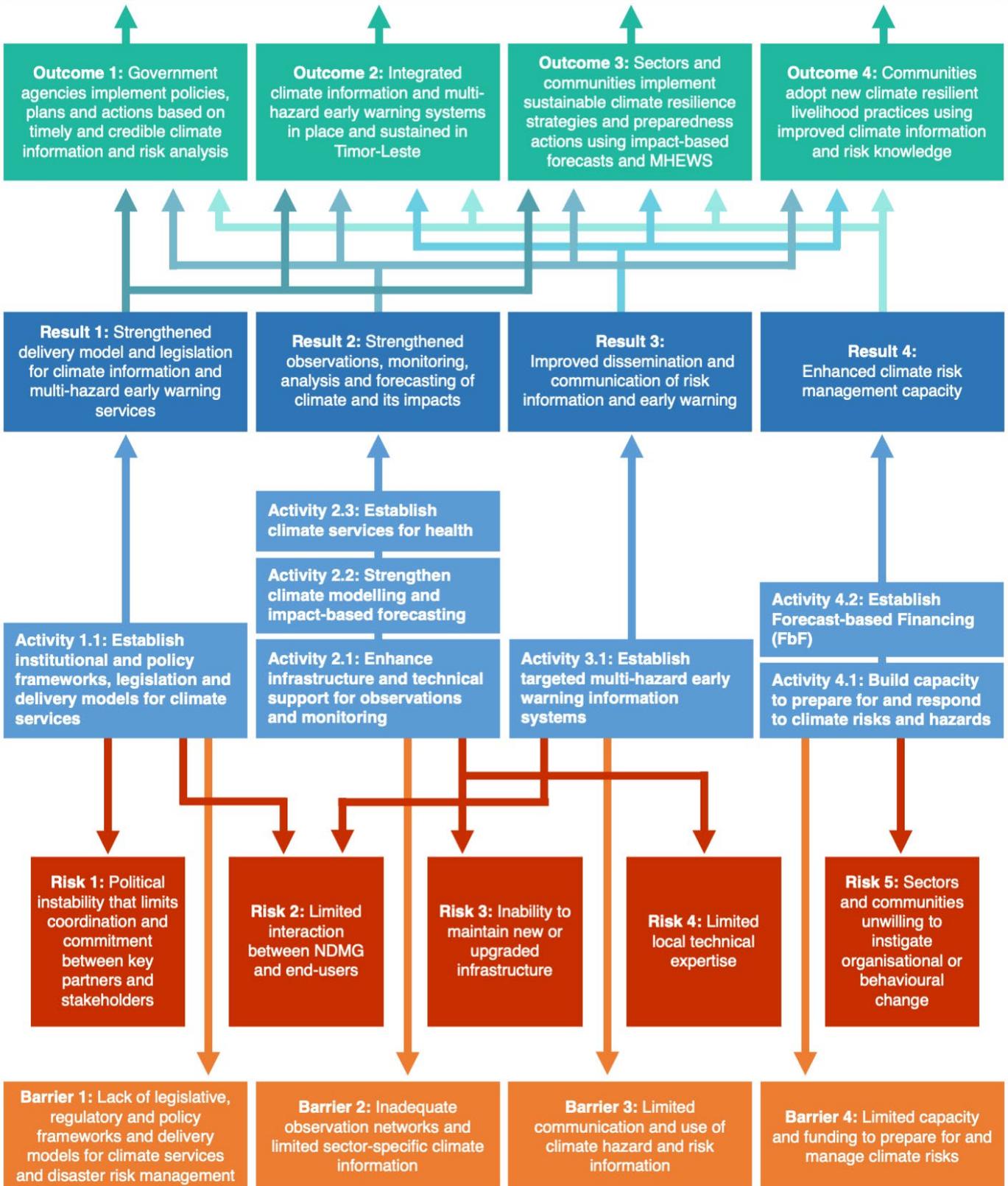
The transformative **Goal** of the Project will be **enhanced livelihoods and increased resilience to climate change and climate-related hazards of sectors – including health, agriculture, disaster risk reduction, water and environmental management – and communities in Timor-Leste.** This will be achieved through:

- i) Reduced expected losses of lives and economic assets due to the impact of extreme climate-related disasters;
- ii) An increase in the number of males and females benefiting from the adoption of diversified, climate resilient livelihood options; and

iii) Number of food-secure households in areas / periods at risk of climate change impacts.

The Theory of Change diagram below shows how the implementation of Project Activities leads to the achievement of the project-level Results, which in turn will contribute to achieving the longer-term Outcomes and ultimately the intended Goal. The Project Results are further unpacked in section B.3.

**GOAL: IF timely, accurate and actionable climate and ocean information is available THEN sectors and communities in Timor-Leste will be able to enhance their livelihoods and increase their resilience to climate change and climate-related hazards BECAUSE policies, planning, preparedness and response actions can be informed by scientific evidence and impact-based multi-hazard early warning**



**Assumptions:**

- Government of Timor-Leste is committed to the development of climate services and early warning systems
- Government is committed to mainstreaming climate information into policy and planning
- Stakeholders and partners are willing to adopt new governance, institutional and regulatory mechanisms to ensure the incorporation of climate and oceans information into decision making and policy planning
- Sectors are willing to utilise climate and early warning information to make their businesses more efficient and resilient to climate change impacts
- Government, private sector and local councils participate, cooperate and coordinate effectively
- NMHSs engage with end-users and ensure that their inputs are reflected
- Communities, households and individuals are willing to change behaviours and adopt climate-resilient livelihoods practices by using climate information and early warning systems
- Communities, households and individuals are able to access and understand new information on climate risks and undertake appropriate response actions

**Drivers:**

- Capacity of NDMG to deliver high-quality and reliable data for increased resilience against climate change
- Awareness of the value of using climate information to be better prepared for and resilient against the impacts of climate change
- Capacity of communities to change behaviours and adopt new livelihood practices based on improved climate information and multi-hazard early warning systems
- Collaborative partners at the national and regional levels

Figure 2. Project Theory of Change

The Project will contribute to the attainment of selected targets and indicators of the Paris Agreement, Sustainable Development Goal (SDG) 13 on Climate Action, SDG 3 on Good Health and Well-Being and the Sendai Framework on Disaster Risk Reduction, as detailed in the below table:

Table 2. Contribution of Project Outcomes to the Paris Agreement, Sendai Framework and Sustainable Development Goals (SDGs)

Outcome	Contribution to Paris Agreement	Contribution to the Sendai Framework	Contribution to SDGs
<b>1. Government agencies implement policies, plans and actions based on timely and credible climate information and risk analysis</b>	Article 7, 7a: “Sharing information, good practices, experiences and lessons learned, including, as appropriate, as these relate to science, planning, policies and implementation in relation to adaptation actions”.	Priority 1 (Understanding Disaster Risk), 24 (n): “To apply risk information in all its dimensions of vulnerability, capacity and exposure of persons, communities, countries and assets, as well as hazard characteristics, to develop and implement disaster risk reduction policies”.	SDG 13, Target 13.2: “Integrate climate change measures into national policies, strategies and planning”.  SDG 3, Target 3.D: “Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.”
<b>2. Integrated climate information and multi-hazard early warning systems in place and sustained in Timor-Leste</b>	Article 7, 7c: “Strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs	Priority 1 (Understanding Disaster Risk), 24 (a): “To promote the collection, analysis, management and use of relevant data and practical information and ensure its dissemination, taking into account the needs of	SDG 13, Target 13.3: “Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact

	<p><i>climate services and supports decision-making”</i></p>	<p><i>different categories of users, as appropriate”.</i></p> <p>Priority 1 (Understanding Disaster Risk), 24 (m):  <i>“To promote national strategies to strengthen public education and awareness in disaster risk reduction, including disaster risk information and knowledge, through campaigns, social media and community mobilisation, taking into account specific audiences and their needs.”</i></p> <p>Priority 4 (Enhancing disaster preparedness for effective response), 33 (b):  <i>“To invest in, develop, maintain and strengthen people-centred multi-hazard, multisectoral forecasting and early warning systems, disaster risk and emergency communications mechanisms, social technologies and hazard-monitoring telecommunications systems; develop such systems through a participatory process; tailor them to the needs of users, including social and cultural requirements, in particular gender...”.</i></p>	<p><i>reduction and early warning”.</i></p> <p>SDG 3, Target 3.D:  <i>“Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.”</i></p>
<p><b>3. Sectors (including health, agriculture, disaster risk reduction, water and environmental management) and communities implement sustainable climate resilience strategies and preparedness actions using impact-based forecasts and multi-</b></p>	<p>Article 7, 7d:  <i>“...identifying effective adaptation practices, adaptation needs, priorities, support provided and received for adaptation actions and efforts, and challenges and gaps, in a manner consistent with encouraging good practices.”.</i></p> <p>Article 8, 4:</p>	<p>Priority 1 (Understanding Disaster Risk), 24 (i):  <i>“To ensure...the development and implementation of policies, strategies, plans and programmes of specific sectors, with a cross-sectoral approach, which should be tailored to localities and to the context.”</i></p>	<p>SDG 3, Target 3.D:  <i>“Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.”</i></p>

<p><b>hazard early warning systems</b></p>	<p><i>“Accordingly, areas of cooperation and facilitation to enhance understanding, action and support may include: (a) Early warning systems; (b) Emergency preparedness; ... (h) Resilience of communities, livelihoods and ecosystems.”</i></p>	<p>Priority 4 (Enhancing disaster preparedness for effective response), 33 (a): <i>“To prepare or review and periodically update disaster preparedness and contingency policies, plans and programmes with the involvement of relevant institutions, considering climate change scenarios and their impact on disaster risk, and facilitating, as appropriate, the participation of all sectors and relevant stakeholders.”</i></p>		
<p><b>4. Communities adopt new climate resilient livelihood practices using improved climate information and risk knowledge</b></p>	<p>Article 7, 5: <i>“Parties acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate”.</i></p> <p>Article 8, 4: <i>“Accordingly, areas of cooperation and facilitation to enhance understanding, action and support may include: (a) Early warning systems; (b) Emergency preparedness; ... (h) Resilience of communities, livelihoods and ecosystems.”</i></p>	<p>Priority 1 (Understanding Disaster Risk), 24 (i): <i>“To ensure the use of traditional, indigenous and local knowledge and practices, as appropriate, to complement scientific knowledge in disaster risk assessment...”</i></p> <p>Priority 1 (Understanding Disaster Risk), 24 (o): <i>“To enhance collaboration among people at the local level to disseminate disaster risk information through the involvement of community-based organizations and nongovernmental organizations”.</i></p>	<p>SDG 13, Target 13.1: <i>“Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries”.</i></p> <p>SDG 3, Target 3.D: <i>“Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.”</i></p>	

The proposed Project will develop integrated climate information services covering oceans and impact-based MHEWS in Timor-Leste, in alignment with the five components of the Global Framework for Climate Services (GFCS):<sup>115</sup> i) Observations and Monitoring (through *Activity 2.1*); ii) Climate Services Information System (through *Activities 2.1 and 2.2*); iii) Research, Modelling and Prediction (through *Activity 2.2*); iv) User Interface Platform (through *Activity 1.1*); and v) Capacity Development (building national capacity to deliver climate services will be a focus throughout all Activities).

The Project will utilise a value-chain approach to climate services delivery, with an end-to-end early warning system that incorporates the four main elements of efficient, people-centred MHEWS: i) Disaster risk knowledge based on the systematic collection of data and disaster risk assessments; ii) Detection, monitoring, analysis and forecasting of hazards and possible consequences; iii) Dissemination and communication of timely, accurate and actionable impact-based warnings; and iv) Preparedness for disaster risk response at all levels.<sup>116</sup>

The Project will enhance the resilience of Timor-Leste's population to climate change impacts and climate-related hazards through the following interventions.

### **Result 1: Strengthened delivery model and legislation for climate information and multi-hazard early warning services**

This Result will enable Timor-Leste to establish a National Framework for Climate Services (NFCS), which will structure the science–policy interface so that sector agencies have ready access to sound scientific data and useable information. It will support Timor-Leste's Meteorological Service (DNMG) to create coordination mechanisms with key climate-sensitive sectors – including health, agriculture, water, disaster risk reduction, water and environmental management – to facilitate the integration of climate information and disaster risk knowledge into their decision making. Responsibility for the provision of climate and weather services and roles in disaster warning will be negotiated, clarified and formalised through the development of a National Meteorology Act and National Meteorological Strategy. A systematic User Interface Platform will be established for continuing, regular stakeholder engagement by the sector agencies through meetings and workshops with DNMG. This interaction will enhance coherence and complementarity, and inform the development of tailored, accessible products and services that serve the practical needs of end users and ensure that essential climate information reaches the last mile.

Long-term sustainability of climate services and disaster risk management will be achieved through the active maintenance and strengthening of institutional and stakeholder partnerships, identification of opportunities for future private sector engagement and investment as part of the development of a financial framework and business model for climate services. These interventions will ensure that the value of climate services is reflected in the allocation of public funding for weather, water and climate data collection, analysis and adaptation planning and options for other sources of revenue are explored based on the value-chain approach captured in the figure below.<sup>117</sup>

---

<sup>115</sup> WMO. About the Global Framework for Climate Services (GFCS). Available from: <https://gfcs.wmo.int/about-gfcs>

<sup>116</sup> WMO, 2018. Multi-hazard Early Warning System: A Checklist

<sup>117</sup> World Bank, 2013. Weather and Climate Resilience. Effective Preparedness through National Meteorological and Hydrological Services

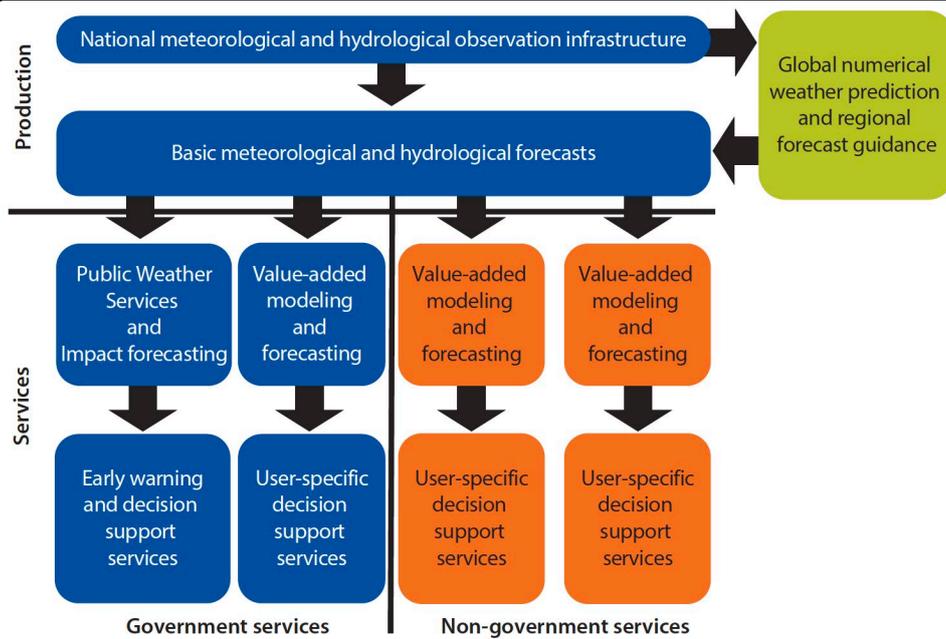


Figure 3. Weather and climate services value chain. Note: Users are governments, households and businesses. (Source: World Bank, 2013)

Furthermore, this Result will instigate a best practice approach to data governance, initially for climate data, by strengthening DNMG’s climate data management system. The Project will advance the integration of climate, health, agriculture, hydrology/hydraulics and other data for improved forecast and early warning by strengthening data sharing and coordination among DNMG and other relevant stakeholders. It will support Timor-Leste’s Statistics Directorate in using climate data and information with data from other sectors in order to mainstream climate considerations into the work of those sectors. The Water Sector – a priority area of the Global Framework for Climate Services – will be strongly engaged, recognising the critical importance of continuous weather, water and climate data for the assessment of fluctuations and trends and the risks arising from exposure and vulnerability to natural hazards as well as for effective Integrated Water Resource Management.

**Activity 1.1: Establish institutional and policy frameworks, legislation and delivery models for climate services**

Sub-Activity 1.1.1 – Establish a National Framework for Climate Services

The Project will develop a National Framework for Climate Services (NFCS) to coordinate, facilitate and strengthen collaboration among national institutions for enhanced use of climate information and provision of climate services in Timor-Leste. The NFCS will be developed through the following steps:<sup>118</sup> i) Organise national consultation workshops on climate services to bring together the key stakeholders who link climate knowledge to adaptation on the ground to identify key elements and priorities for NFCS development; ii) Develop a national strategic plan and a costed action plan and timelines to implement the NFCS and improve climate services delivery; iii) Convene a meeting with national stakeholders to endorse national strategic plan and the action plan; iv) Launch the agreed NFCS and initiate its implementation; and v) Implementation will include scheduled monitoring and evaluation: decisions will be revisited each year during the National Climate Outlook Forum and modified according to feedback and learnings. This process will be repeated in the second, third and fourth years with the private sector, NGOs and community representatives respectively and in an evaluation workshop with all stakeholders in the fifth year.

Once established, the NFCSs will serve the following functions:

<sup>118</sup> WMO, 2018. Step-by-step Guidelines for Establishing a National Framework for Climate Services

- A platform for institutional coordination, collaboration and co-production amongst relevant technical departments across line ministries at national and sub-national levels, DNMG, and technical experts to develop and deliver user-oriented climate services. This will offer sector agencies the opportunity to articulate what information they require, and how they would like it to be provided to them.
- A framework for collaboration at the national level to generate and share user-oriented climate services for use by the relevant social and economic sectors. This will help stakeholders to identify and agree on specific functions, relationships and services to ensure that their operations take into account climate variability and climate change impacts.
- An opportunity to bridge the gap between available climate services and user needs at national, sub-national and local levels, which will continuously identify user needs for climate services, communicate available climate products and services to users in the relevant sectors, and obtain feedback from users on climate products and services.
- A vehicle for scientific coordination to monitor the state of the climate at the national level and disseminate climate knowledge outputs for policymaker actions founded on scientific evidence through the Climate Services Information System. A series of professionally facilitated workshops will assist public sector agencies (including ministerial departments for the five Global Framework for Climate Services priority sectors – agriculture, health, disaster risk reduction, water and energy) to identify and articulate how they need to use climate information in the future. These decisions will be revisited each year during the National Climate Outlook / Monsoon Forum (NCOF: held each year in March and October, see Sub-Activity 1.1.3) and modified in the light of experience.
- A functional chain for linking climate knowledge with action on the ground so as to maximise the application of climate information and products, including the identification and removal of bottlenecks for improved delivery of climate services.
- An opportunity for enhancing the contribution of climate science to the development of national adaptation plans, disaster risk reduction, Sustainable Development Goals and national development policies by enhancing the integration of climate information and products into decision-making as well as into national policies.

In order to clarify and formalise the mandate of DNMG and its relationship with other national institutions and sectors. This sub-activity will also support Timor-Leste to develop a draft Meteorology Act for approval by the Council of Ministers and a National Meteorological Strategy to guide its implementation. The Act will mandate the responsibilities of the DNMG to provide weather and climate services (including flood forecasting) and formalise the DNMG's role in monitoring and analysing changes, advising on adaptation, contributing to warnings, and briefing delegates to international climate forums. It will also formalise its relationship with other agencies – including the National Directorate of Water Resources Management (DNGRA), which has the mandate for hydrology and hydraulics. Hence it will formalise DNMG's role in inter-agency partnerships, as well as provide budget security. The draft National Meteorological Strategy will document the process by which DNMG will put its Meteorology Act into operation.

#### Sub-Activity 1.1.2 – Establish a User Interface Platform

A User Interface Platform (UIP) will be established as a forum for interaction between DNMG – as the climate services provider – and its stakeholders and end users of climate information services. The UIP is a key pillar of the National Framework for Climate Services (NFCS),<sup>119</sup> to be developed under Sub-Activity 1.1.1, and will focus on achievement of outcomes in four priority areas: Feedback, Dialogue, Outreach and Monitoring and Evaluation.

---

<sup>119</sup> WMO, 2012. Guidelines on Frameworks for Climate Services at the National Level

The National Climate Outlook / Monsoon Forum (NCOF) will be a critical component of the UIP and will be held twice each year, in October before the wet season and in March before the dry season. The NCOF will facilitate delivery of the intended outcomes of the UIP, as outlined below:

- **Feedback** – The NCOFs will provide a facilitated forum for DNMG to obtain feedback on how effectively its products and services are meeting the needs of user communities. The Forums will enable DNMG to respond to forecast information requests from users. Elicitation of decision makers’ information requirements will support the development of tailored climate products for each sector.
- **Dialogue** – The NCOFs will build dialogue between climate service users – including government agencies, NGOs, private sector representatives, civil society organisations, women’s groups and community representatives – and technical institutions responsible for the observation, reach and information system pillars of the NFCS – in particular, DNMG. The Forums will provide a venue for DNMG to present its forecast products and services, including a long-range forecast of expected rainfall, ocean conditions and tropical cyclone incidence. The NCOFs will include sessions on preparedness planning, which will help to enhance users’ capacity to interpret and integrate forecast information of various timescales into their own plans and decisions.
- **Outreach** – The NCOFs will support improved climate literacy in the user community and literacy of the climate community in user needs. They will provide platform for knowledge sharing between climate services providers and sectors, so that stakeholders can better understand the content and uncertainties in climate forecasting and the meaning and use of probability rankings about likely climate risks.
- **Evaluation** – The NCOFs will provide a mechanism to monitor and evaluate the development, delivery and effectiveness of climate services in Timor-Leste<sup>120</sup> to ensure that products and services meet the needs of stakeholders. This will facilitate that the NFCS promotes evidence-based decision-making and planning for climate resilience across priority sectors and in vulnerable communities. The NFCS strategic plan and action plan (Sub-Activity 1.1.1) will include the Monitoring and Evaluation (M&E) process and reporting (the “M&E mechanism”) to be undertaken, which will provide feedback on the performance progress of the NFCS. As per WMO guidance,<sup>121</sup> the NCOFs will implement the M&E mechanism outlined in the NFCS using a results-based approach that is roughly based on the Logical Framework Approach. The Logical Framework Approach develops a common understanding of the expectations of a Framework (in this case, the NFCS) by delineating a hierarchy of Activities (**how**), Outputs (**what**), Purpose (**why**) and Goals (**greater why**) that collectively will lead to accomplishment of the greater Goal of the Framework.

The Water Sector – a priority area of the Global Framework for Climate Services – will be strongly engaged through the NFCS and NCOFs, recognising the critical importance of ongoing climate data for the assessment of fluctuations and trends and the risks arising from exposure and vulnerability to natural hazards (floods and droughts) as well as for effective Integrated Water Resource Management.<sup>122</sup> Increased dialogue and joint action facilitated by the NCOFs will help to maximise the usefulness of climate services and foster development in new and improved applications of climate information for the water sector. Moreover, dialogue facilitated through the NCOFs will simultaneously support improved water literacy among the weather and climate service community, enabling DNMG to better understand the decision-making context of water managers.

The NCOF will also be an opportunity to establish partnerships for implementing the Early Action Protocols (EAPs) developed in Activity 4.2. The sector workshops held in each year of the Project will also form part of the UIP, as will outreach work on making climate information more accessible to communities.

---

<sup>120</sup> The approach to Monitoring and Evaluation (M&E) for this proposed GCF project can be found in Annex 11.

<sup>121</sup> WMO, 2014. Annex to the Implementation Plan of the Global Framework for Climate Services – User Interface Platform Component

<sup>122</sup> WMO, 2014. Water Exemplar to the User Interface Platform of the Global Framework for Climate Services

### Sub-Activity 1.1.3 – Enhance climate data management and governance

This sub-activity will support the Government of Timor-Leste and DNMG in managing and using climate data and information in conjunction with data from other sectors in order to mainstream climate considerations into the work of those sectors. This is particularly important for the highly climate-sensitive sectors of health, agriculture, water and fisheries. Although some ministries have made significant progress on data collection, in most sectors, decisions are being made based on sub-optimal evidence. In addition, there is an immediate need for stronger integration of environmental science and analysis – supported by up-to-date, quality-assured, and relevant data – at both the national and international levels. The Government of Timor-Leste wants to be able to combine data from various sector sources with climate data when it reports to the international community on its implementation of multilateral environmental agreements such as the Paris Agreement and the UNFCCC in general. As such, the following will be conducted:

- *Data governance:* Through a series of consultative workshops with key stakeholders, a Climate Data Strategy and Action Plan for DNMG and the Statistics Directorate will be drafted to support improved climate-related data management, governance and enhanced inter-sectoral data coordination, particularly relating to health, agriculture, disaster risk reduction, water and environmental management. Strengthened data sharing and coordination among DNMG and other key stakeholders, including DNGRA, will maximise the value of existing datasets (such as water-level monitoring observations) and advance the integration of multi-sectoral data for improved forecasting and early warning. The Strategy and Action Plan will be submitted for approval at the government level.
- *Upgrade and Training in Climate Database Management Systems:* RIMES will install a Climate Data Informatics System (CDIS), which will provide an integrated platform for climate and scientific data analytics and visualisation, with linkages to sectoral decision-making tools. As part of the installation of CDIS, RIMES will support DNMG to ensure that the current and historical meteorological data is ingested seamlessly into CDIS. The CDIS will also host all hydrological data (along with weather and climate data) to provide a single integrated platform for easier access, quality control, and generation of derived products. As an intergovernmental entity, RIMES will not charge Timor-Leste any licensing and/or update/upgrade fees for CDIS. RIMES will also provide free ongoing technical support both during and after the Project lifespan. Installation of CDIS will enable the establishment and operationalisation of the national Forecasting Centre (Sub-Activity 2.2.1).

### Sub-Activity 1.1.4 – Mainstream climate risk knowledge into health, agriculture, disaster risk reduction and other sectors

The Project will support a systematic five-year process of integrating climate considerations into the decision making and planning of government, private and community sectors by supporting them to understand and appropriately utilize climate information services supplied by DNMG. A National Climate Sector Action and Communication Plan (CSACP) will be co-developed with key stakeholders in each of the five GFCS priority sectors – health, agriculture and food security, disaster risk reduction, water and energy. The recommendations from the CSACP and sector-specific data and information products will be used to conduct sector specific training by DNMG for the five GFCS priority sector agencies on climate basics and the logistics of integrating climate information and climate change knowledge into the functions of their agencies.

### Sub-Activity 1.1.5 – Establish a financial framework and business model for sustainable climate services

Once foundational capacity building for climate services is initiated, the Project will start to demonstrate the value, reliability and utility of climate information products and services. This is expected to generate interest from climate-sensitive sectors in utilising the strengthened climate services to address their needs for climate information (which are generally recognised and outlined in Section 6 of the Feasibility Study – Annex 2).

In order to prepare the ground for private sector engagement and mobilisation opportunities in the longer term (beyond the Project's duration), this sub-activity will further scope viable opportunities for sectors and business

segments to utilise the strengthened climate services and identify opportunities to develop value-added climate products and services (e.g. targeting a particular sector such as agriculture or health, or related to a particular climate-related hazard); and potential for public-private partnerships and private investment in climate services. This will feed into the establishment of a financially sustainable business model for climate services in Timor-Leste.

Based on the NFCS established under Sub-Activity 1.1.1, the Project will develop a financial framework to ensure that DNMG has the means to sustain and ensure the ongoing operation of its mandated services in order to mitigate weather-, climate-, and water-related risks beyond the term of the Project, as capacity to generate marketable climate products is developed. The financial framework will cover the following elements:

- Opportunities for greater cooperation between the public and private sectors and academia, thereby delivering win-win situations that fulfil public sector responsibility to provide weather and climate services as a public good, whilst also meeting the need of economic sectors that increasingly depend on meteorological information for safe and efficient operations. Accordingly, the Project will enhance awareness at the government and sectoral level of the economic value of climate information – for example, in reducing the costs of recovery due to tropical cyclone damage to critical infrastructure; and reducing the need for transport of drinking water and food aid to remote communities as a result of severe flooding or drought.
- Coordination and/or integration of financing for climate services and disaster risk management to establish adequate and reliable funding for disaster risk reduction and preparedness activities, which are mostly dependent on ad-hoc donor funding. This would facilitate a more efficient and streamlined approach to implementing often overlapping actions for climate change adaptation and disaster risk management. This will incorporate the financial mechanism for Forecast-based Financing (FbF) / Early Warning Early Action (EWEA) to be developed under Activity 4.2.
- Identification of the elements of a sustainable business model for DNMG based on the climate services value chain, which highlights the different roles of NMHSs in providing basic forecasts and warnings to protect society from the adverse effects of severe weather (a public good typically supported by governments, for which predictable national budget allocations need to be ensured) but also in providing specialised value-added services to sectoral government agencies and individual businesses (which may offer opportunities for cost-recovery from governmental and non-governmental sources beyond the term of the Project). The business model will identify opportunities for DNMG to provide specialised value-added services to government agencies and individual businesses. As services are established and valued, the Project will also assist DNMG to identify potential options for cost-recovery, recognising the need to be able to first demonstrate the value, reliability and utility of climate information products.
- Potential to establish a National Climate Fund (NCF) as a mechanism to support Timor-Leste to manage its engagement with climate finance by facilitating the collection, blending, coordination of, and accounting for climate finance directed towards climate services. Functions of the NCF could include: i) Support goal setting and the development of programmatic strategies for climate resilience; ii) Fund capitalisation; iii) Management of strategic partnerships; iv) Climate services project support mechanisms; v) Support policy insurance; vi) Provision of financial control; vii) Performance management, including monitoring and reporting on activities and resource disbursement; and viii) Knowledge and information management.<sup>123</sup>
- Potential for continued support from the Systematic Observations Financing Facility (SOFF) as part of the Alliance for Hydromet Development, which was launched in December 2019 by 12 international organisations including UNEP. The SOFF is envisaged to ensure provision of basic systematic observations as a global public good by providing equitable, predictable, sustainable and performance-based finance as well as technical assistance to developing countries for the provision of foundational

<sup>123</sup> UNDP, 2015. Blending Climate Finance Through National Climate Funds

observations data as per the Global Basic Observing Network (GBON) standard adopted by the WMO Congress. GBON aims to improve the global availability of the most essential surface-based data by defining obligations for countries to implement a minimal set of surface-based observations, for which international exchange of observational data will be mandatory. Further details are provided under Activity 2.1.

## **Result 2: Strengthened observations, monitoring, analysis and forecasting of climate and its impacts**

This Result will strengthen the technical capacity and modernise Timor-Leste's national meteorological service (DNMG), enabling it to collect higher quality data at higher resolution and from a wider geographical range, including its oceans, and to use the extra data. This will be achieved through the installation of new and upgraded infrastructure and equipment to extend the coverage of weather, climate and ocean observations; through training and support for observations, monitoring, modelling and prediction; and through training in maintenance.

The Project will upgrade and expand the surface-based observations and monitoring network in Timor-Leste to enable compliance with the WMO Global Basic Observing Network (GBON), which represents a new approach for the international exchange of the most essential surface-based observational data and will facilitate access to 24/7 global observations as a global public good.<sup>124</sup> Installation and capacity building for weather radar observations will further enhance extreme weather monitoring and early warning systems, and support validation of Numerical Weather Prediction (NWP) forecasts. The establishment of a national Forecasting Centre will provide the three critical elements of telecommunications, data management and forecasting – supported by technical training and capacity building to ensure that DNMG has the ability to translate weather, water, climate and ocean observations into impact-based forecasts and value-added products and services. The Project will also build national capacity to implement innovative and cost saving technologies and practices, such as the deployment of Internet of Things (IoT) technology for climate services applications.

One of the key activities in the Project will be to establish climate services for health. Climate change is increasingly affecting public health and well-being<sup>125</sup> – for example, deaths from extreme weather events, wildfires and emerging infectious diseases. Air quality, weather and climate, and health are closely linked, with climate variability and change expected to magnify exposure to particulate matter, ozone and other pollutants.<sup>126</sup> As such, there is an increasing demand for relevant, timely and usable information about weather and climate variability, change, risks and impacts to enable decision-makers – from public health officials to individual citizens – to take appropriate action to keep people safe and healthy. The Project will address this critical need through several interventions, including institutional strengthening through a national Climate and Health Working Group, establishment of a hybrid ambient air quality monitoring system, air pollution forecasting and health impact advisory, and the delivery of tailored forecasting and decision-support systems for the health sector.

### **Activity 2.1: Enhance infrastructure and technical support for observations and monitoring**

#### **Sub-Activity 2.1.1 – Expand and upgrade the meteorological observation network to GBON standards**

The Project will enhance, modernise and automate Timor-Leste's hydrometeorological observation and monitoring network in alignment with the draft WMO Global Basic Observing Network (GBON) technical requirements, using emerging cost-effective technologies and piloting innovative technologies where possible. The sub-activity will fill gaps in Timor-Leste's hydrometeorological observation network, as identified in the Feasibility Study (Annex 2), by increasing the number of Automatic Weather Stations (AWS) and Automated

<sup>124</sup> SOFF, 2020. The value of Surface-Based Meteorological Observation Data: Costs and benefits of the Global Basic Observing Network

<sup>125</sup> WHO, 2020. WHO Global Strategy on Health, Environment and Climate Change

<sup>126</sup> WMO, 2014. Air Quality and Human Health, a Priority for Joint Action. Available at: <https://public.wmo.int/en/resources/bulletin/air-quality-and-human-health-priority-joint-action>

Weather Observing Systems (AWOS) and by building in-country capacity to ensure sustainable operations and maintenance.

