National Coastal Vulnerability Assessment and Designing of Integrated Coastal Management and Adaptation Strategic Plan for Timor-Leste

Coastal Adaptation Strategies

28th February 2018

List of Abbreviations

ABC	Allowable Biomass Catch
ADB	Asian Development Bank
ASR	Aquifer Storage and Recovery
ATSEA	Arafura and Timor Seas Ecosystem Action
AUSAID	Australian Agency for International Development
CC	Climate Change
CCA	Climate Change Adaptation
CCCBTL	Centre for Climate Change and Biodiversity Timor-Leste
CBA	Cost Benefit Analysis
CEA	Cost-Effectiveness Analysis
CHW	Coastal Hazard Wheel
CIVAT	Coastal Integrity Vulnerability Assessment Tool
cm	centimetres
CO_2	Carbon Dioxide
COP	Conference of Parties
CTC	Coral Triangle Center
CVA	Coastal Vulnerability Assessment
CVI	Coastal Vulnerability Index
DRM	Disaster Risk Management
EIA	Environmental Impact Assessments
WS	Early Warning System
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GIS	Geographical Information System
GoTL	Government of Timor-Leste
Ha	Hectare
HAT	Highest Astronomical Tides
ICM	Integrated Coastal Management
ICZM	Integrated Coastal Zone Management
INC	Initial National Communication
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
Km	Kilometre
LAT	Lowest Astronomical Tides
M	meters
MAF	Ministry of Agriculture and Forestry
MCA	Multi-Criteria Analysis
MCIE	Ministry of Commerce, Industry and Environment
MED	Ministry of Economy and Development
mm	millimetres
MoF	Ministry of Finance
MPA	Marine Protected Area
MPSI	Ministry of Planning and Strategic Investment
MPW	Ministry of Public Works
MSS	Ministry of Social Solidarity
MTAC	Ministry of Tourism, Arts and Culture
NAPA	National Adaptation Programme of Action
NDCC	National Directorate for Climate Change

NDMD	National Disaster Management Directorate
NGO	Non-governmental organization
NOP	National Ocean Policy
RDTL	Republika Demokratika Timor-Leste
SDP	Strategic Development Plan 2011-2030
SLR	Sea Level Rise
SMS	Short Messaging Service
SRES	Special Report on Emission Scenario
SSE	State Secretariat for Environment
SST	Sea surface temperature
SWH	Significant Wave Height
TL	Timor-Leste
ToR	Terms of Reference
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNTL	National University of Timor-Leste
USAID	United States Agency for International Development
USGS	United States Geological Survey
VA	Vulnerability Assessment

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Executive Summary

Climate change is expected to impact all aspects of life in Timor-Leste, particularly the coastal zones. Global sea level rise increases coastal vulnerability causing more abrasion and sedimentation thereby amplifying coastal instability. In addition, the current hazard events of floods, droughts, landslides and strong winds have already a devastating impact on the coastal zone including its communities, developments, and environment.

The assignment "National Coastal Vulnerability Assessment and Designing of Integrated Coastal Management and Adaptation Strategic Plan for Timor-Leste" is a part of the project "Building Shoreline Resilience of Timor-Leste to Protect Local Communities and Their Livelihoods", funded by the Global Environmental Facility. The aim was addressing key climate change induced challenges of the coastal areas in Timor-Leste, by conducting an extensive coastal vulnerability assessment[1]. The results of the assessment served as a basis to develop a set of appropriate National Coastal Adaptation Strategies.

The development process of those Coastal Adaptation Strategies for Timor-Leste followed these steps:

Vulnerability Context of Timor-Leste[2]

Timor-Leste is a country covering 14,954 km^2 of area, with a coastline of 783 km. The country has a population of 1,183,643, with approximately two thirds of the population living in the low lands. Approximately 70% of the population of Timor-Leste lives in rural areas. The coastline is mostly inhabited by rural communities, mainly dependent on (semi-)subsistence farming and fishing (GCCM 2008). Only few urban settlements are located directly along the coast, except in Dili. The changing climate coupled with the physical and socio-economic condition of the country induce its vulnerability.

The vulnerability level of the coastline of Timor-Leste was determined by applying the Coastal Vulnerability Index (CVI) method using physical parameters (i.e. relative sea-level rise, maximum tide range, mean significant wave height and coastal instability) and non-physical parameters, (i.e. socio-economic, infrastructure and mangrove ecosystem).

The assessment has been undertaken through an extensive survey of the coastline of Timor-Leste, including Atauro Island and the enclave Oé-cusse. Also a total of 14 community consultations, including 25 Sucos were conducted in strategically chosen sites to represent different typologies and

[1] Presented in Vol. 1 Coastal Vulnerability Assessment.
[2] Detailed assessment is presented in Vol. 1 Coastal Vulnerability Assessment.

geographical settings across the country. Furthermore, the results include socio-economic analysis and analysis of the current development plans and policies of the country related to costal zones.

The results of the vulnerability assessment using only the physical parameters indicate that the southern coast are more vulnerable than the northern coast. The analysis also shows that the coastal instability parameter is determinant to the CVI value, particularly due to the locality of influence. With regards to the index of oceanographic parameters, the values in the northern coast are always lower than in the southern coast, i.e. lower rate of sea level rise, calmer wave and lower tide range. This balances the erodibility rate of the northern coast and thus the coasts are physically less vulnerable.

On the contrary, with respect to the coastal vulnerability assessment using only non-physical parameters, the results show that the northern coast is more vulnerable than the southern coast. This result derives especially from the concentration of important infrastructures and community's settlements located in the northern coasts, influencing the country's economic development. However, it is important to take into account the development agenda of the southern coast. Roads and highways which are currently being constructed can be determining factors for the mushrooming of new settlements and the corresponding infrastructures. If this infrastructure development is not managed properly, it will negatively influence the future vulnerability level of the southern coasts.

The results of the overlayed physical and non-physical parameters show that vulnerability level of the Timorese coast is mainly defined by its physical vulnerability indicators. Typologies of coastal sucos vulnerability and its influencing indicators are presented in the table below.

High Influencing Vulnerability Indicator*				Municipality (Sucos)
Physical	Ecosystem	Infrastructure	Socio-Economic	
x				**Ainaro** (Foho-AL-Lico, Leolima II), **Bobonaro** (Sanirin), **Covalima** (Camenaca, Labarai, Tashilin), **Liquiçá** (Lauhata, Motaulun, Vatuvou), **Manufahi** (Caicasa, Uma Berloic), **Oé-cusse** (Nipani, Usi-Taco) and **Viqueque** (Fatu Dere)
x		x		**Bobonaro** (Aidabaleten), **Covalima** (Maudemo, Suai Loro), **Liquiçá** (Vaviquina), **Manufahi** (Betano, Mahaquidan) and **Oé-cusse** (Costa)
x		x	x	**Viqueque** (Uma Uain Leten)
x			x	**Bobonaro** (Batugade), **Covalima** (Casabauc, Raimea), **Lautem** (Trilolo), **Oé-cusse** (Suni-Ufe, Taiboco), and **Viqueque** (Babulo, Macadique, Matahoi, Maluro, Uma Quic, Vessoru)
x	x			**Covalima** (Beco, Lalawa), **Liquiçá** (Tibar), **Manatuto** (Aubeon), **Manufahi** (Clacuc) and **Viqueque** (Bibileo, Luca)
x	x		x	**Viqueque** (Irabin de Baixo, Uani Uma)
x	x	x		**Liquiçá** (Ulmera)
	x	x		**Dili** (Duyung)
	X		x	**Lautem** (Uitame)
	X	x	x	**Lautem** (Baiduro, Pairara)
	X			**Dili** (Hera, Sabuli)

Coastal Adaptation Policies

To date, there is no specific document designated for coastal management in Timor-Leste. Coastal management and protection is embedded in several national and sectoral laws and regulations, especially those concerning the country's strategic plans, environment as well as fisheries and agriculture. These laws and regulations are calling for an integrated management plan of the coast, taking into account the limits of natural processes and long-term equilibrium of further components such as environmental, economic, social, cultural and recreational services.

In the context of climate change, coastal management and protection is one of the country's priority areas. The National Adaptation Programme of Actions (NAPAs), Initial National Communication (INC), Nationally Determined Contributions (NDCs) as well as the upcoming National Adaptation Plans (NAPs) and Climate Change Policy strongly indicate the needs of integrated actions. This way, the coastal sector will benefit from the measures implemented in other priority issues, such as Agriculture/Food Security, Natural Disaster, physical infrastructure as well as development of the national capacity and vice versa.

The cross-sectoral nature, diversity, complexity and richness of shoreline protection and coastal management impose the need for an integrated approach, assuring positive long-term impacts to the development and conservation of the coastal areas. To embark on an integrated coastal management, however, a national definition of coastal areas is necessary. The recent Law on Base for Spatial Planning 2017 presents a definition of coastal area. This definition, however, has not specified yet the portion of land that extends areas inlands. A more precise definition still needs to be developed to ensure that legal requirements are fully satisfied and to provide clarification of responsibilities of the various agencies.

Building on the existing policy framework relevant for coastal management of the country, a national coastal adaptation strategy is developed. The strategies integrate actions to protect coastal areas and populations. It also identifies gaps in the current framework and makes recommendations for further steps.

Coastal Adaptation Strategies for Timor-Leste

The objective of the coastal adaptation strategy is defined by building a comprehensive understanding of the context of coastal vulnerability and coastal management policies. To this end, coastal adaptation strategy is aimed to serve as a foundation for: 1) Ecosystem conservation initiatives including mangrove restoration, 2) Coastal livelihood development programmes, and 3) Contribute to the development of a national shoreline management and adaptation plan.

The formulation of coastal adaptation strategy takes into consideration 1) the array of stakeholders involved in coastal management, 2) the relevant policies and regulations regarding coastal areas, and 3) the adaptation options prioritized by the national stakeholders using Multi-Criteria Analysis. At the end, three strategic directions are developed and presented follow:

1. **Strategic direction 1: Country-wide options for coastal adaptation**
   This direction for coastal adaptation proposes strategic options to be carried out nationally. They serve as fundaments for adaptation to climate change at coastal areas and are not necessarily site-specific. They are also important to support the government agenda in assuring protection for coastal communities as well as continuing infrastructure development.