The following interventions will contribute to Timor-Leste's achievement of WMO Category 2 (Essential) status for climate services:

- **Enhance the network of surface-based observation stations** measuring atmospheric pressure, temperature, humidity, horizontal wind and precipitation, at a horizontal resolution of 200 km or better with at least hourly reporting of data **in compliance with Global Basic Observing Network (GBON)** technical requirements, which will be finalised at the WMO Congress in 2021.<sup>127</sup> The Project will install new climate monitoring stations: nine automatic weather stations (AWS) – including, amongst others, automatic rain gauges – and one automated weather observing system (AWOS), which will feed data into GBON for use in global Numerical Weather Prediction (NWP). Based on the Systematic Observations Financing Facility (SOFF) GBON gap analysis,<sup>128</sup> which used a basic method of dividing the country area by 40,000 km<sup>2</sup> (200 x 200 km) to obtain the number of surface-based observing stations required, Timor-Leste (area: ~15,000 km<sup>2</sup>) requires one automatic weather station (AWS) to comply with GBON. Given that the maximum length of the country is 470 km, this could translate to the requirement for two AWSs. Therefore, the proposed equipment installations surpass the GBON requirements for resolution. All new/upgraded stations will report data on an hourly basis, thus ensuring compliance with GBON requirements for frequency.
- **Increase observation station density** based on national requirements and guided by the observation Network Development Plan developed by WMO in compliance with GBON. This will include the installation of a marine buoy, which will enable marine forecasts to be produced.
- **Introduce weather radar for severe weather and climate monitoring** through installation of a network of three dual-polarization X-band Doppler radar systems, supported by technical training and remote support to build in-country capacity for radar operations, maintenance and data applications for weather and climate monitoring and analyses. Establishment of a network of low-cost, high temporal resolution, short-range, small radars is an innovative and practical solution for Timor-Leste; the country's highly mountainous topography challenges the effectiveness of more advanced long-range radar systems due to issues with shielding, inhomogeneous beam filling and signal attenuation.<sup>129</sup> Amongst others, precipitation measurements by radar provide areal rainfall determination, and thus complement point rain gauge data with finer spatial resolution of the precipitation field – the outputs of which are advantageous for grid-based models. Radar data also provide real-time data availability and the ability to track approaching storms before they reach the boundary catchment of interest.<sup>130</sup> The blending of radar data with NWP in short lead time rain and flood forecast models has resulted in considerable scientific advances, enabling prediction of rain cell development and decay as well as trajectory.<sup>131</sup>
- **Improve observations through compliance with WMO Integrated Global Observing System (WIGOS)** regulatory and guidance material. This will include formulation of a long-term operations and maintenance schedule, procurement of spare parts and calibration equipment, and iterative training on calibration and maintenance with development partners.
- **Build capacity to use Information and Communication Technology (ICT)** for the collection and exchange of hydrometeorological observations, required for analysis, monitoring and forecasting and the

<sup>127</sup> GBON draft technical requirements will be submitted to the World Meteorological Congress in 2021 for its approval. SOFF, 2020. The gaps in the Global Basic Observing Network (GBON)

<sup>128</sup> SOFF, 2020. Outcomes of the joint kick-off meeting 15 May 2020. Summary outcomes of Working Group 2: GBON gap analysis and implementation outcomes

<sup>129</sup> Gabella, M. *et al.*, 2012. A Network of Portal, Low-Cost X-Band Radars. In book: Doppler Radar Observations – Weather Radar, Wind profiler, Ionospheric Radar, and Other Advanced Applications

<sup>130</sup> WMO, 2011. Manual on Flood Forecasting and Warning

<sup>131</sup> WMO, 2013. Integrated Flood Management Tools Series. Flood Forecasting and Early Warning

delivery of comprehensive and effective weather, climate and ocean information services and products. The Project will provide ICT technical support and knowledge transfer for DNMG staff to build in-house capacity to maintain operational and cost-effective systems sustainably beyond the five years.

- **Enhance data and data management – including data archival processes and systems** to ensure security, integrity, retention policy and technology migration – to be delivered under Activity 1.1. This will facilitate that historical and real-time atmospheric, surface-based and oceanic observations of the Essential Climate Variables (ECVs) prepared by the Global Climate Observing System (GCOS) and partners for climate monitoring purposes are exchanged freely for use in Regional Climate Centres (RCCs) for at least one Global Surface Network site.
- **Generate generic monitoring products** for surface-based atmospheric and marine observations, weather radar data, air quality and fire risk monitoring.
- **Compute sector-specific climate indices** and other sector-oriented climate products – to be delivered under Activity 2.2.
- **Create value-added products** – to be delivered under Activity 2.2.
- **Establish a Quality Management System (QMS)** – to be delivered under Sub-Activity 2.1.2.
- **Enhance forecasting systems** – to be delivered under Activity 2.2.

The new and upgraded observation equipment will measure precipitation, temperature, atmospheric pressure, wind speed and direction to WMO standards for contribution to GBON. Terrestrial and ocean data will be ingested directly into the Global Telecommunications System (GTS). The improved range, volume and quality of the data will enable Timor-Leste to make a valuable contribution to the Global Climate Observing System (GCOS), which supports the sustained provision and availability of climate observations throughout the world and regularly reports on the adequacy of the current climate observing system to the UNFCCC.<sup>132</sup>

#### Sub-Activity 2.1.2 – Implement a robust program of training and capacity building including QMS

Throughout its five-year term, the Project will manage a robust program of staff recruitment and training, capacity building and modernisation of the organisational structure of the DNMG to adapt to new processes and functions and additional human resources. DNMG staff will undertake Basic Information Package – Meteorological Training (BIP-MT) for two months in Year 1, with refresher training in Year 5. A week-long training program for 30 staff in Quality Management Systems (QMS) will be conducted in Years 1 and 5; and testing to achieve WMO certification for the trained staff.

The DNMG is committed to providing a sound Operations and Maintenance (O&M) program for its expanded hydrometeorological networks during and after the Project (see Annex 21). DNMG has assumed responsibility for securing O&M after the Project implementation period for up to 20 years. The draft plan provided as Annex 21 will be refined during the Programme's inception and implementation. Furthermore, DNMG has formally committed to sustaining some of the critical functions to be introduced by the Project (meteorology, oceanography and Operations & Maintenance) after its implementation period. As a Technical Partner in this Project, the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) has also formally committed to continue supporting DNMG after the end of the proposed Project. This will include back-up support, technical enhancements, and system upgrades to the Climate Data Informatics System (CDIS), as well as decision support systems for ocean services, agriculture, disaster management and health sectors. Development partners (WMO members with advanced NMHSs and regional organisations) have expertise and experience in the deployment and management of equipment in tropical environments and will contribute to DNMG's acquisition of skills in maintenance and calibration. This will occur through two weeks of technical training at a Technical Partner's site,

<sup>132</sup> WMO, IOC-UNESCO, UNEP and ISC. About GCOS. Available from: <https://gcos.wmo.int/en/about>

including training on automatic weather stations (AWSs), manual station assembly and calibration, and provision of training materials such as operational competency workbooks. Robust and user-friendly new communications equipment will make it possible to contact remote communities reliably, even in extreme conditions, and will also be covered by the maintenance schedules.

Other training will cover more advanced meteorology and climatology. The DNMG also proposes to engage an ocean science officer in response to demand for ocean climate services: this officer will lead sector workshops introducing information users to the potential for ocean data to inform their work. The officer will engage with coastal communities to explain the contribution that ocean data can make to understanding extreme events and improving warning times. S/he will monitor threats to Timor-Leste's reefs—warming and bleaching—so that harm can be minimised.

The Project will support the ocean science officer and the DNMG to conduct ocean data stakeholder engagement workshops twice each year of the Project, focusing on communicating the impact of hazards. This regular interaction between the ocean science officer, the DNMG, the Project team, national agencies and coastal communities will improve the understanding of stakeholders and the likelihood that they will act upon warnings. The ocean science officer will establish feedback mechanisms to make sure his/her delivery of information is effective and is modified if needed.

#### Sub-Activity 2.1.3 – Initiate Internet of Things (IoT) approaches

The Project will support the DNMG in advancing towards an Internet of Things (IoT) approach to collecting data and disseminating information. The Project will contribute equipment and training to support the development of innovative and cost-saving technologies for observations, modelling and prediction, with special focus on the application of ICT. An annual workshop will be conducted for 30 delegates, led by a technical specialist from the International Centre for Theoretical Physics (ICTP<sup>133</sup>), on the use of wireless connectivity and IoT for climate services and disaster risk management.

Working closely with local partners, the Project will implement a pilot study consisting of 20 low-cost weather stations based on IoT technology. The aim of the pilot will be to develop and demonstrate the potential of diverse, low-cost sensors to provide weather data. This will be achieved through the integration of three technologies into a common data processing platform:

- LoRaWAN<sup>134</sup>-enabled weather stations will be deployed to send data to a solar-powered, GSM<sup>135</sup>-compatible gateway.
- Infrastructure will be set up to enable remote data collection and will be available for future extensions (water level monitoring, air quality, landslide detection, drought monitoring, etc.).
- A local server will collect data from TTN<sup>136</sup> and will enable user-friendly visualisation of weather data.

### **Activity 2.2: Strengthen climate modelling and impact-based forecasting**

#### Sub-Activity 2.2.1 – Establish a National Forecasting Centre

The Project will establish a Forecasting Centre with hardware, software, installation/set-up and training of DNMG staff in data management, IT and the forecasting sub-systems. This is crucial to strengthening DNMG's capacity to deliver multi-hazard early warning products and services. The Centre will provide the three critical elements of telecommunications, data management and forecasting – including numerous databases and models/analytic engines for short, medium and long-range modelling and forecasting, flood monitoring and forecasting, and

<sup>133</sup> <https://www.ictp.it/>

<sup>134</sup> The LoRaWAN specification is a Low Power, Wide Area (LPWA) networking protocol designed to wirelessly connect battery operated 'things' to the internet in regional, national or global networks.

<sup>135</sup> Global System for Mobile communication

<sup>136</sup> The Things Network (TTN) is a global community building an open-source and decentralised LoRaWAN network

climate prediction, amongst others. This sub-activity will provide technical support and in-country capacity building for transmitting, storing, managing, processing and visualising data from different data streams, including numerical weather prediction (NWP), satellite, radar, lightning and observation networks. The system will be built on open-source code, highly flexible and scalable so that any forecasting sub-system can be integrated with it. Technical experts will provide technical guidance to DNMG on the design, models, analytics and visualisation aspects of the various forecasting modules of the system, which will facilitate forecasting and verification of multi-hazard (i.e., meteorological, hydrological and climatological) forecasts for different timeframes. This sub-activity will also integrate ocean forecasting models into the Forecasting Centre and provide training to DNMG staff on ocean modelling and marine forecasting. The Project will support DNMG to customise the Ocean State Forecasting and Advisory System (OSFAS)<sup>137</sup> Decision Support System (DSS), a web-based system for generation of advisories based on location-specific ocean state forecast information. The system disseminates 3-day forecasts of wave and swell height, direction, and period, sea surface current and temperature, and wind speed, with accompanying advisories; displays real- or near real-time observation data – including satellite altimetry, sea surface and rainfall data; and receives user feedback for validating forecast information. It can also provide marine fishery advisories and coral reef mapping and health monitoring information. In addition, OSFAS has capability to track wave rider buoy location and has an alert messaging service in case of buoy drift. This will enable DNMG to provide forecasts to the marine sector to improve safety, efficiency and sustainability.<sup>138</sup>

#### Sub-Activity 2.2.2 – Enhance climate change risk modelling and prediction

The Government of Timor-Leste has recommended that academic institutions such as the National University of Timor-Leste (UNTL) Climate Change Centre have better access to and apply UNFCCC climate change scenarios to establish or improve drought and flooding predictions in support of the DNMG. Specifically, the Centre for Climate Change and Biodiversity (CCCB) in the Faculty of Agriculture of UNTL is already providing some climate change related training to relevant ministries, such as crop modelling by using DSSAT – the decision support system for agrotechnology.

This sub-activity will provide the CCCB access to climate change models such as CMIP5 (Coupled Model Intercomparison Project Phase 5) and provide related training on risk models and output interpretation. The Project will also utilise a training of trainers (ToT) approach to provide intensive technical training on climate modelling to CCCB staff in Year 1 so that they can enhance the accuracy of their trainings to relevant ministries and stakeholders.

#### Sub-Activity 2.2.3 – Establish impact-based forecasting and decision-support systems for agriculture, disaster risk reduction and marine sectors

The Project will support Timor-Leste to establish a multi-hazard impact-based forecasting approach that translates information on weather and climate-related hazards into sector- and location-specific impacts. It will provide technical support and capacity building for DNMG to generate sub-seasonal forecasts (2-week, 3-week and 4-week), monthly and seasonal (3-month) forecasts and to include other parameters besides rainfall in its forecasting system. Concurrently, it will support DNMG and key stakeholders to translate hydrometeorological, climate and sector information into sector-relevant impact-based forecasts. In turn, this will feed into sector-specific decision-support systems (DSS) for agriculture, disaster risk reduction (DRR) and marine sectors to enhance preparedness planning, early warning and information dissemination.

---

<sup>137</sup> OSFAS is a web-based system for generation of advisories based on location-specific ocean state forecast information. The system disseminates 3-day forecasts of wave and swell height, direction, and period, sea surface current and temperature, and wind speed, with accompanying advisories; displays real-/ near real-time observation data; and receives user feedback for validating forecast information. It can also provide marine fishery advisories and coral reef mapping and health monitoring information. In addition, OSFAS has capability to track wave rider buoy location and has an alert messaging service in case of buoy drift.

<sup>138</sup> For instance, warnings that the sea surface temperature is high, stressing coral reefs and fish species, allows local managers to limit human interference so that ecosystems recover faster.

Within the scope of the Project, the aim will be to establish in-country capacity to integrate hazard forecasts produced by DNMG with vulnerability curves to generate potential impacts of forecasted hazards. Simultaneously, the Project will develop overarching DSS tools containing the data, models, analytics and visualisation components that allow operational users and end users to access impact-based early warning information and advisories. In developing the sector-specific DSSs, technical partners will work intensively with DNMG and relevant sectoral agencies to i) populate the tools with the required hydrometeorological and sectoral data; ii) identify hazard thresholds and vulnerability curves (where available); and iii) develop impact assessments (based on historical disasters, agriculture impacts, etc.) as well as decision trees/sectoral advisories for different forecast/hazard scenarios. The DSSs will be developed through a participatory process to support risk-informed decision making of operational managers and users in climate-sensitive sectors. A key priority will be the integration of data from multiple sources, standardisation of data collection processes, and inter-agency cooperation in generating and sharing the derived products. Therefore, it will add value to existing projects such as GCF-funded FP109 (which has a strong focus on hydrology and hydraulics) by its integrating vulnerability assessments and flood risk maps (descriptive and predictive analytics) for use in generating the analytics required for the impact-based forecasting.

The overall aim of the DSS will be to complement and improve efficiency in the dissemination of forecasts, early warning and response advisories. It will provide a means for decision makers and disaster managers to correlate between scientific parameters and potential impacts by visualising information in a user-friendly, understandable and actionable format. The DSS aims to enhance risk knowledge through improved access to such knowledge. Whilst enhanced risk knowledge can contribute to strengthened adaptive capacity in the longer term, it should be noted that the implementation of concrete adaptation and disaster risk reduction actions is not within the scope of the Project.

The sector-specific decision support systems to be developed under this sub-activity are detailed below:

- *Agriculture stress index system (ASIS)*: This global system assesses the severity (intensity, duration and spatial extent) of agricultural drought and expresses the results at administrative level, providing the possibility for comparison with the agricultural statistics of the country. This sub-activity will calibrate ASIS for Timor-Leste using crop masks delineated by landcover classification/ mapping. The Project will support the streaming of high-resolution decadal satellite imagery (20 m resolution Sentinel 2 imagery) into ASIS and the training of ALGIS staff on the operation of the ASIS tool. It will train MAF staff on the analysis protocol in conjunction with agromet data and the development of monitoring indicators, thresholds and triggers for early actions. The intervention will include both global and regional climate information and forecasts for additional real time monitoring data. Trained agricultural experts will undertake crop monitoring field visits in municipalities—covering main agriculture production areas—to validate ASIS early warning products. A systematic drought analysis will be conducted in the maize and rice production areas, using ASIS data and 30-year time-series crop drought analysis. Combined with the monitoring system, analysis of drought vulnerabilities and risks to agricultural dependent livelihoods, drawing on the existing village level hazard, vulnerability and livelihood assessments will enable MAF to produce impact-based forecasts and action-oriented early warnings for dissemination to municipalities and villages.
- *Early Warning for Agriculture*: the information will feed into the Specialized Expert System for Agrometeorological Early Warning (SESAME) Decision Support System (DSS). SESAME DSS will address some of the constraints faced by farmers by giving them access to location- and crop-specific agromet advisories, information on quality inputs and potential retailers. SESAME will be customised with high-resolution baseline information (cropland cover, soil map, etc.), hazard information (drought), and crop-specific information (sunlight and temperature requirements, pest and fertiliser information, input sources, etc.), as well as socio-economic vulnerability of agricultural livelihoods. The high-resolution baseline information will be integrated into the DSS to i) strengthen risk monitoring with agreed indicators and data sources; ii) support the development and dissemination of agrometeorological advisories to

farming communities; and iii) enhance thresholds for early warning and triggering of anticipatory early actions – to be established under Activity 4.2.

- *Early Warning for Disaster Risk Management:* This intervention will work with DNMG and the National Disaster Management Directorate (NDMD) to customise the System for Multi-Hazard Potential Impact Assessment and Emergency Response Tracking (SMART) DSS<sup>139</sup> – a dynamic, multi-hazard, impact-based forecast and advisory platform that integrates all four elements of people-centred, multi-hazard early warning systems. SMART uses baseline information on disasters, hazards, exposure, vulnerabilities and resources, and will overlay forecasts from DNMG in order to generate real-time forecasts, impact assessments and response advisories for affected communities. The DSS will integrate inputs of weather, water and climate hazards from DNMG, MAF/ALGIS and RIMES/UNDP’s flood forecast model outputs.<sup>140</sup> Data on historical disasters will be secured from NDMD’s disaster loss database. The SMART system will empower Timor-Leste with a unique operational DSS for policymakers, disaster managers and communities to manage disaster risks holistically, by transforming generic weather forecast data into actionable, impact-based early warning information and advisories, which can be disseminated to communities through various channels – including SMS, mobile app and social media.
- *Mobile applications for disaster management, agriculture, water/marine sectors:* This intervention will develop mobile applications for Multi-Hazard Potential Impact Assessment and Emergency Response Tracking (SMART), Specialized Expert System for Agrometeorological Early Warning (SESAME) and Ocean State Forecasting and Advisory System (OSFAS) decision-support systems in English and Timorese (Tetum) versions. These web-based systems can disseminate advisories through SMS, social media and other channels. The development of their app versions will increase redundancies in information dissemination, and generally improve the availability, access and application of weather/forecast information in the disaster management, agriculture, and water/marine sectors. The mobile app will enable users to visualise the impact assessment, unlike SMS where information is generally in text format and has input length limitations. A mobile app is also useful for key people such as emergency responders, extension workers, and port authorities.

### Activity 2.3: Establish climate services for health

#### Sub-Activity 2.3.1 – Establish a national Climate and Health Working Group

This sub-activity aims to enhance coordination and collaboration between the climate and health communities in Timor-Leste. It will convene and provide technical advisory to experts in meteorology and climatology (from DNMG), public health and epidemiology through the establishment of a national Climate and Health Working Group. With support from the chief technical advisor, the main focus areas for the Working Group will be to determine the key climate-related health risks for Timor-Leste; identify climate and weather information and service needs of the health sector, including gaps in current data, information and service delivery; and enhance the capacity of DNMG to meet the specific needs of the health sector. Multi-stakeholder trainings will be organised to improve knowledge and understanding of climate data and information, linkages between health and climate (including a specific focus on the disproportionate climate-related health impacts on women and girls), and methods to access, analyse and interpret both epidemiological and climate data. Representatives from health-relevant partners, disaster risk management actors, and agencies delivering health services at the community

<sup>139</sup> SMART is a web-based system for assessing potential impacts of a hazard using weather forecast information, and for evaluating, generating, and disseminating impact management options. SMART also acts as a data management system for managing and processing weather, disaster risk, and emergency response resources data for resource allocation, rapid deployment, and management. The system generates and disseminates weather forecasts, forecast-based risk maps, and accompanying advisories. It can visualise emergency response resource locations and quantities and can also display updates from the ground that are entered by registered users, thus allowing disaster managers to track and manage ongoing emergency response.

<sup>140</sup> RIMES’s Flood Cautioning and Alert System (FloCAST) is a basin-based flood forecasting and warning system. It is a web-based system built on open-source code for i) generation of basin discharge and river level forecasts based on 3- and 10-day weather forecasts; ii) analysis and mapping of flood risks; and iii) generation and issuance of appropriate advisories. The system ingests real-time observation data for water level monitoring. It has modules for correction of biases in rainfall and discharge forecasts.

level will also be invited to participate. The Working Group will also support development of the National Climate Sector Action and Communication Plan for Health (Sub-Activity 1.1.4).

#### Sub-Activity 2.3.2 – Establish an air quality monitoring framework

This sub-activity will build in-country capacity to better understand, manage and reduce the impacts of poor air quality on human and environmental health in Timor-Leste through monitoring, forecasting, early warning and impact advisory. Air quality is strongly dependent on weather and is therefore sensitive to climate change.<sup>141</sup> Climate change can affect air pollution both physically and chemically in a manner that reduces air quality. In particular, increasing temperatures and extreme heat can increase the concentration of fine particulate matter (PM<sub>2.5</sub>) and ground-level ozone (O<sub>3</sub>).<sup>142</sup> PM<sub>2.5</sub> is a significant contributor to ill health (including cardio- and cerebrovascular disease, adult chronic and child acute respiratory illnesses, and lung cancer<sup>143</sup>) and is identified as the highest priority pollutant for air quality monitoring.<sup>144</sup> Nitrogen dioxide (NO<sub>2</sub>) is a precursor for PM<sub>2.5</sub> and O<sub>3</sub>, of which exposure to high concentrations is associated with increased mortality due to respiratory and cardiovascular diseases.<sup>145</sup>

The Project will establish a hybrid ambient air quality monitoring system consisting of low-cost sensors for fine particulate matter (PM<sub>2.5</sub> / PM<sub>10</sub>), NO<sub>2</sub> diffusion tubes and reference grade particle counters overlaid with MAIAC/Aerosol Optical Depth (AOD) PM<sub>2.5</sub> satellite data. High-resolution remote sensing data can be derived from NASA<sup>146</sup> and Copernicus global products.<sup>147</sup> The combined use of surface-based and satellite observations will facilitate the collection of high-resolution spatiotemporal air pollution data. This will provide a robust baseline of gaseous and particulate pollutants for the capital Dili that can be incrementally scaled across the nation. Establishment of the monitoring system will be facilitated by development of an air quality monitoring framework – including co-location and monitoring protocols with local authorities. To enhance understanding, internalisation and application of the new information and datasets, the Project will deliver in-country technical training and capacity building, including on data management, quality assurance and reporting.

The data outputs will feed into a customised mobile application that can disseminate hyperlocal air pollution forecasts, warning alerts and health impact advisories and advocacy. Local stakeholder engagement workshops will be conducted to enhance awareness of air pollution, its sources (including anthropogenic contributors such as vehicle emissions and burning of household waste), related health risks and appropriate actions to reduce impacts on health and well-being – including impacts on biodiversity and ecosystems health.

#### Sub-Activity 2.3.3 – Co-develop tailored forecasting and decision support for health

This sub-activity will support the co-development of tailored information products that will provide decision-makers with timely and relevant information to proactively manage weather and climate-related health risks. The Project will work with DNMG and the Ministry of Health to integrate weather, climate, epidemiological and other relevant data (e.g., disease prevalence/incidence, models, indices, and analytics) to generate health risk forecasts that anticipate when and where changes in key parameters – such as humidity, temperature, particulate matter (PM) readings – may increase the likelihood for health impacts to occur. The forecasts will be visualised through a web-based decision-support system (DSS), which will be co-developed in collaboration with the national Climate and Health Working Group (Sub-Activity 2.3.1) to ensure that the DSS is responsive and tailored to the most

---

<sup>141</sup> Jacob, D.J. and Winner, D.A., 2009. Atmospheric Environment. Effect of climate change on air quality

<sup>142</sup> Exhaustion.eu., 2020. The feedbacks between climate change and air pollution. Available at: <https://www.exhaustion.eu/resources/the-link-and-feedbacks-between-climate-change-and-air-pollution>

<sup>143</sup> IPCC, 2014. Climate Change 2014: Impacts, Adaptation and Vulnerability. Chapter 11 – Human health: impacts, adaptation, and co-benefits

<sup>144</sup> WMO, 2014. Air Quality and Human Health, a Priority for Joint Action. Available at: <https://public.wmo.int/en/resources/bulletin/air-quality-and-human-health-priority-joint-action>

<sup>145</sup> Zhang, J., *et al.*, 2019. Frontiers in Immunology. Ozone Pollution: A Major Health Hazard Worldwide

<sup>146</sup> Keller, C.A. *et al.*, 2021. Journal of Advances in Modeling Earth Systems. Description of the NASA GEOS Composition Forecast Modeling System GEOS-CF v1.0

<sup>147</sup> <https://apps.ecmwf.int/datasets/data/cams-nrealtime/levtype=sfc/>

pertinent needs of Timor-Leste. Workshops will be conducted to build capacity of the Ministry of Health and related authorities to identify the required data to assist with analysis, modelling and decision-making.

The DSS will address the critical need for increased access, understanding and use of weather and climate information for risk-informed decision making in the health sector.<sup>148</sup> This could include the following tailored information products and services:

- i) Heat/cold spells and indices indicating potential impacts to health;
- ii) UV radiation for UV exposure forecasts;
- iii) Atmospheric chemical observations to generate haze and air pollution information advisory;
- iv) Potential disease outbreaks/hotspots, especially during the rainy season where incidence of dengue, malaria and water-borne diseases (e.g. diarrhoea) could increase; and
- v) Monitoring for other critical communicable diseases in Timor-Leste, such as tuberculosis (TB).

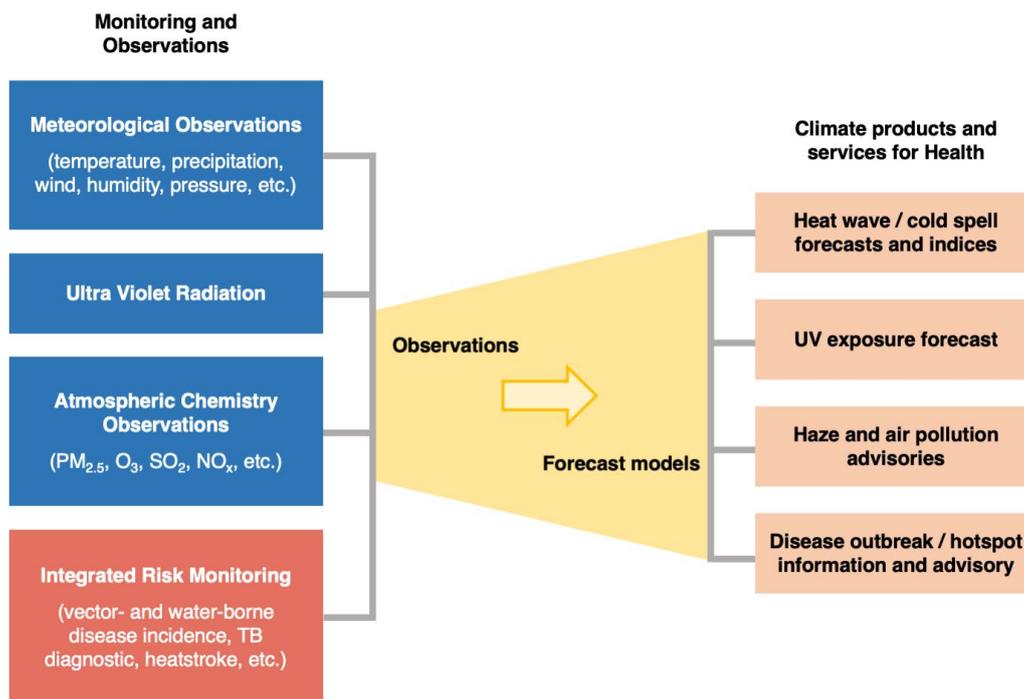


Figure 4. Example framework for the translation of monitoring and observations information into climate products and services for health. (Source: Adapted from Liisa Jalkare, WMO)

#### Sub-Activity 2.3.4 – Develop a mobile app for health-related forecasts and advisories

This sub-activity will develop a mobile application to enhance access to health-related forecasts and advisories for the general public. The app will expand the reach of the tailored forecasts and information products in the health DSS (Sub-Activity 2.3.3) by delivering actionable information services and health advisories that are relevant to individual-level decision making. Where data exist, the forecasts will be combined with thresholds to develop targeted early warnings that can alert the population to rapid-onset emergencies such as extreme weather or disease outbreaks, thus increasing the lead time to prepare and respond to the potential disaster event. The content of the forecasts and advisories will be guided by the localised communication strategies (Sub-

<sup>148</sup> WMO, 2014. Health Exemplar to the User Interface Platform of the Global Framework for Climate Services

Activity 3.1.2) so that the information can better reach vulnerable populations and provide an evidence base for proactive risk-informed decision making and planning.

### **Result 3: Improved dissemination and communication of risk information and early warning**

This Result focuses on the targeted dissemination and communication of climate risk information and early warnings as a key element of a people-centred impact-based Multi-hazard Early Warning System (MHEWS). The Project will build capacity for the delivery of clear messages containing straightforward, practical and actionable information, which are critical to enable appropriate preparedness and response actions that can safeguard lives and livelihoods.<sup>149</sup> Trust is an essential part of effective risk communication, facilitating those at risk to respond proactively to information received. Engagement with “last-mile” communities to integrate Traditional Knowledge into NMHS products and services will be a key intervention in this regard. Furthermore, the Project will convene a regular working group with government agencies involved in disaster management, national and international NGOs and CBOs, and community representatives to maximise the coordination of their work, generate consistency in messages, improve technical capability and extend awareness of risks and effective mitigation measures at all levels of society.

#### **Activity 3.1: Establish targeted multi-hazard early warning information systems**

##### Sub-Activity 3.1.1 – Convene a technical working group for EWS

This sub-activity will ensure the effective and coordinated delivery of early warning systems, and by extension the impact-based forecasting that feeds into the EWS, through strengthened organisational and decision-making processes of DNMG, NDMD, civil society organisations and other key actors. The Project will convene a regular working group to leverage the large network of organisations with the capacity to further disseminate messaging, reach community-level actors, and build a robust network of community (*suco*) level early warning communication systems to support the national system.

In conjunction with the establishment of the National Framework for Climate Services (Sub-Activity 1.1.1), the technical working group will define the functions, roles and responsibilities of key EWS actors and include them in standard operating procedures (SOPs), such as the Early Action Protocols to be developed in Activity 4.2. The UNDP and JICA project teams managing complementary GCF-funded projects in Timor-Leste will be invited to participate in the technical working group. This will facilitate regular communication between EWS actors to improve coordination and avoid duplication of efforts. Participation of the UNDP project team in the EWS Working Group will therefore provide an opportunity to realise complementarity of FP109 outputs in impact-based forecasting / EWS.

The Project will engage a full-time Gender Expert who will be responsible for ensuring that gender needs are integrated into EWS and disaster risk management activities; tracking gender-specific indicators; and assessing progress towards achieving gender equality. Traditional knowledge holders (such as indigenous elders) will also be engaged to ensure that the EWS builds on and incorporates local and traditional methods of forecasting and responding to climate extremes and natural hazards. International research has made clear that the integration of traditional knowledge into NMHS products and services greatly increases community acceptance of their materials and concurrently improves communication and understanding.<sup>150</sup>

Warning communication strategies will be developed to ensure coordination between DNMG – as warning issuers – and downstream dissemination channels, such as community volunteer networks and women’s groups. The strategies will include development of community feedback mechanisms to verify that warnings have been received and to alert DNMG to potential gaps in communication networks. The feedback mechanisms will relay

---

<sup>149</sup> WMO, 2018. Multi-hazard Early Warning Systems: A Checklist

<sup>150</sup> Bremer, S. *et al.* Climate Services, 2019. Towards a multi-faceted conception of co-production of climate services

experience directly from the communities in which partner agencies are working and their local Disaster Management Committees regarding the outreach and effectiveness of the system.

In addition, this sub-activity will work with Cruz Vermelha de Timor-Leste (CVTL – Timor-Leste Red Cross Society) to build national capacity for EWS through in-country training on planning, monitoring, evaluation and reporting and EWS. It will also support attachment training at Palang Merah Indonesia (PMI – Indonesian Red Cross Society) for peer learning on EWS and sharing of best practices and lessons learned.

#### Sub-Activity 3.1.2 – Co-develop socially inclusive and gender-responsive localised communication strategies

The Project will engage in multi-stakeholder dialogue to analyse the effectiveness of existing warning communication and dissemination systems and identify the ways in which gender and other intersectional vulnerabilities impact on the accessibility, reach and understanding of early warnings. This will be facilitated through a series of consultations with community leaders (e.g., the Suco Chief, traditional/indigenous leaders and *sucos* council representatives) and community members – with a proactive focus on meaningful engagement with marginalised and/or vulnerable groups, such as women, youth, elderly people and people with disabilities, and including with indigenous peoples.

Based on the initial consultations, the Project will coordinate with the EWS working group (Sub-Activity 3.1.1) and community stakeholders to co-develop localised socially inclusive and gender-responsive communication strategies based on understanding of last-mile connectivity (which population groups can be reached by different communication channels) and tailored to the differential vulnerabilities and needs of specific population groups. This will include the integration of local and traditional/indigenous knowledge systems as a critical means to enhance the understanding and reach of scientific knowledge-based communications. An important focus of the strategies will be on ensuring the effective communication of climate-related risks to health and well-being of the population in Timor-Leste. The Climate and Health Working Group (Sub-Activity 2.3.1) will be engaged in this regard to provide inputs and ensure coherence and complementarity with local public health messaging. The Project will employ an inclusive and intersectional approach – acknowledging the interaction of gender with other socially excluding factors – to build trust between stakeholders and ensure that warning communication and dissemination systems work effectively for all members of the community.

#### Sub-Activity 3.1.3 – Enhance community-based early warning systems

This sub-activity will work with the Timor-Leste Red Cross Society (CVTL) to establish community-based early warning systems (EWS). With trained volunteers at the municipal level and well-established community volunteer teams within *sucos*, CVTL is well positioned to extend the reach of the national EWS to the community level and ensure that early warning messages are understood and translated into action. To this end, CVTL will train municipal and community-based volunteers to understand, monitor and communicate available forecasts, which will facilitate that in the event of an impending disaster early warning messages reach the last mile.

In addition, the Project will install flood/sea level markers, megaphone systems, information signboards, and solar panels to detect landslides – a key hazard for which EWS are needed. Localised EWS frameworks will be developed, taking into account the different risks and needs of subpopulations in the target communities, including differential vulnerabilities (women and men, elderly people and youth, people living with a disability, etc.). Regular field monitoring will be conducted to evaluate and maintain the EWS and ensure that it remains operational and effective. These interventions will be further complemented by capacity building to enhance disaster preparedness under Sub-Activity 4.1.1.

#### Sub-Activity 3.1.4 – Disseminate sector-specific early warning information for agriculture

MAF has a network of 305 agriculture extension officers and 65 extension coordinators covering 423 rural *sucos* in the country. This sub-activity will provide training on disaster risk management to all agriculture extension officers, their supervisors and 105 MAF staff members, enabling them to understand forecasts and early warnings and to integrate agriculture disaster risk management in their services to farmers. Provision of basic tablets will

partly address the extension officers' need for accessible climate and EWS information and will facilitate knowledge sharing among officers. Access to modern technology will link them to social networks, allowing them to disseminate early warnings and other information about climate resilient agriculture. The dissemination of agriculture-related early warnings through agriculture extension services will reinforce communities' awareness of risks and options to mitigate risks in the agriculture sector.

In addition, the Project will disseminate agricultural sub-sector-specific forecast and early warning products (developed under Sub-Activity 2.2.3), such as agrometeorological advisories, food security bulletins and action-oriented early warnings to local agriculture offices and extension workers. Existing MAF information sharing systems such as the Ministry's website as well as social media will be used. Agriculture extension workers will be trained to establish social media networks among farmers in their responsible areas and disseminate localised advisories and early warnings. Furthermore, a compendium of agriculture early actions and climate resilient agriculture practices adapted to Timor-Leste will also be developed, which could be applied by farmers with support from the extension officers, as part of the Forecast-based Financing / Early Warning Early Action approaches established under Activity 4.2.

#### **Result 4: Enhanced climate risk management capacity**

The value of climate information and early warning services in supporting disaster risk reduction (DRR) is clearly acknowledged in the resilience agenda of post-2015 international agreements and frameworks<sup>151</sup> – in particular, the Sendai Framework for Disaster Risk Reduction (2015 – 2030), which explicitly highlights climate services under Priority 4: *Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction*. This Result is therefore designed to increase coherence and mutual reinforcement between disaster risk management – defined as the application of DRR policies and strategies<sup>152</sup> – and climate information and early warning services, which will be strengthened under Results 1 – 3.

Result 4 focuses on capacity building to prepare for climate risks and hazards and the introduction of Forecast-based Financing (FbF) – also known as Early Warning Early Action (EWEA)<sup>153</sup> – an innovative mechanism whereby early actions at community and government level are pre-planned based on in-depth forecast and risk analysis, and resources are automatically allocated when a specific threshold is reached. FbF/EWEA been shown to minimise losses and damages caused by climate-related hazards and reduce the need for humanitarian assistance in their aftermath.<sup>154</sup> The development and operationalisation of disaster preparedness measures, including community-based disaster risk reduction plans, and targeted public awareness and education campaigns will build capacity of the institutions and people of Timor-Leste to act early when warnings are received, facilitated by enhanced risk education.

The outcomes of this Result will complement focused training on disaster risk management to be undertaken by DNMG staff through the GCF UNDP Project, *Safeguarding Rural Communities*. It will also put in practice the *Disaster Risk Management Training Manual* prepared by NDMD, a complete plan to reduce the impacts of natural disasters in the country, particularly from landslides, floods and strong winds.

#### **Activity 4.1: Build capacity to prepare for and respond to climate risks and hazards**

##### Sub-Activity 4.1.1 – Enhance disaster preparedness capabilities from national to community level

---

<sup>151</sup> Frontiers, 2020. Research Topic – Climate Services Supporting Disaster Risk Reduction. Available at: <https://www.frontiersin.org/research-topics/15248/climate-services-supporting-disaster-risk-reduction#overview>

<sup>152</sup> PreventionWeb, 2017. Terminology – Disaster risk management. Available at: <https://www.preventionweb.net/terminology/view/476>

<sup>153</sup> Forecast-based Financing (FbF) and Early Warning Early Action (EWEA) are synonymous. Both terms have become popular in recent years on account of the various agencies who frequently use them. While there has been a shift towards streamlining this language, an agreement is yet to be reached. As such, the Funding Proposal will refer to both terms according to that used by the relevant technical partner.

<sup>154</sup> WFP, 2018. Forecast-based Financing Factsheet. Available from: <https://www.wfp.org/publications/forecast-based-financing-factsheet>

The Project will work with Cruz Vermelha de Timor-Leste (CVTL – Timor-Leste Red Cross Society) and the National Directorate for Climate Change (NDCC) to enhance disaster preparedness capabilities from national to municipal to community level for effective action in response to climate variability and climate change.

At the national level, this sub-activity will support the Government of Timor-Leste to hold two National Climate Change Conferences over the term of the Project, which will aim at enhancing country ownership and abilities to better prepare for and manage climate-related risks. In addition, the Project will support regular Community-Based Disaster Risk Management (CBDRM) Working Group and stakeholder coordination meetings to facilitate a coherent strategy for disaster preparedness, including plans and standard operating procedures. It will also build capacity among national institutions and stakeholders to better understand community perceptions on existing early warning processes and optimise their effectiveness in relation to preparedness capabilities, which in turn is more likely to result in early action at the local level. This will be complemented by targeted capacity building for CBDRM and disaster preparedness municipal/district-level actors.

At the community level, the Project will use participatory approaches such as risk mapping and focus group discussions to support vulnerable population groups to assess their own exposure to and capacity to deal with climate-related hazards. Understanding differential vulnerabilities and capacities is an integral part of disaster preparedness and contributes to the development of community-based initiatives that are mutually supportive and responsive to the needs of the people most closely concerned. Accordingly, this sub-activity will support the co-development of Community Action Plans (CAPs) to improve preparedness for early action in response to early warning messaging. Indicative activities may include developing community-level contingency plans, identifying suitable evacuation sites and routes, identifying strategies for protecting household assets and conducting simulation exercises. Co-development of the CAPs will complement the enhancement of community-based early warning systems under Sub-Activity 3.1.3.

In addition, this sub-activity will conduct community-based workshops across Timor-Leste in each year of the Project. The workshops will train community members on the use of climate forecasts to support contingency planning and preparedness measures based on improved understanding of disaster risk. Basic climate and climate change concepts and information will also be introduced. The overall aim of the workshops will be to sensitise communities to the value of climate information and early warnings towards reducing the impact of climate-related hazards and providing an entry point to build trust in scientific knowledge systems and demonstrate their complementarity with local knowledge.

#### Sub-Activity 4.1.2 – Build capacity of the National Disaster Management Directorate (NDMD) for EWS

This sub-activity will employ an integrated and holistic approach to build the technological, technical and institutional capacity of NDMD to utilise EWS information for performing its mandated functions in disaster preparedness. The Project will work with NDMD to co-develop Standard Operating Procedures (SOPs) for disaster preparedness, taking into account the differential vulnerabilities and needs of population groups. Targeted training for NDMD staff will be delivered to enhance risk knowledge on weather, water and climate-related hazards that could impact the population, and build capacity to deliver effective, people-centred early warning systems that facilitate a constant state of preparedness and, in the longer term, reduce disaster risks.

The Project will ensure that staff in all 13 Municipal Disaster Management Committees (MDMCs) of Timor-Leste have the capacity to use the existing disaster loss database – the Baze de Dadus Dezastre Timor-Leste (BDDTL)<sup>155</sup> – and that the MDMCs have the requisite knowledge to oversee appropriate data collection by the Suco (village) Disaster Management Committees, for which they are responsible. Improving disaster loss data collection will provide essential data to better quantify the impacts of climate hazards and climate change in Timor-Leste and will provide valuable inputs to the impact-based forecasting and decision-support systems developed under sub-activities 2.2.3 and 2.3.3.

---

<sup>155</sup> <http://tidd.mss.gov.tl/DesInventar/main.jsp?countrycode=tl&lang=EN>

In addition, this sub-activity will facilitate equipment maintenance and upgrade to ensure resilience of communication channels and early warning system hardware, supported by technical training and IT expertise for long-term sustainability. It will also establish capacity in NDMD to deploy broadband wireless links to complement the existing network infrastructure.

Sub-Activity 4.1.3 – Increase public awareness and education on climate hazards, related health risks and early warning

Despite the prevalence of disasters in communities around Timor-Leste, there is relatively little awareness of risk, and in the absence of an operational end-to-end Early Warning System, vulnerable communities lack understanding or knowledge on how to use early warnings or weather information. As a fully functional end-to-end MHEWS is constructed in Timor-Leste, the Project will work with the Timor-Leste Red Cross Society (CVTL) to implement a broader awareness and education campaign to ensure that communities across Timor-Leste better understand climate hazards, risks, the early warning services available, and appropriate actions to take to reduce disaster risk and increase their resilience. The campaign will support communities to understand the differential vulnerabilities, exposure and impacts of hazards and how to act upon warning messages to minimise loss and damage during disasters. The International Day for Disaster Risk Reduction on 13<sup>th</sup> October will be celebrated in a national event, as well as through awareness campaigns across several municipalities.

Moreover, health risks are increasing due to climate change. Accordingly, CVTL will conduct targeted awareness-raising from national to municipality to community level to improve understanding of climate-related health risks, communicate local evidence of climate and weather impacts on community health, and provide education on community-based health and first aid. The outcomes of the multi-stakeholder dialogue on localised communication strategies (Sub-Activity 3.1.2) will inform utilisation of the most effective media (e.g., established broadcasting media, social networks, informal communication channels, etc.) to ensure that awareness-raising reaches vulnerable communities at the last-mile.

Timor-Leste's Secretary of State for the Environment will complement the work of CVTL through information dissemination and environmental educational outreach throughout the Project.

Sub-Activity 4.1.4 – Conduct a targeted disaster risk awareness and education campaign for women

This sub-activity will focus on empowering women through enhanced awareness and understanding of disaster risks to support increased participation in disaster risk management and decision making for climate resilience. The Project will establish localised women's networks – through linkages with women's groups and local NGOs/CBOs – to disseminate IECs tailored to the specific needs of women and other vulnerable groups (e.g., youth, elderly people and people with disabilities) and participate in disaster risk education workshops. The networks will enhance women's roles in disaster risk awareness-raising and support increased engagement in peer-to-peer learning. Given the disproportionate effects of climate change on women's health, the campaign will seek to educate women on how to use risk information to take actions at the household and individual levels to protect health. Training of trainers (ToT) workshops will support women's group facilitators to expand the disaster risk awareness and education campaigns to other communities, thereby developing local educators and enhancing sustainability beyond the Project implementation period. These interventions will support implementation of the socially inclusive and gender-responsive localised communication strategies developed under Sub-Activity 3.1.2.

**Activity 4.2: Establish Forecast-based Financing (FbF)**

The Project will introduce Forecast-based Financing (FbF) – also known as Early Warning Early Action (EWEA) – in Timor-Leste. FbF is an innovative mechanism whereby early preparedness actions at community and government level are pre-planned based on in-depth forecast and risk analysis, and resources are automatically allocated when a specific threshold is reached. FbF/EWEA has been shown to enhance preparedness, and

reduce loss and damage caused by climate-related disasters and the need for humanitarian assistance in their aftermath.<sup>156</sup> Most importantly, FbF/EWEA saves lives.<sup>157</sup>

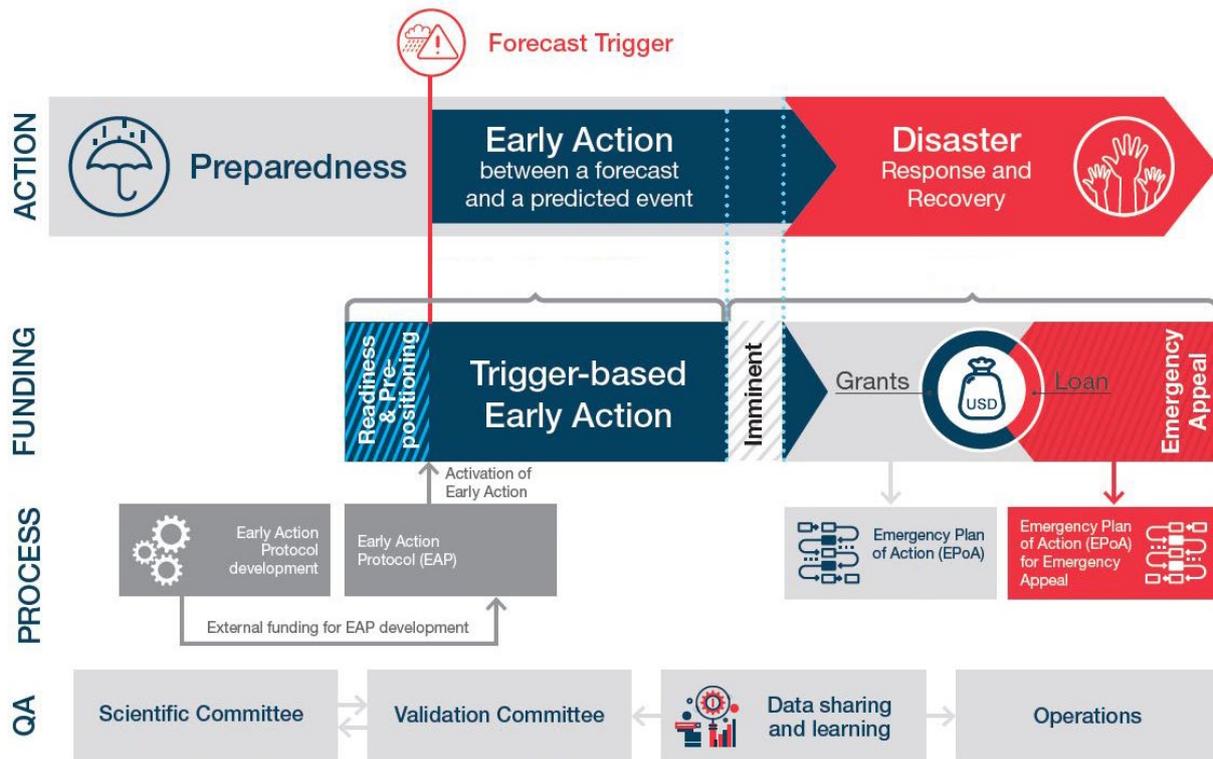


Figure 5. Forecast-based Financing conceptual framework (Source: Adapted from IFRC, 2020)<sup>158</sup>

The approach taken in the Project follows the precedent set by the approved GCF project “Enhancing Climate Information and Knowledge Services for resilience in 5 island countries of the Pacific Ocean” (FP147),<sup>159</sup> for which the combination of impact-based forecasting and FbF was commended as an innovative mechanism that would improve disaster preparedness and enable more efficient management of government budgets. The International Federation of Red Cross and Red Crescent Societies (IFRC) – as the lead international agency spearheading FbF – has designed this activity based on their experience in developing FbF in low-capacity countries and will lead its implementation together with Timor-Leste’s National Red Cross Society (CVTL).

#### Sub-Activity 4.2.1 – Establish a Roadmap for FbF

This sub-activity will establish a Roadmap for Forecast-based Financing in Timor-Leste, which will identify the early warning information – based on forecast attributes (magnitude, probability and lead time) – and decision criteria that can trigger worthwhile action.<sup>160</sup> The Roadmap will include the following components:<sup>161, 162</sup>

<sup>156</sup> World Food Programme, 2019. Forecast-based Financing (FbF) – Anticipatory actions for food security. Available at: <https://docs.wfp.org/api/documents/WFP-0000104963/download/>

<sup>157</sup> IFRC, 2017. Forecast-based Financing: Effective early actions to reduce flood impacts. Available at: [https://www.preventionweb.net/files/62642\\_casestudy5bangladeshfbfinal.pdf](https://www.preventionweb.net/files/62642_casestudy5bangladeshfbfinal.pdf)

<sup>158</sup> IFRC, 2020. Forecast-based Action (FbA) by the DREF. Available from: <https://media.ifrc.org/ifrc/fba>

<sup>159</sup> <https://www.greenclimate.fund/project/fp147>

<sup>160</sup> Lopez, Coughlan de Perez, Bazo, Suarez, Van den Hurk, Van Aalst, 2018: Bridging forecast verification and humanitarian decisions: A valuation approach for setting up action-oriented early warnings

<sup>161</sup> IFRC, 2018. Forecast-based Financing Early Action Protocol template

<sup>162</sup> IFRC, 2021. FbF Practitioners Manual. Available at: <https://manual.forecast-based-financing.org/en/>

- **Stakeholder Identification** – The Roadmap will identify the key stakeholders to be involved in the development and implementation of FbF, including international, national, regional and local actors and lead agency/s.
- **Risk Assessment** – The Assessment will utilise a participatory approach to analyse risk factors, key hazards, past impact, exposure and vulnerability. Based on the analysis, the priority impacts to be addressed will be identified. The assessment will provide an overview of the different types of early actions that could be taken to mitigate risk by the identified stakeholders, in different sectors (including agriculture, water, health, etc.).
- **Impact-based Forecasting (Triggers)** – The Trigger is the specific threshold value, based on weather and climate forecasts, that dictates when an early action is initiated. In line with an impact-based forecasting approach, the trigger model will be developed based on detailed risk analysis, and analysis of exposure and vulnerabilities.
- **Financial Mechanism** – The Roadmap will identify a country-driven, scalable financial mechanism for FbF that will provide a sustainable source of funding for early action suitable for the context of Timor-Leste.

The first phase in development of the Roadmap will comprise a scoping study that will cover feasible hazards to target with FbF, forecasting capability, and the institutional landscape in Timor-Leste. For FbF to be a sustainable and effective mechanism, it must be embedded in national institutions, who have roles and responsibilities for taking early action. The scoping phase will identify national and/or sub-national actors (government and civil society) and enter into a dialogue with them about the potential for FbF, its effectiveness, and added value to existing disaster risk management efforts.

Following the scoping phase, the second phase of Roadmap development will consist of collaborative consultations with institutional stakeholders and local communities to delineate three key elements that would enable country-led design of a FbF mechanism:

- Defined triggers, based on improved forecasts, for preparedness actions aiming at avoiding losses and damage if an extreme event materialises;
- A “menu” of the available early warning information derived from forecasts that can trigger the early actions;
- A potential framework of country-level technical working groups and institutional ownership for FbF, including funding mechanisms when necessary. A lead national agency/s in which to embed EAPs will be identified.

Forecast-based Financing is only as strong as the National Society supporting it.<sup>163</sup> Accordingly, the Project will undertake extensive capacity development to ensure that CVTL has the requisite knowledge and skills to develop and implement EAPs, and foster ownership to establish FbF. This will include technical support to connect with existing national and sub-national strategies, mechanisms and/or priorities to improve coordination and enhance countrywide understanding and buy-in for FbF. In addition, specific links between FbF/EWEA approaches and the principles and activities embedded in other areas of the Project will be identified – for example, collaboration with the national Climate and Health Working Group (Sub-Activity 2.3.1) to identify opportunities to implement forecast-based early action in the health sector.

Building on the scoping study, the Project will identify a financial mechanism to ensure that key stakeholders have access to immediate, reliable and sustainable funding in the event of Early Action Protocol (EAP) activation. The Project will initially explore existing financial mechanisms currently operational in Timor-Leste, and hence

---

<sup>163</sup> IFRC, 2021. FbF Practitioners Manual. – Make your National Society FbF Ready. Available at: <https://manual.forecast-based-financing.org/en/chapter/make-your-national-society-fbf-ready/>

assess a variety of potential financing tools for early action – including dedicated funds, specific windows in existing emergency response funds (e.g. IFRC’s Disaster Relief Emergency Fund<sup>164</sup>), and direct links to regular resource allocation processes, including ring-fenced budgets. This scoping and assessment will identify whether efforts would be best place adapting an existing fund or creating a new one; and inform the design of a sustainable source of funding for FbF. Given the existing baseline, the financial mechanism is expected to utilise public sector resources in the first instance. Private sector financing for FbF is not envisaged within the five-year implementation period; however, the Project aims to build a foundation for mobilising and integrating private sector resources in the longer term.

Finally, this sub-activity will initiate the process of Early Action Protocol (EAP) development. The EAP is a tool to guide the timely and effective implementation of early actions based on impact-based early warning information. It contains information on triggers, early actions and funding allocation, and describes the step-by-step process for the implementation of early actions once a trigger is hit. To identify what should be in the EAP, the Project will convene a technical working group, engaging stakeholders at all levels – including community representatives, disaster risk management actors, women’s groups, civil society organisations, local and national government departments, NGOs and private sector actors. The technical working group will build on the consultations in the second phase of Roadmap development to complete the Risk Assessment and set the Trigger, and accordingly identify and select the most appropriate forecast-based early actions. The draft EAP will be presented to the identified key Stakeholders for validation and refinement. It should be noted that actual implementation of the EAP is beyond the scope of the Project.

#### Sub-Activity 4.2.2 – Develop capacity for Early Warning Early Action (EWEA) in agriculture

This sub-activity will build capacity of national, sub-national and community-based partners to utilise impact-based forecasts and early warning information for FbF/EWEA in agriculture – given the importance of this sector for the population of Timor-Leste – with a focus on institutionalising the forecast-based early action approach.

The Project will work with DNMG, NDMD and the Ministry of Agriculture and Fisheries (MAF) to enhance mutual understanding of the value of forecast-based early action for the agriculture sector and facilitate collaboration to co-develop EAPs focused on addressing sector-specific risks. It will engage Suco Disaster Management Committees (SDMCs), MAF local staff, agriculture extensionists and local NGOs will be engaged to enhance the local relevance of EAPs; and deliver targeted training – including Training of Trainers (ToT) – to develop capacity of local stakeholders to use the improved forecasts, EWS and on-the-ground data and information (supported under Results 1 – 3) to identify early actions with the highest potential to reduce the identified impacts.

### **B.4. Implementation arrangements (max. 1500 words, approximately 3 pages plus diagrams)**

#### **Accredited Entity**

UNEP will be the Accredited Entity for the Project and will be responsible for managing the implementation, financial management, evaluation, reporting and closure of the activities under the Project. UNEP will monitor and supervise the execution of the Project and ensure the proper management and application of GCF Grant Proceeds by the Executing Entities. UNEP will ensure that the Grant Proceeds are utilised in accordance with the terms of the Funded Activity Agreement to be entered into between GCF and UNEP and the Accreditation Master Agreement. UNEP will also assume a limited role as Executing Entity, as described in the relevant section below.

UNEP brings more than 25 years’ experience working on climate change issues and is an established GCF Accredited Entity. It brings a comprehensive approach to climate change mitigation and adaptation that is grounded in both natural science and economics and is tied to the environmental and development concerns of

---

<sup>164</sup> IFRC, 2020. Disaster Relief Emergency Fund (DREF)

countries. Based on its core science-based mandate, one of UNEP's seven sub-programmes is entirely dedicated to keeping the world environment under review.

Through its Science Division, UNEP has longstanding expertise in environmental and climate change information management and early warning systems. For example, with GEF and EC funding it is currently supporting over 50 countries in establishing or strengthening their environmental information management systems and using them for reporting progress on SDGs and MEAs. Its Science Division manages the CLIMWARN and Country Level Impacts of Climate Change (CLICC) projects, the Global Environment Monitoring System for Air (GEMS Air), and UNEP also convenes and facilitates regional environmental information networks and the world adaptation science program (former PROVIA). Through its work on climate information, early warning and foresight, UNEP enables stakeholders to respond to the latest emerging issues related to environment and climate change. A concrete example is the approved UNEP GCF FP147 on "Enhancing Climate Information and Knowledge Services for resilience in 5 island countries of the Pacific Ocean".<sup>165</sup>

UNEP is also a key player in the "One Health" approach – a cross-cutting and systematic approach to health that recognises the interdependence of human, animal and environmental health as critical for addressing the three planetary crises: the climate crisis, the nature and biodiversity crisis, and the pollution and waste crisis. As a member of the One Health High-Level Expert Council, UNEP is supporting the collection, distribution and publicizing of reliable scientific information on the links between human, animal and environmental health, which in turn aims to assist public officials to make appropriate decisions to address future crises and to inform citizens.

In addition, the United Nations Country Team (UNCT) works to ensure inter-agency coordination and decision-making at the country level, building on the comparative advantages of the UN family and in line with "Delivering as One" model endorsed by the UN General Assembly. The UNCT provides an overarching framework for coordination and cooperation among UN entities operating in Timor-Leste. UNEP's Asia Pacific Regional Office is already participating in the UNCT for Timor-Leste. The work of the United Nations in Timor-Leste is guided by the UN Sustainable Development Cooperation Framework (UNSDCF) 2021 – 2025, which outlines the actions needed for more strategic, transformative and integrated UN support to accelerate Timor-Leste's progress towards achieving the Sustainable Development Goals and its national development priorities. The UNSDCF was developed through a consultative and participatory process involving the Government of Timor-Leste, civil society and development partners. This Project will specifically support national efforts in the UNSDCF Strategic Priority 6, which aims at achieving enhanced resilience to climate change impacts and natural hazards.

UNEP's participation in the UNCT and related processes will amongst others facilitate coordination, cooperation and complementarity with the UNDP GCF-funded project FP109. To this end, UNEP and UNDP have a Memorandum of Understanding (MoU) to increase collaboration and joint activities in support of internationally agreed environment and sustainable development goals established by member countries. The MoU builds on existing collaborative arrangements and lessons learned seeking to further enhance effectiveness and avoid duplication. The MoU between UNEP and UNDP is provided as Annex 22.

Enhancing the UNEP/UNDP strategic partnership is a priority of both organisations to deliver synergies, demonstrate clear added-value and show that multi-lateral action is more than the sum of its respective parts. The UNEP/UNDP collaboration requires no extra cost from the Project and both organisations are committed to continuing collaboration long beyond the Project's five-year duration.

### **Project Management Unit (PMU)**

At the request of the NDA, UNEP will set up and manage a Project Management Unit (PMU) drawing on its Global Support Services Agreement with the UN Office for Project Services (UNOPS), where necessary. The PMU will provide management and support to the national implementation of the Project through coordination by the national Executing Entity (SSE) and Technical Partners involved in Project implementation, in line with their

---

<sup>165</sup> <https://www.greenclimate.fund/project/fp147>

obligations under the respective legal instruments and will coordinate to ensure that reports are received. The PMU will consolidate all half yearly progress reports and quarterly financial reports, including co-financing reports and annual audit reports, from the EE and Technical Partners and submit these to the AE. The PMU will provide guidance and source expertise as needed on project management, financial management, procurement and technical issues. It will establish contact with other development partners working with Timor-Leste to ensure that activities in related fields are complementary, and to seek opportunities for collaboration. The PMU will also provide secretariat services to the Project Steering Committee (PSC).

The PMU will be staffed by three full-time staff reporting to UNEP in its EE capacity: a Project Manager (PM), a Fund Management, Monitoring and Procurement Officer (FMMPO), and a Finance and Admin Assistant (FAA). The FMMPO and FAA will report directly to the PM. All staff will be recruited in line with UN regulations, rules and policies. The PMU will be overall responsible for the day-to-day management of the Project. This role will include an overall responsibility for:

- i. Coordinating the Project Steering Committee (PSC);
- ii. Managing the Project in line with the budget and workplans, and in accordance with GCF and UNEP guidelines;
- iii. Being responsible for financial management and disbursements;
- iv. Coordinating the national EE and Technical Partners to manage the Project effectively;
- v. Consolidating national EE and Technical Partner reports and report to the AE; and
- vi. Ensuring exchange of information and knowledge across the EE and Technical Partners.

To achieve the targets of the proposed Project the PM will, inter alia:

- i. Acquire on-the-ground information to inform UNEP progress reports;
- ii. Engage with Project stakeholders;
- iii. Arrange PSC, PMU and other meetings;
- iv. Provide technical support, including measures to address challenges to Project implementation;
- v. Participate in training activities;
- vi. Write technical reports;
- vii. Facilitate relevant expert activities; and
- viii. Establish the necessary operational linkages with the UNDP team managing FP109 in Timor-Leste as part of the overall UNDP-UNEP Strategic Partnership.

Additionally, the PM will liaise with members of the PSC, technical experts, government staff and stakeholders involved to coordinate the implementation of the proposed Project's activities.

A range of equipment (i.e., AWS, AWOS, weather radars, etc.) and communication infrastructure upgrades will be procured to strengthen observations in Timor-Leste, based on the priorities identified in the Feasibility Study (Annex 2). In addition to undertaking direct procurement as part of UNEP's EE function (with the support of UNOPS where necessary), the PMU will provide guidance and support to the national EE and technical partners on procurement in line with the provisions of the respective Project Cooperation Agreements (PCAs). The PMU will ensure compliance with the UN rules and regulations related to procurement.

### **Executing Entities (EEs)**

The Secretary of State for the Environment (SSE) in Timor-Leste will serve as the national Executing Entity (EE). The SSE will be accountable to UNEP as AE for Project execution at the national level and for the effective and efficient use of resources.

UNEP will enter into an appropriate agreement (Project Cooperation Agreement) with the SSE for the execution of the Project. The Project Cooperation Agreement (PCA) will establish clear roles and responsibilities for the delivery of the proposed activities, and the schedule and conditions for instalments, the determination of the prevailing fiduciary standards and the terms and conditions for arbitrations and termination of contract. The PCA will include specific obligations for the national EE on Project execution, financial management, personnel administration and reporting, as well as arbitration and liability terms.

The national EE will be responsible for establishing national project implementation in a relevant part of the government administration to provide implementation guidance and support to national service providers and Technical Partners (see below section). The national EE will thus provide technical and implementation guidance and will facilitate cooperation and coordination among the national service providers. It will be accountable to and submit regular progress reports to the PMU.

At the request of the NDA, UNEP will undertake limited Executing Entity functions. Through its Global Support Services Agreement with UNOPs, UNEP is able to operate at the country level without necessarily having a national office. The Agreement covers the provision of HR and procurement services. UNEP will execute the Project in line with its programme manual and standard business procedures and will contract international consultants and Technical Partners to undertake relevant activities as appropriate.

Amongst others, UNEP will undertake EE functions to establish climate services for health in Timor-Leste (Activity 2.3), through provision of technical advisory to the Climate and Health Working Group and operationalisation of the Health Decision Support System (DSS). Moreover, UNEP's Global Environment Monitoring System for Air (GEMS Air) will lead on establishment of an air quality monitoring framework. GEMS Air supports countries to provide quality assured data to keep the state of the world's air quality under continuous review; develops capacity of member states; provides information and services across the science-policy-public interface; and fosters transformation by leveraging the collective knowledge of a global network of partners.

Implementation arrangements for the EEs are outlined in the table below.