Strategic options	Description
Implementation of Coastal Zoning	Implementation of coastal zoning along the coast of Timor-Leste, assigning different purposes and user restrictions to coastal areas. The strategy shall serve as a mean to protect natural coastal areas while at the same time allowing some level of economic activities.
Early Warning System	Early Warning System (EWS) becomes an integrated part of the disaster risk management at the coastal areas in Timor-Leste in an effective and efficient manner. It aims at empowering coastal communities to prepare for natural hazards occurring at the coasts.

2. Strategic direction 2: Priority options for adaptation in highly vulnerable sucos

The strategic direction 2 proposes strategic options to cope with the impacts of climate changes to be carried out in the suco level.

Strategic Options	Description
Application of effective buffers for upland water & sediment fluxes	Application of effective buffers for upland water and sediment fluxes to improve watershed and coastline protection from climate change impacts. The buffers will be established between agricultural lands and water bodies. The strategy will contribute to protection and conservation of biodiversity in forest and coastal areas as well as development and management of watershed areas
Reforestation in upland	Reforestation and restoration of forests in the upland, including those of degraded areas, to improve watershed and coastline protection. Strategy for reforestation shall be done in a consistent manner, streamlined with the economic agenda.
Restoring mangrove and coastal forest	Mangrove restoration to assure their essential functions in terms of coastal flood and erosion management. The implementation of the strategy shall take into account community's participation, while assuring their safety and socio-economic benefits.
Provision of information about associated risks of development	The national government of Timor-Leste ensures the provisioning of full knowledge and information to respective stakeholders, entailing sub-national public authorities, private sectors operating in the areas, as well as coastal communities, about the risk of sea level rise and its associated uncertainties for development in highly vulnerable areas.
Adaptive management of water resources	Implementation of an adaptive management of water resources addresses water scarcity and quality issues at the coastal areas, which is crucial for domestic and agriculture use. In this context, adaptive refers to a management framework based on implementation, monitoring, and periodic reassessment of adaptation measures.
Preventing/Restriction of development	The national Government of Timor-Leste possess the right to limit development in specially protected areas (including mangroves and coral ecosystems) and highly vulnerable areas. This right involves land acquisition, prohibition of reconstruction of property damaged by coastal hazards, reduction of subsidies and incentives for development.
Resettlement	Resettlement of inhabitants, or arranging migration for coastal inhabitants, may need to take place when risk to the coastal communities becomes intolerable.

3. Strategic direction 3: Enabling conditions

The strategic direction 3 focuses on the enabling conditions, which are essential to guarantee successful implementation of the adaptation strategies

1. Provision of Legal Foundation

a. Formalization of Coastal Adaptation Strategies
b. Development of national definition of coastal zone, including a precisely defined boundary
c. Mainstreaming of Coastal Adaptation Strategies into the Government Plan (and other existing policies in the country)
d. Formalization of Tara Bandu to support the implementation of the Coastal Adaptation Strategies.

2. Institutional Arrangement and Capacity

a. Advocate the establishment of Coastal Management Committee
b. Strengthen stakeholders' engagement and coordination
c. Strengthen Institutional Capacities

3. Information and Knowledge

a. Improve data management system
b. Enhance awareness raising and education for communities
c. Foster knowledge exchange

4. Monitoring and Evaluation

1 Introduction

1.1 Background

Climate change is expected to impact all aspects of life in Timor-Leste, particularly the coastal zones. About 66% of the population lives in coastal and lowland areas below an elevation of 500m (USAID 2015). Satellite data indicate the rise of sea level in Timor-Leste by about 9 mm annually, over the past 25 years (PCCSP 2011). This figure is significantly higher than the global average of 2.8 - 3.6 of mm per year (PACCSAP 2015), and is expected to continue to rise.

The natural resources available at the coastal zone are vital for the economy of the country and especially of the coastal communities. The historical background of the Indonesian occupation, that brought along unsustainable practices, led to the destruction of mangroves. Additionally, rapid growth of coastal populations combined with urban development resulted in the fast deterioration of coastal ecosystems in the country. Furthermore, sea-level rise will accentuate the impact of storm surges as well as increase risks of coastal inundation and erosion (PACCSAP 2015, ADCP 2012).

With the increasing vulnerability of coastal areas and its communities, it is deemed imperative to assess the level of Timorese coastal vulnerability, induced by physical and socio-economic characteristics of the country. This assessment shall be then used as a basis to develop a set of appropriate adaptation strategies at the national level. To this end, a team, consisting of risk/vulnerability assessment experts, coastal geomorphologist/geology experts, oceanographers, coastal hazard experts, socio-economic vulnerability and adaptation experts, and GIS expert, is undertaking a Coastal Vulnerability Assessment (CVA) and developing Coastal Adaptation Strategies for Timor-Leste. This activity is part of the project “Building Shoreline Resilience of Timor-Leste to Protect Local Communities and Their Livelihoods”, funded by the Global Environmental Facility.

1.2 Scope and Objective

This assignment aimed at addressing key climate change induced challenges of the coastal areas in Timor-Leste. Implementing the project involved a process of conducting extensive coastal vulnerability assessment, used as a basis to develop coastal adaptation strategies for Timor-Leste. The final products are divided into two, as presented in table 1.1 below.

Table 1.1 Description of the reports

Vol 1. Coastal Vulnerability Assessment Report	Assessment of coastal and shoreline vulnerability combined with the socio-economic analysis.
Vol 2. Coastal Adaptation Strategies	Formulation of strategies for coastal management and adaptation to address key climate change induced challenges (especially due to sea-level rise) at the coastal areas.

This document presents the Coastal Adaptation Strategies, build upon the CVA report. It entails integrated measures to deal with the adverse impacts of climate change on coastal communities while still maintaining ecological integrity. Furthermore, this document presents strategies which are intended to build synergy among the different national development interventions, in order to contribute to the coastal resilience building effort.

Similar to the development of CVA, formulation of the adaptation strategies also involved consultations to national stakeholders. Through this approach, the quality and appropriateness of the results are assured, and ownership is built. The strategies are formulated to support the Government of Timor-Leste in their decisions related to adaptation to climate change in coastal areas.

Additionally, capacity building is an intrinsic part of the the development of the adaptation strategies. Training on the development of adaptation strategies was delivered to relevant national stakeholders in October 2017. Prioritization of the adaptation options was also carried out during the training. The training was delivered by adaptation strategy experts, assuring the most effective transfer of knowledge.

The report entails:

Chapter 1. Introduction to the scope and objective of the report, as well as the general methodology used.

Chapter 2. Vulnerability Context of Timor-Leste. The chapter provides a summary of the vulnerability context in Timor-Leste (based on Vol 1. Coastal Vulnerability Assessment Report).

Chapter 3. Policy Framework Analyses. The chapter presents a synthesis of the national policies and institutional framework relevant for coastal management and adaptation in Timor-Leste.

Chapter 4. Adaptation Strategy for Coastal Areas. The chapter discusses the different typologies of vulnerability in Timor-Leste, used as a basis to design an adaptation strategy and formulate adaptation options, integrating the concept of adaptation to climate change and managing coastal zones.

Chapter 5. Prioritization of Adaptation Options. It elaborates the process of prioritizing adaptation options with the national stakeholders in Timor-Leste. It also presents the final prioritization results.

Chapter 6. Coastal Adaptation Strategies. Founded on the prioritized options jointly developed with national stakeholders, the adaptation strategies include strategic directions and suggests modalities to assure implementation.

1.3 Methodology

The formulation of the Coastal Adaptation Strategies requires integrated information that represents coastal vulnerability and risk to climate change on the national level. And therefore, the following information was gathered (see Table 1.2)

Table 1.2 Information collated to develop adaptation strategies

		Methodology
Vulnerability	What do we know about the country's vulnerability? What ecosystems, sectors, regions, and populations are particularly vulnerable to climate change?	• Literature review • Institutional Interviews • Field Observation • CVI + Modified CVI analysis • Consultations with Communities and Stakeholder
Policy context	What is the policy context for development and adaptation in the country? What are the exsiting and new policies relevant to be considered for coastal adaptation	
Stakeholders	Which set of stakeholders represents the various sectors, regions, and populations being considered. What is the existing institutional arrangement to adapt to the changing climate in coastal sector.	

The development process of those Coastal Adaptation Strategies for Timor-Leste followed these steps: (see. Figure 1.1).

Figure 1.1 Steps in developing adaptation strategies

1. *Analysis of Policy Framework (Chapter 3)*
   Analysing previous Climate Change related policies (particularly on adaptation), as well as development planning related documents. This step helps to understand:
   - the capacity of the country to adapt,
   - the overall policy context, and
   - the involvement of the various national stakeholders.

2. *Design Adaptation Strategy (Chapter 4)*
   The objectives of the adaptation strategies must be defined. In this context, the adaptation strategy is aimed to serve as a foundation for:
   - ecosystem conservation initiatives including mangrove restoration,
   - coastal livelihood development programmes, and
   - contribute to the development of a national shoreline management and adaptation plan.

3. *Formulation of Adaptation Options (Chapter 4)*
   Adaptation options are selected based on the circumstances in Timor-Leste, impliying that selection of adaptation options takes into consideration the following aspects:
   - Level of vulnerability, as represented by the result of the CVA.
   - Socio-economic condition
   - Development strategies and agenda.

4. *Selection and Prioritization of Options (Chapter 5)*
   In line with scope of this assignment, the proposed adaptation options were prioritized using Multi-Criteria Analysis method. This analysis has been conducted jointly with national stakeholders during a workshop organized by UNDP in Dili.

5. *Formulation of Adaptation Strategy (Chapter 6)*
   The final recommendations for the adaptation strategy take into consideration 1) the array of stakeholders involved in coastal management, 2) the relevant policies and regulations regarding coastal areas, and 3) the adaptation options prioritized by the national stakeholders. Furthermore, these recommendations are accompanied by a set of supporting instruments for implementation.

2 Vulnerability Context of Timor-Leste

This chapter provides a summary of the vulnerability context in Timor-Leste, in which details are presented in the CVA Report. The CVA report has been used as a basis in developing the Coastal Adaptation Strategies. Detailed information regarding the elements of this chapter are presented in Vol. 1 Coastal Vulnerability Assessment Report

Timor-Leste is an island country, covering 14,954 km^2 of area, including the enclave Oé-cusse, Atauro Island and Jaco Island. It has a coastline of 783 km. The changing climate coupled with the physical and socio-economic condition of the country are responsible for its vulnerability. Approximately two thirds of the population lives in the low lands, from the coastline up to 500 meters above sea level. Low-lying areas in Timor-Leste are generally more arable and also better connected to transportation and communication networks.

The country is inhabited by a population of 1,183,643, the ratio between male and female population being almost 1:1 (MoF 2015). Timor-Leste used to be among the countries with the highest population growth in the world at around 3-4 percent per year, until 2009. Since then, the population growth has been slowing down to 2.1% per year in 2015 (MoF 2015). This rapid growth rate results in a high percentage of young population, more than 40% of all citizens are under the age of 15 (Population Pyramid 2016).

It is recorded that 70% of the population of Timor-Leste is living in rural areas. Only few urban settlements are located directly along the coast, except in Dili. The coastline is mostly inhabited by rural communities, mainly dependent on (semi-)subsistence farming and fishing (GCCM 2008). Almost 50% of the rural population is affected by severe poverty. Coastal municipalities with the highest poverty rate include Oé-cusse (62,1%) and Ainaro (52,3%) (OPHI 2017). The following sections describe in detail various aspects of vulnerability taken into account.

2.1 Physical Characteristics of Coastal and Land Areas of Timor-Leste

Timor-Leste is a mountainous island, characterised by rugged steep terrain and small narrow valleys. About 44% of the country has a steep to very steep slope (> 40%). The soil characteristic of the country is highly erodible and infertile soils.

Along the southern coast, a number of wide, yet low-laying, coastal plains can be found. River deltas, lagoons, floodplains and swamps are characteristics for this part of the coast (RDTL and CDU 2006). These plains are suitable for agricultural activities along the coast and are mostly cultivated or covered by plantations and at the same time, however, they are very susceptible to coastal inundation. The coastal bathymetry is shallow with heavy wave and turbid nearshore water (Sandlund et al. 2001).

The northern coast is mainly characterized by the steep mountains falling directly into the sea, making for rocky and steep coast along most of the shoreline. Narrow coastal plains can be found only in some areas around Manatuto and Dili. In contrast to the south, the coast water is clear with calm wave, however the nearshore littoral zone is very narrow, and the sea floor sharply drops off to the deep sea (RDTL and CDU 2006). Arid woodlands are the dominant vegetation type along most of the north coast.

2.1.1 Climate Condition

The climate in Timor-Leste is humid, tropic, and warm, with high temperature and rainfall, characterized by the alternation of two monsoons. The climate condition in Timor Leste is influenced by dynamical atmospheric circulation in the Maritime Continent region and part of the Pacific small island countries.

In general, the rainfall pattern in Timor-Leste is strongly characterized by the Australian Monsoons. The peak of the rainy seasons usually occurs in January or February with around 250 mm/month in average, and the dry seasons appear in July to October with the lowest rainfall average around 25 mm/month (TL-SSE 2014). Rainfall patterns in Timor-Leste vary from the driest area in the north-eastern part to wetter areas in the western part of the country.

Based on historical rainfall and temperature record, the region is divided into three different climatic zones, i.e. (i) north coast region, characterized by average mean temperature of more than 24 ^{0}C, annual rainfall amount less than 1,500 mm (ii) mountainous region, characterized by average mean temperature less than 24 ^{0}C, annual rainfall amount more than 1,500 mm (iii) South coast region, characterized by average mean temperature more than 24 ^{0}C, annual rainfall amount of about 2,500 mm (Kirono 2010 in TL-SSE 2014).

2.1.2 Ocean Condition

It is indicated that there is gradual warming of sea water temperatures around Timor-Leste since the 1970s, at approximately 0.16°C per decade (TL-SSE 2014). Projections indicate that the annual average air temperature and sea-surface temperature will further increase. Air temperature is projected to increase between 0.5 – 1.1°C by 2030 under very high emission scenario (PACCSAP 2015). This increase will result in an increase in the number of hot days and warm nights, and a decrease in cooler weather.

The average Sea Surface Temperature (SST) increases with rising trend from 0.075°C/decade from the beginning of 20th century to 0.22°C/decade during the recent decades. Furthermore, with the rise of emissions, not only in Timor-Leste but globally, acidity levels of sea water will continue to increase over the 21st century (PCCS 2011). Data shows that since the 18th century the level of ocean acidification has been slowly increasing in Timor-Leste's waters (Ibid.).

The sea level has risen near Timor-Leste by about 9 mm per year since 1993, larger than the global average of 2.8–3.6 mm per year (PCCS 2011). A study done by the PCCS in 2011, indicates that under a very high emission scenario sea level may rise between 9–18 cm by 2030 (Ibid.).

The characteristic of tide at the Timor Sea waters is semi-diurnal type, which means the occurrence of two high water levels and two low water levels daily with approximately the same height. The tidal ranges variation of about 1-2 m in the northern sea and around 2-4 m in the southern sea (Sofian 2014). Whereas, ocean wave heights in Timor-Leste are influenced by the seasonal wind. During the Asian monsoon, the Significant Wave Height (SWH) in Timor-Leste is about 0.75 m while during the Australian monsoon the SWH is about 1.5-1.75 m (Sofian 2014).

2.1.3 Land Use

Forest is the dominating land cover in Timor-Leste, 63.2% of the total area in 2012 was covered by forests (MAF 2017). This includes 21.2 % of dense forest, 37.7% of sparse forest and 4.3% of very

sparse forest. However, at the same time forest degradation and deforestation is deemed a critical issue. From 2003 to 2012, decrease in forest cover varied between 1-30% depending on the municipality (Ibid.). About 27 % of the total land area is covered with grasslands and 4.3% is used for crop land. Agriculture areas are mainly located in rural areas, comprising community crop land and land for agribusiness (TL-SSE 2014). The detailed land use information is presented in Table 2.1.

Table 2.1 Detailed land use information

Category	Land Use/Cover	Area (Ha)	Percent
Forest Land	Dense Forest	312.930,67	21,2%
	Sparse Forest	556.199,74	37,7%
	Very Sparse Forest	63.173,45	4,3%
Grassland	Grassland/Shrubs	403.247,22	27,4%
Crop Land	Rice Field	41.387,36	2,8%
	Dry Farm	22.152,57	1,5%
Settlement	Settlement	2.988,57	0,2%
Other Land	Water Body	22.877,31	1,6%
	Bare Land	48.717,01	3,3%

Source: TL-SSE 2014

2.2 Socio-Economic Condition

The efforts of the Timorese Government are directed at developing its economy, as articulated in the Strategic Development Plan (SDP) of Timor-Leste for 2011-2030. The plan reflects the medium- and long- term development challenges of the country while simultaneously paving a path to achieve its vision for 2030 as a country with a diversified economy and equipped with high quality infrastructure. Given the importance of economic development for the country, discussion about the socio-economic condition of the coastal population is imperative, as the sector will be highly affected by the impact of coastal hazards and climate change. The following sections (See. 2.2.1 and 2.2.2) elaborate on the economic and livelihood structure as well as the social and cultural structure in Timor-Leste. Both of which are deemed influencing the vulnerability level in the country.

2.2.1 Economic Structure and Livelihood

Economic activity in Timor-Leste is dominated by the agriculture sector. In terms of GDP, in 2014, the service sector contributed about 61.6% to the total country GDP, agriculture 19.8%, followed by the industry sector at 18.6% (WB 2017). Over 80% of the population is active and highly dependent on the agriculture sector (MED 2010), yet contribution to GDP is deemed low.
An overview of the main relevant sectors for the coastal areas are presented in the table 2.3:

Table 2.2 Main relevant sectors at the coastal areas of Timor-Leste

Sector	Opportunities	Challenges
Agriculture	• Important source of income and employment • Crucial sector to improve food security(MoI 2017)	• Climate change and physical condition of the country contribute to the lack of agricultural productivity • Lack of access to irrigations • Unsustainable agricultural practices (slash and burn) are still on-going • Local nature of subsistence farming • Poor connectivity hampers access to markets and income
Fisheries	• Expansion of the industry have positive impacts on income and employment of coastal communities • It contributes to the country's economic development • It increases food security. • It must be done in a controlled manner to avoid overexploitation.	• the sector is currently still underdeveloped • number of families involved in full time fishing and marine-based activities is relatively small (ATSEA Program 2012) • fishing activities are limited to low-technology inshore fishing, leading to low productivity and lack of competitiveness
Tourism	• It is one of the growing sector • The labour-intensive industry nature leads to employment and income generation • It leads to development of infrastructures, i.e. transportation access, and other tourism infrastructures • Development of the sector could reduce the socio-economic vulnerability of coastal communities	When not done sustainably, expansion of the tourism industry will: • alter coastal landscapes • disturb coastal ecosystems • increase vulnerability of the communities from coastal hazards.
Mining	• The country has abundant reserves of gas and oil • The growing industries pose a positive impact to the development of major infrastructure, especially in improving access to markets and thus income.	• Location of the mining infrastructures add to the vulnerability of coastal areas due to coastal hazards • At the same time, it poses risks of coastal degradation • It has the potential in endangering the indigenous livelihood (although not in all cases) and further marginalize the poor segment of the population.

Source: Own elaboration. Detailed can be found in CVA Report Vol. 1

2.2.2 Social and Cultural Structure

Patriarchal structures are deeply rooted in the society and play an important role in shaping vulnerability of women in the country. Despite the fact that the country's constitution grants equal rights in terms of ownership to both men and women, this right is rarely exercised by women. Some Timorese women have limited access to cash (Mills et al 2013), especially relevant for large purchases (e.g. fishing gear), investment (e.g. starting small businesses) and engaging in livelihoods that are not solely dependent on the men fishing (USAID 2015). This lack of ownership and access to cash leave a number of Timorese women to depend entirely on the male members of the family.

Timorese women are known as being highly engaged in agricultural work. But only 20% of these women are being paid for their work, although the high rate of subsistence farming in the country is deemed to play a role in this percentage. Moreover, according to the census done in 2015, it is reported that 31,9% of women in Timor-Leste have never been to school (MoF 2015). Of those who have been in school, about 50% have some primary education, 33% have some secondary education or have completed secondary school, and about 9% of women have more than secondary school education (Ibid.). Although, it is also noted due to the government's rigorous efforts and commitments in improving access to and quality of education, female school attendance increased over the years. The position of many Timorese women in the society is more vulnerable due to lack of rights to ownership and access to cash, educational levels. And therefore, gender issues must be considered in assessing coastal vulnerability in Timor-Leste.