Table 3. Details of Executing Entities (EEs) and role in project sub-activities

Executing Entity	Details of EE and track record	Role in project sub-activities
<p>Secretary of State for the Environment (SSE)</p>	<p>The SSE assists the Coordinating Minister for Economic Affairs to support the implementation of policies for economic governance areas, including ensuring national development in an environmentally sustainable manner. The Acting Executive Secretary and Principal Adviser for Climate Finance and Resource Mobilisation Director of the SSE is the NDA and the Focal Point for interaction with the Green Climate Fund.</p> <p>A HACT assessment was carried out of SSEs capacity on behalf of UNDP in 2019. In addition, SSE has provided details of its track record in implementing projects over the past 5 years:</p> <ul style="list-style-type: none"> <li>• GCF/UNDP: Safeguarding Rural Communities and their Physical Assets from Climate Induced Disasters in Timor-Leste (\$59,443,867; GCF –</li> </ul>	<p>SSE will deliver parts of and engage relevant service providers to implement <b>sub-activity 1.1.1</b>: Development of the National Framework for Climate Services (NFCS) and coordination of inputs and review of draft legislation; <b>sub-activity 1.1.2</b>: Establishment of a User Interface Platform; <b>sub-activity 1.1.3</b>: Coordination to enhance climate data management and governance; <b>sub-activity 1.1.4</b>: Mainstream climate services and disaster risk knowledge into sectors; <b>sub-activity 1.1.5</b>: Advisory for development of the financial framework and business model for climate services; <b>sub-activity 2.1.1</b>: Ensure that meteorological observation equipment is suited to the national context through coordination with DNMG and technical partners in alignment with GBON obligations and WMO standards; <b>sub-activity 2.1.2</b>: Engagement of an ocean science officer and coordination of training and capacity building for DNMG; <b>sub-activity 2.1.3</b>: Coordination of Internet of Things (IoT) workshops; <b>sub-activity 2.2.1, 2.2.2 and 2.2.3</b>: Coordination of national service</p>

	<p>\$22,356,805, Government of Timor-Leste – \$36,687,062)</p> <ul style="list-style-type: none"> <li>• GEF – Access Benefit Sharing (ABS) (\$1,300,000)</li> <li>• GEF Dugong and habitat (sea grass) Conservation (\$830,000)</li> <li>• EU- GIZ Adapting to Climate Change and Sustainable Energy (ACSE) (\$1,000,000)</li> <li>• Intra-ACP GCCA+ PACRES - USP Component, climate change advocacy (\$188,266)</li> <li>• Intra-ACP GCCA+ Pacific Adaptation to Climate Change and Resilience Building (PACRES) (\$354,000)</li> <li>• GCF Readiness project stage 2 (\$695.038)</li> <li>• GCF Readiness stage 1 (\$300,000)</li> <li>• Climate Technology Centre &amp; Network (CTCN), GCF (\$30,449)</li> </ul>	<p>providers and technical partners to strengthen climate modelling and impact-based forecasting; <b>sub-activity 2.3.1:</b> Coordination to establish a national Climate and Health Working Group; <b>sub-activity 3.1.1, 3.1.2, 3.1.3 and 3.1.4:</b> Coordination of national service providers, technical partners and local consultants to establish targeted multi-hazard early warning information systems; <b>sub-activity 4.1.1, 4.1.2, 4.1.3 and 4.1.4:</b> Coordination of national service providers, technical partners and consultants to build climate risk preparedness capacities; and <b>sub-activity 4.2.2:</b> Coordination of national service providers and technical partners to develop capacity for Early Warning Early Action in agriculture.</p>
<p>UN Environment Programme (UNEP)</p>	<p>UNEP has significant experience in working on climate change and is an established GCF Accredited Entity. Through its Science Division, UNEP has longstanding experience in environmental and climate change information management and early warning systems, with recent examples including:</p> <ul style="list-style-type: none"> <li>• GEF-funded “Inform” project (\$4.3 million);</li> <li>• Climate Change Early Warning (CLIM-WARN) project in Kenya, Ghana and Burkina Faso;</li> <li>• Country-Level Impacts of Climate Change (CLICC) project.</li> </ul> <p>UNEP also convenes and facilitates regional environmental information networks, the World Adaptation Science Programme (formerly PROVIA) and the Global Environment Monitoring System for Air (GEMS Air).</p>	<p>UNEP, including through its Global Environment Monitoring System for Air (GEMS Air), will deliver <b>sub-activity 2.3.1:</b> Technical advisory to the Climate and Health Working Group; and <b>2.3.2:</b> Establishment of an air quality monitoring framework; <b>sub-activity 3.1.1:</b> Technical advisory to the EWS Working Group.</p> <p>UNEP will contract international consultants to deliver parts of <b>sub-activity 1.1.1, 1.1.3, 1.1.4 and 1.1.5:</b> Development of institutional and policy frameworks, legislation, data strategy, sector-specific plans and training, and a financial framework and business model for climate services, and mainstreaming gender throughout the project; and <b>sub-activity 4.1.4:</b> Deliver targeted disaster risk awareness and education workshops for women.</p> <p>UNEP will conclude Project Cooperation Agreements with technical partners to deliver parts of <b>sub-activity 1.1.3; sub-activity 2.1.1, 2.1.2 and 2.1.3; sub-activity 2.2.1 and 2.2.3; sub-activity 2.3.3 and 2.3.4; sub-activity 3.1.3 and 3.1.4; sub-activity 4.1.1 and 4.1.2; sub-activity 4.2.1 and 4.2.2.</b></p>

The PMU will convene regular meetings with the EEs and the service providers to monitor the progress, facilitate cooperation among the implementing organisations and seek collaborative solutions to any issues that arise. As part of project management, the EEs will undertake regular monitoring exercises. The EEs will contribute to the continuous monitoring of project implementation, a formative Mid-Term Evaluation and a summative Terminal Evaluation of the overall Project.

## Technical Partners

The Project will benefit from the expertise of a broad coalition of Technical Partners who have long-standing experience and expertise on-the-ground, thereby ensuring coherence and complementarity. Technical Partners will include FAO, RIMES, IFRC (including its Climate Centre and national society – CVTL), BMKG and ICTP. These are highly qualified, internationally recognised professional agencies with many years' experience of partnership in the Asia-Pacific region. Based on the priorities of Timor-Leste, the Technical Partners will lead or provide support for the implementation of specific interventions that require highly technical or scientific expertise and are in line with their mandates and comparative advantages. These agencies will be sub-contracted by UNEP in its capacity as Executing Entity, in line with UNEP's procedures and policies – i.e. to deliver their agreed body of work in Timor-Leste through consultation and coordination with the national EE. Technical Partners will report to the PMU and Project Steering Committee.

Table 4. Technical Partner agencies, mandates and role in project sub-activities

Agency supporting national execution	Details of technical partner and track record	Role in project sub-activities
<p>Food and Agriculture Organization (FAO)</p>	<p>FAO is a specialised agency of the United Nations that leads international efforts to achieve food security for all. Climate change is a top-line priority for FAO, which is implementing a series of global programmes and projects to create an enabling environment for agricultural development under climate change.</p> <p>FAO is an established GCF Accredited Entity and has a track record in managing similar projects and initiatives, including:</p> <ul style="list-style-type: none"> <li>• GCF-funded Transforming the Indus Basin with Climate Resilient Agriculture and Water Management in Pakistan (USD 47.7 million);</li> <li>• GCF-funded Upscaling climate resilience measures in the dry corridor agroecosystems of El Salvador (RECLIMA) (USD 127.7 million);</li> <li>• Modelling System for Agricultural Impacts of Climate Change (MOSAICC);</li> <li>• Analysis and Mapping of Impacts under Climate Change for Adaptation and Food Security (AMICAF);</li> <li>• Agriculture Stress Index System (ASIS).</li> </ul>	<p>FAO will support delivery of <b>sub-activity 2.2.3</b>: Enhancement of the Agriculture Stress Index System (ASIS) for Timor-Leste; <b>sub-activity 3.1.4</b>: Technical support to disseminate sector-specific early warning information; and <b>sub-activity 4.2.2</b>: Technical support to develop capacity for Early Warning Early Action (EWEA) in agriculture.</p>
<p>Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES)</p>	<p>RIMES is an international and intergovernmental institution for the generation and application of early warning information covering Africa and Asia. Timor-Leste is a Member State of RIMES.</p> <p>RIMES has an extensive track record of implementing similar projects, including:</p> <ul style="list-style-type: none"> <li>• Development of flood forecast technology in Bangladesh (USD 1.46 million);</li> </ul>	<p>RIMES will support delivery of <b>sub-activity 1.1.1</b>: Technical support to help draft the NFCS and support The National Climate Outlook Forum (NCOF)); <b>sub-activity 1.1.3</b>: Technical support to install the Climate Data Informatics System (CDIS); <b>sub-activity 2.1.1</b>: Technical support for the installation of the Buoy; <b>sub-activity 2.2.1</b>: Establishment of a National Forecasting Centre; <b>sub-activity</b></p>

	<ul style="list-style-type: none"> <li>• End-to-end Early Warning of Tsunamis and other Natural Hazards in the Indian Ocean and Southeast Asia: Phase 2 (USD 1.21 million);</li> <li>• Enhanced Climate Risk Management Technical Assistance Support Project (USD 1.05 million).</li> </ul>	<p><b>2.2.3:</b> Establishment of sector-specific impact-based forecasting and SMART, SESAME and OSFAS decision-support systems; <b>sub-activity 2.3.3:</b> Establishment of tailored forecasting and decision support for health; and <b>sub-activity 2.3.4:</b> Development of a mobile app for health-related forecasts and advisories.</p>
<p>International Federation of Red Cross and Red Crescent Societies (IFRC) – including its Climate Centre and national society (Cruz Vermelha de Timor-Leste – CVTL)</p>	<p>IFRC assists the Red Cross and Red Crescent Movement and its partners to reduce the impacts of climate change and extreme weather events on vulnerable people. Together with CVTL and the National Disaster Management Directorate, IFRC will support the Project with expertise on last-mile delivery and Forecast-based Financing (FbF).</p>	<p>CVTL will support delivery of <b>sub-activity 3.1.1:</b> National capacity building on Early Warning Systems (EWS); <b>sub-activity 3.1.3:</b> Enhance community-based EWS; <b>sub-activity 4.1.1:</b> Enhance disaster preparedness capabilities from national to community level; and <b>sub-activity 4.1.3:</b> Awareness and education on climate hazards, related health risks and early warning.</p> <p>IFRC will support delivery of <b>sub-activity 4.2.1:</b> Technical support to establish a Roadmap for FbF.</p>
<p>Indonesian Meteorological, Climatological and Geophysical Agency (Badan Meteorologi, Klimatologi dan Geofisika – BMKG)</p>	<p>BMKG is an Indonesian government agency with a ministry status. It is headed by a Director General who reports directly to the President of the Republic of Indonesia. BMKG is responsible for monitoring and providing information services on weather, climate, air quality, earthquake, tsunami and related environmental information. In addition to its role in disaster risk reduction and management, BMKG provides weather services to the agriculture, fisheries, forestry and aviation sectors amongst others.</p> <p>BMKG has a Memorandum of Understanding (MoU) with Timor-Leste’s Ministry of Public Work, Transport and Communication (under which the national meteorological service operates) to provide technical support for the calibration of meteorological equipment, human resource development, and to exchange data and information about meteorology, climatology and geophysics. In addition, as an established WMO Regional Training Centre, BMKG delivers training and capacity building in meteorology, climatology, hydrology and related sciences to fulfill the needs of the RA II (Asia) and RA V (South-West Pacific) regions.</p>	<p>BMKG will support delivery of <b>sub-activity 2.1.1:</b> Technical support for the assembly, installation, calibration, operation and maintenance of observations equipment in compliance with the Global Basic Observing Network (GBON) requirements; <b>sub-activity 2.1.2:</b> Technical support, training and capacity building for DNMG staff.</p>
<p>Abdus Salam International Centre for Theoretical Physics (ICTP)</p>	<p>Founded by Abdus Salam (Nobel Laureate in Physics), ICTP operates under a tripartite agreement among two UN agencies – UNESCO</p>	<p>ICTP will support delivery of <b>sub-activity 2.1.3:</b> Technical support and training to initiate Internet of Things (IoT) approaches; and <b>sub-activity 4.1.2:</b> Technical support</p>

	<p>and IAEA – and the Italian Government. ICTP is a Category 1 UNESCO institute.</p> <p>The mission of ICTP is to foster advanced studies and research in developing countries. Its activities encompass most areas of theoretical and applied sciences, including Earth System Physics and ICT. Since its establishment, the Centre has received around 120,000 scientists, half of whom have come from the developing world. Since 2019, ICTP hosts the only European ITU Centre of Excellence in Internet of Things (IoT), Big Data and Statistics.</p>	<p>and capacity building for NDMD to plan, deploy and maintain wireless infrastructure.</p>
--	--	---

### Project Steering Committee

The Project Steering Committee (PSC) will be established comprising the NDA (also serving as national EE) and UNEP. It will meet at least once per year and will be co-chaired by the NDA and the AE (UNEP). The PSC will provide high-level oversight and guidance towards achieving Project objectives. The PSC is a consensus-based decision-making body within the Project governance structure and will provide, review and monitor strategic direction and policy guidance to the Project team. Among other functions, the PSC will review and approve the annual workplan and budget and approve the Project’s annual report as prepared by the PMU and national EE. The committee will also provide recommendations on Project approaches and participate in discussing general strategies and opportunities for project planning and implementation.

The functions of the Steering Committee are:

- Providing overall guidance for Project execution to the PMU, especially on cross-cutting issues which require consensus from the various stakeholders involved in the Project;
- Ensuring that recommended policy and institutional strengthening undertaken under the Project is consistent with the Project’s overall agenda;
- Ensuring full cooperation of various regional and national stakeholders under their jurisdictions to provide access and support to the Project team in carrying out their tasks;
- Representing the interests of civil society and communities derived from a regular formal dialogue between the NDA and national peak bodies;
- Reviewing and monitoring progress in Project execution; and
- Ensuring that complementarity with other GCF-funded projects (in particular, the UNDP-led FP109) is effectively operationalised.

The members of the Steering Committee will be the NDA, the UNEP AE Representative and national EE representatives. Observers will include:

- the Project Manager;
- Representatives from the Technical Partner agencies involved in Project implementation – FAO, RIMES, IFRC, BMKG, ICTP and others as appropriate;
- Representatives from additional entities involved in Project implementation, in particular DNMG, NDMD, DNGRA, MAF and community-based organisations with experience in disaster risk management;
- Representatives of civil society and women’s organisations; and
- Representatives of the private sector.

Secretariat services will be provided by the Project Management Unit (PMU). The minutes of the meetings will be provided to the AE by the Project Manager.

### **National Service Providers**

National service providers will be engaged through relevant agreement modalities by the national EE. These include the National Directorate for Meteorology and Geophysics (DNMG), National Disaster Management Directorate (NDMD), National Directorate for Water Resource Management (DNGRA), Ministry of Agriculture and Fisheries (MAF), the National University of Timor-Leste's Center for Climate Change and Biodiversity (CCCB), and the National Directorate for Climate Change (NDCC), amongst others.

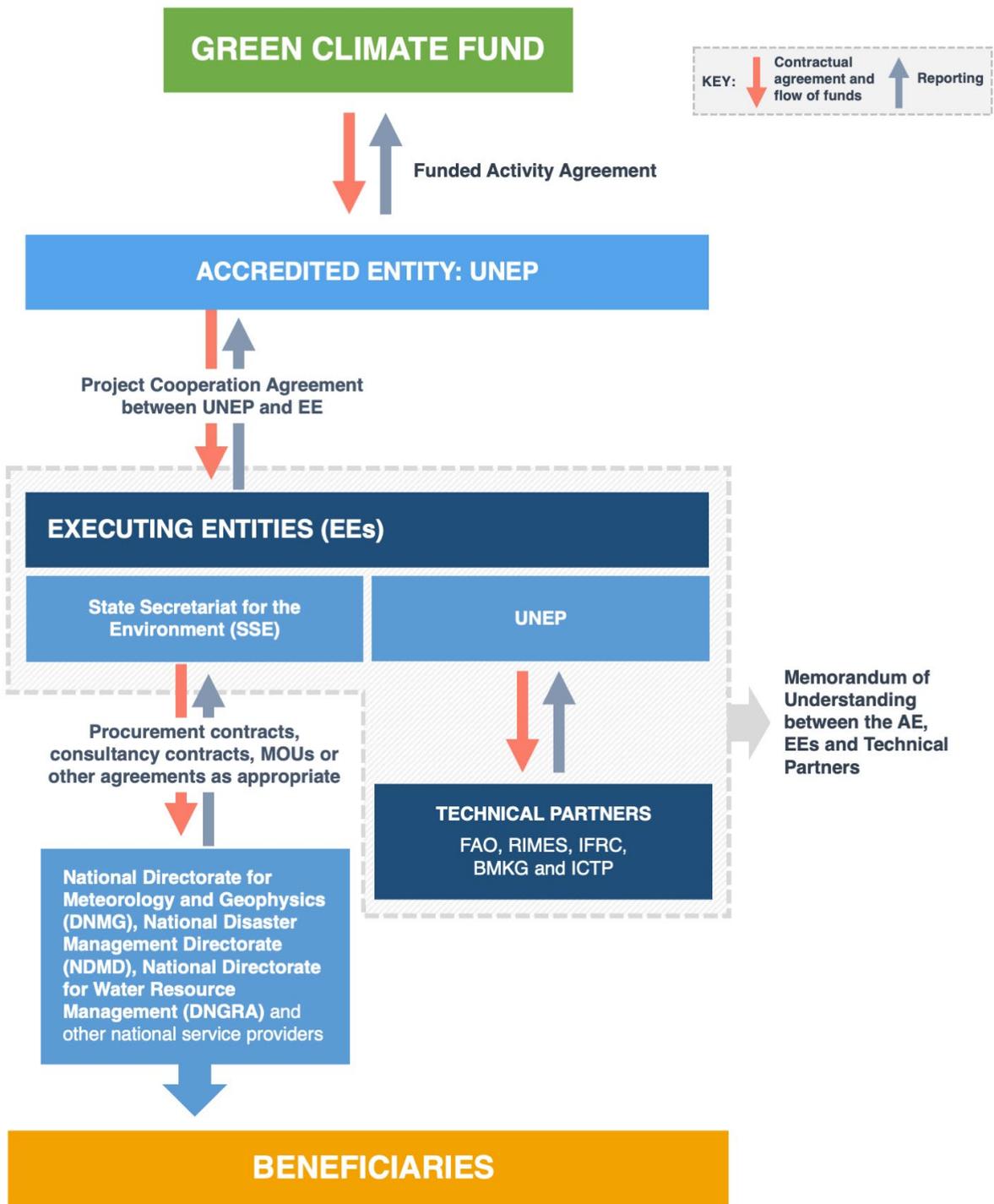


Figure 6. Flow of funds and contractual arrangements for Project implementation. Red arrows indicate the contractual agreements, including the types of contracts between relevant parties, and flow of funds. Blue arrows indicate the reporting arrangements.



Figure 7. Project governance arrangements. Yellow arrows indicate the flow of guidance between relevant parties.

As per the GCF policy, which states that Projects must provide a “grievance redress mechanism to receive complaints and feedback”, the Project has created a Stakeholder Response Mechanism (SRM). The SRM provides Stakeholders with a mechanism that ensures that Grievances filed in relation to the Project are addressed thoroughly and systematically. Annex 6 sets forth the procedures for the SRM in detail.

**B.5. Justification for GCF funding request (max. 1000 words, approximately 2 pages)**

Timor-Leste is a Least Developed Country (LDC), a Small Island Developing State (SIDS) and a post-conflict newly independent country whose infrastructure and governmental systems have been devastated by a 25 year war of independence—between 1975 and 1999, in which about one-third of the population was killed.<sup>166</sup> In 1999, the large majority of East Timorese voted in a referendum for independence from Indonesia, which resulted in unrest: 1400 Timorese were killed, 300,000 people moved to West Timor as refugees and the majority of the country's infrastructure and means of production were destroyed.<sup>167</sup> Timor-Leste suffered further civil unrest in 2006. Although it is now stable, in 2019 its GDP per capita rank is estimated at 146<sup>th</sup> of 181 countries listed.<sup>168</sup> Landslides, floods and drought typically cause most damage to Timor-Leste, disrupting transport links, destroying private houses and public infrastructure and challenging the country's economy development. Climate change is increasing these impacts and contributes to food insecurity, prompting further degradation of the environment and threats to biodiversity.

Infrastructure, institutions and essential services in Timor-Leste are being rebuilt from a very low base and climate services must compete with more visible needs such as health, education and basic infrastructure. Direct revenue will not be an outcome of the GCF investment and therefore loans or non-grant instruments are not considered feasible. Although there is a clear need for climate information, there is currently no real market demand for climate information services. Climate-sensitive sectors have little awareness of the economic value of climate information services and little capacity to pay for it, given that the private sector is weak and primarily dependent on government contracts. The Project is expected to generate interest in using climate information products and multi-hazard early warning systems (MHEWS), but this will be aimed at reducing risks to lives and food security during the Project duration. Nonetheless, Result 1 includes the development of a financial framework and business model for DNMG, which will pave the way for financial sustainability in the future (i.e. after the Project's lifespan).

Early warning services are regarded as a public good and are expected to be provided as an outcome of budget appropriation for the DNMG, but there is little scope for the Government of Timor-Leste to increase appropriation at this moment. The basic level of information being provided, its limited reach and lack of understanding about its use make it difficult for the DNMG to make a case for the increased public funding that would enable it to improve its services. Moreover, the dual impacts of the COVID-19 pandemic and severe flooding in April 2021 are putting significant strain on Timor-Leste's already fragile economy. This has diminished the country's already limited capacity to invest in climate information and early warning systems, despite the demonstrated need.

Although the Project is expected to generate interest from the private sector in using climate information products and MHEWS, cost-recovery is not considered feasible during the 5-year term of the Project. Timor-Leste's government institutions, academic institutions, private sector and rural and urban populations are not yet able to pay for climate information services and so cost recovery for these essential services is not practicable.

Donor and bilateral support are also currently not available for the comprehensive approach to improving climate services proposed in this Project. The GCF is best positioned to provide this grant as no other financing institution, private company or donor is currently likely to do so. However, strengthening and extending the observation network will provide a foundation of high-quality data from an expanded geographical area, including from ocean surface monitoring equipment. This data will be most valuable to future development partners in planning adaptation activities and de-risking investments, thereby avoiding waste and maladaptation. Specifically, it will contribute to the approved GCF UNDP Project (FP109) climate-proofing small-scale rural infrastructure.

Provision of grant funding is fully in line with the GCF Board Decision B.07/04 (b) in reference to the initial results management framework of the Fund: section (iii) Project/programme level outcomes for adaptation calls for (6.0)

---

<sup>166</sup> CAVR, 2005. *Chega! The Report of the Commission for Reception, Truth, and Reconciliation Timor-Leste*

<sup>167</sup> *Ibid.*

<sup>168</sup> [https://photius.com/rankings/2019/economy/gdp\\_per\\_capita\\_2019\\_0.html](https://photius.com/rankings/2019/economy/gdp_per_capita_2019_0.html)

Increased generation and use of climate information in decision-making and (7.0) Strengthened adaptive capacity and reduced exposure to climate risks.

This situation may change towards the end of the Project's term. Public and private sector economic benefits, anticipated from the Project due to better management of resources and risks from using improved climate products and services, could translate to or catalyse further investments in climate-resilient development. Demonstration of the avoided cost from impact-based forecasting and advisories could create incentives for the Government to increase its funding and investment, or to develop favourable policies for climate information and early warning services. Similarly, the recognition of climate risks and impacts by the private sector and communities could lead to the establishment of an insurance market, as impact-based forecasting could lead to improved risk reduction and lowering of insurance premium rates. It should be noted that such investments could be realised only after demonstration of the benefits from use of improved climate products and services.

The Project will support the DNMG to identify opportunities to develop value-added climate products and services, particularly for climate-sensitive sectors – e.g. infrastructure, agriculture, health, aviation, road and maritime transport, tourism and water management; and potential for public-private partnerships and private investment in climate services. The Project will focus on the most promising sectors to develop targeted information products, monitor their uptake and regularly reassess options for revenue diversification. The identification and examination of possible funding modalities for climate information services in the national budget will contribute to good public financial management. Valuable lessons from the experience of other SIDS in making this transition are already available and will be used.

#### B.6. Exit strategy and sustainability (max. 500 words, approximately 1 page)

The Project is designed to address key barriers to delivering sustainable climate information services and MHEWS to enhance climate resilience. It will create an enabling environment for long-term climate resilience through the integration of climate services and MHEWS into key policies, strategies, plans and budgets, and this will provide a foundation for uptake of climate information in decision-making in different sectors. Its sustainability will be further ensured through targeted activities for capacity building, knowledge management and learning. Potential sources of continuing future support, particularly in-country revenue sources, will be investigated throughout the implementation of the Project.

The following are key elements of the exit strategy, ensuring sustainability beyond the Project's lifespan:

- The Project is **demand-led**: it is closely aligned with key government policies and commitments – Timor-Leste's UN Sustainable Development Cooperation Framework (2021 – 2025), its Intended Nationally Determined Contributions (2016), its Initial National Communication to the UNFCCC (2014), the Environmental Policy (2012), Timor-Leste's National Adaptation and Program of Action (NAPA) on Climate Change (2010) and the National Disaster Risk Management Policy (2008). The highest priorities of key stakeholders were established during individual consultations and a workshop with stakeholders in Timor-Leste (23 – 24 November 2017). Project activities have been identified through extensive consultation with in-country users and potential users of climate information. The close engagement in the design process of the DNMG and other agencies who will implement the Project, and their engagement in adjusting its inputs over the Project's term, ensures that they will continue to be invested in its success.
- The Project is also **aligned to the objectives of WMO's Regional Area V (RAV)**, which covers South-East Asia and the Pacific. Partners in neighbouring Indonesia have committed to provide peer-to-peer, South-South support over the term of the Project. Furthermore, the Project will facilitate actions outlined in the Timor-Leste Strategic Development Plan 2011 – 2030, in particular through improving cooperation between government agencies to support vulnerable people impacted by natural disasters; and building strong capabilities across Timor-Leste to prepare for and manage disaster risks.
- The Project prioritises a **robust knowledge management approach** to maximise the value of climate information and support long-term replicability and sustainability of Project outcomes. Targeted training

and capacity building throughout the Project will support enhanced in-country skills, knowledge and expertise. Where relevant, a training of trainers (ToT) approach will be utilised – the concept of which is to initiate a training cascade: skills and knowledge are taught to a small group of trainees who become trainers and go on to transfer those skills to others. ToT is a strong predictor of sustainability due to its potential to upskill the workforce rapidly, cheaply and exponentially by developing local educators.<sup>169</sup> The ToT approach will ensure that capacity to train new employees is sustained beyond the lifetime of the Project. The establishment of a User Interface Platform (UIP) will provide a dedicated forum for multi-stakeholder knowledge sharing on climate services and disaster risk management. The UIP will facilitate enhanced stakeholder coordination and sharing of lessons learned, enabling interventions to be continuously optimised for improved efficiency, economy and effectiveness. The national Climate and Health Working Group will specifically promote coordinated and sustained collaboration and information exchange between the climate and health sectors, which will improve understanding and application of climate knowledge for health. Furthermore, the Project will strengthen Traditional Knowledge management to simultaneously enhance the capacity of communities to understand and use scientific forecasts and warnings, whilst also building the awareness and capacity of scientific forecasters to integrate traditional knowledge and downscale forecasts for relevance at the local level. This approach will facilitate enhanced complementarity between traditional and scientific knowledge systems.

- The Project will **strengthen the existing national hydrometeorological service (DNMG) and National Disaster Management Directorate (NDMD) rather than creating new parallel structures for climate services and disaster risk management**. It will build on the DNMG's existing strengths and capacities and be informed by its local knowledge. Implementation of a Quality Management System (QMS), enveloping the total value-chain of climate services (institutional, operational infrastructure, human resources, systems and processes) and the achievement of QMS certification will contribute to sustained operations and maintenance in the longer-term. Sustainability will be supported by the establishment of the National Framework for Climate Services, and its fine-tuning over the Project's term, to ensure the effective governance, coordination and management of the DNMG's services. The Framework will progress from initial discussion of priorities and options, using feedback and review mechanisms, to develop the climate information services most useful to end-users at all levels. The EWS will be fully integrated into the national emergency management framework and budgets, making its actual cost transparent to the Government and its development partners.
- The Project will adopt a **broad multi-stakeholder approach** and bring on board different ministries, agencies, educational institutions, NGOs, private sector actors, communities and others, representing both producers and users of climate information and early warning products. The National Climate Outlook Forum (NCOF) will be a key platform for these interactions. The NCOFs will facilitate the Project to build on mutual and complementary strengths, and leverage emerging synergies from existing stakeholders, networks and initiatives. In particular, the NCOFs will provide an enabling environment to enhance cooperation and maximise synergies between the multiple actors in weather, water and climate services in Timor-Leste – including the UNDP project team and national stakeholders involved in the GCF project FP109. Multiple stakeholders will thus have interests in the continuance of the Project's outputs and outcomes. Capacity development activities and awareness raising will enhance the capacity of all stakeholders to use climate information and early warnings effectively to better prepare for and reduce the impacts of climate change. The public outreach and demonstration outcomes will be documented, and benefits quantified, to generate evidence to convince policy- and decision-makers of the added value of climate information and early warning services supported by the Project and invest in its long-term maintenance.

---

<sup>169</sup> Mormina, M. and Pinder, S. Globalization and Health. 2018. A conceptual framework for training of trainers (ToT) in global health

- The focus of Result 1 is to establish a **sustainable delivery model for climate services** in Timor-Leste based on a **value chain approach** to service delivery. This will include establishment of a National Framework for Climate Services (NFCS) to coordinate, facilitate and strengthen collaboration between national institutions for enhanced use of climate information and provision of climate services. The NFCS is based on the Global Framework for Climate Services (GFCS), which is the principal framework for delivery of climate services for science-informed decision-making on climate change and sustainable development. The NFCS will be supported by stakeholder coordination mechanisms – including establishment of a **User Interface Platform** and **National Climate Sector Action and Communication Plans** for each of the five GFCS priority sectors – to integrate climate risk knowledge into climate-sensitive sectors. Climate risk-informed investment will be essential for technically sound, effective and sustainable development for long-term climate resilience. The benefits resulting from investments in climate services are far greater than the losses they will help prevent. To facilitate establishment of the sustainable delivery model, the Project will identify opportunities for i) development of value-added climate products and services; ii) public-private partnerships in the generation, translation and transfer function; and iii) private sector investment and sponsorship. The Project will establish a **new framework for financing climate services** to ensure a long-term financially sustainable business model for DNMG. The identification of appropriate funding modalities and capitalisation opportunities for climate information services will ensure that DNMG has more predictable and sufficient funds to sustain and ensure the ongoing operation of its mandated services, including through the Systematic Observations Financing Facility (SOFF), which is being established by WMO and partners to support the Global Basic Observing Network (GBON) as a public good. The Project will also facilitate the development of information products and services that have commercial value to climate-sensitive industries such as agriculture in the future. For example, long-range climate forecasts enable farmers to manage the entire value chain – from land preparation to crop harvesting – to maximise productivity.
- The Project will introduce new and cost-effective hydrometeorological equipment and tools for strengthened observations, monitoring, modelling and prediction with assistance from international experts to strengthen in-country technical skills and maintenance capability. Under Result 2, the Project will **expand and upgrade the meteorological observation network** in compliance with the Global Basic Observing Network (GBON) and to enable DNMG to achieve WMO Category 2 (Essential Services). Establishment of a **low-cost weather radar network** is an innovative means to complement GBON investments with high spatio-temporal resolution data from equipment that is practical to the context of Timor-Leste – both in terms of capacity and its highly mountainous topography. The enhanced accuracy, timeliness and resolution of observations will enable DNMG to develop and communicate **actionable climate information products, impact-based forecasts and multi-hazard early warnings**. Regional organisations and development partners will continue to provide technical assistance, research and technology transfer beyond the term of the Project. Furthermore, through sector engagement and targeted last-mile delivery, stakeholders from national to community level will start to appreciate the **value of improved climate information** for safeguarding lives and assets, as well as for climate-resilient development in the longer term. Through dedicated interventions in Result 1, this will provide the foundation for potential **cost recovery for climate services** beyond the Project implementation period. For example, weather radar data is highly valuable in increasing the accuracy and reliability of weather forecasts. X-band radar in particular provides precise measurements for a specific location, enabling accurate detection and nowcasting of hazardous conditions – a crucial asset for the aviation sector. Building DNMG's capacity in weather radar operations could catalyse investment in more advanced systems for revenue generation beyond the Project's lifespan.
- The Project will introduce **Forecast-based Financing (FbF) / Early Warning Early Action (EWEA) to ensure timely and sustainable preparedness actions**. The innovative mechanism will enhance the impact of early warning systems by build capacity to catalyse pre-planned early actions based on forecast triggers, supported by pre-allocated funding. Long-term sustainability will be ensured through the

identification of a country-driven, scalable financial mechanism that will deliver predictable and sustainable funding. FbF/EWEA will be incorporated into the overarching financial framework for climate services to maximise coordination between the climate and disaster risk management sectors. The Project will partner with the IFRC and FAO, which have already successfully implemented pilot projects that demonstrate FbF/EWEA to be a sustainable and effective mechanism.

- The Project will maintain climate resilience at the last mile through its emphasis on **community engagement, local capacity building and targeted multi-channel communications** to reach vulnerable populations. The Project will engage with communities through targeted and gender-responsive public awareness and education campaigns; agriculture extension services; and co-development of community-based early warning systems, disaster risk management approaches, Community Action Plans (CAPs) and Early Action Protocols (EAPs) to build preparedness capabilities that are practical in the local context. Community-based activities will be guided by participatory approaches to better understand differential vulnerabilities and capacities to ensure that capacity building activities are mutually supportive and responsive to the needs of the people most closely concerned. The establishment and operationalisation of localised coordination mechanisms, SOPs and contingency plans, and active participation of CBOs and women's groups, will anchor interventions at the local level so they are not dependent on ongoing external support. Accurate forecasting, impact-based early warnings and well-developed local preparedness capabilities are highly complementary and mutually reinforcing. The Project will concurrently address these elements to facilitate that behavioural and attitudinal changes in the use of climate information sustain the value of the early warning system beyond the Project lifespan.
- The Project has developed a comprehensive plan for **Operations and Maintenance (O&M)**, which outlines how specific O&M needs and costs will be addressed and budgeted for both during and post implementation of the Project. DNMG has assumed responsibility for securing O&M after the Project implementation period for up to 20 years. The draft plan provided as Annex 21 will be refined during the Project's inception and implementation. Furthermore, DNMG has formally committed to sustaining some of the critical functions to be introduced by the Project (meteorology, oceanography and Operations & Maintenance) after its implementation period. In addition, as a Technical Partner in this Project, the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) has also formally committed to continue supporting DNMG after the end of the GCF Project. This includes back-up support, technical enhancements, and system upgrades to the Climate Data Informatics System (CDIS) as well as decision support systems for ocean services, agriculture, disaster management and health sectors. During implementation, the Project Manager will ensure that O&M inputs are recorded in annual national budget documentation. The costs will be provided as detailed, disaggregated line items at an appropriate point in the financial year to ensure that they are included in budget preparations and to establish an accurate understanding of the required expenses. Targeted training for O&M will be delivered by the Indonesian Meteorological, Climatological and Geophysical Agency (BMKG) to build the capacity of DNMG to sustain equipment operations beyond the Project implementation. Moreover, through the Global Basic Observing Network (GBON) initiative, it has been widely recognised that accurate weather and climate observations required for global Numerical Weather Prediction (NWP) are a global public good to be financed in a sustainable and predictable manner. Accordingly, the Systematic Observations Financing Facility (SOFF) is being established as a priority of the Alliance for Hydromet Development, of which the GCF, GEF, Multilateral Development Banks and the AE amongst others are members. The SOFF is envisaged to be launched at the UN Climate Change Conference (COP26) in November 2021. Following the Project implementation period, technical and financial assistance from the SOFF is expected to be available to Timor-Leste to support sustained GBON compliance. The SOFF is also expected to enable Timor-Leste to access on-demand O&M advisory services through tailored and hands-on peer-to-peer support via the WMO Country Support Initiative.

- The Project will **generate additional datasets of climate information of significant value** both to Timor-Leste and to its development partners. Donors supporting infrastructure, agriculture, fisheries, health, transport, tourism and water management activities need reliable data for climate-resilient sustainable development and to avoid waste, maladaptation and the creation of stranded assets. The observed value of improved datasets and regular reporting of these outcomes through Project communications via public and social media will reinforce support for the ongoing maintenance of the improved observation network, data management and new DNMG functions. The importance to the international scientific community of extended, better quality data, including ocean data, and its value to global observing systems is also likely to generate continued support from international development partners beyond the term of the Project.

## C. FINANCING INFORMATION

### C.1. Total financing

The financing outlined below represents the entire budget for the Project, without the need for any additional financing.

(a) Requested GCF funding (i + ii + iii + iv + v + vi + vii)		Total amount		Currency			
		\$20,980,722.33		USD (\$)			
GCF financial instrument		Amount	Tenor	Grace period	Pricing		
(i)	Senior loans	Enter amount	Enter years	Enter years	Enter %		
(ii)	Subordinated loans	Enter amount	Enter years	Enter years	Enter %		
(iii)	Equity	Enter amount	Enter years		Enter % equity return		
(iv)	Guarantees	Enter amount					
(v)	Reimbursable grants	Enter amount					
(vi)	Grants	\$20,980,722.33					
(vii)	Result-based payments	Enter amount					
(b) Co-financing information		Total amount		Currency			
		\$748,400.00		USD (\$)			
Name of institution		Financial instrument	Amount	Currency	Tenor & grace	Pricing	Seniority
Government of Timor-Leste		In kind	\$748,400.00	USD (\$)	5 years 5 years	Enter%	Options
(c) Total financing (c) = (a)+(b)		Amount		Currency			
		\$21,729,122.33		USD (\$)			
(d) Other financing arrangements and contributions (max. 250 words, approximately 0.5 page)		The Government of Timor-Leste will provide co-financing as detailed at the Activity level in section C.2 below. Timor-Leste has signed a Co-Financing Commitment Letter (see Annex 13).					
		Co-financing for Timor-Leste will be provided through equipment (MAF supported tables for extension officers), training/workshop/conferences (MAF provision of training facilities) and staff costs (Secretary of State for the Environment awareness and education activities).					

### C.2. Financing by component

Project Result	Budget	GCF financing		Co-financing		
		Amount	Financial Instrument	Amount	Financial Instrument	Name of Institutions
	million USD (\$)	million USD (\$)		million USD (\$)		
1. Strengthened delivery model and legislation for climate information and multi-hazard early warning services	<b>Activity 1.1 – Establish institutional and policy frameworks, legislation and delivery models for climate services</b>					
	\$491,269.80	\$491,269.80	Grants			
<b>Total Result 1</b>	<b>\$491,269.80</b>	<b>\$491,269.80</b>				
2. Strengthened observations, monitoring, analysis	<b>Activity 2.1 – Enhance infrastructure and technical support for observations and monitoring</b>					
	\$6,552,651.27	\$6,552,651.27	Grants			

and forecasting of climate and its impacts	<b>Activity 2.2 – Strengthen climate modelling and impact-based forecasting</b>					
	\$3,822,278.00	\$3,822,278.00	Grants			
	<b>Activity 2.3 – Establish climate services for health</b>					
	\$2,397,812.70	\$2,397,812.70	Grants			
<b>Total Result 2</b>	<b>\$12,772,741.97</b>	<b>\$12,772,741.97</b>				
<b>3. Improved dissemination and communication of risk information and early warning</b>	<b>Activity 3.1 – Establish targeted multi-hazard early warning information systems</b>					
	\$2,532,683.55	\$2,384,283.55	Grants	\$148,400.00	In kind	Gov of Timor-Leste
<b>Total Result 3</b>	<b>\$2,532,683.55</b>	<b>\$2,384,283.55</b>		<b>\$148,400.00</b>		
<b>4. Enhanced climate risk management capacity</b>	<b>Activity 4.1 – Build capacity to prepare for and respond to climate risks and hazards</b>					
	\$2,054,413.26	\$1,488,163.26	Grants	\$566,250.00	In kind	Gov of Timor-Leste
	<b>Activity 4.2 – Establish Forecast-based Financing (FbF)</b>					
	\$1,688,405.00	\$1,688,405.00	Grants			
<b>Total Result 4</b>	<b>\$3,742,818.26</b>	<b>\$3,176,568.26</b>		<b>\$566,250.00</b>		
<b>Project Management Costs</b>	\$987,100.30	\$953,350.30	Grants	\$33,750.00	In kind	Gov of Timor-Leste
<b>Monitoring and Evaluation Costs</b>	\$932,508.45	\$932,508.45	Grants			
<b>Contingency</b>	\$270,000.00	\$270,000.00	Grants			
<b>Total (USD\$)</b>	<b>\$21,729,122.33</b>	<b>\$20,980,722.33</b>		<b>\$748,400.00</b>		

**C.3 Capacity building and technology development/transfer (max. 250 words, approximately 0.5 page)**

C.3.1 Does GCF funding finance capacity building activities?

Yes  No

C.3.2. Does GCF funding finance technology development/transfer?

Yes  No

The Project includes significant capacity building inputs across government bodies and civil society organisations involved in the provision of early warning services relating to climate variability and climate change. Transfer of appropriate technology will be effected through the contribution of modern, low maintenance observation and communication equipment, with on-going training in operation and maintenance. Over its five-year term, the Project will help build national capacity to provide the essential high-resolution data and climate information needed in planning all nationally and internationally funded climate-sensitive investments.

The Project interventions are designed to establish the value of climate data to all levels of Timor-Leste's economy from government policy- and decision-makers to subsistence farmers, and to establish sustainable financial support so that strengthened capacity can be maintained.

All four Project Results include capacity building activities. Result 1 will enable Timor-Leste to develop institutional and policy frameworks for strengthened climate information services, working with the National Directorate for Meteorology and Geophysics (DNMG) to create coordination mechanisms with key climate-sensitive sectors, including disaster risk reduction, water and health. A comprehensive National Framework for Climate Services (NFCS) will give sector agencies ready access to sound scientific research and useable information, building their capacity to implement effective adaptation policies and practices. In addition, the Project will build capacity in data governance by strengthening the DNMG's climate data management

system with the support of RIMES. Timor-Leste's Statistics Directorate will also be supported in using climate data and information with data from other sectors in order to mainstream climate considerations into the work of those sectors. Strengthened data sharing and coordination among DNMG and other key stakeholders, including the National Directorate for Water Resource Management (DNGRA), National Disaster Management Directorate (NDMD) and the Statistics Directorate, will maximise the value of existing datasets (such as water-level monitoring observations) and advance the integration of multi-sectoral data for improved forecasting and early warning.

Result 2 will fund the procurement and installation of new technology and build DNMG capacity in climate observation, monitoring, modelling and prediction, and through training in operations and maintenance. It will also develop the customised System for Multi-Hazard Potential Impact Assessment and Emergency Response Tracking Decision Support System (SMART DSS) and enable relevant agencies to utilise impact-based forecasts and overlay multi-hazard assessments and maps with development plans and processes. The Project will also establish new technologies for health risk forecasting and decision support, including a mobile app and a hybrid ambient air quality monitoring system. Targeted capacity development in the NDMD, DNGRA, Ministry of Health, the Ministry of Agriculture and Fisheries, and other relevant authorities will ensure that Timor-Leste has the requisite skillsets to maintain and benefit from the new technologies in the long term. Advancement in establishing Internet of Things (IoT) for innovative weather, water and climate applications will further contribute.

Result 3 will build national capacity to deliver effective Early Warning Systems (EWS) and work with agriculture extension officers, building capacity to understand climate data and its implications and to explain information to the farmers they advise. It will also work with communities to co-develop socially inclusive and gender-responsive communication strategies that will enhance the effectiveness of the EWS and public awareness campaigns.

Result 4 will enhance disaster preparedness capabilities from the national to community level through targeted capacity building workshops, awareness raising and education. It will upgrade the NDMD's EWS infrastructure and access to the Internet and to consistent IT support, which will ensure that NDMD is able to communicate with other agencies, including NGOs and with communities during extreme weather events. Furthermore, agencies (Government ministries and directorates, local and international NGOs) with current responsibilities and experience in disaster preparedness will be supported to accelerate their capacity in forecasting and advising on effective preparation for responding to extreme climate events, including through the development of Forecast-based Financing capacity.

## D. EXPECTED PERFORMANCE AGAINST INVESTMENT CRITERIA

*This section refers to the performance of the project/programme against the investment criteria as set out in the GCF's [Initial Investment Framework](#).*

### D.1. Impact potential (max. 500 words, approximately 1 page)

This Project will deliver transformative impact in Timor-Leste. It will increase resilience and enhance livelihoods of the population of Timor-Leste through a paradigm shift to evidence-based decision making, and through strengthened preparedness to climate risks. This will be achieved by strengthened delivery of climate services and multi-hazard early warnings, which are crucial for building the climate resilience of Timor-Leste and its vulnerable communities. As climate-related hazards increase, the Project will enhance delivery of timely, credible, impact-based and actionable climate and weather information. Moreover, the Project will reach the “last mile” by engaging communities in the understanding and use of actionable climate information products and targeted early warning alerts. This will eventually lead to a reduction in the number of people affected by climate-related hazards.

The Project will contribute to the achievement of the following Fund-level impacts stated in the GCF Performance Measurement Framework (PMF):

#### **A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities, and regions.**

The Project aims to improve the resilience of 1,293,119 people (51% male and 49% female). This represents the entire population of Timor-Leste who are expected to benefit from the Project's significant in-country capacity building to deliver integrated weather, water and climate information services, impact-based multi-hazard early warning systems (MHEWS), and evidence-based decision-making and planning underpinned by high-resolution data, information and risk knowledge. This includes 1,034,495 direct beneficiaries (80% of the total population), which is the estimated population most at risk from worsening climate-related hazards, particularly from drought, flooding, and landslides that are often precipitated by extreme rainfall events. People are also affected by coastal inundation, storm surges and cyclones. Both coastal populations and communities in remote inland areas are increasingly at risk from loss of livelihoods and assets as well as injury and loss of life.

The cost-benefit analysis (CBA) for EWS in Timor-Leste shows a positive net present value (NPV) of US \$56.01 million with a 10% discount rate. The economic internal rate of return (EIRR) of 104.3% exceeds the discount rate, making the proposed investment economically viable. Sensitivity analysis has been used to test key parameters such as a decrease in benefits by 10% or an increase in costs of 10%. Although the EIRR decreased with those simulated cost benefit changes, the EIRR remained well above the 10% threshold in both cases (90.2% and 91.5% respectively). In addition, an even more pessimistic scenario combining a decrease in benefits by 10% and an increase in costs by 10% still results in a very high NPV and EIRR (US \$46.81 million and 79.4%). The overall conclusion is that proposed EWS interventions will have substantial benefits, even if costs have been underestimated and benefits overestimated. The CBA provides positive quantitative justification for the Project, which is estimated to generate a benefit-cost ratio of 5.7:1. This suggests that each USD 10 invested will translate to benefits with a value of USD 57.

The Project aims to reduce the expected losses of lives and economic assets from the impacts of extreme climate-related disasters and is expected to achieve an overall reduction in damages and losses through increasing the safeguarding of assets (such as fishing boats and equipment, agricultural land and properties) from climate-related hazards through accurate, timely and actionable early warning services established by the Project. Actionable climate information products, particularly for agriculture, health, water and disaster management, will increase resilience and reduce the risks from climate-related hazards, thus minimising losses and damage to crops and other assets. Strengthening DNMG with modern and cost-effective infrastructure and support for local capacity and institutional development will enable Timor-Leste to improve

services to the level required to provide the evidence base for risk-informed decision making and planning, Forecast-based Financing and Early Warning Early Action.

## **A2.0 Increased resilience of health and well-being, and food and water security**

The Project will promote multi-stakeholder climate action, bringing together actors in sectors such as public health, disaster risk management, agriculture and water resource management and empowering them with actionable knowledge to enhance their resilience to increasing climate threats. Improved understanding of climate risks to health and well-being, and food and water security, through tailored forecasting and a health sector-specific decision support system together with targeted training, awareness-raising and climate-related health impact advisories will enable decision-makers – from government leaders to individual citizens – to take appropriate actions to keep the population of Timor-Leste safe and healthy. Continuous engagement of multiple stakeholders across the climate services value chain – for example, through the national Climate and Health Working Group – will enable identification of climate-related health, food and water security priorities and development of the most appropriate products and services to address these priorities. Moreover, the Project proposes to increase the proportion of households that have secure food and water sources through the establishment of end-to-end early warning systems for extreme climate events that threaten food production and water supplies. A high proportion of rural households are known to have very precarious incomes and resources, which are put further at risk by their lack of information about climate threats. Currently, Timor-Leste has insufficient capacity, data and infrastructure to provide adequate warnings. Furthermore, the Project will work with agriculture extension officers to introduce the use of sector-specific forecasts and early warnings to inform climate-resilient planning, and the Project will also address the need for early warnings of extreme events.

A complementary GCF-funded UNDP project “Safeguarding communities and their physical assets from climate-induced disasters in Timor-Leste” (FP109) is addressing key elements of hydrology and hydraulics, which will contribute to enhancing water security. This includes flood risk mapping, flood modelling, and forecasting for major river basins. The Project will build on their outputs and address the critical gap of integrating the observation data from monitoring stations (including hydrometric and hydrological) maintained by various agencies (including the National Directorate for Water Resource Management – DNGRA). The proposed Climate Data Informatics System (CDIS) will host all hydrological data along with weather and climate data in a single platform for easier access, quality control, and generation of derived products. The approach taken to integrate hydrology and hydraulics throughout the Project takes into account the low baseline capacity in Timor-Leste and has been carefully designed to complement FP109, rather than duplicate it. Complementarity with FP109 will be accomplished without any additional budgetary allocation. A multi-level institutional arrangement has been developed to facilitate establishment of synergy and effective collaboration. The arrangement is outlined in Section 9 of the Feasibility Study (Annex 2).

## **A6.0 Increased generation and use of climate information in decision-making**

The Project will substantially expand the geographical coverage of weather and climate observations in Timor-Leste and its coastal waters by modernising observation and communication equipment, refurbishing and upgrading weather stations and installing additional observation equipment in compliance with Global Basic Observing Network (GBON) requirements. Additional data will be made available as information to government sector agencies and other relevant platforms (such as cloud computing).

The Project will support the development of tailored information products for communities, climate-sensitive sectors and other relevant stakeholders, with a particular emphasis on the agriculture, health, water and disaster risk management sectors. It will support DNMG and key stakeholders to translate hydrometeorological, climate and sector information into sector-relevant impact-based forecasts, which in turn will feed into sector-specific decision-support systems (DSS). The overall aim of the DSS will be to complement and improve efficiency in the dissemination of forecasts, early warning and response advisories. It will provide a means for decision makers and disaster managers to correlate between scientific parameters and potential impacts by visualising information in a user-friendly, understandable and actionable format.

The Project interventions (namely Sub-Activities 2.2.3 and 2.3.3) are designed to ensure that development and operationalisation of the DSS is realistic within the budget and timescale of the Project and will be sustainable beyond the implementation period – as elaborated in Section 9 of the Feasibility Study (Annex 2).

Moreover, the Project will foster mutually beneficial partnerships between the DNMG and climate information users, so that the meteorological service understands how sectors and communities want to use information. It will support DNMG in training users to understand climate basics and apply information to planning. The National Climate Outlook Forums / Monsoon Forums, established in Year 1, will serve as the key vehicles for facilitating the use of climate information in different sectors, such as agriculture, fisheries, water and disaster management. The national Climate and Health Working Group to be established will enhance collaboration between DNMG and health professionals to co-produce health-tailored climate information; and build capacity for climate services to be institutionalised as decision tools to improve public health outcomes. The Project will also directly introduce tailored products to various audiences such as subsistence and commercial farmers, either through agricultural extension officers or directly through community outreach by DNMG.

#### **A7.0 Strengthened adaptive capacity and reduced exposure to climate risks**

The Project will establish a people-centred, impact-based multi-hazard early warning system (MHEWS), derived from a systematic needs assessment (see Feasibility Study – Section 6) of the existing situation and in partnership with organisations active in disaster risk management. Result 4 addresses an integral element of MHEWS by enhancing disaster preparedness capabilities from national to local level, whilst concurrently equipping and empowering communities with the risk knowledge to make informed decisions to better prepare for and manage the impacts of climate-related hazards. Enhanced risk knowledge contributes to strengthened resilience and adaptive capacity. The actual implementation of specific adaptation or “response” activities is beyond the scope of the Project.

The Project will develop actionable early warnings supporting the work of extension officers with subsistence and commercial farmers on restorative agriculture. It will provide training and awareness workshops to build community capacity to prepare for forecasted climate-related hazards. A targeted awareness and education campaign for women will empower them with enhanced knowledge and understanding of disaster risks to support increased participation in disaster risk management and decision making for climate resilience. The Project will work with local partners that have expertise in engaging with communities in Timor-Leste to ensure that EWS information reaches the “last mile”. In addition, the Project will introduce seasonal forecasting and generate data from ocean areas, which will support safety of life at sea, generate local-scale forecasts and monitoring of extreme events in real time, and improve communication to and from all communities through robust, reliable technology.

#### **A8.0 Strengthened awareness of climate threats and risk-reduction processes**

The Project is expected to significantly increase awareness of climate hazards and appropriate disaster risk reduction measures within the government agencies, sectors and communities. It will support sector agency officers to understand climate processes and mainstream climate awareness into policy and planning through the conduct of National Framework for Climate Services workshops, the annual National Climate Outlook / Monsoon Forum, national Climate and Health Working Group, tailored information products, sector-specific training and workshops.

The Project will work with communities and partners to develop basic understanding of climate processes and climate change, and related health and environmental risks. It will support the development of effective preparedness actions to early warnings of climate hazards, which will facilitate acceptance of the DNMG’s warnings and advice, and contribute to saving lives, livelihoods, crops and assets.

The inclusion of activities that aim at building preparedness capabilities (namely Result 4) is in line with the approved GCF project FP147<sup>170</sup> and are included as a key element in a holistic climate information and early warning services (CIEWS) project designed to deliver transformational impact to the last mile. Such activities provide an opportunity to extend the reach of the CIEWS to the last mile – sensitising communities to the value of climate information and early warnings towards reducing the impact of climate-related hazards and providing an entry point to build trust in scientific knowledge systems and demonstrate their complementarity with local knowledge. The inclusion of Result 4 is in line with international best practices for delivering end-to-end, people-centred multi-hazard early warning systems (MHEWS) that “*empower individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner to reduce the possibility of personal injury and illness, loss of life and damage to property, assets and the environment*”, as stated in the Checklist prepared by the partners of the International Network for Multi-Hazard Early Warning Systems.<sup>171</sup> The need to “ensure that financing covers all segments of the EWS value chain” is also a key strategic recommendation in the WMO 2020 State of Climate Services report.

## D.2. Paradigm shift potential (max. 500 words, approximately 1 page)

The Project will enable a paradigm shift to evidence-based planning and early action through accurate, timely and actionable climate information, impact-based forecasting, people-centred multi-hazard early warning systems (MHEWS) and Forecast-based Financing – an innovative mechanism for disaster preparedness and early action demonstrated to save lives.<sup>172</sup> This will result in a transformation to increased resilience to climate change threats and enhanced livelihoods, and a reduction in the damages and losses incurred through the increased frequency of climate-induced disasters, such as flooding and landslides. Avoided economic losses will result from better preparedness to extreme events due to the use of improved forecasts, early warning and early action, with sustained engagement and involvement of end-users in disaster risk management.

### Potential for scaling-up and replication

The Project is expected to achieve transformational change in the understanding and use of climate information and early warnings from national to community level. The National Framework for Climate Services (NFCS) to be developed will be designed to facilitate delivery of best practice climate services throughout Timor-Leste. The NFCS will facilitate the integration of climate services into relevant national policies, strategies and plans, providing a solid foundation for the uptake of climate information into decision-making and upscaling of Project interventions. This will be further complemented by development of a sustainable financial framework and business model for climate services, including budget allocation and identification of cost-recovery options, and institutional and capacity building of DNMG. To sustain forecast-based early action, a country-driven, scalable financial mechanism will be identified.

The Project’s approach to development of climate products and services tailored to specific end-user needs has intrinsic replication potential, as does the development of methodologies, standard operating procedures (SOPs) and forecast-based early action mechanisms. In addition, the location of community-based interventions will be selected to optimise the spatial distribution of activities and outcomes, thereby increasing the likelihood that climate resilient approaches (e.g., community-based disaster management and preparedness actions) are observed and adopted by non-direct beneficiary communities. There is high potential for in-country scalability of community-based activities and South-South knowledge sharing (including with FP147<sup>173</sup>), supporting replication in other Pacific SIDS. Finally, the User Interface Platform

<sup>170</sup> <https://www.greenclimate.fund/project/fp147>

<sup>171</sup> WMO, 2018. Multi-hazard Early Warning Systems: A Checklist

<sup>172</sup> IFRC, 2017. Forecast-based Financing: Effective early actions to reduce flood impacts. Available at: [https://www.preventionweb.net/files/62642\\_casestudy5bangladeshfbfinal.pdf](https://www.preventionweb.net/files/62642_casestudy5bangladeshfbfinal.pdf)

<sup>173</sup> <https://www.greenclimate.fund/project/fp147>

will enable information, advice and lessons learned to be communicated to multiple stakeholders, which will facilitate the successful upscaling of Project activities across Timor-Leste.

### **Potential for knowledge and learning**

Timor-Leste's circumstances mean that it will benefit from the lessons learnt by other SIDS in the transition to evidence-based planning and early action. Established relationships with Pacific SIDS neighbours will be useful, particularly with countries experiencing similar constraints and implementing similar programs, though from a more advanced starting point. There is potential for Timor-Leste to accelerate its progress in procurement methodologies, technology option decision-making, the development of effective communication techniques and in identifying potential business models, drawing on the experience of neighbouring SIDS.

The Project will promote robust knowledge management – including through targeted capacity building, training of trainers (ToT), mentoring, attachments and technical advisory – which will facilitate that information exchange and lesson-learning remains a priority throughout the implementation period. Engagement with RIMES, the Indonesian meteorological service (BMKG) and the Indonesian Red Cross (PMI) through this Project will enhance South-South cooperation by strengthening Timor-Leste's relationships with neighbouring countries and establishing links between DNMG and nearby national meteorological services in more developed countries. Networking with Pacific island countries engaged in similar programs and among development partners working with both Timor-Leste and Pacific countries will foster sharing of lessons with particular relevance to SIDS.

At the national and sub-national level, the National Climate Outlook Forum will function as a knowledge management platform between climate information providers and end-users to facilitate exchange of knowledge and lessons learned. The national Climate and Health Working Group will enhance this function with specific emphasis on delivering climate services for public health and well-being. Knowledge and learning will be a key focus of Project interventions – from technical training for agriculture extensionists to community-based disaster risk reduction workshops. The Project recognises the complementarity of the traditional and scientific knowledge systems, and the critical importance of integrating such knowledge for effective climate resilience at the local level. Traditional knowledge provides observations and interpretations at a much finer spatial scale than climate science and with considerable temporal depth, identifying elements that may be overlooked by climate scientists.<sup>174</sup> Engagement with communities to develop localised Community Action Plans (CAPs) and SOPs will integrate both traditional and modern scientific climate knowledge to improve community understanding of climate science, and DNMG's understanding of how traditional knowledge is used. Involvement of communities in the development and implementation of Project interventions will ensure that decision-making is accountable and responsive to the populations affected and ensure local appropriateness of international best practices.

Furthermore, the Monitoring and Evaluation Plan and regular activity monitoring processes will be used to revise and improve the Project interventions throughout its 5-year term to ensure impact evaluation, with progress documented and publicised.

### **Contribution to the creation of an enabling environment**

An important focus of the Project is to support the establishment of an enabling environment for long-term sustainability, which will be facilitated through the integration of climate services and MHEWS into key policies, strategies, plans and the national budget. This will provide a foundation for uptake of climate information in decision making and support sustainable service provision in the long-term, beyond the Project's duration. The National Framework for Climate Services, seasonal National Climate Outlook

---

<sup>174</sup> UNESCO, 2012. Traditional knowledge for climate change assessment and adaptation

Forums, national Climate and Health Working Group and the new framework for financing climate services will be critical to achieving this.

Enhancing coordination and forging robust multi-stakeholder partnerships for climate services, early warning systems, disaster risk management, water resource management and public health will create an enabling environment for long-term resilience. This includes the development or strengthening of policy, legal and regulatory frameworks conducive to increased political commitment, and to awareness in public and private sectors of disaster risk reduction and management as a strategic development priority. This will promote the allocation and mobilisation of the resources required to sustain resilience building. The Project will build capacity for forecast-based early action through Forecast-based Financing and Early Warning Early Action (EWEA) for agriculture and food security. In the longer term, this will facilitate that climate-resilient early actions from national to community level are identified and funded before a climate shock and become an integral component of disaster risk reduction and management in Timor-Leste.

Furthermore, the Project contains several interventions that will emphasise and support private sector mobilisation. In particular, the User Interface Platform will provide a forum for dialogue and wider partnerships between the public and private sector, thereby creating an enabling environment for public-private partnerships and mutually beneficial cost-recovery mechanisms. The Project will identify opportunities for specialised climate information and early warning products with commercial value to catalyse private sector interest. Moreover, the new financial framework will emphasise private sector mobilisation as a means to enhance the sustainability of climate services and improve efficiency. In developing the framework, the Project will identify suitable revenue streams and effective strategies to incentivise and mobilise private sector resources.

### **Contribution to the regulatory framework and policies**

Timor-Leste is in the process of building its legislative and regulatory framework in most sectors, since its achievement of independence in 2002, and of establishing national policies relating to environmental management and disaster risk reduction. The Project presents an opportunity to clarify and formalise relationships among relevant agencies and with users of weather, water and climate data and information.

The Project will support Timor-Leste in building capacity to provide the essential high-resolution data and climate information needed to plan all nationally and internationally funded climate-sensitive investments and establish sustainable support so that strengthened capacity can be maintained. Data from the monitoring network and vulnerability assessments will allow for better understanding and anticipation of the effects of hydrometeorological and climate events and will inform the risk assessments carried out by the GCF UNDP project (FP109). The data will also support the future formulation of science-based adaptation policies, regulations and planning for adaptation to climate change, disaster risk reduction and public health management.

The integration of climate information services into key policies, decision-making and operational processes of government entities will facilitate transformational planning and programming. This will be facilitated by establishing institutional, policy, planning and regulatory frameworks to optimise coordination between DNMG and other governmental agencies. The National Climate Sector Action and Communication Plans and National Meteorological Strategy will facilitate that developed policies (e.g. the NFCS and National Meteorology Act) are being effectively applied at the national and sub-national level. Local level frameworks (e.g. gender-responsive communication strategies, Community Action Plans (CAPs) and Early Action Protocols) will support proactive climate-resilient action at the community level.

### **Overall contribution to climate-resilient development pathways**

Timor-Leste articulated its commitment to pursuing climate-resilient sustainable development in its Intended Nationally Determined Contributions (2016) but asserted that international support will be required to increase its adaptive capacity. This Project will support climate-resilient development in Timor-Leste from national level to “the last mile”. The NFCS will provide the overarching framework to integrate climate

information into evidence-based planning and decision-making for climate resilience. Building capacity of the National Disaster Management Directorate (NDMD) in EWS will ensure that coordination and technical support is available to the Government, sectors and communities to effectively prepare for climate-related hazards and support disaster risk reduction in Timor-Leste. Strengthening climate resilience will help to minimise the social, economic and environmental costs of climate impacts so that they do not hinder progress towards development goals.

The development and dissemination of targeted and actionable climate information products will be transformational in building the climate resilience of key economic sectors, particularly agriculture, health and disaster risk management, but also water management, shipping, tourism and insurance. Delivered through a suite of outreach, learning and knowledge management activities, information products will catalyse more efficient and evidence-based approaches and response actions to climate risks and prevent maladaptation. This will be transformational in building the long-term resilience of sectors and communities to climate change, but also in immediate reduction of losses of assets and livelihoods caused by climate-related hazards.

Enhanced climate information will enable resilience planning for critical infrastructure impacted by climate change and climate-related hazards, through embedding tailored and actionable climate risk information into their planning, design, construction and management frameworks. A significant focus of the Project will be to build the capacity of communities to take appropriate preparedness actions and utilise climate information to better manage disaster risks. This will be facilitated through the co-development of *suco* level Community Action Plans; enhanced community-based early warning systems, particularly to support climate resilience in agriculture, health and water management; and the development of Forecast-based Financing mechanisms for proactive preparedness to manage climate risks.

As described in Section D.1., the Project will complement the GCF-funded UNDP project FP109. A multi-level institutional arrangement has been developed to facilitate this (see Feasibility Study – Section 9). The Project will extend the application of FP109 outputs beyond the initial small-scale rural infrastructure focus by linking the UNDP-led vulnerability assessments and flood hazard maps with newly established near real-time rainfall forecasts to generate sector-specific impact-based forecasts. In a mutually reinforcing manner, the enhanced data availability facilitated by the Project will provide valuable data inputs for several activities implemented under FP109. The accuracy of the hydrological and hydraulic models developed under FP109 is dependent on the quality of the input data, and particularly the availability of high-quality rainfall data for model calibration and verification. By building the infrastructural and technical capacity of DNMG to provide high-quality data in line with WMO specifications, the Project will contribute to enhanced accuracy of FP109 outputs, which in turn will improve the inputs (namely the flood hazard maps) available for integration into the Project-developed decision-support system.

### D.3. Sustainable development (max. 500 words, approximately 1 page)

The Project will create long-term social, environmental and economic benefits, as well as support gender-responsive development – as detailed below.

The Project is aligned with the Sustainable Development Goals (SDGs), the Paris Agreement, the Sendai Framework, the SAMOA Pathway, and international and national laws. With respect to the SDGs, the Project will contribute to Timor-Leste's progress towards disaster risk reduction, ecosystem protection, climate change adaptation, health and sustainable economic development. Through the proposed activities, the Project will contribute to six out of the 17 UN Sustainable Development Goals (SDGs), namely: SDG 3 – Good Health and Well-being; SDG 5 – Gender Equality; SDG 10 – Reduced Inequalities; SDG 13 – Climate Action; SDG 14 – Life Below Water; and SDG 15 – Life on Land.

The Project is also fully aligned with Outcome 6 of the UN Sustainable Development Cooperative Framework for Timor-Leste on “Sustainable management of natural resources and resilience to climate change”, which identifies “*Strengthening early warning system and capacities*” as a specific priority.

### **Environmental co-benefits**

The long-term environmental co-benefits of the Project are expected to be significant. The increased availability and use of actionable climate information can enhance natural resource management, from climate risk-informed policymaking to conservation and arresting biodiversity loss.

The Project will support Timor-Leste's national meteorological service (DNMG) to generate and deliver impact-based forecasts, decision-support systems and advisories tailored to natural resource-dependent sectors – such as agriculture and fisheries – that will facilitate the rapid identification of weather, water and climate hazards that pose environmental risks and consequently inform the safeguarding of natural resources and biodiversity. Strengthened data sharing and inter-institutional coordination with the Water Sector, as well as the provision of data inputs to enhance the accuracy of flood hazard mapping and modelling, will contribute to improved water resource management and management of hydrological risks. In addition, the establishment of marine forecasting will support improved management of coastal habitats and inform sustainable fisheries practices to minimise environmental impacts.