With regards to customary law in the local communities, there is a need to support the collection and recording of information on customary practices. Tara Bandu is one of the traditional ceremonies still being practiced enforcing peace and reconciliation through public agreement (TAF 2013). The custom was oppressed during the Indonesian occupation, however nowadays it has become a priority of the 5th Constitutional government as a part of efforts to strengthen local governance through effective conflict resolution in social, political, economic and even ecological (environment) matters (AUSAID 2014). In addition to Tara Bandu, there are many others customary ceremonies being practiced by local communities and coastal communities that have developed a special relationship with the coastal and marine environment.

Moreover, customary law is a central element to land tenure issues in Timor-Leste. It must be noted that customary land tenure system has been perceived to have contributed to sustainable and equitable natural resource management for centuries (Batterbury et.al 2016). The country's SDP 2011-2030 articulated that the reform of land tenure law is crucial for long-term private sector development of agriculture. To this end, meaningful recognition of traditional customs for land tenure system is a pre-requisite for a conflict free resolution, while still promoting equality and sustainability in the development of rural areas.

2.3 Infrastructure

A central element such as Infrastructure serves as a major link for trade, services, tourism and commerce, and thus to the development of Timor-Leste's economy. The SDP 2011-2030 articulates the need to develop necessary infrastructure aimed at building a diversified economy and transforming the country into a modern nation (RDTL 2011). In the context of climate change, infrastructures can be sensitive to climate hazards. But at the same time, it could also function to strengthen the socio-economic condition, and thus increase the adaptive capacity of the communities. Therefore, taking into account infrastructure in determining the vulnerability level in the country is imperative.

Infrastructures discussed in the framework of this study entail road infrastructures and node infrastructures. Road infrastructures are the primary mode of transport and allow development and the delivery of resources to urban as well as rural areas. The national road network comprises two coastal roads along the north and south coast and five roads crossing the country and connecting with the two coastal roads, which consist of around 1,426 km of national roads, 869 km of district roads and 3,025 km of rural roads (RDTL 2011). Node infrastructures cover important infrastructures

in Timor-Leste such as airports, helicopter land zones, seaports, health facilities, education facilities and bridges (OCHA 2008). Some of these infrastructures are already planned to be expanded in the future, like the Presidente Nicolau Lobato airport and the development of National Toll Road in southern area (RDTL 2011). The future rehabilitation of these facilities, and/or even new development shall take into account the level of vulnerability in the area, to assure and sustain the full functioning of these infrastructures in case of disaster. If infrastructure is being developed or has already been developed, climate proofing action must be taken into account to protect these infrastructures.

Access to safe water and sanitation is a vital element to improve social and economic development of the country. The SDP reported that lack of safe water and sanitation facilities could lead to an average loss of 2% of Gross Domestic Product per year (RDTL 2011). According to the latest census in 2015, more than 40% of the total households have access to drinking water via the public tap (Ministry of Finance 2015). The impact of climate change will certainly exacerbate the already existing problem with water availability and quality (in the case of sea water intrusion), especially for those who live in the rural areas.

Education is a critical approach to reduce poverty and move towards community development, and thus simultaneously increase the adaptive capacity of the population. Since independence in 2002, there has been progress in the education sector of the country. The Strategic Development Plan (2011) includes the education sector as a key parameter to improve the wellbeing and opportunities of the population and at the same time reach the country's economic development goals. Yet, there are still significant discrepancies, especially when it comes to access and quality of education in urban and rural areas. Regarding coastal areas defined for this assignment, this discrepancy can be clearly identified by looking at the situation of Oé-cusse (55,55% access to education) and Dili (77,34% access to education). In general terms, Dili, the capital and centre of political and economic life of Timor-Leste shows the best numbers in any specific category in the education sector: primary and secondary education, academic education as well as vocational training.

2.4 Ecosystem

The marine and coastal zone around Timor-Leste consists of shallow seas with valuable marine resources, such as fish, seagrasses, seaweeds, coral reefs, etc. Vegetation surrounding the coast of Timor-Leste are usually mangroves and coastal forests. The country is home of more than 1.200 species of reef fish and 400 reef-building coral species (CTC 2017). Land areas close to the sea serve as important resources for the population's subsistence. There are two designated marine protected areas (MPAs) in the country, Atauro and the Nino Konis Santana National Park. The latter includes a large oceanic area covering nearly 350 km^2 of coral reef (ibid.)

Mangrove forest are mainly located in the north coast of Timor-Leste, especially in the regions between Tibar and Manatuto (GoTL 2015). Only few mangrove fringes are located in the south (Alongi 2014). Mangrove cover in Timor-Leste is decreasing at an alarming rate. In 2013, it was estimated that, only 1,300 hectares of mangrove were left, decreasing from 9,000 ha in 1940 (Ibid.). The fragmented nature and small size of most mangrove stands, along the north and south coast are making them less resilient. Not only tree harvesting for timber and fuelwood, infrastructure development and in some cases establishment of aquaculture are causing mangrove degradation,

but also sedimentation from the upland and coastal development play a significant role: it changes mangrove ecosystem into dry sandy flats.

2.5 Hazards Identification

Geographically, Timor-Leste is located in a region particularly sensitive to the impact of climate change and El Niño. Changes in rainfall pattern and increasing rainfall may impact agricultural productivity and water availability, as well as induce more occurrences of landslide, soil erosion and local flooding. Sea-level rise will increase coastal erosion and destruction of infrastructure as well as salinization of water sources (MCIE 2016). The country is also facing frequent climate events such as strong tropical windstorms, landslides, flash flood, and events such as earthquakes and tsunamis. As an impact, economic losses from these climate change hazards are predicted to reach 10% of Timor-Leste's annual GDP by 2100, making it one of the worst hit in the Pacific region (ADB 2013).

Hazards at the coastal areas of Timor-Leste were identified through combined desktop analysis, field observation and consultations to selected coastal communities. With regard to community consultations, the perceptions of more than 300 people were gathered during the activities conducted in 25 sucos across the northern and southern coast (including Atauro Island and Oé-cusse) serving as illustration of the situation in coastal communities characterized by high and very high vulnerability

The Table 2.3 present the hazards identified at the coastal areas:

Table 2.3 Identified hazards at the coastal areas

Hazard	Description	Risk level	Impact	Community perception
Coastal Erosion	In coastal areas, wave energy, tidal current, and wind interact with coastal geomorphological structure and coastal sedimentation through erosion, sedimentation, and sedimentation transport.	77% of the coastline is having high relative susceptibility to coastal erosion (NDMD 2012)	• Excessive coastal erosion could result in significant economic-, social-, and ecological- losses. • Increased erosion of beaches, shorelines and coastal land, • Loss of breeding and nesting habitats.	Only 7 out of 25 sucos consulted perceive coastal erosion as a hazard. Costa, Maudemo, Beco, Betano, Aubeon, Luca and Uma UainLaten. The community in Aubeon reported that erosion happened since 2012 and the coastline retreat about 100 m or equal to 20 m / year.
Landslide	Landslides may be triggered by earthquakes and/or rising of groundwater levels on the slopes which is influenced by the intensity of rainfall.	About 30% of the country area is highly susceptive for earthquake induced landslide. About 80% of the country area is susceptible to rainfall induced landslide. (NDMD 2012)	• Loss of lives and livestock • Damages to roads, infrastructure, and property	11 out of 25 sucos consulted were aware of this risk: Costa, Maudemo, Beco, Betano, Clacuc, Aubeon, Luca, Uma UainLaten, Tibar, Ulmera, Aidabaleten In Tibar and Ulmera participants indicated that in lowland the risk is triggered by land clearing due to road construction.
Flash Flood	Flash flood occurs when heavy seasonal rain water in high catchment basins converges in tributaries as it descends downward resulting in the rapid rise of discharge along the water courses (NDMD 2012)	During the field observation (done in May 2017), traces of flash flood were seen in almost all Timor-Leste's rivers, such as in Comoro Liquiçá, Ainaro, Manatuto and Suai.	• Inundation along the river as well as loss of lives and properties.	Out of 25 sucos, only 4 sucos name flash food events as risk: Aubeon, Luca, Uma UainLaten and Aidabaleten. In Luca, flash flood was recorded by the community in 2006. Whereas in Uma UainLaten one flash flood event was recorded in 1996, claiming one live at the Lugasa river.
Earthquake	Earthquake in the area of Timor is triggered by the movement of the north Australian Plate colliding with the Asian	It is estimated that Timor-Leste has a 40% chance of experiencing strong to very strong levels of ground shaking in the next 50	• Light to moderate damage to well-engineered buildings and more severe damage to structures built	8 out of 25 consulted sucos name earthquakes as a hazard. Participants from Tibar and Ulmera remember one event more

Hazard	Description	Risk level	Impact	Community perception
	Continental Plate.	years, at least once.(PCRAFI 2011)	with less stringent criteria.	than 10 years ago.
Tsunami	Timor-Leste's susceptibility to earthquake increases its susceptibility to Tsunami.	It is estimated that Timor-Leste has a 40% chance of experiencing strong to very strong levels of ground shaking in the next 50 years, at least once(PCRAFI 2011)	• Damage is first caused by the immense force of the tidal wave hitting the shoreline. • Tsunami flooding usually causes damage for several more weeks.	7 out of 25 sucos consulted perceive a Tsunami as a hazard to their community. In 2006 there was a small earthquake and tsunami. People were aware and immediately saved themselves.
Strong Wind / Storm Surges	Storm surge refers to the rise of water beyond the normal high tide, including large waves. With the changing climate, projections tend to show a decrease in the frequency of tropical cyclones, yet the existing ones are expected to be stronger, due to the increase in the average maximum wind speed of cyclones and rainfall rates of the cyclone centre.	Under future climate projection the wind hazard would potentially increase slightly for the 100-year return period. The event of the 100-year return period winds have a 40% chance of being equalled or exceeded once in 50 years. There are no previous studies on responses of cyclones on ocean surge dynamics in Timor-Leste or surroundings.	• Risk to human security. • In more extreme events loss can increase from 72% to 260% in the worst climate change scenario. Causing heavy damage to • Buildings, infrastructure&crops. • Education, health, housing, lifelines and transportation sector. (PCRAFI 2013)	19 out of 25 sucos consulted describe strong wind as a hazard. In Dili (Fatuhada, Hera, Duyung, Sabuli) Seawall was once destroyed and had to be rebuilt. Since 2013 there are also rocks protecting the coast line
Drought	Changes in rainfall and temperature patterns due to climate Change may intensify drought hazard in the future	El Niño-related droughts might occur with higher frequency.	• Loss of water and food security • Hygiene and health impacts • Increased risk of wildfire leading to risk to human security and loss of biodiversity	11 out of 25 sucos consulted are aware of this risk: Lifau, Costa, Beco, Betano, Clacuc, Aubeon, Luca, Uma UainLaten, Sanirin, SuniUfe, Oenunu. For example, drought has been causing water scarcity, crop failure, and food shortage in SuniUfe. Many years ago, drought has caused Forest Fire in Costa.