Air pollutants can have severe impacts on ecosystem function and contribute to biodiversity loss. For example, chemical transformations of nitrogen oxides in the atmosphere and subsequent deposition causes acidification and eutrophication of soil and water bodies respectively, which in turn affect productivity and plant growth. The Project will establish a high-resolution air quality monitoring and alerting framework that will provide multiple pathways for the Government of Timor-Leste to reduce climate change and air pollution impact through evidence-based mitigation policy and interventions.

With regard to the energy sector, detailed climate and air quality information is necessary for comprehensive environmental impact assessments and can inform energy management decisions to improve efficiency and reduce greenhouse gas emissions.

At the local level, the Project will raise awareness on weather, water and climate hazards and related risks, including to environmental health, and will build preparedness capabilities for effective early action in response to hazard warnings. Moreover, through training on the use of climate forecasts, the Project will sensitise communities to the value of climate information and early warnings towards reducing the impact of climate-related hazards, including on natural resources, ecosystems and biodiversity. This will contribute to enhanced local ownership for environmental protection and resilience building of natural environments.

At the global scale, the increased generation of essential surface-based observation data will enhance global forecasting capabilities, which in turn will improve the ability to predict and mitigate the impacts of impending environmental hazards across the world.

Moreover, the Project design emphasises alternatives to international travel, when possible. Capacity building that can be undertaken by in-country staff or delivered remotely will be the preferred option. When international travel is necessary, the Project activities will seek to consolidate the travel to avoid multiple missions. With respect to national travel, consultants will be encouraged to use low-emission vehicles, when they are available, and plan workshops in central locations to avoid unnecessary travel.

### **Social co-benefits including health impacts**

The Project interventions have many inherent social co-benefits, particularly with regard to positive impacts on health and population well-being. Climate and health are inextricably linked. There is an increasing demand for relevant, timely and usable information about weather and climate variability, change, risks and impacts to improve decision-making for enhanced resilience. There is also an urgent need to correlate these factors with air pollution – the world's largest single environmental health risk<sup>175</sup> – and to enhance joint action between the meteorological, climate and health communities to understand and reduce the health risks of

---

<sup>175</sup> WMO, 2014. Air Quality and Human Health, a Priority for Joint Action. Available at: <https://public.wmo.int/en/resources/bulletin/air-quality-and-human-health-priority-joint-action>

poor air quality. This requirement for “focusing action on upstream determinants of health, the environment and determinants of climate change in an integrated and mainstreamed approach across all sectors” is emphasised in the World Health Organization (WHO) Global Strategy on Health, Environment and Climate Change 2019.

In the case of the health sector, the Project will create an enabling environment for coordinated and sustained collaboration between climate and health experts and decision-makers to enhance understanding and application of climate knowledge for health – facilitating targeted interventions that save more lives, reduce disease burden, and enable cost savings in service delivery. The establishment a national Climate and Health Working Group will be key in this regard. The Project will work with DNMG and the Ministry of Health to co-develop tailored forecasting and a sector-specific decision support system, together with a mobile app to extend the reach of health-related forecasts and advisories to the general public. Continuous engagement of multi-sectoral and multi-disciplinary stakeholders along the climate services for health value chain will enable identification of health priorities and development of the most appropriate services to address these priorities; increase participation and ownership; improve perceptions towards the value of climate services; build in-country capacity; and align stakeholders’ objectives and expectations.<sup>176</sup>

A high-resolution spatiotemporal hybrid air quality monitoring system for fine particulate matter (PM<sub>2.5</sub> / PM<sub>10</sub>) and nitrogen dioxide (NO<sub>2</sub>) – a precursor for PM<sub>2.5</sub> and ozone (O<sub>3</sub>) – will be established in the capital city of Dili, with data feeding into a customised mobile application for air pollution warnings, forecasting and health impact advisory. In the longer term, the data will inform evidence-based air quality management policies and enable Timor-Leste to reduce its air pollution. Whilst its Intended Nationally Determined Contributions (INDC) do not require Timor-Leste to report on steps to reduce short-lived climate pollutants (SLCPs) – even though meeting the targets of the Paris Agreement is likely impossible without cutting SLCP emissions<sup>177</sup> – acting quickly to reduce SLCP emissions will benefit human health immediately and slow the rate of near-term warming.<sup>178</sup> Moreover, this intervention will support achievement of SDG target 11.6 “By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality...”, indicator 11.6.2 “Annual mean levels of fine particulate matter (e.g., PM<sub>2.5</sub> and PM<sub>10</sub>) in cities (population weighted)”. It also contributes to the aims of the WMO Global Atmosphere Watch (GAW) Programme to provide information and services on atmospheric composition to the public and to decision-makers relating to urban air pollution, especially fine particles, which is affecting human health.

Moreover, the implementation of end-to-end early warning systems will contribute to reducing harm to populations and destruction of property through improved disaster preparedness capabilities. Prevention and timely action will likely lower mortality rates and contribute to the improvement of safety, particularly within isolated and/or coastal communities. This should reduce the costs associated with recovery actions, and consequently, have a positive economic impact (see economic co-benefits below).

At the community level, the Project will conduct targeted awareness-raising and education on climate-related health risks, as a key trigger in encouraging protective behaviours and increasing collective local capacity to prepare for and manage climate impacts. Moreover, the Project will build capacity to understand and use weather, water and climate forecasts and identify climate risks. This will enhance local knowledge and empower communities to increase their resilience to climate change impacts. Avoided loss of assets and livelihood sources will help to alleviate poverty in beneficiary communities through reduced loss of income. Social cohesion will be promoted through community-based interventions and co-development of localised climate risk management plans.

---

<sup>176</sup> WMO and WHO, 2016. Climate Services for Health

<sup>177</sup> BBC, 2019. Cut air pollution to fight climate change – UN. Available at: <https://www.bbc.co.uk/news/science-environment-49134175>

<sup>178</sup> WHO, 2018. First WHO Global Conference on Air Pollution and Health. Climate change and air pollution: two sides of the same coin. Available at: [https://www.who.int/airpollution/events/conference/Climate\\_change\\_background.pdf](https://www.who.int/airpollution/events/conference/Climate_change_background.pdf)

In addition, the Project activities will create employment opportunities for national employees, particularly through hiring local consultants who will be employed by civil society organisations and government institutions. Local businesses will also benefit, as catering services, conference venues and interpreters will be employed as part of the workshop activities. Lastly, GCF and UNEP labour standards will be integrated into the Project interventions, thus ensuring international best practices regarding safety and labour standards for activities that involve small-scale construction.

### **Economic co-benefits**

The Project will contribute to reduced economic damage and loss in Timor-Leste through enhanced preparedness to extreme events and climate risk-informed decision-making and actions. High-resolution baseline data, hazard information and vulnerability assessments will be integrated into targeted early warning and decision-support systems to enhance the climate resilience of sectors and communities. Early warning systems are reported to save lives and assets worth at least ten times their cost. Just 24 hours lead-time of an impending storm or heatwave can reduce the consequent damage by 30 percent.<sup>179</sup> In addition, the Project will establish capacity for Forecast-based Financing (FbF) to enhance preparedness and ensure sustainable funding for pre-planned disaster risk management actions. FbF improves the efficiency of those implementing interventions<sup>180</sup> and has been shown to minimise damage and loss caused by climate-related hazards and reduce the need for humanitarian assistance in the aftermath.<sup>181</sup>

Economic gains are expected from better management of resources – for example, due to the use of impact-based forecasts in agriculture and water resources. Studies in several countries have shown that increased availability and use of weather and climate forecasts can reduce the impacts of weather variability on agricultural production by up to 30%. In the water sector, the use of forecasts to optimise water system supply operations can translate to up to 33% or more in performance improvements.<sup>182</sup> In the aviation and marine industries, weather data can improve supply chain efficiencies while reducing emissions and fuel usage.<sup>183</sup> Weather-optimised routing has been shown to reduce shipping emissions by up to 4% and reduce fuel consumption by up to 10%.<sup>184</sup> The Project will contribute to sustained local economies as a result of more strategic risk-informed local development planning. Improved decisions for weather events (e.g. farmers may earn higher incomes by avoiding crop losses and by tailoring their planting or harvesting decisions to a seasonal forecast) are expected to result in smoothing consumption and lower prices for food. Indirect economic benefits will be derived by the Project's contribution to food security and self-sufficiency, which will reduce the need for imports.

It should be noted that the economic benefits for the Project (see Annex 3 – Economic Analysis) are underestimated, both due to analyses having been done following conservative assumptions and because there are economic benefits that are difficult to measure and/or are derived in the long-term. For example, the use of more accurate climate forecasts will reduce income uncertainty and contribute to smoothing consumption. Most importantly, early warning systems save lives and this is arguably impossible to translate to dollar terms. In the longer term, climate-sensitive sectors will be facilitated to make better informed investments that will yield long-term economic benefits. Reducing uncertainty is also shown to have direct positive effects on individual welfare.<sup>185</sup> There are different methods to quantify the value of climate services – including decision theory, avoided cost calculations, partial equilibrium models, game theory, contingent

<sup>179</sup> Global Commission on Adaptation, 2019. *Adapt Now: A Global Call for Leadership on Climate Resilience*

<sup>180</sup> UNEP, 2021. *Adaptation Gap Report 2020*

<sup>181</sup> WFP, 2019. *Forecast-based Financing Factsheet*. Available from: <https://www.wfp.org/publications/forecast-based-financing-factsheet>

<sup>182</sup> World Bank, WMO and UK Met Office, 2021. *The Value of Surface-based Meteorological Observation Data*

<sup>183</sup> Forbes, 2021. *Using Weather Data Helps Businesses Address Challenges of Climate Change*. Available at: <https://www.forbes.com/sites/rennyvandewege/2021/05/03/using-weather-data-helps-businesses-address-challenges-of-climate-change/?sh=402e4efd1f9e>

<sup>184</sup> European Commission, 2013. *Timor for international action on CO<sub>2</sub> emissions from shipping*. Available at: [https://ec.europa.eu/clima/sites/clima/files/transport/shipping/docs/marine\\_transport\\_en.pdf](https://ec.europa.eu/clima/sites/clima/files/transport/shipping/docs/marine_transport_en.pdf)

<sup>185</sup> Alem, Y. and Colmer, J., 2015. *Consumption smoothing and the welfare cost of uncertainty*. Centre for Climate Change Economics and Policy Working Paper No. 138. Grantham Research Institute on Climate Change and the Environment Working Paper No. 118.

valuation, benefits transfer, and econometric models. The combination of these evaluations, provided that they do not overlap, contribute to improved understanding of the whole spectrum of potential benefits. For the Project's Cost-Benefit Analysis (Annex 3), the avoided cost calculations method was deemed most suitable as it is consistent with previous evaluations performed in Timor-Leste, and in the Pacific islands.

### **Gender-responsive development impact**

The Project will facilitate gender-responsive development in Timor-Leste through the mainstreaming of gender considerations throughout its design, implementation, monitoring and evaluation – as detailed in the Gender Assessment and Gender Action Plan (Annex 8). This will ensure that gender concerns are addressed and that existing gender inequalities are not reinforced, thus maximising the outcomes and transformative impact of the Project.

The Project will aim to:

1. Raise gender awareness and increase understanding at national, sectoral and community level of the differential impacts of climate change on women and men.
2. Address the climate vulnerabilities of both women and men through meaningful stakeholder engagement and the delivery of climate information and early warning services tailored to the specific needs of end-users.
3. Promote the empowerment of women through equal representation and participation in planning, decision making, capacity building and skills development.

A summary of the gender-responsive strategies and actions to be incorporated and implemented in the Project is provided in section G.2.

### **Impact of COVID-19 on the Global Observing System – a potential co-benefit of the Project**

Any lack of observations over one area negatively impact on the quality of forecast and analysis products globally. Whilst a significant portion of the global observing system is either partly or fully automated, some parts have already been severely affected due to COVID-19. Aircraft observations have drastically declined, with an overall reduction in aircraft observations of 75 – 80 % compared to normal. The decrease is close to 90% in the tropics and Southern Hemisphere, where there are already fewer observations available. The availability of surface data has decreased significantly since the beginning of the COVID-19 crisis. The main suspected cause is reliance on manned observing stations subject to lockdown. For ocean observations, the main impact has been on voluntary ship observations, which are down around 80% compared to the pre-COVID-19 baseline.<sup>186</sup> Thus, the COVID-19 crisis exemplifies the importance of the Global Basic Observing Network (GBON) and the Systematic Observations Financing Facility (SOFF) – namely, the transition to automation will improve reporting frequency and resilience. Through the development of a financial framework for sustainable climate services (Sub-Activity 1.1.5), the Project will engage with SOFF to ensure that Timor-Leste can benefit from its support to sustain its systematic basic observations networks as a global public good.

### **Impact of COVID-19 on lives, livelihoods and assets – a potential co-benefit of implementing Forecast-based Financing (FbF) and integrated disaster risk management**

The vulnerability of Timor-Leste is evident from the devastating impacts of the recent tropical cyclone, heavy rains, flooding and landslides that occurred between 29<sup>th</sup> March and April 2021, and which affected over

---

<sup>186</sup> WMO, 2020. COVID-19 impacts observing system. Available at: <https://public.wmo.int/en/media/press-release/covid-19-impacts-observing-system>

30,300 households and caused 48 fatalities.<sup>187</sup> In addition to causing considerable human and economic loss, the flooding and landslides significantly undermined COVID-19 response efforts as Timor-Leste struggled to contain the virus' second wave. Heavy flooding in the National Laboratory and medical storage facility led to the loss of vital medical supplies and a COVID-19 isolation facility had to be temporarily evacuated. Moreover, displaced people sheltered in improvised evacuation centres and in the homes of relatives, which likely exacerbated the spread of the virus.<sup>188,189</sup> The compounding impacts of weather hazard-induced disasters and the COVID-19 pandemic provide demonstrable evidence of the potential for a repeat of the “unprecedented double disaster” warned of by the UNDRR Asia Pacific COVID-19 Brief in April 2020, following the devastation of large areas of Vanuatu by Tropical Cyclone Harold.<sup>190</sup> In addition, the Brief emphasises “the need for countries to focus on a multi-hazard integrated disaster risk management approach that includes high levels of disaster preparedness and accelerated disaster risk reduction across sectors”.<sup>191</sup> The dual challenge of climate change and a global pandemic highlights the relevance of the proposed Project, and the urgency required to prioritise health sector resilience, disaster risk management efforts and enhancement of multi-hazard early warning systems. Furthermore, when Forecast-based Financing is combined with early response to a climate shock and resilience or disaster risk reduction activities, the co-benefits are maximised:

- A 2018 return on investment study in Nepal on implementing the approach, found that USD 22 million can be saved when responding to an emergency of an average size (175,000 affected people). Over 20 years, USD 34 and 42 kg of CO<sub>2</sub> emissions can be saved per dollar invested, after deducting the investment cost.<sup>192</sup>
- A 2018 USAID study on Ethiopia, Kenya and Somalia indicates that early response to drought, combined with safety net transfers and resilience-building activities, could over a 15-year period save USD 4.3 billion, or an average of USD 287 million per year.<sup>193</sup>
- A 2015 Cost-Benefit Analysis carried out in Sudan and Nigeria shows that using a forecast-based system would lower the cost of an emergency response by 50 percent and that the net cost of a late humanitarian response is four to seven times higher than multi-year resilience-building.<sup>194</sup>

The above studies exemplify the economic co-benefits of implementing the Forecast-based Financing / Early Warning Early Action mechanisms proposed under this Project.

#### D.4. Needs of recipient (max. 500 words, approximately 1 page)

Timor-Leste gained independence in 2002. With a population of 1.3 million people occupying the eastern half of the island of Timor, Timor-Leste has functioned as a democratic republic since independence. While elections have generally been regarded as free and fair, and the media provided with freedom of expression, many aspects of Timor-Leste's development remain a challenge. Poverty levels remain high, with an estimated 42% of the population living in poverty in 2014, and the 2017 Human Capital Index<sup>195</sup> standing at 0.43 (compared to the regional average of 0.61).<sup>196</sup> Investment in infrastructure and human capital is heavily

<sup>187</sup> UN Resident Coordinator's Office (RCO) Timor-Leste, 2021. Timor-Leste: Floods. Situation Report No. 10 (As of 18 June 2021). Available at: <https://timorleste.un.org/sites/default/files/2021-06/TL%20April%20Flood%20Response%20Situation%20Report%2010%20%2821%20June%2021%29.pdf>

<sup>188</sup>

<sup>189</sup> UN News, 2021. 5 April 2021. UN steps up response, as thousands impacted by Timor-Leste floods. Available at: <https://news.un.org/en/story/2021/04/1089012>

<sup>190</sup> UNDRR, 2020. UNDRR Asia Pacific COVID-19 Brief. Combating the Dual Challenge of COVID-19 and Climate-Related Disasters

<sup>191</sup> UNDRR, 2020. UNDRR Asia Pacific COVID-19 Brief. Combating the Dual Challenge of COVID-19 and Climate-Related Disasters

<sup>192</sup> WFP, 2019. Forecast-based Financing in Nepal: A Return on Investment Study

<sup>193</sup> WFP, 2018. Forecast-based Financing: Moving from crisis response to risk management

<sup>194</sup> WFP, 2018. Forecast-based Financing: Moving from crisis response to risk management

<sup>195</sup> The Human Capital Index (HCI) quantifies the contribution of health and education to the productivity of the next generation of workers. The HCI can be used to assess how much income is forgone due to gaps in human capital.

<sup>196</sup> World Bank, 2019. The World Bank in Timor-Leste Overview. Available from: <https://www.worldbank.org/en/country/timor-leste/overview>

dependent on the petroleum sector, which accounts for the vast majority of government revenue. As natural resources are depleted, diversification will be essential for the future of Timor-Leste's economy and social infrastructure spending. The preservation of natural environmental and commercial agriculture is likely to play a key role in the diversification process.

### ***Climate change in Timor-Leste***

Timor-Leste is vulnerable to floods and landslides, earthquakes, tsunamis, and tropical cyclones, and it is also prone to severe droughts. While Timor-Leste has a medium exposure to hazards, the isolation of many of the local communities, accentuated by the topographic conditions, and poor access to infrastructure, tend to exacerbate negative impacts, making it one of the most disaster-prone countries in the world. Socioeconomic development is curbed by inability to respond appropriately to climate-related hazards.

The vulnerability of Timor-Leste is evident from the devastating impacts of the recent tropical cyclone, heavy rains, flooding and landslides that occurred between 29<sup>th</sup> March and April 2021, and which affected over 30,300 households and caused 48 fatalities within the population.<sup>197</sup> As of 16<sup>th</sup> July 2021, 730 people remained temporarily displaced, which corresponds to 6% of the total number of people in evacuation centres at the peak (recorded 8<sup>th</sup> April 2021). The ongoing COVID-19 pandemic is putting a severe strain on Timor-Leste's already fragile economy – estimates suggest that the economy contracted by 7 percent in 2020, the largest decline since independence<sup>198</sup> – and has hence diminished the country's already limited capacity to invest in early warning systems.

Monitoring and forecasting of occurrences, intensities, and evolution of extreme hydrometeorological events have been critical for humanitarian and government bodies to plan, mitigate, and manage responses to disaster, aiming at saving lives and limiting economic and environmental losses. This Project proposes to enhance climate information and knowledge services in Timor-Leste, in order to make the country more resilient to climate-related impacts and hazards. Better climate-related information and knowledge will improve security and economic livelihoods, through resilience building, and appropriate interventions addressing climate change threats, requiring tailored climate information and people-centred knowledge services covering oceans and islands across all sectors.

Further inhibiting Timor-Leste's stability is extreme weather and climate variability, including flooding and storm surges, often associated with tropical storms and extreme precipitation. Moreover, Timor-Leste is also exposed to geophysical hazards, including earthquakes, heavy rains, and landslides, as well as unsafe levels of air pollution. The aforementioned socio-economic characteristics of Timor-Leste contribute to its vulnerability. Many Timorese live close to coasts, which subjects them to storm surges, river flooding, and saltwater intrusion of freshwater resources and agricultural land. As such, developing comprehensive early warning systems should have a significant impact on both social and economic outcomes in Timor-Leste.

### ***Underlying vulnerabilities***

Climate change will increase the exposure of the entire population of Timor-Leste to environmental hazards; however, it will also exacerbate existing imbalances in vulnerability as a result of both geographic and socioeconomic factors.<sup>199</sup> The Project has been developed based on extensive stakeholder engagement, including dedicated consultations to inform the Gender Assessment and Action Plan (Annex 8), such that interventions are responsive to the needs of specific vulnerable groups in Timor-Leste.

According to the Asian Development Bank (ADB) study on asset-based measurement of living standards in least developed *sucos* (villages) in Timor-Leste, *sucos* with the lowest living standards are the most remote,

---

<sup>197</sup> UN Resident Coordinator's Office (RCO) Timor-Leste, 2021. Timor-Leste: Floods. Situation Report No. 10 (As of 18 June 2021). Available at: <https://timorleste.un.org/sites/default/files/2021-06/TL%20April%20Flood%20Response%20Situation%20Report%2010%20%2821%20June%2021%29.pdf>

<sup>198</sup> World Bank, 2021. Timor-Leste Economic Report: Charting a New Path

<sup>199</sup> Thomas, K. et al. WIRES Climate Change, 2019. Explaining differential vulnerability to climate change: A social science review

have small populations, have the lowest literacy rates and are more engaged in agricultural activity. To achieve fair and inclusive development, additional focus is required to support *sucos* with lower living standards.<sup>200</sup> The Project includes specific interventions to develop targeted community-based early warning systems and disaster risk management and build capacities from the *suco* level upwards for improved preparedness measures to climate hazards. Around 70% of the population of Timor-Leste rely on climate-sensitive rain-fed agriculture as their primary source of income.<sup>201</sup> Accordingly, the Project will develop the capacities of farmers to utilise climate information, including from crop advisories, sector-specific decision support systems (DSS) and agriculture extension services.

Women in Timor-Leste are disproportionately affected by climate change due to existing inequalities and multi-dimensional social factors that influence their adaptive capacities, resilience and participation in climate action.<sup>202</sup> Based on the Gender Development Index (GDI), Timor-Leste is in GDI Group 5, which corresponds to countries with the lowest gender equality in human development achievements.<sup>203</sup> The Project has and will continue to adopt a gender mainstreaming approach throughout its development and implementation. This includes the implementation of gender-responsive actions, such as providing gender-specific needs training to DNMG staff; designated leadership roles for women's groups in early warning protocols; and ensuring that all relevant data is gender disaggregated. Further details are provided in Section G.2. and in the Gender Assessment and Action Plan (Annex 8).

#### D.5. Country ownership (max. 500 words, approximately 1 page)

The Government of Timor-Leste has highlighted the critical importance of services relating to climate change, early warning systems for climate-related hazards, and disaster risk reduction in major national policy documents. These are summarised in the list below and detailed in the Feasibility Study (Annex 2).

Dialogue on this Project began in 2015 when Timor-Leste expressed interest in the World Meteorological Organization's (WMO) proposal for a multi-country programme in the Pacific region to strengthen early warning capacity for hydrometeorological extreme events. A Concept Note was approved by GCF in 2015 for five countries—four Pacific island countries and Timor-Leste. WMO undertook an intensive consultation process during 2017 with Timor-Leste and four Pacific island countries to develop effective approaches to establishing EWSs that would reach people at the last mile with accurate, timely, actionable warnings and advice ahead of extreme climate events. Carriage of the proposal has since passed to UNEP, which has undertaken further consultation with potential users and stakeholders in Timor-Leste, as reported in detail in the Stakeholder Engagement Plan (Annex 7). Timor-Leste's National Designated Authority (NDA) for interaction with the GCF (and Director of the Climate Change Department) has been actively engaged in the development of the Project and has formally endorsed it. Moreover, the Project is identified as a priority adaptation project in Timor-Leste's National Adaptation Plan (NAP) submitted to the UNFCCC Secretariat in March 2021.

The Secretary of State for the Environment (SSE) in Timor-Leste will serve as the lead Executing Entity (EE) for the Project and will therefore be responsible for establishing national project implementation. This modality will enhance country ownership of the Project and build in-country capacity to lead on future climate resilience actions and initiatives.

The Project will first build capacity by leveraging the technical expertise of international partners, who have been engaged at the request of the country based on their track record and expertise in Timor-Leste. In order to retain capacity in Timor-Leste beyond the Project implementation period, it should be noted that Timor-Leste is a Member State and representative of the Regional Integrated Multi-Hazard Early Warning

<sup>200</sup> ADB, 2013. Least Developed Sucos – Timor-Leste

<sup>201</sup> Bündnis Entwicklung Hilft, 2017. World Risk Report – Analysis and prospects 2017

<sup>202</sup> See Annex 4 for a detailed assessment of the gender context of Timor-Leste

<sup>203</sup> UNDP, 2019. Briefing note for countries on the 2019 Human Development Report – Timor-Leste

System for Africa and Asia (RIMES). Under the membership agreement, RIMES is committed to providing technical and backup support to DNMG and all national stakeholders during and beyond any project period.

### ***Alignment with existing national policies addressing climate change***

The proposed Project will contribute to the achievement of priorities articulated by the Government of Timor-Leste in the following documents:

- **Green Climate Fund Country Programme (2019)** – The Project will provide essential information for evidence-based decision making and planning for the national priorities outlined in the Country Programme, enhancing their efficacy and preventing maladaptation. The Country Programme also explicitly prioritised this Project in its original form (with WMO as AE).
- **National Disaster Risk Management Policy (2008)** – The Project will directly address two key priorities of the Policy’s objective relating to the prevention of natural disasters: i) Create early warning systems, particularly relating to rain and drought; and ii) Establish inter-sectoral coordination mechanisms to respond to natural disasters.
- **Timor-Leste National Adaptation and Program of Action (NAPA) on Climate Change (2010)** – The NAPA prioritises community awareness, increased monitoring and risk forecasting, and support for the adaptation of government policies and strategies to improve climate change resilience among vulnerable groups. The Project will contribute to Timor-Leste’s achievement of these objectives either directly with communities or through mainstreaming climate services and knowledge into the work of other government agencies.
- The **Environmental Policy (2012)** directs that “land-use development and planning of inland areas shall consider the need for integrated management of water resources bearing in mind the potential impacts these may have on coastal areas”.
- The **Timor-Leste Initial National Communication (INC) to the UNFCCC (2014)** identifies some key adaptation actions relevant to Early Warning Systems: i) Strengthening capacity of national and local institutions as well as communities in managing climate risks through the development of an effective climate information system, including the development of early warning system and decision support system tools for policy makers; and ii) Research and development of technologies more adaptive to climate change particularly for key sectors. The Project will contribute directly to the achievement of the first action and will generate data and information needed for effective implementation of the second.
- **Intended Nationally Determined Contributions (INDC) Timor-Leste (2016)** – The Project will directly address the priority measures for adaptation to natural disasters identified in the INDC: i) Improve institutional and staff capacity in the disaster sector in relation to climate change induced disasters; ii) Establish early warning systems in areas identified as vulnerable to disasters such as floods and storms; and iii) Integrate climate risk information into traditional disaster risk reduction and management. The Project will also address priority measures for adaptation related to human health identified in the INDC, in particular relating to the promotion of “evidence-based decision making...taking into consideration of climate change and its adverse effects on diseases, particularly water, air and vector-borne diseases such as malaria and dengue”.
- **Timor-Leste Second National Communication (SNC) to the UNFCCC (2020)** – The Project will directly address the following adaptation needs identified in the SNC: i) Increase the number of weather stations in Timor-Leste; ii) Assist, encourage and warn people who are at risk from natural disaster; iii) Promote early warning systems; and iv) Education and public awareness. In addition, it will contribute to an enabling environment for “integrating consideration of climate change to develop

policies and programmes” and for “budget allocation within relevant Ministries [to] reflect the more vulnerable populations”.

- **Timor-Leste’s National Adaptation Plan (2021)** – As noted above, the Project is identified as a priority adaptation project in Timor-Leste’s National Adaptation Plan (NAP). In addition, the Project will contribute to the achievement of the following priorities and outcomes: i) Strengthening the capacity of national, local institutions and communities in managing climate risks; ii) Reduce the vulnerability of farmers and pastoralists to increased drought and flood events; iii) Improve institutional and community capacity to prepare for and respond to climate change-induced natural disasters; iv) Integrate climate risk information into traditional disaster risk reduction and management; v) Enhance government and community strategies to respond to drought exacerbated by climate change; vi) Establish surveillance for health early warning systems and response mechanisms for climate-related health risks.
- **UN Sustainable Development Cooperation Framework Timor-Leste (2021 – 2025)**: The Project is fully aligned with Outcome 6 on “Sustainable management of natural resources and resilience to climate change”, which identifies “*Strengthening early warning system and capacities*” as a specific priority.

The Government of Timor-Leste has key agencies relating to the implementation of climate and natural disaster services and these agencies have been consulted in the preparation of the proposed Project. This includes the National Directorate for Meteorology and Geophysics, the Ministry of Agriculture and Fisheries, the Ministry of Social Solidarity, the National Directorate for Climate Change, the Directorate General for Environment, the Cabinet Vice Ministry for Habitation, Ordainment and Environment, and the Ministry of Development and Institutional Reforms.

The Project is aligned with the Sustainable Development Goals (SDGs), the Paris Agreement and the Sendai Framework:

- SDG 13 advocates urgent action to combat climate change and its impacts. Target 13.1 advises countries to “*Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries*”.
- SDG 3 advocates to ensure healthy lives and promote well-being for all at all ages. Target 3.D aims to “*Strengthen capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks*”.
- The Paris Agreement in Article 7, Sub-paragraph 7(c) calls for “strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making”.<sup>204</sup>
- The Sendai Framework for Disaster Risk Reduction 2015–2030<sup>205</sup> in paragraph 33 b) stresses that it is important “To invest in, develop, maintain and strengthen people-centred multi-hazard, multisectoral forecasting and early warning systems, disaster risk and emergency communications mechanisms, social technologies and hazard-monitoring telecommunications systems; develop such systems through a participatory process; tailor them to the needs of users, including social and cultural requirements, in particular gender; promote the application of simple and low-cost early warning equipment and facilities; and broaden release channels for natural disaster early warning information”. The Sendai Framework’s Seven Global Targets calls for efforts to “substantially

<sup>204</sup> [https://unfccc.int/sites/default/files/english\\_paris\\_agreement.pdf](https://unfccc.int/sites/default/files/english_paris_agreement.pdf)

<sup>205</sup> [https://www.unisdr.org/files/43291\\_sendaiframeworkfordrren.pdf](https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf)

increase the availability and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.”

The Project will contribute directly to Timor-Leste’s achievement of progress towards these objectives.

**Engagement with civil society organisations**

The Project will support an existing group of Government ministries and UN agencies responsible for coordinating early warning, climate change adaptation, and disaster risk reduction, expanding the group to include NGOs/CBOs and enabling the group to convene regularly. The following agencies will be invited to establish a coherent approach to and understanding of EWS in Timor-Leste—UN agencies (such as FAO and IOM), international NGOs (including Mercy Corps, CARE, Oxfam, PLAN, World Vision, Caritas, and Child Fund), and local organisations (CVTL<sup>206</sup>, RHTO<sup>207</sup>, ASRRD<sup>208</sup>, Fraterna<sup>209</sup> and others). Existing ad-hoc early warning related work at the community level will benefit from improved coordination and integration into a broader national system.

**D.6. Efficiency and effectiveness (max. 500 words, approximately 1 page)**

The Government of Timor-Leste is requesting a GCF grant to enable the efficient and effective delivery of the proposed Project interventions to achieve the stated impact. The requested grant is considered the most appropriate financial instrument to enhance climate services, disaster risk reduction and MHEWS due to the public good nature of such services and limited availability of government funding as a result of prioritisation of immediate development needs.<sup>210</sup> The investment will directly address financial, technical, capacity and coordination barriers to the effective delivery of climate information and multi-hazard early warning services. This comprehensive approach will ensure investment in all elements of the value chain for climate services, given that each link in the value chain is essential for enhancing the effectiveness of the overall outcome. Although direct revenue will not be an outcome of the GCF investment, the Project is expected to develop information products with commercial value that will enable cost recovery options and private sector engagement beyond its term. Such opportunities will be identified under Sub-Activity 1.1.5.

The Cost-Benefit Analysis (CBA) has identified and assessed the costs and benefits of the proposed interventions and has made inherent trade-offs explicit. The feasibility of the investments was determined by calculating the economic internal rate of return (EIRR) and economic net present value (NPV). A 5% discount rate has been applied. The CBA shows that, assuming a 10-year useful life of proposed interventions at a 10% discount rate, discounted NPV is positive (US \$56.01 million). The economic internal rate of return (EIRR) of 104.3% exceeds the discount rate, making the proposed investment economically viable.

Sensitivity analysis has been used to test key parameters such as a decrease in benefits by 10% or an increase in costs of 10%. Although the EIRR decreased with those simulated cost benefit changes, the EIRR remained well above the 10% threshold in both cases (90.2% and 91.5% respectively). In addition, an even more pessimistic scenario combining a decrease in benefits by 10% and an increase in costs by 10% still results in a very high NPV and EIRR (US \$46.81 million and 79.4%).