Source: Own elaboration, based on the description provided in the CVA report Vol. 1

Despite the potential adverse impact of coastal erosion, very few communities have identified coastal erosion or loss of seashore as a hazard to their assets and/or livelihoods. Participants, however, seemed to be more familiar with the issue of soil erosion from arable slopes or uphill damaging their assets and reducing their agricultural productivity.

Information gathered in all sucos provide evidence that extreme flood events are becoming increasingly common and severe, damaging private and public property as well as animals, farming lands and irrigation channels among others. The frequency, intensity and duration of the flooding vary from suco to suco. Also, some areas in Dili are affected by this phenomenon. However, results of the community consultation in Dili suggest that the cause of flooding was not necessarily the excessive water volume but rather the limited urban planning and improper drainage system in the suco.

2.6 Coastal Vulnerability Index

Coastal Vulnerability Index (CVI) has been applied as a tool to display vulnerability due to coastal instability and sea-level rise at the national level. CVI was initially used by the United States Geological Survey (USGS) to assess the impacts of sea-level rise and coastal changes especially on some national parks in the western and eastern of the United States and the Gulf of Mexico in 1999. It is an elementary measure of physical vulnerability on a nation-wide coastal scale. The index allows the physical parameters to be related in a quantifiable manner. It highlights those regions where the various effects of sea-level rise on the coastal instability or destruction are expectedly the greatest.

In the case of Timor-Leste, CVI was applied by considering four physical parameters that are all related to potential coastal destruction hazards (or coastal destruction susceptibility). Methods and data used in determining the level of vulnerability of each parameter are described in the Table 2.4:

Table 2.4 Methods and results per parameter

No	PARAMETER	METHOD	Results
(a)	Coastal Instability	• Determination of scale based on coastal geomorphology, coastal slope and sediment materials (*proxies*) • Mapping, inter-polation, and GIS analysis • Adjustment and correction using field observation data	• Most of the southern coast of Timor-Leste has a very high index (very unstable coast) susceptible to erosion. • Very high index in coastal instability: Manufahi (98,4%), Ainaro (91,8%), Covalima (91,14%), Viqueque (87,16%), Manatuto (64,71%), Liquiçá (63,04%), Bobonaro (62,75%), and Oé-cusse (56,72%). • Baucau, Dili, and especially Lautem are more resistant to erosion
(b)	Relative sea-level rise	• Using IPCC Model by the Special Report on Emission Scenario (SRES) A1B with projection of CO_2in 2100 as 750ppm (part per million) • Mapping, interpolation, and GIS analysis	• high relative sea level rise (<7.6 mm/year): Oé-cusse, Bobonaro, Liquiçá, Dili (including coastline of Atauro Island), Manatuto, Baucau, Lautem, Viqueque, and some part of Manufahi, • very high relative sea level rise (>7.6 mm/year): Ainaro, Covalima and parts of Manufahi.
(c)	Mean tide range	• Calculation of Highest and Lowest Astronomical Tides (HAT and LAT) by using a tidal hydrodynamics model • Mapping, inter-polation, and GIS analysis	Only the north-western coast is characterized by a moderate level of vulnerability.
(d)	Mean wave height	• Calculation of Significant Wave Height • Mapping, interpolation, and GIS analysis	• The northern coast has low susceptibility • most areas at the southern coast have a relatively higher susceptibility.

Source: Own elaboration, adopted from USGS 2000

2.7 Coastal Vulnerability Index for Timor-Leste

The CVI value distribution shows that the southern coast is physically more vulnerable than the northern coast. The analyses show that coastal instability parameter is a determinant factor to the CVI value, particularly due to the locality of influence. The index of oceanographic parameters in the northern coast is found to be always lower than in the south, i.e. lower rate of sea level rise, calmer wave and lower tide range. This balances the erodibility rate of the northern coast and thus the shoreline is physically less vulnerable.

Despite the low awareness of the severity of coastal erosion, the analysis showed that out of 121 coastal sucos, a total of 58 sucos are representing areas with high and very high level of vulnerability. Of those 58 sucos, 23 sucos are distributed along the north coast of Timor-Leste and 35 are located on the south coast.

The CVI value distribution along coastline of Timor-Leste is presented in Figure 2.1.

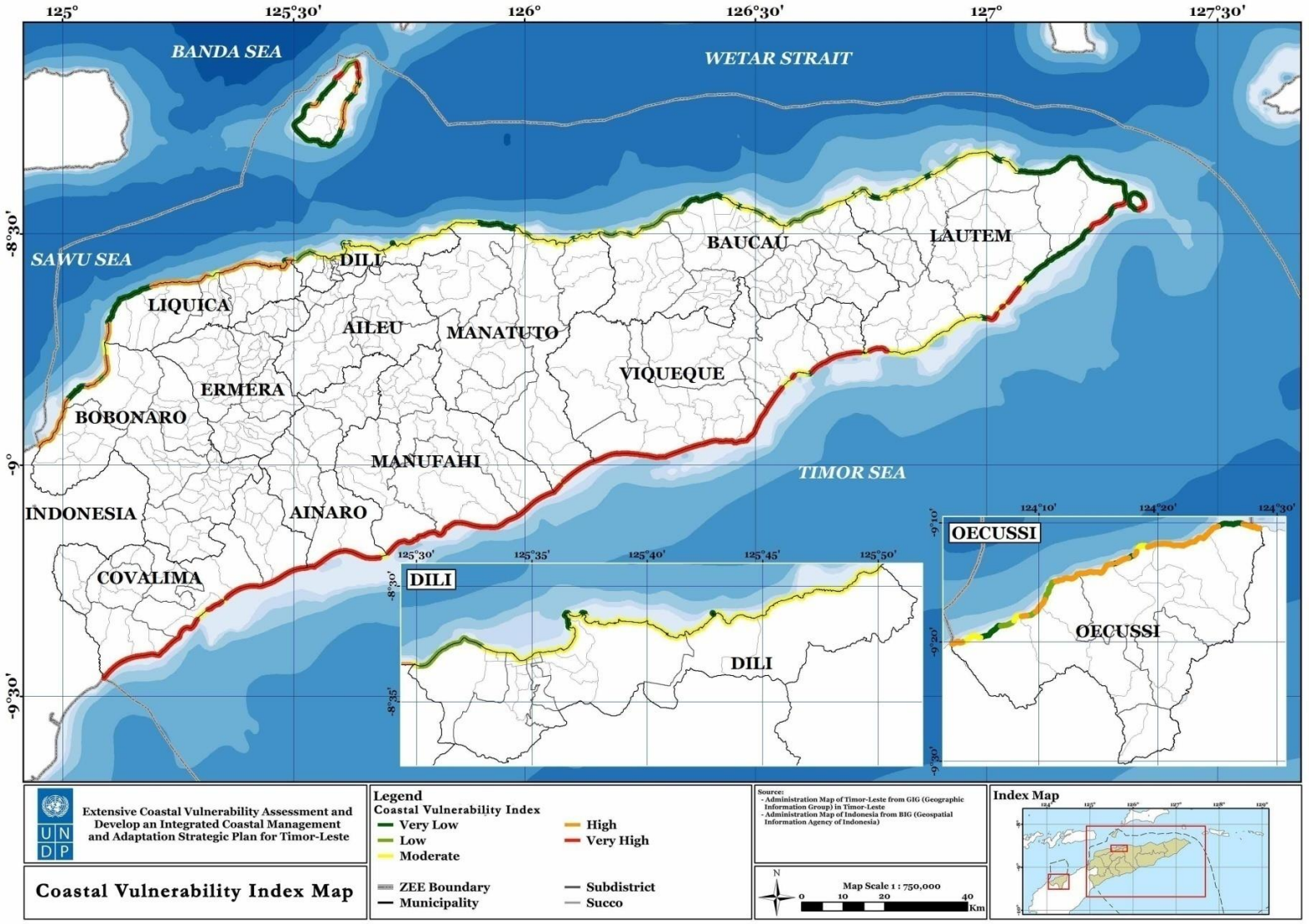

Figure 2.1 Coastal Vulnerability Index Map of Timor-Leste

Table 2.5 CVI value distribution: Sucos with Physically High Level of Vulnerability– Very High Level of Vulnerable