There is uncertainty in the findings of the CBA, with the total net benefits ranging from USD 63.76 million and USD 40.99 million, depending on various assumptions and parameters used. Nevertheless, the sensitivity analysis provides support for the Project across all scenarios considered, as scenarios show a positive economic NPV and an EIRR greater than the discount rate, which are the criteria used to determine the efficiency of the Project. However, the net benefits are likely to be underestimated due to conservative assumptions used in calculations in addition to the omission of the qualitative benefits excluded from the

<sup>206</sup> Cruz Vermelha de Timor-Leste: Red Cross

<sup>207</sup> Ra’es Hadomi Timor Oan: the Disabled People’s Organisation

<sup>208</sup> Asosiasaun Serbisu Redusaun Risku Dezaster: Association for Disaster Risk Reduction

<sup>209</sup> Fraterna: local environmental / disaster response NGO

<sup>210</sup> See Annex 2 – Feasibility Study

quantitative analysis, such as social and environmental benefits derived from the Project interventions. Most importantly, effective early warning systems save lives, and this is arguably impossible to translate to dollar terms. As a result, the CBA (Annex 3) provides a positive quantitative justification for the Project, which is estimated to generate a benefit-cost ratio of 5.7:1. This suggests that each USD 10 invested in the Project will translate to benefits with a value of USD 57.

The benefits calculated in the CBA take the form of avoided economic damages and losses. Without the Project, economic losses incurred through increased frequency or intensity of climate-related disasters, such as flooding, drought and storm surge, will be exacerbated, particularly when considering the negative impacts of potential changes in weather patterns. Avoided economic damages include impacts on infrastructure and physical assets, particularly contents, and crops. Effective climate services and impact-based MHEWS developed by the Project have the potential to partially reduce the loss of contents and crop loss. Improved hazard information and dissemination, providing better preparedness and longer lead times to evacuate, move content and harvest crops, are key contributors to these avoided damages. Avoided economic losses represent changes in economic flows arising from the disaster, lasting up to several years. The Project aims to increase sectoral and community resilience to climate-related hazards and extreme climate events, resulting in improved productivity and avoided losses to agriculture, fisheries and other relevant sectors.

Considering the baseline low capacity to provide climate information and early warning services (CIEWS) in Timor-Leste, the Project employs a holistic capacity building approach, maximising synergies and complementarity with existing initiatives (e.g., GCF project FP109<sup>211</sup>) to enhance efficiency and effectiveness. The Project will build on existing networks and strengths in Timor-Leste, such that capacity for climate services is developed in an efficient, cost-effective and complementary manner. The establishment of a National Framework for Climate Services and development of a financial framework and business model will provide a robust foundation for effective and sustainable delivery of climate services and disaster risk management beyond the term of the Project. Climate services investments return benefits that are far greater than the losses they will help prevent, with an overall cost benefit ratio of one to 10. Moreover, systematic investment in the WMO global-regional-national climate information system could provide a return on investment of as much as 80 to one.<sup>212</sup> The implementation of an integrated value-chain approach to strengthening climate information and early warning services will deliver long-term efficiency and effectiveness benefits. Benefits from early warning systems will be maximised by developing them in parallel to disaster risk management plans and investments, such as the community-level capacity building for disaster preparedness and Forecast-based Financing (FbF) / Early Warning Early Action (EWEA). The inclusion of Result 4, which focuses on enhancing risk management and preparedness capabilities, is in line with international best practices<sup>213</sup> and is critical to ensure that investments are effective to the last mile.

The Project will leverage the specialised knowledge of regional and international technical partners to ensure that the most effective technologies and best practices for climate information services and disaster risk management are utilised. Technical partners will deliver targeted training in areas that are essential for transformative impact beyond the term of the Project, including: i) Innovative and cost-efficient technologies for observations, monitoring and prediction, including Internet of Things (IoT) applications to revolutionise climate services and disaster risk management; ii) Operations and Maintenance (O&M); iii) Enhancing institutional effectiveness through Quality Management Systems (QMS) and related certification; iv) Enhancing institutional efficiency through impact-based forecasting and FbF/EWEA; v) Options for ensuring long-term financial sustainability, including a funding mechanism for forecast-based early action; vi) Use of alerts, information exchange and coordination in the first instance after major sudden-onset disasters; and vii) Integration of Traditional Knowledge to enhance the effectiveness of early warning systems. The Project

---

<sup>211</sup> <https://www.greenclimate.fund/project/fp109>

<sup>212</sup> WMO, 2019. State of Climate Services 2019

<sup>213</sup> WMO, 2018. Multi-Hazard Early Warning Systems: A Checklist

will also ensure that all infrastructure, systems and processes are compliant with the WMO Global Basic Observing Network (GBON) and internationally recognised standards, as relevant.

Effectiveness of the Project will be further enhanced by its direct contribution to key national priorities and strengthening of existing national mechanisms. For example, the National Disaster Risk Management Policy (NDRMP) 2008-2013 elevated Disaster Risk Management (DRM) to national priority, generated political commitment, made the policy a multi-sector responsibility, and allocated the necessary resources for implementing it. The National Disaster Management Directorate (NDMD), under the Ministry of Social Solidarity (MSS), acts as a lead organisation for DRM in the country and coordinates with all line-ministries, District Disaster Management Committees (DDMD), Sub-district Administrators, and Suco Chiefs. Participatory implementation will enhance ownership through proper engagement of all relevant stakeholders, which will lead to efficiency and sustainability. Effectiveness is expected to increase as factors influencing the decision-making become less of an obstacle – for example, access to credit, and lack of skills to interpret information received.

Further details can be found in the Economic Analysis (Annex 3).

## E. LOGICAL FRAMEWORK

This section refers to the project/programme's logical framework in accordance with the GCF's [Performance Measurement Frameworks](#) under the [Results Management Framework](#) to which the project/programme contributes as a whole, including in respect of any co-financing.

### E.1. Paradigm shift objectives

Please select the appropriated expected result. For cross-cutting proposals, tick both.

- Shift to low-emission sustainable development pathways  
 Increased climate resilient sustainable development

### E.2. Core indicator targets

Provide specific numerical values for the GCF core indicators to be achieved by the project/programme. Methodologies for the calculations should be provided. This should be consistent with the information provided in section A.

E.2.1. Expected tonnes of carbon dioxide equivalent (t CO <sub>2</sub> eq) to be reduced or avoided (mitigation and cross-cutting only)	Annual	Click here to enter text. t CO <sub>2</sub> eq
	Lifetime	Click here to enter text. t CO <sub>2</sub> eq
E.2.2. Estimated cost per t CO <sub>2</sub> eq, defined as total investment cost / expected lifetime emission reductions (mitigation and cross-cutting only)	(a) Total project financing	_____ Choose an item.
	(b) Requested GCF amount	_____ Choose an item.
	(c) Expected lifetime emission reductions	_____ t CO <sub>2</sub> eq
	<b>(d) Estimated cost per t CO<sub>2</sub>eq (d = a / c)</b>	_____ Choose an item. / t CO <sub>2</sub> eq
	<b>(e) Estimated GCF cost per t CO<sub>2</sub>eq removed (e = b / c)</b>	_____ Choose an item. / t CO <sub>2</sub> eq
E.2.3. Expected volume of finance to be leveraged by the proposed project/programme as a result of the Fund's financing, disaggregated by public and private sources (mitigation and cross-cutting only)	(f) Total finance leveraged	_____ Choose an item.
	(g) Public source co-financed	_____ Choose an item.
	(h) Private source finance leveraged	_____ Choose an item.
	<b>(i) Total Leverage ratio (i = f / b)</b>	_____
	(j) Public source co-financing ratio (j = g / b)	_____
	(k) Private source leverage ratio (k = h / b)	_____
E.2.4. Expected total number of direct and indirect beneficiaries, (disaggregated by sex) <sup>214</sup>	Direct	Male: 522,805 Female: 511,690
	Indirect	Male: 653,506 Female: 639,613 Indirect beneficiaries (including direct beneficiaries) – the entire population of Timor-Leste is expected from the strengthening of nationwide climate information services, end-to-end multi-hazard early warning services and risk-informed decision-making.
	<i>For a multi-country proposal, indicate the aggregate amount here and provide the data per country in annex 17.</i>	
E.2.5. Number of beneficiaries relative to total population (disaggregated by sex)	Direct	80% (Male: 522,805; Female: 511,690)
	Indirect	100 % (Male: 653,506; Female: 639,613)

<sup>214</sup> Population figures obtained from the World Bank. Available at: <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TL>

*For a multi-country proposal, leave blank and provide the data per country in annex 17.*

E.3. Fund-level impacts						
Expected Results	Indicator	Means of Verification (MoV)	Baseline	Target		Assumptions
				Mid-term	Final	
<i>A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions</i>	<i>A1.1 Change in expected losses of lives and economic assets (US\$) due to the impact of extreme climate-related disasters</i>	UNDRR Global Assessment Report Supported by further analysis of data from underlying platforms: EM-DAT / DesInventar / Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI)	Average annual losses (AAL) caused by natural disasters estimated at USD 51.3 million including direct and emergency losses (see Annex 3: <i>Economic Analysis Report</i> ) Average annual mortality rate due to natural disasters: 9 deaths per year	Introduction of the early warning system reduces the average damage to economic assets <sup>215</sup> incurred due to extreme climate-related events by 15% or USD 7.7 million and reduce life losses due to extreme climate-related events by 40% or 4 persons.	Introduction of the early warning system reduces the average damage to economic assets <sup>216</sup> incurred due to extreme climate-related events by 30% or USD 15.4 million and reduce life losses due to extreme climate-related events by 80% or 7 persons.	Data for losses of lives and economic assets continues to be available through UNDRR and the EM-DAT / DesInventar platforms
<i>A2.0 Increased resilience of health and well-being, and food and water security</i>	<i>A2.1 Number of males and females benefiting from introduced health measures to respond to climate-sensitive diseases due to the impact of extreme climate-related disasters</i>	Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) records National Project Implementation progress reports Health Information Platform for the WHO South-East Asia Region	0 – None of the population has access to health-related early warnings	At least 500 people (approx. 50% male and 50% female) <sup>217</sup> downloaded the mobile app for health-related forecasts and advisories developed by the Project	At least 1,000 people (approx. 50% male and 50% female) downloaded the mobile app for health-related forecasts and advisories developed by the Project	Populations are willing to use health-related early warnings and information Mobile phone coverage and internet quality in Timor-Leste are adequate

E.4. Fund-level outcomes					
	Indicator		Baseline	Target	Assumptions

<sup>215</sup> Economic assets are defined as buildings, infrastructure and cash crops. "Buildings" include residential, commercial, public and industrial properties. "Infrastructure" includes ports, airports, power plants, bridges and roads. See Pacific Catastrophe Risk Assessment and Financing Initiative data and documents. Available from: <http://pcrafi.spc.int>

<sup>216</sup> Economic assets are defined as buildings, infrastructure and cash crops. "Buildings" include residential, commercial, public and industrial properties. "Infrastructure" includes ports, airports, power plants, bridges and roads. See Pacific Catastrophe Risk Assessment and Financing Initiative data and documents. Available from: <http://pcrafi.spc.int>

<sup>217</sup> Numbers to be validated and refined in the Project's performance monitoring and evaluation framework

Expected Outcomes		Means of Verification (MoV)		Mid-term	Final	
A5.0 Strengthened institutional and regulatory systems for climate-responsive planning and development	<i>A5.1 Institutional and regulatory systems that improve incentives for climate resilience and their effective implementation</i>	National Coordination Committee reports National Project Implementation progress reports	Zero: No national meteorological legislation or strategies are in place in Timor-Leste	Timor-Leste has submitted a draft National Meteorology Act and National Meteorological Strategy to the Council of Ministers	Timor-Leste has a National Meteorology Act and National Meteorological Strategy in place regulating the provision of meteorological services and providing incentives for efficiency and coordination	Council of Ministers continues to be operational and has the availability and quorum to adopt the Meteorology Act
A5.0 Strengthened institutional and regulatory systems for climate-responsive planning and development	<i>A5.2 Number and level of effective coordination mechanisms</i>	Reports from National Climate Outlook / Monsoon Forums National Coordination Committee reports National Project Implementation progress reports	Zero: No National Framework for Climate Services (NFCS) and related coordination mechanism is established in Timor-Leste	National Framework for Climate Services launched for the effective coordination and collaboration among national institutions in the provision and use of climate services	National Framework for Climate Services established and refined for the effective coordination and collaboration among national institutions in the provision and use of climate services	National government entities and sector representatives have the required capacity to engage in the establishment and operationalisation of the NFCS
A6.0 Increased generation and use of climate information in decision-making	<i>A6.1 Use of climate information products/services in decision-making in climate sensitive sectors</i>	Reports from sectors to the National Climate Outlook / Monsoon Forums National Coordination Committee reports National Project Implementation progress reports	Climate information products and services are not mainstreamed in decision making in climate-sensitive sectors (e.g. agriculture, disaster risk management, health, water) <sup>218</sup>	Climate Sector Action and Communication Plans and Sector Specific Climate Training programs developed for five key sectors to integrate climate information and climate change knowledge into the functions of their agencies	Use of climate information for decision making and prioritisation in climate-sensitive sectors (e.g. agriculture, disaster risk management, health, water) through implementation of the Climate Sector Action and Communication Plans and training under the Sector Specific Climate Training programs in five key sectors	Sectors willing to make operational changes based on climate information as per the Climate Sector Action and Communication Plans
A7.0 Strengthened	<i>A7.1 Use by vulnerable</i>	Surveys conducted by	Zero	Use of EWS services,	Use of EWS services,	Households, communities

<sup>218</sup> To be re-confirmed at the climate services and disaster risk knowledge workshop in Year 1

<p>adaptive capacity and reduced exposure to climate risks</p>	<p><i>households, communities, businesses and public-sector services of Fund-supported tools instruments, strategies and activities to respond to climate change and variability</i></p>	<p>the Project among target beneficiaries in Timor-Leste (in Year 3 and 5 of the Project) National Project Implementation progress reports DNMG CVTL</p>		<p>forecasts, advisories, etc. and implementation of recommended preparedness actions to climate-related hazards by 10% of female-headed households and 10% of male-headed households within the direct beneficiary group<sup>219</sup></p>	<p>forecasts, advisories, etc. and implementation of recommended preparedness actions to climate-related hazards by 40% of female-headed households and 40% of male-headed households within the direct beneficiary group</p>	<p>and individuals are receptive to EWS services and willing to adopt behavioural change Data from the surveys conducted by the Project can be triangulated by other data sources, such as reports from DNMG and CVTL</p>
<p>A7.0 Strengthened adaptive capacity and reduced exposure to climate risks</p>	<p><i>A7.2 Number of males and females reached by [or total geographic coverage of] climate-related early warning systems and other risk reduction measures established/strengthened</i></p>	<p>Surveys conducted by the Project among target beneficiaries in Timor-Leste (in Year 3 and 5 of the Project) Project Implementation progress reports DNMG CVTL IFRC</p>	<p>Zero</p>	<p>Introduction of EWS that holistically addresses i) disaster risk knowledge; ii) detection, monitoring, analysis and forecasting; iii) dissemination and communication; and iv) preparedness and response capabilities reaches 40,000 people in Timor-Leste</p>	<p>Introduction of EWS that holistically addresses i) disaster risk knowledge; ii) detection, monitoring, analysis and forecasting; iii) dissemination and communication; and iv) preparedness and response capabilities reaches 100,000<sup>220</sup> people in Timor-Leste</p>	<p>Political commitment for climate-related early warning systems and early actions from national level down to <i>suco</i> level authorities DRM/CCA authorities, MAF technicians and agriculture extensionists are willing to actively collaborate on climate-related early warning and early actions Communities are receptive to EWS information and are willing to contribute and organise themselves effectively to implement early actions for disaster risk reduction</p>

<sup>219</sup> Absolute numbers to be defined in the Project's performance monitoring and evaluation framework

<sup>220</sup> Absolute numbers to be validated and refined in the Project's performance monitoring and evaluation framework

<p>A8.0 Strengthened awareness of climate threats and risk-reduction processes</p>	<p><i>A8.1 Number of males and females made aware of climate threats and related appropriate responses</i></p>	<p>Surveys conducted by the Project among target beneficiaries in Timor-Leste (in Year 3 and 5 of the Project) Steering Committee reports Project Implementation progress reports</p>	<p>Zero (Limited understanding at community level)<sup>221</sup></p>	<p>Population aware of climate threats and related appropriate responses increased to at least 10% of direct beneficiaries (103,449 people<sup>222</sup>)</p>	<p>Population aware of climate threats and related appropriate responses increased to at least 50% of direct beneficiaries (517,245 people<sup>223</sup>)</p>	<p>Communication channels for climate information and early warning (including cellular networks) are adequate for the Project's awareness raising activities</p>
--	--	---	--	---	---	---

**E.5. Project/programme performance indicators**

Expected Results	Indicator	Means of Verification (MoV)	Baseline	Target		Assumptions
				Mid-term	Final	
<p><b>Result 1:</b> Strengthened delivery model and legislation for climate information and multi-hazard early warning services</p>	<p>Establishment of the NFCS and operationalisation of the NCOF</p>	<p>National Framework for Climate Services (NFCS) documentation Reports of meetings between NMDG and other government entities on the establishment of the NFCS National Coordination Committee reports National Project Implementation progress reports National Climate Outlook / Monsoon Forum (NCOF) reports</p>	<p>Timor-Leste has no NFCS or NCOF</p>	<p>Timor-Leste has established an NFCS</p>	<p>Timor-Leste has established an NFCS and operationalised the NCOF</p>	<p>Government of Timor-Leste is committed to the development of climate information and MHEWS and mainstreaming climate information into policy and planning Government, private agencies and <i>sucos</i> (villages) will participate and coordinate the inputs of each sector DNMG will engage with end-users and ensure that their inputs are reflected Stakeholders are willing to adopt new governance, institutional</p>

<sup>221</sup> To be re-confirmed in the climate services and disaster risk management workshop in Year 1

<sup>222</sup> Absolute numbers to be validated and refined in the Project's performance monitoring and evaluation framework

<sup>223</sup> Absolute numbers to be validated and refined in the Project's performance monitoring and evaluation framework

						and regulatory mechanisms Sectors are willing to utilise climate information to make their business more efficient and resilient to climate change impacts
<b>Result 2:</b> Strengthened observations, monitoring, analysis and forecasting of climate and its impacts	Level of enhancement of the climate observation network <sup>224</sup>	Review of data inventory from the new meteorological stations Country inputs to the WMO Integrated Global Observing System (WIGOS) National Coordination Committee reports National Project Implementation progress reports	Timor-Leste is at level 1 <sup>225</sup> on a scale for enhanced climate observation networks	Timor-Leste is at level 3 on a scale for enhanced climate observation networks	Timor-Leste is at level 5 on a scale for enhanced climate observation networks	Supply, transport and installation of new observing equipment is unaffected by COVID-19 pandemic restrictions
<b>Result 3:</b> Improved dissemination and communication of risk information and early warning	Increased dissemination and communication of climate risk information and multi-hazard early warnings <sup>226</sup>	Surveys conducted by the Project among target beneficiaries (in Year 3 and 5 of the Project) Reports from consultations with communities on receiving climate risk and MHEWS information EWS strategies and protocols, and localised communications strategies National Project Implementation progress reports	There is limited or no capacity for communities to understand climate risk and MHEWS information There is limited capacity in local government agencies and DNMG to disseminate climate risk and MHEWS information	Community-based early warning systems (EWS) established in two <i>sucos</i> by the Timor-Leste Red Cross Society (CVTL)	Community-based early warning systems (EWS) established in six <i>sucos</i> by the Timor-Leste Red Cross Society (CVTL)	EWS stakeholders cooperate and coordinate effectively to develop and implement EWS protocols and strategies Communities are willing to co-develop gender-responsive localised communication strategies

<sup>224</sup> Aligned with Paris Agreement Article 7, 7c: *Strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making*

<sup>225</sup> Scale for effectiveness of national climate and ocean observations and monitoring networks: (1): Country has significant gaps in network coverage and no ocean information services; (2): Country has designed strengthened observation and monitoring network to fill most critical gaps in coverage; (3): Country has designed strengthened observation and monitoring network and ocean information services to fill most critical gaps in coverage; (4): Country has upgraded and expanded observation and monitoring network to fill most critical gaps in coverage; (5): Country has upgraded and expanded observation and monitoring network to fill most critical gaps in coverage and established ocean information services.

<sup>226</sup> Aligned with Sendai Framework Priority 1 (Understanding Disaster Risk), 24 (o): *To enhance collaboration among people at the local level to disseminate disaster risk information through the involvement of community-based organizations and nongovernmental organizations*

		CVTL reports				
<b>Result 4:</b> Enhanced climate risk management capacity	Number of municipalities implementing disaster preparedness initiatives based on the Forecast-based Financing (FbF) Roadmap due to increased awareness of climate risks and preparedness measures <sup>227</sup>	Surveys conducted by the Project among target beneficiaries (in Year 3 and 5 of the Project) Reports from consultations with communities on establishing and operating MHEWS National Project Implementation progress reports	There is limited or no capacity for communities to understand climate risk and MHEWS information and take appropriate disaster preparedness actions No municipalities are implementing FbF for disaster preparedness	Use of climate risk and MHEWS information based on public awareness raising and the FbF Roadmap in 5 municipalities	Use of climate risk and MHEWS information based on public awareness raising and the FbF Roadmap in 10 municipalities	Stakeholders are willing to work together and agree on indicators, thresholds and mechanisms for early action Political commitment as expressed in national budget plans to allocate budget to finance Early Action Protocols (EAPs) and Early Warning Early Action (EWEA) Communities and relevant stakeholders are motivated to act on the information provided to them

**E.6. Activities**

Activity	Description	Sub-activities	Deliverables
<b>1.1 – Establish institutional and policy frameworks, legislation and delivery models for climate services</b>	This Activity will establish comprehensive institutional and policy frameworks, legislation and delivery models for strengthened climate services in Timor-Leste, including the development of a National Framework for Climate Services (NFCS), National Meteorology Act and Meteorological Strategy. A User Interface Platform (UIP) will be established to facilitate interaction between DNMG, its stakeholders and end-users of its climate information products and services.	1.1.1 Establish a National Framework for Climate Services 1.1.2 Establish a User Interface Platform 1.1.3 Enhance climate data management and governance 1.1.4 Mainstream climate risk knowledge into health, agriculture, DRR and other sectors 1.1.5 Establish a financial framework and business model for	<ul style="list-style-type: none"> <li>• Consultation workshops on climate services to develop and refine the NFCS (Years 1 – 4)</li> <li>• NFCS review workshop (Year 5)</li> <li>• Timor-Leste National Framework for Climate Services (NFCS)</li> <li>• National Meteorology Act</li> <li>• National Meteorological Strategy</li> <li>• National Climate Outlook Forum (NCOF) / Monsoon</li> </ul>

<sup>227</sup> Aligned with SDG Target 13.3 *Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning* and in particular SDG indicator 13.b.1 *Number of least developed countries and small island developing States that are receiving specialized support, and amount of support, including finance, technology and capacity-building, for mechanisms for raising capacities for effective climate change-related planning and management, including focusing on women, youth and local and marginalized communities*. Also supports SDG Target 3.D *Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks*.

	<p>The NFCS will be supported by a systematic five-year process of integrating climate considerations into the decision-making and planning of government, private and community sectors through development of a National Climate Sector Action and Communication Plan (CSACP) and sector-specific training – including in health, agriculture and disaster risk reduction.</p> <p>This Activity will also support Timor-Leste to manage and use climate data and information in conjunction with data from other sectors in order to mainstream climate considerations, as well as to integrate data from various sector sources with climate data for reporting to the international community on implementation of multilateral environmental agreements such as the Paris Agreement and the UNFCCC in general.</p> <p>Furthermore, a financial framework and business model for sustainable climate services will be developed. Engagement with the private sector and national budget processes will enable justification of the value of climate services, strengthen funding for disaster risk management and contribute to the identification of long-term sources of funds.</p>	<p>sustainable climate services</p>	<p>Forum conducted twice per year (Years 2 – 5)</p> <ul style="list-style-type: none"> <li>• National Climate Data Strategy and Action Plan for DNMG and the Statistics Directorate – including data archival processes and systems strategy and actions to ensure security, integrity, retention policy and technology migration</li> <li>• Climate Data Informatics System (CDIS) providing an integrated platform for climate and scientific data analytics and visualisation, with linkages to sectoral decision-making tools</li> <li>• Technical support and training on climate data management, governance and inter-sectoral data coordination – including data collection, storage and back-up, Quality Assurance, and compliance with WMO QMS standards</li> <li>• Data and data management enhanced so that historical and real-time land, ocean and atmospheric observations of Essential Climate Variables (ECVs) are exchanged freely for use in Regional Climate Centres (RCCs) for at least one Global Surface Network site</li> <li>• National Climate Sector Action and Communication Plan</li> <li>• Sector Specific Climate Training Program developed</li> <li>• Training of trainers (ToT) workshop for DNMG</li> <li>• Sector Specific Climate Training for five GFCS priority sectors</li> <li>• Comprehensive and tailored financial framework for climate services in Timor-Leste based on a value chain approach</li> </ul>
--	---	-------------------------------------	---

<p><b>2.1 – Enhance infrastructure and technical support for observations and monitoring</b></p>	<p>This Activity will enhance infrastructure and in-country technical capacity for climate observations and monitoring in Timor-Leste. Amongst others, this will be achieved through expansion and upgrade of the meteorological observation network in compliance with the WMO Global Basic Observing Network (GBON), enhanced ocean observations and monitoring capacity, and installation of a low-cost dual polarization X-band Doppler weather radar network.</p> <p>Furthermore, this Activity will support DNMG in advancing towards an Internet of Things (IoT) approach to collecting data and disseminating information. An annual workshop will be conducted with 30 key delegates, led by a technical specialist from the International Centre for Theoretical Physics, on the use of wireless connectivity and IoT for climate services and disaster risk management. The Project will also implement a pilot study consisting of 20 low-cost weather stations based on IoT technology, with the aim of developing and demonstrating the potential of diverse, low-cost sensors to provide weather data.</p>	<p>2.1.1 Expand and upgrade the meteorological observation network to GBON standards</p> <p>2.1.2 Implement a robust program of training and capacity building including QMS</p> <p>2.1.3 Initiate Internet of Things (IoT) approaches</p>	<ul style="list-style-type: none"> <li>• Surface-based observation station network measuring atmospheric pressure, temperature, humidity, horizontal wind and precipitation established in compliance with GBON – including 1 new AWOS and 9 new AWS</li> <li>• Ocean observations and monitoring enhanced based on national requirements outlined in the Network Development Plan – including deployment of 1 marine buoy, tide gauge, depth sonar and ocean drone</li> <li>• Network of 3 dual-polarization X-band Doppler weather radars installed and operational</li> <li>• Compliance with WMO Integrated Global Observing System (WIGOS) regulatory and guidance material enhanced</li> <li>• Climate indices and derived products for monitoring of climate change and climate extremes computed</li> <li>• Generic monitoring products (i.e. drought monitoring, climate watch, etc.) generated</li> <li>• Sector-specific climate indices and other sector-oriented climate products computed</li> <li>• Value-added products, such as graphics, maps and reports to explain climate characteristics and evolution, according to the needs of specific sectors (e.g. health, agriculture, water and disaster risk management) generated</li> <li>• Basic Information Package Meteorological Training (BIP-MT) and Quality Management Systems (QMS) training program for DNMG</li> </ul>
--	---	--	---

			<ul style="list-style-type: none"> <li>• QMS established to enhance the quality of DNMG activities, including streamlining and optimising the processes and procedures applied and the products and services provided, with the aim of obtaining certification in compliance with relevant ISO standards</li> <li>• Technical support and training on equipment operations, maintenance and calibration, and ICT applications for DNMG</li> <li>• Training on advanced meteorology and climatology to enhance climate science capacity at DNMG</li> <li>• Annual workshops on the use of wireless connectivity and IoT for climate services and disaster risk management</li> <li>• 20 low-cost weather stations based on IoT technology deployed and piloted in selected communities</li> </ul>
<p><b>2.2 – Strengthen climate modelling and impact-based forecasting</b></p>	<p>This Activity will establish a national Forecasting Centre in Timor-Leste, which will provide the three critical elements of telecommunications, data management and forecasting that are crucial to strengthening DNMG’s capacity to deliver multi-hazard early warning products and services. A national Fire Management Dashboard will also be established to facilitate fire risk mapping and fire event analysis.</p> <p>The Project will build capacity of DNMG to generate sub-seasonal forecasts (2-week, 3-week and 4-week), monthly and seasonal (3-month) forecasts and to include other parameters besides rainfall in its forecasting system. In turn, this will enable the deployment of the following decision-support systems (DSS) for key sectors:</p> <ul style="list-style-type: none"> <li>• System for Multi-Hazard Potential Impact Assessment and</li> </ul>	<p>2.2.1 Establish a national Forecasting Centre</p> <p>2.2.2 Enhance climate change risk modelling and prediction</p> <p>2.2.3 Establish impact-based forecasting and decision-support systems for agriculture, disaster risk reduction and marine sectors</p>	<ul style="list-style-type: none"> <li>• National Forecasting Centre established to enable DNMG to transmit, store, manage, process and visualise data from different data streams – including Numerical Weather Prediction, satellite, radar, lightning and observation networks – for forecasting and verification of multi-hazard (i.e., meteorological, hydrological and climatological) forecasts for different timeframes</li> <li>• Training and capacity building workshops on ocean modelling and marine forecasting, including customisation of ocean forecast products</li> <li>• Access to and training on climate change models (e.g. CMIP5) and interpretation of model</li> </ul>

	<p>Emergency Response Tracking (SMART) DSS;</p> <ul style="list-style-type: none"> <li>• Agriculture Stress Index System (ASIS);</li> <li>• Specialised Expert System for Agrometeorological Early Warning (SESAME);</li> <li>• Ocean State Forecasting and Advisory System (OSFAS) DSS;</li> </ul> <p>Furthermore, this Activity will enable access for the Centre for Climate Change and Biodiversity (CCCB) at the National University of Timor-Leste to climate change models such as Coupled Model Intercomparison Project Phase 5 (CMIP5) and CCCB staff will undergo intensive training on climate modelling and output interpretation, which in turn will enhance CCCB trainings to relevant ministries and stakeholders.</p>		<p>outputs for Timor-Leste's Centre for Climate Change and Biodiversity</p> <ul style="list-style-type: none"> <li>• Training and workshops on impact-based forecasting and sector-specific decision support systems (DSS) for DNMG, NDMD and MAF</li> <li>• Sub-seasonal forecasts (2-week, 3-week and 4-week), monthly and seasonal (3-month) forecasts generated</li> <li>• Sector-specific DSS for disaster risk management, agriculture and water/marine sectors established (e.g., SMART, OSFAS, SESAME and ASIS)</li> <li>• Mobile applications for SMART, OSFAS and SESAME DSS developed</li> <li>• Training for MAF staff on agromet data analysis and development of monitoring indicators, thresholds and triggers for early action</li> <li>• Systematic drought risk analysis and crop monitoring field visits conducted</li> </ul>
<p><b>2.3 – Establish climate services for health</b></p>	<p>This Activity will address the increasing demand for relevant, timely and usable information about weather and climate variability, change, risks and impacts to enable decision-makers to take appropriate actions to keep people safe and healthy. This will include institutional strengthening through establishment of a national Climate and Health Working Group; establishment of a hybrid ambient air quality monitoring system and customised mobile application; and the co-development and delivery of tailored forecasting and health decision-support systems, including a mobile application.</p>	<p>2.3.1 Establish a national Climate and Health Working Group</p> <p>2.3.2 Establish an air quality monitoring framework</p> <p>2.3.3 Co-develop tailored forecasting and decision support for health</p> <p>2.3.4 Develop a mobile app for health-related forecasts and advisories</p>	<ul style="list-style-type: none"> <li>• National Climate and Health Working Group established and operational</li> <li>• Multi-stakeholder training workshops on climate and health conducted</li> <li>• Hybrid ambient air quality monitoring system – including low-cost sensors for fine particulate matter (PM2.5 / PM10) and nitrogen dioxide diffusion tubes overlaid with Aerosol Optical depth (AOD) PM2.5 satellite data</li> <li>• Training and capacity building on air quality monitoring conducted</li> <li>• Customised mobile application for air quality monitoring developed</li> </ul>

			<ul style="list-style-type: none"> <li>• Stakeholder engagement workshops to enhance awareness of air pollution, related health risks and actions to reduce impacts on health and well-being</li> <li>• Sector-specific DSS for health sector established</li> <li>• Capacity building workshops for the Ministry of Health and related authorities conducted to identify the required data for analysis, modelling and decision-making</li> <li>• Mobile application for health-related forecasts and advisories developed</li> </ul>
<p><b>3.1 – Establish targeted multi-hazard early warning information systems</b></p>	<p>This Activity will establish multi-hazard early warning information systems targeted to the specific needs of different population groups in Timor-Leste. To leverage the large network of organisations with the capacity to further disseminate early warnings, reach community-level stakeholders, and build a robust network of localised early warning systems (EWS) to support the national system, the Project will establish a technical working group for EWS and regularly convene a set of stakeholders for information sharing, updates and feedback for development of the EWS. Gender-responsive localised communication strategies will be co-developed and tailored to the different vulnerabilities and needs of women, as well as other vulnerable groups such as youth, elderly people and people with disabilities.</p>	<p>3.1.1 Convene a technical working group for EWS</p> <p>3.1.2 Co-develop socially inclusive and gender-responsive localised communication strategies</p> <p>3.1.3 Enhance community-based early warning systems</p> <p>3.1.4 Disseminate sector-specific early warning information for agriculture</p>	<ul style="list-style-type: none"> <li>• Technical working group for EWS established and operational (including government departments, NGOs, private sector entities, community-based organisations and women’s group representatives)</li> <li>• EWS organisation and decision-making processes defined</li> <li>• Training on EWS and planning, monitoring, evaluation and reporting (PMER) conducted – including peer learning in Indonesia</li> <li>• Early warning communication strategies and community feedback mechanisms developed</li> <li>• Gender-responsive localised communication strategies developed</li> <li>• Training for municipal and community-based volunteers to improve understanding, monitoring and communication of forecasts to translate early warnings into effective action</li> <li>• Community-based EWS (including flood/sea level markers, megaphones, information signboards, solar panels, and localised frameworks) established in 4 <i>sucos</i></li> </ul>