CVI SORTED BY HIGH AND VERY HIGH RANK								
DISTRICT	SUB DISTRICT	SUCO	TIDE	WAVE HEIGTH	SEA LEVEL RISE	COASTAL STABILITY	AGGREGATE	CVI CLASSIFICATION
BOBONARO	BALIBO	BATUGADE	3	1	5	5		4
		SANIRIN	3	1	5	5		4
DILI	ATAURO	ATAURO VILA/MAUMETA	3	1	5	5		4
		BELOI	3	1	5	5		4
		BICELI	3	1	5	5		4
LIQUICA	BAZARTETE	LAUHATA	3	1	5	5		4
		MAUMETA	3	1	5	5		4
		MOTAULUN	3	1	5	5		4
		TIBAR	3	1	5	5		4
		ULMERA	3	1	5	5		4
	LIQUICA	DATO	3	1	5	5	0,244949	4
	MAUBARA	VATUBORO	3	1	5	5		4
		VATUVOU	3	1	5	5		4
		VAVIQUINIA	3	1	5	5		4
OECUSSI	NITIBE	BENE-UFE	3	1	5	5		4
		SUNI-UFE	3	1	5	5		4
		USI-TACO	3	1	5	5		4
	PANTE MACASAR	COSTA	3	1	5	5		4
		LIFAU	3	1	5	5		4
		NIPANI	3	1	5	5		4
		TAIBOCO	3	1	5	5		4
AINARO	HATU-UDO	FOHO-AI-LICO	2	2	5	5		5
		LEOLIMA	2	2	5	5		5
COVALIMA	SUAI	BECO	2	2	5	5		5
		CAMENA?A	2	2	5	5		5
		LABARAI	2	2	5	5		5
		SUAI LORO	2	2	5	5	0,282843	5
	TILOMAR	CASABAUC	2	2	5	5		5
		LALAWA	2	2	5	5		5
		MAUDEMO	2	2	5	5		5
	ZUMALAI	RAIMEA	2	2	5	5		5
		TASHILIN	2	2	5	5		5
DILI	ATAURO	BELOI	3	2	5	5	0,34641	5
		BICELI	3	2	5	5		5
LAUTEM	ILIOMAR	TIRILOLO	2	2	5	5		5
	LOSPALOS	LORE I	2	2	5	5		5
	TUTUALA	TUTUALA	2	2	5	5		5
MANATUTO	BARIQUE/NATARBORA	AUBEON	2	2	5	5		5
		UMA BOCO	2	2	5	5		5
MANUFAHI	ALAS	DOTIC	2	2	5	5		5
		MAHAQUIDAN	2	2	5	5		5
		UMA BERLOIC	2	2	5	5		5
	FATUBERLIU	CAICASA	2	2	5	5		5
		CLACUC	2	2	5	5		5
	SAME	BETANO	2	2	5	5		5
VIQUEQUE	UATUCARBAU	IRABIN DE BAIXO	2	2	5	5	0,282843	5
		UANI UMA	2	2	5	5		5
	VIQUEQUE	BIBILEO	2	2	5	5		5
		LUCA	2	2	5	5		5
		MALURO	2	2	5	5		5
		UMA QUIC	2	2	5	5		5
		UMA UAIN LETEN	2	2	5	5		5
		WATU DERE	2	2	5	5		5
	WATULARI	BABULO	2	2	5	5		5
		MACADIQUE	2	2	5	5		5
		MATAHOI	2	2	5	5		5
		UAITAME	2	2	5	5		5
		VESSORU	2	2	5	5		5

2.8 Modified Coastal Vulnerability Index

The analysis of the socio-economic characteristics of Timor-Leste (see. Vol 1, chapter 5) shows that the vulnerability of people living in coastal areas are represented mainly by three critical non-physical indicators: infrastructure, the socio-economic structure as well as the ecosystem exposed to coastal hazards. However, the CVI approach focuses only on the physical parameters of the coastal areas. To overcome this limitation, the CVI was modified to include proxy data on those non-physical indicators. With that in mind, the CVI method is hereafter referred as modified CVI. This modified CVI was developed in two steps, a) developing vulnerability index, b) Merging CVI with the results of vulnerability index. Figure 2.2provides an illustrative overview on vulnerability indicators included in this project.

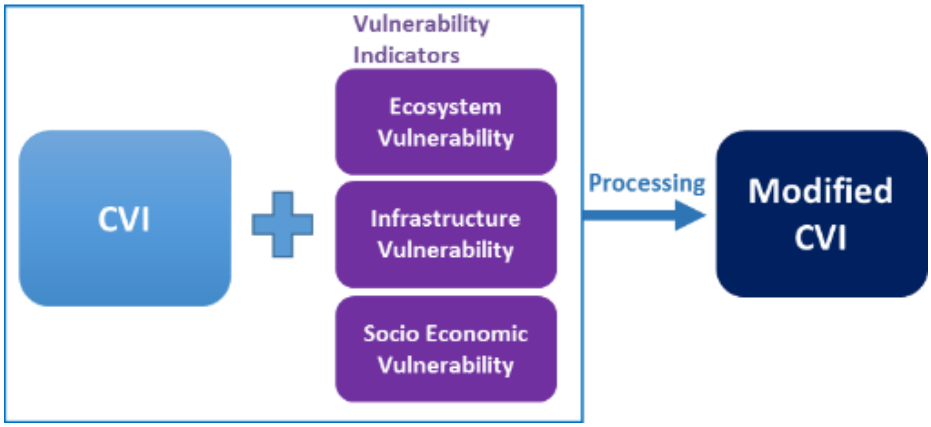

Figure 2.2Illustrative overview on vulnerability indicators

2.8.1 Analysis of Socio-Economic Vulnerability

There are 4 parameters representing socio-economic vulnerability for this study: population density, dependency ratio, gender ratio, and level of education. The Table 2.6 below presents these parameters as well as the vulnerability results. For a more detailed presentation of the parameters see Volume 1 of the report.

Table 2.6 Parameters of Socio-Economic Vulnerability

Parameter	Description	Results
Population Density	Population density is calculated based on number of population divided by road length. The higher the population density, the more vulnerable in the context of exposure to coastal hazards.	• In the northern part, almost all sucos located in Dili (i.e.: Becora, Culu Hun, Bairro Pite, Fatuhada, Acadiru Hun, Santa Cruz, and Macarenhas) can be considered of high population density. • In the southern part, especially Viqueque (Macadique and Matahoi) counts for a number of highly populated sucos.
Dependency	• Dependency ratio measures	Vulnerability with regards to dependency is highest in

Parameter	Description	Results
Ratio	the amount of people of nonworking age (0–14 and > 65) compared to the number of the working age population (15 – 64). • The high ratio in this study means the population is more vulnerable because the working population faces a greater burden in supporting the non-working population.	the Eastern and South- Eastern part of Timor-Leste, with the most vulnerable sucos being: • Bobonaro: Rairobo • Lautem: Illiomar II, Trilolo, Baduro, Com, and Muapitine • Cima: Irabin de Cima, • Viqueque: Maluro, WatuDere, Babulo, Vessoru
Gender Ratio	• Overall, women would rather stay at home, have less education and are economically less independent, which makes them more vulnerable to the impacts of climate change. • In general terms, the gender ratio between women and men in Timor-Leste is 48,84%.	• In coastal sucos gender ratio is 49,22%. • In some of the most rural areas in municipalities such as Lautem or Viqueque this ratio goes up to 53%,
Education Level	• The percentage of population in coastal sucos receiving education varies between 55,55% in Oé-cusse and 77,34% in Dili. • Education improves people´s awareness of the natural hazards that affect their community and the ability to cope with them.	• Vulnerability with regards to the level of education is generally high, especially in rural areas. • Sucos with the highest vulnerability with regards to the educational level, are mostly located in Bobonaro and Oé-cusse.

The socio-economic vulnerability index has been developed merging the results of the abovementioned parameters. The results show that in total there are three sucos, which have a very high socio-economic vulnerability index and seventeen sucos that have a high socio-economic vulnerability index. Three sucos, which have a very high socio-economic vulnerability index are located in the southern part of the country: Macadique, Matahoi, and Vessoru in Viqueque.

In addition to the above presented indicators, whose data allow GIS mapping analysis, there are some other parameters which need to be considered, despite unavailability of data set to allow GIS mapping. On the suco level, detailed information on economic vulnerability, income distribution and other economic factors were limited. The primary information gathered were deemed limited and unsuitable

to represent the condition of the coastal communities in Timor-Leste. Yet, these parameters are significantly relevant for the development of the adaptation strategies. Therefore, data from the municipality level, as well as specific information such as poverty level and main economic activities have been selected for the analysis. They are, however, not included in the mapping process of the modified CVI, considering that the information cannot be compared with the coastal suco level. These parameters are:

1. **Economic Activities**

   Major economic activities in coastal areas are agriculture and fishery. Most people are employed in these sectors and they are the most important income sources and livelihoods for the economically inactive population, especially when it comes to subsistence of the population. 75% of the population depend on subsistence agriculture(GCCM 2008). In coastal areas, the percentage of the inactive population (10 years and over) varies between almost 70% in Lautemand and 42% in Ainaro(MoF 2015). The percentage of women being economically inactive is even higher, with a percentage of over 60% (Ibid.).

   Urban areas and fishing communities such as in Atauro Island or Dili are the most resilient to climate change, which can be traced back to higher incomes due to access to small industrial activities and tourism combined with diversified livelihoods. Vice versa, communities that are depending on a few highly- climate sensitive commodities and do not have sufficient access to income are the most vulnerable (MoI 2017).

   The percentage of employed people in agriculture and fishery is of more than 70% in Ainaro, Manufahi, Manatuto and Viqueque. Only in Dili and Baucau this differs, with Dili as the major economic hub of the country accounting for only 13% of agricultural and fishery workers, and Baucau still accounting for almost 50% of the entire workforce.

2. **Poverty**

   Similar to economic activities, poverty data also varies significantly between the urban and the rural population: 14% of the urban population is affected by severe poverty whereas 46% of the rural population is affected by the same phenomenon. This is reflected in Dili having the least rate of people affected by severe poverty (8%). Coastal municipalities with the highest poverty rate include Oé-cusse (62,1%) and Ainaro (52,3%) (OPHI 2017).

2.8.2 Analysis of Infrastructure Vulnerability

For the development of the infrastructure vulnerability index, infrastructure has been divided into road infrastructure and node infrastructure. See Table 2.7 below:

Table 2.7 Parameters of Infrastructure Vulnerability

Parameters	Description	Results

Parameters	Description	Results
Node Infrastructure:	• infrastructure located close (Infrastructure with low elevation) will have a higher vulnerability index than infrastructure in higher places. • The vulnerability of the node infrastructure of a suco is calculated by adding up the values for each single node infrastructure of the suco.	• Vulnerability with regards to node infrastructure is highest in scattered regions in the northern and southern part. • The most vulnerable suco is Comoro in Dili. This can be explained by a number of important facilities in low elevation such as airport and seaport, education and health facilities as well as a bridge. • Other sucos which have high vulnerability due to infrastructure located close to the coast are Tequino Mata in Baucau, Aidabaleten in Bobonaro, Camenaca and Raimea in Covalima, Bairro Pite in Dili, and Costa in Oé-cusse.
Road Infrastructure	This approach is based on two facts: • In the coastal area, roads with low elevation are generally higher vulnerable than roads located in higher places. • Primary roads are more important for an intact infrastructure than small roads and thus their vulnerability has a higher impact on infrastructure vulnerability. • To assess each suco´s road vulnerability, each road of the suco is given a road class, which is then multiplied with the length of the road. As a next step, all of the values for each suco road are added up.	national roads are oftentimes constructed too close to the coast, and thus affected by severe coastal erosion, accelerating the deterioration process of the roads. • Dili has the highest road density and here particularly the sucos Comoro, Bairo Pite, Hera and Duyung. • Oé-cusse displays the second highest road density. The suco Costa in particular, has a road density almost as high as Comoro in Dili and Nipani.

The Infrastructure vulnerability index has been developed merging the results of the road infrastructure and node infrastructure. Sixteen sucos are vulnerable (three with very high vulnerability and thirteen with high vulnerability). These sixteen sucos also show high vulnerability in road infrastructure, meaning that they have important roads in low elevation and near coastal areas. In addition, the three sucos that scored as very high vulnerable show a high node infrastructure vulnerability. These three sucos are: Aidabaleten in Bobonaro, Comoro in Dili, and Costa in Oé-cusse.

2.8.3 Analysis of Ecosystem Vulnerability

Coastal ecosystems such as mangrove forests protect the coastline from erosion. However, in light of their scattered geographical distribution as well as their poor condition, in Timor-Leste this is not always the case. Mangrove forests in Timor-Leste are rather exposed to coastal hazards and degradation. Degradation results mainly from sedimentation and human activity. For this reason, mangroves are considered vulnerable ecosystems which need to be restored and protected. As a consequence, in this analysis ecosystem vulnerability is represented by the proportion of land area covered by mangrove

forest in coastal areas. Sucos covered by mangrove forest in the country and thus considered as highly vulnerable are Beco in Covalima; Duyung (Sereia) and Sabuli in Dili; Clacuc in Manufahi; and Uaitame in Viqueque are considered particularly vulnerable due to the exceptionally large size of the mangroves.

2.8.4 Results of the Vulnerability Index Assessment

Vulnerabilities that have been mentioned beforehand are then overlayed to create Aggregate Vulnerability Index Map. It can be seen in Figure 2.3 below.

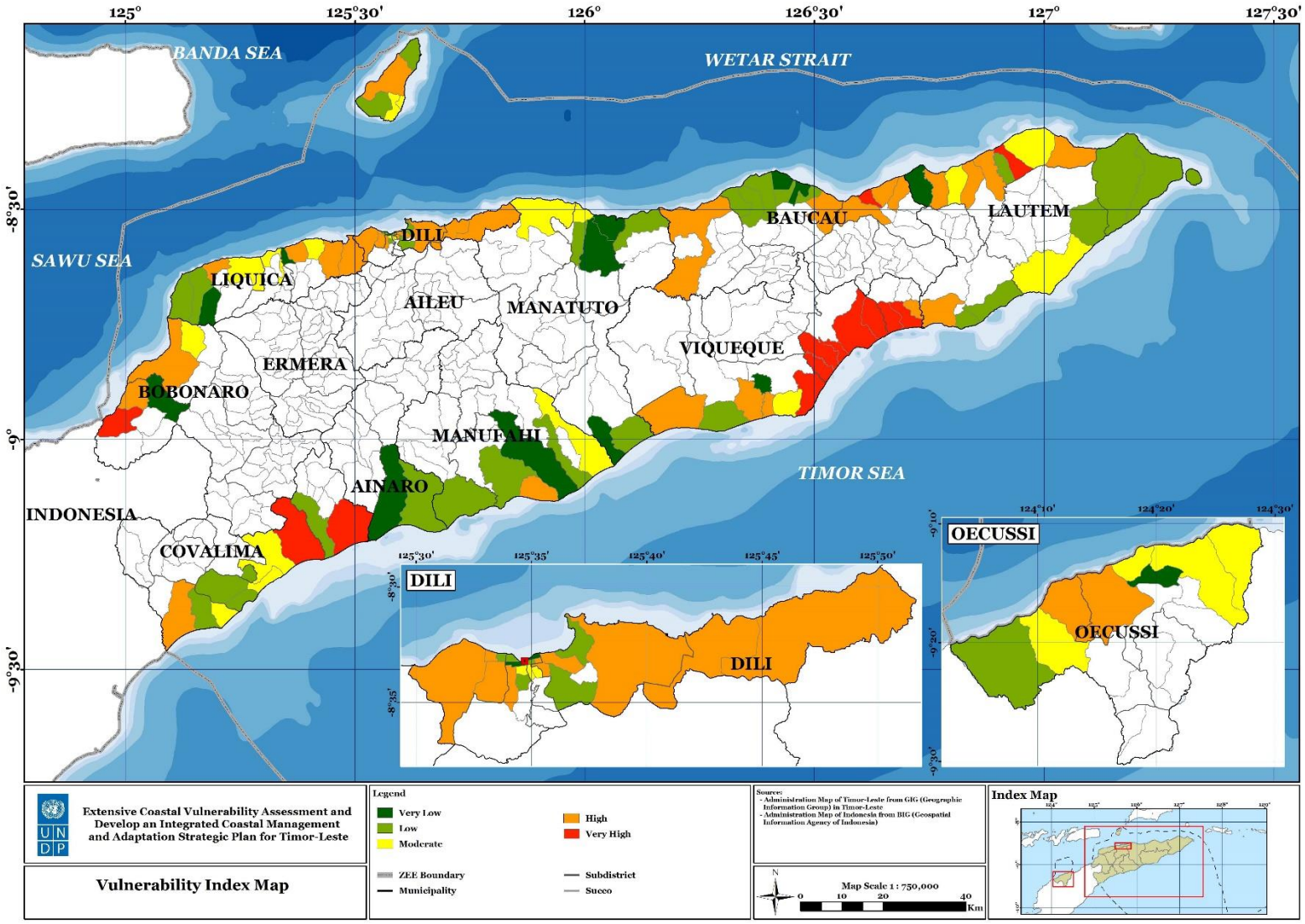

Figure 2.3 Vulnerability Index Map

2.8.5 Results of Modified CVI

The results of the modified CVI are presented in Figure 2.3. There are 17 sucos with a very high vulnerability level and 33 sucos with a high vulnerability level. Each municipality has at least one high or very high risk suco based on results of modified CVI index. The results for of each suco are shown in Table 2.8 and Figure 2.4 below.

Table 2.8 Results of Modified CVI

No	Rank	Municipality	Suco
1	Very Low	Baucau	Trilolo, Caibada II
		Bobonaro	Rairobo, Leolima
		Covalima	Matai, Debos
		Dili	Macadade, Becora, Culu Hun, Bemori, Santa Cruz, Caicoli, Macarenhas, Vila Verde
		Lautem	Ililai, Maina I, Muapitine, Mehara, Tutuala
		Liquiçá	Gugleur, Guico
		Manatuto	Ailili, Aiteas
		Oé-cusse	Lalisuc
		Viqueque	Irabin de Cima, Uma Uain Craic
2	Low	Baucau	Bahu, Bucoli, Buruma, Seical, Triloca, Soba, Tequino Mata, Vemase, Caibada I
		Dili	Atauro Vila/Maumeta, Beloi, Biceli, Maquili, Bidau Santana, MetiAut, Bairro Pite, Kampung Alor, BidauLecidere, Motael, Gricenfor, Colmera
		Lautem	Iliomar I, IliomarI, Com, Daudaere, Euquisi, Serelau
		Liquiçá	Maumeta, Vatuboro
		Manatuto	Umacaduac, Lifau
		Oé-cusse	Lifau
3	Moderate	Baucau	Nunira, Samalari
		Dili	Comoro, Fatuhada, Acadiru Huh
		Lautem	Parlamento, Lore I
		Liquiçá	Dato
		Manatuto	Uma Boco, Ma'abat, Sau
		Manufahi	Dotic
		Oé-cusse	Bene-Ufe
4	High	Ainaro	Foho Ai Lico, Leolima
		Bobonaro	Aidabaleten, Batugade, Sanirin
		Covalima	Camenaca, Labarai, Casabauc, Maudemo, Tashilin
		Dili	Hera, Duyung (Sereia), Sabuli
		Lautem	Baduro, Pairara, Lauhata, Motaulun, Tibar, Vatuvou, Vaviquinia
		Manatuto	Aubeon, Mahaquidan, Uma Berloic, Betano
		Oé-cusse	Suni-Ufe, Usi-Taco, Costa, Nipani, Taiboco, Uma Quic, Uaitame
		Manufahi	Caicasa
		Viqueque	WatuDere
5	Very High	Covalima	Beco, SuaiLoro, Lalawa, Raimea
		Lautem	Trilolo
		Liquiçá	Ulmera
		Manufahi	Clacuc
		Viqueque	Irabin de Baixo, Uani Uma, Luca, Maluro, Uma UainLeten, Babulo, Macadique, Matahoi, Vessoru, Bibileo