			<ul style="list-style-type: none"> <li>• Agricultural sub-sector-specific early warning products (e.g. food security bulletins, warnings, advisories) and a compendium of agriculture DRM/CCA early actions and climate-resilient agriculture (CRA) technologies developed and adapted to Timor-Leste</li> <li>• Training of extension officers, coordinators and MAF staff on DRM/CCA and CRA technologies</li> </ul>
<p><b>4.1 – Build capacity to prepare for and respond to climate risks and hazards</b></p>	<p>This Activity will build the capacity of Timor-Leste to prepare for and respond to the impacts of climate change risks and hazards, including related health impacts. The Project will work with the Cruz Vermelha de Timor-Leste (CVTL – Timor-Leste’s Red Cross Society) and the National Directorate for Climate Change (NDCC) to enhance disaster preparedness capabilities from national to municipal to community level for effective action in response to climate variability and climate change. This will include capacity building and coordination for community-based disaster risk management and co-development of Community Action Plans (CAPs). In addition, the Project will conduct community workshops to train members on the use of climate forecasts to support contingency planning and preparedness measures based on improved understanding of disaster risk. A broader awareness and education campaign will enable communities around Timor-Leste to understand and act upon messages to minimise losses and damage during disasters. This will be supported by a targeted disaster risk awareness and education campaign for women, which will focus on empowering women with the understanding and knowledge for increased participation in disaster risk management and decision-making for climate resilience.</p>	<p>4.1.1 Enhance disaster preparedness capabilities from national to community level</p> <p>4.1.2 Build capacity of the National Disaster Management Directorate (NDMD) for EWS</p> <p>4.1.3 Increase public awareness and education on climate hazards, related health risks and early warning</p> <p>4.1.4 Conduct a targeted disaster risk awareness and education campaign for women</p>	<ul style="list-style-type: none"> <li>• National and municipality level capacity building and coordination for disaster preparedness and risk management, and community-based health and first aid (CBHFA)</li> <li>• Community Action Plans (CAPs) to enhance preparedness for early action developed based on improved understanding of differential vulnerabilities and capacities</li> <li>• Community-based training and workshops on the use of climate forecasts for contingency planning and disaster preparedness</li> <li>• Standard Operating Procedure (SOP) for NDMD co-developed</li> <li>• Targeted training and capacity building for NDMD and Municipal Disaster Management Committees (MDMCs) to enhance risk knowledge, deliver effective EWS and use the existing disaster loss database for improved data collection and analysis</li> <li>• Technical support and training for EWS equipment maintenance and upgrade, IT infrastructure and wireless links</li> </ul>

	<p>The National Disaster Management Directorate (NDMD) is responsible for providing disaster risk management coordination and technical support to the Government and communities of Timor-Leste, including responsibility for disaster preparedness and early warnings. The Project will build the technological, technical and institutional capacity of NDMD to utilise EWS information for performing its mandated functions in disaster preparedness.</p>		<ul style="list-style-type: none"> <li>• International Day for Disaster Risk Reduction (13<sup>th</sup> October) national event and awareness campaigns conducted annually</li> <li>• Public awareness and education campaign focused on climate hazards, related health risks, early warnings, disaster risk reduction and appropriate risk management actions conducted – including community radio broadcasts; Information and Education Communications (IECs); national health education campaign; door-to-door education support; community awareness activities on health and violence prevention; and environmental education</li> <li>• Targeted disaster risk awareness and education campaign for women conducted – including ToT for women’s group facilitators, awareness workshops and targeted IECs dissemination</li> </ul>
<p><b>4.2 – Establish Forecast-based Financing (FbF)</b></p>	<p>This Activity will introduce Forecast-based Financing (FbF) in Timor-Leste as an innovative mechanism whereby early actions are pre-planned based on in-depth forecast and risk analysis, and resources are automatically allocated when a specific threshold is reached. The combination of FbF mechanisms with impact-based forecasting can be a transformative means of improving disaster preparedness and enabling more efficient management of the national budget to promote the shift from traditional post-disaster response to pre-event early action.<sup>228</sup></p> <p>The Project will establish a Roadmap for FbF in Timor-Leste, including the following components: i) Stakeholder Identification; ii) Risk</p>	<p>4.2.1 Establish a Roadmap for FbF</p> <p>4.2.2 Develop capacity for Early Warning Early Action (EWEA) in agriculture</p>	<ul style="list-style-type: none"> <li>• Roadmap for Forecast-based Financing (FbF) established</li> <li>• Capacity built at CVTL for development and implementation of EAPs, and establishment of FbF</li> <li>• Financial mechanism for forecast-based early action identified</li> <li>• Technical working group established to initiate development of EAPs</li> <li>• Draft EAP with information on triggers, early actions and funding allocation developed</li> <li>• Training and capacity building for DNMG, DNMD, MAF, Suco Disaster Management</li> </ul>

<sup>228</sup> IFRC, 2018. DRR in Action Case Study. Forecast-based Financing: Effective early actions to reduce flood impacts

	<p>Assessment; iii) Impact-based Forecasting (Triggers); and iv) Financial Mechanism. In addition, it will initiate the process of Early Action Protocol (EAP) development and build local capacity to utilise impact-based forecasts and early warning information for FbF / Early Warning Early Action (EWEA) in agriculture.</p>		<p>Committees, local NGOs and agriculture extension officers on Early Warning Early Action (EWEA) EAPs co-developed focused on addressing agriculture sector-specific risks</p>
--	---	--	---

**E.7. Monitoring, reporting and evaluation arrangements (max. 500 words, approximately 1 page)**

The Project will engage a Monitoring and Evaluation (M&E) Advisor to design a performance monitoring and evaluation framework to track the Project's progress towards achieving its targets, including gender responsiveness of Project implementation. Working closely with the Project Manager in the PMU, under the oversight of the UNEP Task Manager, the M&E Advisor will be responsible for continuously monitoring progress during Project implementation as outlined in the monitoring and evaluation framework. This will be achieved by i) measuring the indicators to assess the progress of the Project; ii) reporting the Project's performance to the PSC and PMU based on inputs from EEs. At key points (i.e., baseline, annual performance reports, mid-point and end of Project) the PMU will coordinate evidence-gathering exercises to verify this progress. Project targets and results will be triangulated with baseline surveys that will be completed in the Project's first year. In addition to the Project monitoring and evaluation undertaken by the M&E Advisor and PMU team, activities will be monitored by the EEs.

The M&E Advisor will organise training for staff members of the EEs and Technical Partners in data collection and analysis, and on the Project cycle, particularly on effective monitoring and reporting of activities. All training should take a strengths-based approach, both in the training process and in the principles and practices taught. These skills will be reinforced by follow-up training at least annually, to ensure that monitoring activities are collecting meaningful information and that the information is able to be used both for adjusting inputs throughout the implementation phase and for continuous evaluation of progress. During the Mid-Term Evaluation and Terminal Evaluation an evaluation consultant will validate a sample of the data collected through these monitoring tools.

EEs will submit semi-annual progress reports and quarterly financial statements to the PMU and the PMU will consolidate the reports and submit them to UNEP as the AE. In turn, UNEP will submit annual performance reports and semi-annual financial reports to GCF. The detailed reporting timelines are as follows:

Under the PCAs, each EE is to report to UNEP as follows:

- a. Progress reports: by 30 July for January to June;
- b. Annual Performance reports on or before 1 February;
- c. Quarterly financial reports by 15 January, 15 April, 15 July, and 15 October;
- d. Annual audited statements by 30 April;
- e. Final report: within 3 months of Project completion.

UNEP (AE) reports to the GCF:

- a. Annual Performance Reports by 1 March;
- b. Semi-annual Financial Information by 1 March and 30 September;
- c. Mid-Term Evaluation report: halfway through Project;
- d. Final APR: within 6 months of Project completion;
- e. Terminal Evaluation report: within 12 months of Project completion.

Monitoring will also be undertaken by the AE through supervision visits and field missions to track implementation progress and challenges and strategically plan the way forward. The Project reporting relationships, including frequency of reporting, between AE (UNEP) and EEs and other partners in the Project, are described in section B.4. UNEP will be responsible for managing the Mid-Term Evaluation and the Terminal Evaluation (TE). The Task Manager will oversee the process of hiring an external consultant to carry out the Mid-Term Evaluation, which will provide an assessment of Project performance at the Project's mid-point. This will be a formative exercise and will cover whether the Project is on track, what problems and challenges the Project is encountering, and what corrective actions are required so that the Project can achieve its intended outcomes by Project completion in the most efficient and sustainable way. The Project Steering Committee (PSC) and the EEs will participate in the Mid-Term Evaluation process and contribute to a management response to the Review's recommendations, with an implementation plan. The PMU will monitor the implementation of agreed recommendations during the remainder of the Project's implementation. It is the responsibility of the UNEP Task Manager to monitor whether the agreed recommendations are being implemented during the remainder of the Project's operational life.

UNEP's Evaluation Office (EO) will be responsible for undertaking the independent Terminal Evaluation (TE) at the end of Project implementation, which is a summative evaluation, and will liaise with the UNEP Task Manager throughout the process. An independent assessment of Project performance against standard evaluation criteria (e.g. strategic relevance, effectiveness, efficiency, likelihood of impact and sustainability) will be made based on documentary evidence, stakeholder interviews and, if possible, a field mission. Each evaluation criterion will be rated using a six-point rating scheme and a weighted average will be determined to provide an overall performance rating for the Project as a whole. Where there are any differences in ratings between the independent evaluation consultant and the Evaluation Office a final determination will be made by the Evaluation Office when the Terminal Evaluation report is finalised. The draft TE report will be sent to Project stakeholders during a commenting process managed by the Evaluation Office. Formal comments on the report will be shared by the Evaluation Office in an open and transparent manner. This evaluation report will be publicly disclosed and will be followed by a recommendation compliance process.

The costs for results monitoring and performance evaluation are included in the Project budget.

## F. RISK ASSESSMENT AND MANAGEMENT

### F.1. Risk factors and mitigations measures (max. 3 pages)

Please describe financial, technical, operational, macroeconomic/political, money laundering/terrorist financing (ML/TF), sanctions, prohibited practices, and other risks that might prevent the project/programme objectives from being achieved. Also describe the proposed risk mitigation measures. Insert additional rows if necessary.

For probability: High has significant probability, Medium has moderate probability, Low has negligible probability

For impact: High has significant impact, Medium has moderate impact, Low has negligible impact

Prohibited practices include abuse, conflict of interest, corruption, retaliation against whistleblowers or witnesses, as well as fraudulent, coercive, collusive, and obstructive practices

#### Selected Risk Factor 1

Category	Probability	Impact
Technical and operational	Medium	Medium

#### Description

Political instability that limits coordination and commitment between key partners and stakeholders

#### Mitigation Measure(s)

The Project will ensure that interventions are relevant to and aligned with existing national and sectoral priorities, which will increase stakeholder buy-in and support to deliver on the outcomes. The inception workshop will further define stakeholder responsibilities and project management arrangements to ensure alignment with existing mandates, responsibilities and capacities of national and local organisations. Throughout its implementation, the Project will engage with stakeholders through extensive consultations – for example, through development of the National Framework for Climate Services (NFCS) and the User Interface Platform – to ensure:

- i) Understanding and buy-in of the Project at the highest Government level and sustained involvement of Timor-Leste's National Meteorological Service (DNMG), the National Directorate for Climate Change (NDCC), the National Disaster Management Directorate (NDMD), the National Directorate for Water Resource Management (DNGRA) and other key governmental partners in the planning and implementation phases; and
- ii) Relevant partners (Government ministries, agencies and technical partners) are clearly identified, are committed to delivering the Project outcomes, and are aware of their contribution to the Project.

Furthermore, the Project will support the establishment of an active and engaged Project Steering Committee (PSC) to provide high-level oversight and guidance towards achieving the Project outcomes. The functions of the PSC include ensuring full cooperation of regional and national stakeholders and addressing any issues or conflicts that arise. Should political instability arise, the PSC will judiciously monitor the situation and conduct regular consultations with relevant entities to anticipate and address potential impacts to Project delivery.

If necessary, an emergency management / contingency plan will be developed and implemented to ensure continuation of the Project in support of its intended outcomes. Stakeholders at various levels of governance across Government entities and non-governmental organisations will be involved in development of the plan to ensure understanding of Project benefits and incentive for its continuation.

#### Selected Risk Factor 2

Category	Probability	Impact
Technical and operational	Medium	Medium

#### Description

Limited interaction between DNMG and end-users of climate information, products and services

#### Mitigation Measure(s)

The National Framework for Climate Services (NFCS) to be established in Timor-Leste will facilitate regular communication between DNMG and the Government agencies responsible for climate-sensitive sectors – in particular, the five GFCS priority sectors of agriculture and food security, disaster risk reduction, energy, health and water – with dedicated staff to ensure that climate information is integrated into the functions of each sector. Sector-specific training in basic climate science will begin the process of mainstreaming climate considerations into policy making and planning. A sustained two-way feedback mechanism as part of the NFCS and its User Interface Platform (UIP) will be established. This will facilitate regular dialogue between DNMG and end-users of climate information to help DNMG to better understand the information requirements of stakeholders and assist end-users to better understand climate information and early warnings. The technical working group for EWS will provide an additional means of interaction between DNMG and partner agencies working directly with communities, which will be complemented by community-level communication feedback mechanisms. In addition, biannual ocean data stakeholder engagement workshops will be conducted; and the Ocean State Forecasting and Advisory System (OSFAS) to be co-developed by RIMES will include a user feedback mechanism to validate forecast information.

The Project will also build capacity to conduct vulnerability and risk assessments, which will facilitate the dissemination of impact-based early warnings tailored to the specific needs of sectors and communities. The Gender Action Plan (Annex 8) details specific Project interventions targeted to the needs of vulnerable groups – in particular, women, children, elderly people and people with a disability – that have been informed by comprehensive assessment of gender issues in Timor-Leste.

The Project will support DNMG to work with NGOs (in particular, Timor-Leste Red Cross Society – CVTL) and MAF agriculture extension workers, who will feed back directly from beneficiaries at “the last mile”. These organisations, as well as end-users, have been extensively consulted during the Project design process and their contributions have informed the interventions and Project methodology. Furthermore, training will be provided to DNMG staff to enable them to work and coordinate with sectors and communities and to monitor the effectiveness of activities through structured feedback and evaluation mechanisms.

**Selected Risk Factor 3**

Category	Probability	Impact
Technical and operational	High	Medium
Description		
Inability to maintain new or upgraded infrastructure		
Mitigation Measure(s)		
<p>The costs for operation, maintenance and spares for new equipment have been factored into the Project budget, and maintenance and calibration regimes will be agreed with key stakeholders. The Project will engage with technical partners including RIMES and BMKG to support all essential training on equipment, AWSs, and calibration, etc. Training and calibration manuals / information will be provided by technical partners. For some highly technical equipment, relevant partners will maintain the items over the Project lifetime whilst building national capacity to take over this function.</p> <p>The observed value of the data collected, stored and utilised from the additional equipment and infrastructure is likely to generate funding for its maintenance beyond the term of the Project. The new Systematic Observations Financing Facility (SOFF) being established by WMO and partners for the Global Basic Observing Network (GBON) is a probable source of ongoing operations and maintenance support. For the Climate Data Informatics System (CDIS) to be installed by RIMES, Timor-Leste will not incur any licensing or update/upgrade fees and RIMES will provide free ongoing technical support for the CDIS both during and after the Project lifespan, as confirmed in the Operation and Maintenance Plan (Annex 21).</p>		
<b>Selected Risk Factor 4</b>		
Category	Probability	Impact
Technical and operational	Low	Medium

Description		
Limited local technical expertise in national EEs that could result in low performance or delay implementation of the Project		
Mitigation Measure(s)		
<p>UNEP will ensure the following:</p> <ul style="list-style-type: none"> <li>i) Establishment of a Project Management Unit (PMU) to provide guidance and source expertise as required for project management, financial management, procurement and technical issues;</li> <li>ii) Adequate staffing of the PMU through engagement of three full-time time administered by UNEP: Project Manager, Fund Management, Monitoring and Procurement Officer, and a Finance and Admin Assistant;</li> <li>iii) Governance structure and implementation arrangements understood by all Technical Partners;</li> <li>iv) Project risk management framework is coherent and allows for effective management of risks and impacts; and</li> <li>v) Capacity gaps of Technical Partners are assessed and addressed.</li> </ul> <p>The Project will provide on-site technical training, workshops and mentoring in-country and at regional technical agencies and institutions. Targeted and repeated training of local staff and facilitators over the five years in the full range of required skills, including maintenance of new technology, workshop facilitation, effective consultation, communication with non-scientists and Training of Trainers (ToT) approaches will enhance local expertise both during and beyond the term of the Project.</p>		
Selected Risk Factor 5		
Category	Probability	Impact
Other	Medium	Medium
Description		
Sectors and communities unwilling to instigate organisational or behavioural change		
Mitigation Measure(s)		
<p>The paradigm shift to evidence-based planning and preparedness action is a key measure of Project success from national to community level. The Project includes a range of interventions focused on empowering sectors and communities to increase their climate resilience – introduction of seasonal forecasting and its application to climate-sensitive sectors, engagement with communities on traditional climate knowledge and its complementarity to scientific forecasting methods, Forecast-based Financing / Early Warning Early Action mechanisms and co-development of Early Action Protocols, and improved dissemination and communication of climate information and early warnings, with specific emphasis on targeting vulnerable groups.</p> <p>Organisational and behavioural change is very difficult to achieve and will progress incrementally over the Project lifespan. Any change in acceptance of advice and warnings will constitute a worthwhile achievement. The Project's approach to sustainability beyond its five-year term will help to ensure that trust in scientific forecasting will continue, with benefits to lives, livelihoods and assets saved.</p>		
Selected Risk Factor 6		
Category	Probability	Impact
Other	Medium	Medium
Description		
Lack of long-term financial sustainability due to insufficient resources to effectively and efficiently implement Project interventions		

Mitigation Measure(s)		
<p>The Project includes a dedicated intervention to develop a financial framework for sustainable climate services to ensure that DNMG has the means to sustain its operations beyond the Project lifespan. This will be supported by the development of a business model for climate services delivery, which will identify options for value-added products and cost-recovery.</p> <p>In addition, the Project will consult and work with the Government of Timor-Leste and Technical Partners during its development and implementation to improve donor coordination; support mobilisation of domestic and additional resources; and build capacity in agencies that will continue to receive Government support beyond the Project duration. With regard to disaster risk management, the Project will identify a country-driven, scalable financial mechanism for forecast-based early action to ensure the availability of reliable and sustainable funding for Forecast-based Financing, which will be introduced under Activity 4.2.</p>		
Selected Risk Factor 7		
Category	Probability	Impact
Technical and operational	Low	Medium
Description		
Low commitment from regional institutions and at country level for data sharing		
Mitigation Measure(s)		
<p>The Project includes a dedicated intervention (Sub-Activity 1.1.3) to draft a Climate Data Strategy for DNMG and the Statistics Directorate to support improved data sharing, management and governance. The Strategy will be developed based on a series of consultative workshops with key stakeholders and will be informed by consultations and involvement of regional institutions during Project development.</p> <p>During its inception phase, the Project will support the establishment of cooperation agreements for national climate data access and data sharing between key stakeholders, in alignment with national policy.</p>		
Selected Risk Factor 8		
Category	Probability	Impact
Other	Low	Medium
Description		
Fiduciary management risk		
Mitigation Measure(s)		
<p>UNEP will undertake a full assessment of the financial management capacity of the national Executing Entity (EE) to identify risk elements and to prepare appropriate mitigation measures. UNEP will also closely monitor the financial management of the Project using the established Monitoring and Evaluation procedure and financial reporting mechanism, including an annual audit; and establish internal controls for the Project and project fund management.</p> <p>The Project Cooperation Agreements (PCAs) between UNEP and the national EE will include warranties and caveats by the EE to <i>inter alia</i> ensure compliance with the Anti-Fraud and Anti-Corruption Framework of the United Nations Secretariat, as well as the Green Climate Fund Policy on Prohibited Practices.</p>		

## G. GCF POLICIES AND STANDARDS

### G.1. Environmental and social risk assessment (max. 750 words, approximately 1.5 pages)

The Environmental and Social Safeguards (ESS) Screening identifies the risk category of this Project. The scope and depth of the environmental and social assessment is proportional to the level of risks and impacts determined in the ESS Screening as per GCF's ESS policies. None of the potential impacts that have been identified are expected to have significant environmental or social consequences. The majority of the Project activities are related to capacity building and training, which are inherently low-impact activities. While there are some activities that will require low-level monitoring (see Safeguard Standards 1 and 4 below), the environmental and social impacts should be minimal. This Project can therefore be rated as Category C, as per GCF policies and thus an Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) will not be required. As well, the initial screening performed by UNEP has confirmed that this Project is unlikely to have significant environmental or social impacts.

In the interest of providing a thorough overview of the potential environmental and social impacts each of the 7 UNEP Standards are analysed:

**Safeguard Standard 1: Biodiversity conservation, natural habitats, and sustainable management of living resources.**

- The Project will likely have minimal to no impacts on biodiversity conservation, natural habitats, and sustainable management of living resources. Specific activities that have been flagged for monitoring in the implementation phase related are:
  - 2.1.1 Expand and upgrade the meteorological observation network to GBON standards
  - 2.1.2 Establish a national Forecasting centre (in an existing government building)

**Safeguard Standard 2: Resource efficiency, pollution prevention and management of chemicals and wastes.**

- This Project does not significantly impact Safeguard Standard 2, however, international travel should be minimised, where practicable, in order to limit GHG emissions, and national travel should use low-emission vehicles when possible.

**Safeguard Standard 3: Safety of dams**

- Dams are not being implemented as part of the Project's activities.

**Safeguard Standard 4: Involuntary resettlement**

- Involuntary resettlement is not envisioned as a consequence of Project activities. The Government of Timor-Leste (through the Director of DNMG) has provided a formal letter indicating that all equipment will be operated, installed and maintained on government-owned land. These include but are not limited to Sub-activities:
  - 2.1.1 Expand and upgrade the meteorological observation network to GBON standards
  - 2.1.2 Establish a national Forecasting centre

**Safeguard Standard 5: Indigenous peoples**

- In accordance with the analysis of international development banks and other approved GCF projects (e.g. SAP 021), for purposes of development projects, essentially everyone in Timor-Leste is considered indigenous, and thus no specific analysis related to indigenous peoples is required.

**Safeguard Standard 6: Labour and working conditions**

- Manual labour contracts are not envisioned as part of this contract. Contracts for national and international consultants will be executed in accordance with Timor-Leste's Labour Code, Law 4/2012.

**Safeguard Standard 7: Protection of tangible cultural heritage**

- Tangible cultural heritage will likely not be affected by Project activities.

In addition, an Environmental and Social Action Plan (ESAP) is provided in Annex 6.

GCF's Environmental and Social Policy states that Projects must provide a "grievance redress mechanism to receive complaints and feedback." Therefore, the Project has created a Stakeholder Response Mechanism (SRM). The SRM provides Stakeholders with a mechanism that ensures that Grievances filed in relation to the Project are addressed thoroughly and systematically. Annex 6 sets forth the procedures for the SRM in detail. These procedures state:

- Who can Submit a Complaint;
- How a Complaint is Communicated;
- What information should be included in a Complaint;
- Information related to Logging a Complaint, Acknowledgment, and Tracking;
- Information related to Maintaining Communication with Project-affected Communities and Status Updates;
- The SRM's mandate to build consensus and propose a resolution;
- The right of Project-affected Communities to seek alternatives to the SRM.

As per the foregoing analysis, this Project has been assessed as Category C: Projects with Activities with minimal or no adverse environmental and/or social risks and/or impacts. As such, no further actions are required with respect to preparing an Environmental and Social Impact Assessment or Environmental and Social Management Plan.

**G.2. Gender assessment and action plan (max. 500 words, approximately 1 page)**

This Funding Proposal includes a Gender Assessment and Action Plan (Annex 8) that has been informed, analysed and prepared according to the following methodology:

- Stakeholder engagement specifically directed at gender assessment and analysis. This included primary data collection from an in-country stakeholder consultation workshop, interviews and questionnaire responses.<sup>229</sup>
- Comprehensive desk review of existing literature, draft Gender Assessment Report prepared by WMO<sup>230</sup> and gender analysis of the Feasibility Study (Annex 2). Literature was drawn from: research reports from international organisations (United Nations Development Programme – UNDP, United States Agency for International Development – USAID, The Asia Foundation, etc.); multilateral development banks (the World Bank and the Asian Development Bank – ADB); journals (*Climate Risk Management*, *Geography Compass*, *Women's Studies International Forum*, etc.); and grey literature (government reports, policies and plans).
- The stakeholder consultations, literature review, gender analysis of the Feasibility Study and analysis of the draft Gender Assessment Report provided useful data and information to inform the socioeconomic and gender baseline; political, legal and institutional environment in relation to gender priorities; and gender-specific vulnerabilities and adaptation needs in Timor-Leste. Based on the

<sup>229</sup> More details are provided in Annex 8 – Gender Assessment and Action Plan – Appendix 1

<sup>230</sup> The draft Gender Assessment Report was prepared by WMO to support the formulation of a funding proposal on enhancing early warning systems to build resilience to hydrometeorological hazards in the Pacific small island states, including Timor-Leste. The initial programme was not realised; however, outcomes of the stakeholder consultations are relevant to the current proposed project.

information detailed above, gender-responsive recommendation and interventions relevant to the Project are provided.

- Finally, the Gender Action Plan outlines specific indicators and targets for each Activity to ensure that gender mainstreaming is implemented, monitored and evaluated throughout the term of the Project. This will facilitate that the Project is fully aligned with international and national gender priorities in Timor-Leste, as detailed in Annex 8.

Gender mainstreaming throughout the Project is essential to ensure that gender concerns are addressed, existing gender inequalities are not reinforced, and that greater resilience to climate change is possible for the entire population of Timor-Leste. Therefore, the Project will engage a dedicated full-time Gender Expert. Full details of how the Project will deliver against the above objectives are provided in the annexed Gender Assessment and Action Plan. In summary, the following gender-responsive strategies and actions will be incorporated and implemented in the Project:

- All staff engaged in the Project – including Executing Entities, PMU, PSC and Technical Partner agencies – will be made aware of relevant gender policies and priorities (including the Timor-Leste Strategic Development Plan,<sup>231</sup> UNEP Gender Policy<sup>232</sup> and GCF Gender Policy and Gender Action Plan<sup>233</sup>) and will be required to apply by the Gender Policy principles and support gender mainstreaming throughout the Project. Where possible, training on gender equality will be provided to promote gender awareness and gender-responsive action.
- Frameworks, strategies, plans and partner agreements will recognise and require gender mainstreaming and gender-responsive actions to be implemented in line with national priorities and the UNEP and GCF Gender Policies.
- All stakeholder consultations, outlook forums and training processes to be undertaken as part of the Project will adopt a gender mainstreaming approach. The Project will ensure equal representation of women and men; include gender-specific inputs and indicators; and promote the active participation of women through flexible timing and the provision of women-only sessions and focus groups.
- All climate information and early warning products and services will be developed and delivered taking into account the gender-specific (and other) needs of the intended end-user. This will include addressing the gender-based vulnerabilities and multidimensional social factors that influence adaptive capacity, resilience and participation in climate action.
- Targeted interventions focused on improving women's access to early warning information and empowering women with enhanced awareness and understanding of disaster risks are included within Results 3 and 4 of the Project, which will enhance the impact of GCF investments and gender mainstreaming approaches highlighted above.
- Monitoring and evaluation of achievement of the Project objectives in relation to gender equality against the indicators and targets detailed in the Gender Action Plan; and ensure the collection of sex-disaggregated data against each of the relevant indicators outlined in the Logical Framework (Section E).

### G.3. Financial management and procurement (max. 500 words, approximately 1 page)

The financial management and procurement within the Project will be guided by UN financial regulations, rules and practices, as well as UNEP's Project manual. The financial rules of UNEP, which follow

<sup>231</sup> Government of Timor-Leste, 2011. Timor-Leste Strategic Development Plan 2011-2030

<sup>232</sup> UNEP, 2015. Gender Equality and the Environment – Policy and Strategy

<sup>233</sup> GCF, 2020. Gender Policy and Gender Action Plan 2020-2023

International Public Sector Accounting Standards (IPSAS), are promulgated pursuant to the Financial Regulations and Rules of the UN. Within this context, funding allocation mechanisms are managed in accordance with UN rules and procedures, including eligibility criteria, proposal evaluation processes, quality assurance and control, project monitoring and supervision. UNEP is audited annually by the UN Board of Auditors and has established dedicated trust funds for Green Climate Fund resources.

In line with UNEP reporting procedures outlined in section E.7, reports to summarise the disbursement and projected demands for Project funding will be prepared and submitted to a UNEP Project Officer who will conduct Project supervision, in line with reporting standards and methodologies applied in past projects, such as those implemented using GEF modalities.

UN financial regulations and rules require the segregation of duties, and safeguards to ensure compliance with UN financial rules and regulations. All procurement will be undertaken in line with UN procurement regulations, rules and policies. UNEP's modality for project implementation results in funds being transferred in tranches to the Executing Entities (EEs) once the EE has satisfied the conditions that are defined under the legal instrument (Project Cooperation Agreement(s): PCAs) to be signed between UNEP and the EEs. The PCAs will include specific obligations for the EEs on financial management and reporting and will require periodic reporting from the EEs to follow international financial and auditing standards.

The PCAs also specifically require annual audits to be undertaken by a recognised firm of certified public accountants or, for governments, by a government auditor. This auditor should state whether the GCF proceeds were covered by the scope of the audit.

The Secretary of State for the Environment (SSE) as the national EE follows the Government of Timor-Leste's financial and procurement rules, as described in section B.4. During the Project's inception phase, UNEP will conduct more detailed assessments of SSE's capacity to undertake procurement in line with UN regulations, rules and processes. This assessment will guide the procurement monitoring plan that will be agreed between UNEP and SSE. The same will be carried out for the Technical Partners supporting execution in Timor-Leste (FAO, RIMES, IFRC, BMKG, and ICTP), who are subject to financial and procurement guidelines acceptable to their members' or governments' financial and procurement policies and guidelines and are audited annually.

#### G.4. Disclosure of funding proposal

**No confidential information:** The accredited entity confirms that the funding proposal, including its annexes, may be disclosed in full by the GCF, as no information is being provided in confidence.

**With confidential information:** The accredited entity declares that the funding proposal, including its annexes, may not be disclosed in full by the GCF, as certain information is being provided in confidence. Accordingly, the accredited entity is providing to the Secretariat the following two copies of the funding proposal, including all annexes:

- full copy for internal use of the GCF in which the confidential portions are marked accordingly, together with an explanatory note regarding the said portions and the corresponding reason for confidentiality under the accredited entity's disclosure policy, and
- redacted copy for disclosure on the GCF website.

The funding proposal can only be processed upon receipt of the two copies above, if containing confidential information.

## H. ANNEXES

### H.1. Mandatory annexes

- Annex 1 NDA no-objection letter(s) ([template provided](#))
- Annex 2 Feasibility study - and a market study, if applicable
- Annex 3 Economic and/or financial analyses in spreadsheet format
- Annex 4 Detailed budget plan ([template provided](#))
- Annex 5 Implementation timetable including key project/programme milestones ([template provided](#))
- Annex 6 E&S document corresponding to the E&S category (A, B or C; or I1, I2 or I3):  
  - Environmental and Social Impact Assessment (ESIA) or
  - Environmental and Social Management Plan (ESMP) or
  - Environmental and Social Management System (ESMS)
  - Others (please specify – e.g. Resettlement Action Plan, Resettlement Policy Framework, Indigenous People’s Plan, Land Acquisition Plan, etc.)
- Annex 7 Summary of consultations and stakeholder engagement plan
- Annex 8 Gender assessment and project/programme-level action plan ([template provided](#))
- Annex 9 Legal due diligence (regulation, taxation and insurance)
- Annex 10 Procurement plan ([template provided](#))
- Annex 11 Monitoring and evaluation plan ([template provided](#))
- Annex 12 AE fee request ([template provided](#))
- Annex 13 Co-financing commitment letter, if applicable ([template provided](#))
- Annex 14 Term sheet including a detailed disbursement schedule and, if applicable, repayment schedule

### H.2. Other annexes as applicable

- Annex 15 Evidence of internal approval ([template provided](#))
- Annex 16 Map(s) indicating the location of proposed interventions
- Annex 17 Multi-country project/programme information ([template provided](#))
- Annex 18 Appraisal, due diligence or evaluation report for proposals based on up-scaling or replicating a pilot project
- Annex 19 Procedures for controlling procurement by third parties or executing entities undertaking projects financed by the entity
- Annex 20 First level AML/CFT (KYC) assessment
- Annex 21 Operations manual (Operations and maintenance)
- Annex 22 Memorandum of Understanding (MoU) between UNEP and UNDP

*\* Please note that a funding proposal will be considered complete only upon receipt of all the applicable supporting documents.*