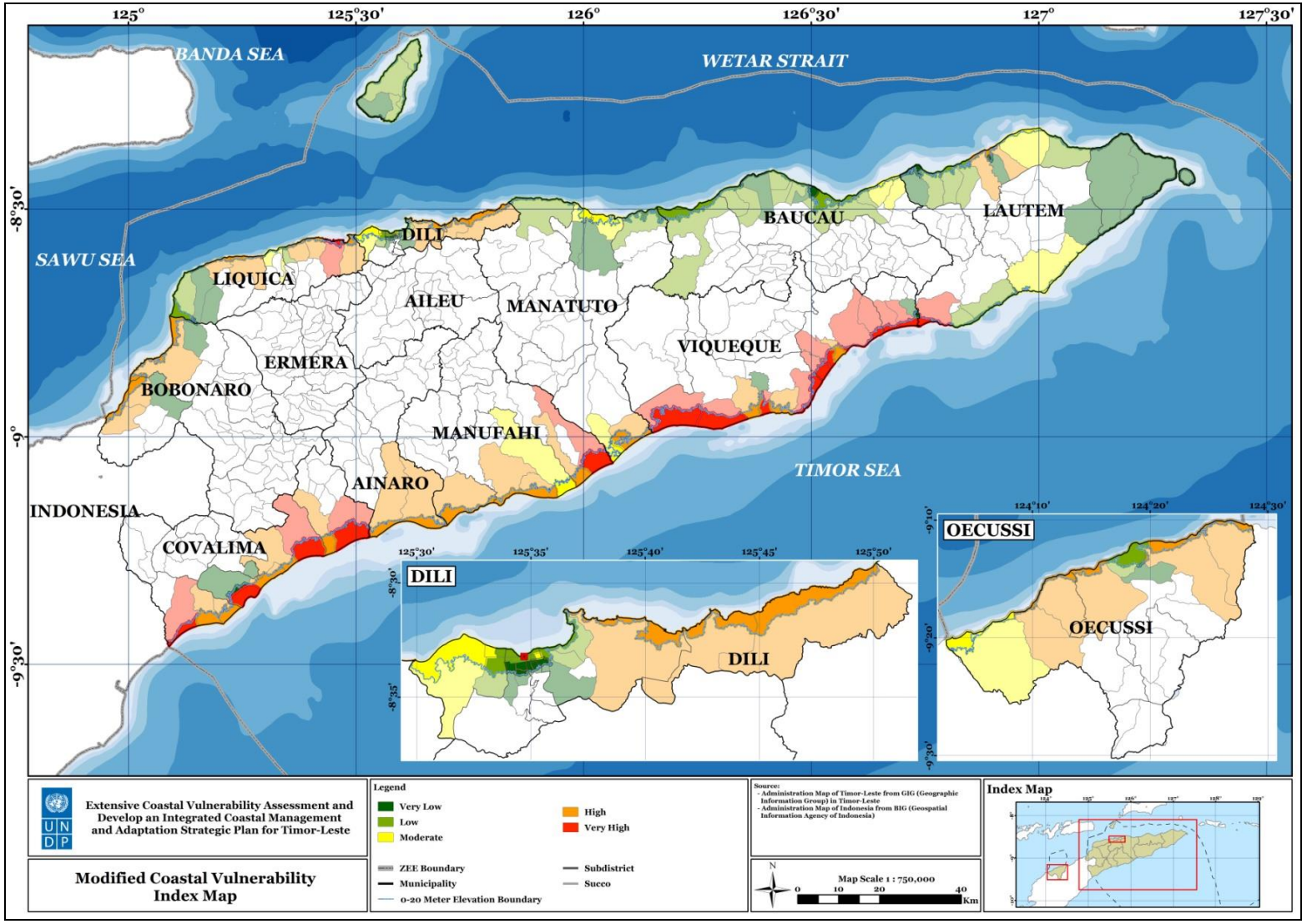

Figure 2.4 Modified CVI Map

3 Policy Framework Analyses

This chapter presents the result of the analysis of existing policies and programmes related to climate change adaptation and coastal management. This information allows understanding the policy context, gaps and opportunities, the capacity to adapt as well as the key stakeholders engaged in the process.

3.1 Strategic Issues at the coastal areas

The Timorese people have a strong dependency on their environment to sustain their lives and families. The occupation history of the country posed extreme destruction of the environment, such as forest overlogging and burning which led to landslide, erosion, threatening biodiversity and most importantly food sources (RDTL 2011). As of now, poverty is recognized as the main driver of environmental degradation in Timor-Leste. Bad agricultural practices and overgrazing, changing of land use patterns as well as use of fuelwood for energy (accounted 90% of households in Timor-Leste) result in continued deforestation and loss of ecosystems, i.e.: forests and mangroves. But more importantly, also leading to even more hardship of the people living in the rural areas.

Climatic and non-climatic risks are cross cutting. Coastal zone may be perceived as one sector, but its existence and management must be recognized as interdependent to other sectors located at the coast and vice versa (see. figure 3.1). Suboptimal water management, could lead to shortage of water for drinking and agriculture and/or severe floods at the coast, affecting the population, especially in the context of extreme seasonal change. Another example would be the lack of buffer for riparian sediment leading to siltation that could negatively affect the mangrove ecosystem. On the other hand, healthy mangroves provide protection to the coastal physical assets (e.g. communities' house and public infrastructure) as well as economic benefits to the coastal population (e.g. silvo-fisheries and natural resources).

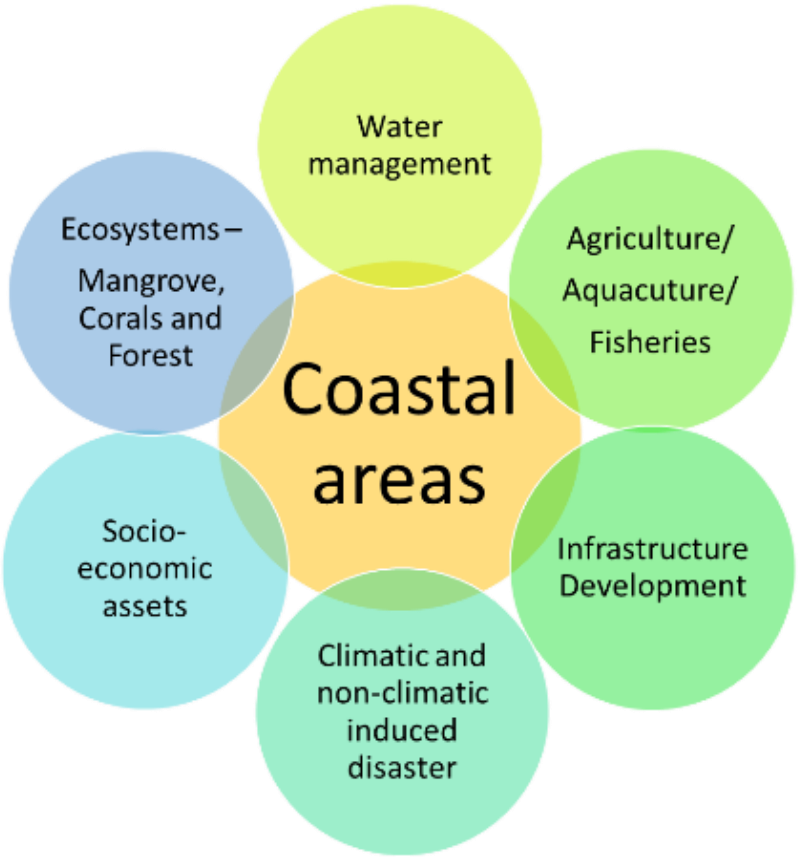

Figure 3.1 Interdependency of sectors in the coastal areas

As envisioned in the SDP 2011-2030, the most important factors to increase ability to adapt to climate change will be continued economic and social development, including infrastructure, institutional capacity, the economy, and poverty reduction efforts. The SDP highlights climate change as one important topic to be addressed in the view of sustainable and inclusive development of Timor-Leste. Similarly, the Dili Declaration on Climate Change Adaptation recognized that the government's priorities as set out in the Strategic Development Plan can only be sustainably achieved when Climate Change Adaptation is set as a pre-condition. Identified actions addressing urgent and immediate climate change adaptation for the most vulnerable groups, shall support the ambitious national development plan. To this end, when formulating adaptation strategy, as a key response to make sure that the effects of climate change on coastal zones are reduced and kept to a minimum, an integrated approach shall be considered.

3.2 Climate Change Policies in Coastal Sector

Timor-Leste ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 2006 and came into force in 2007. National Adaptation Programme of Actions (NAPA) was submitted in 2011, followed by the Initial National Communication (INC) in 2014. The Intended Nationally Determined Contributions (INDCs) was submitted at the end of 2016.

The Government is currently in the process of formulating National Adaptation Plans, which is built upon the NAPA experiences as well as the current climate risk. The NAP process enables the country to formulate and implement national adaptation plans as a means of identifying medium- and long-term adaptation needs. It laso develops and implements strategies and programmes to address those needs. In addition, a Climate Change policy has recently been approved and is on its way to formalization.

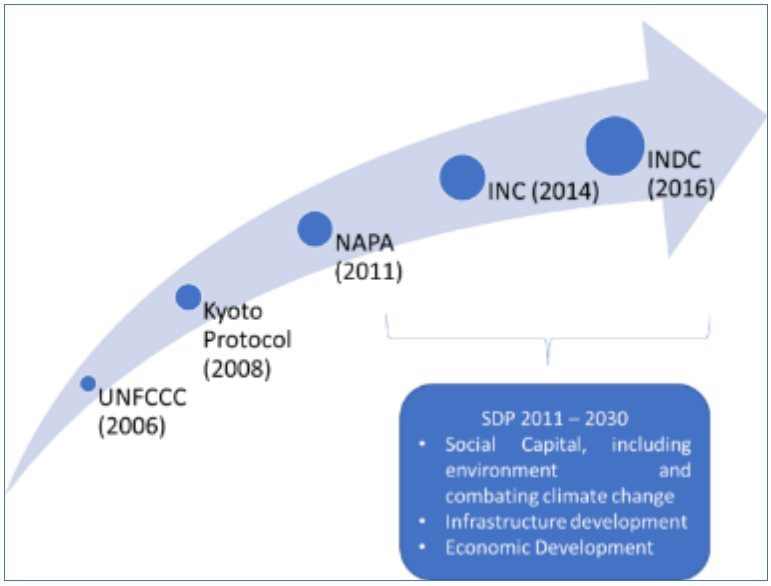

Figure 3.2 Climate change policies for Timor-Leste

In the context of climate change, coastal management has gained proper attention. Coastal protection is set as one, among nine priorities, in adapting to climate change aligned with the development vision of Timor-Leste in NAPA, INC, INDC as well as the upcoming NAPs and Climate Change Policy.

The NAPA document provides a starting point from which climate change adaptation can be mainstreamed into development plans as a key strategy for attaining sustainable development and poverty reduction (RDTL 2010). The document envisions the Timorese population to be resilient to climate change (RDTL 2010), through concerted efforts made by the GoTL and Non-Government Organizations (NGOs). Coastal management is ranked as the 5th priority in the NAPA, after food security, water management, health and natural disaster. A total of 32,253,000 US$ was committed to NAPA implementation, spread across nine projects (UNTL-CCCB 2015), of which 7,000,000 US$ is allocated specifically for coastal management (Ibid.).

As a country that ratified the UNFCCC, Timor-Leste has an obligation to report its National Communication to the Conference of the Parties (COP). While the assessment of vulnerability in the coastal sector presented in the INC is minor, it elaborates the impacts of climate change on coastal and marine resources of Timor-Leste, which include; 1) Loss or destruction of coastal vegetation, species and habitats including wetlands and mangroves due to flooding, 2) Reduced health, diversity and productivity of coastal and inshore marine ecosystems and species, 3) Increased erosion of beaches,

shorelines and coastal land, loss of breeding and nesting habitats, and 4) Salinization of soil, freshwater, coastal lands, infrastructure and agriculture by seawater intrusion (TL-SSE 2014).

The latest climate change related submission made by the GoTL was the INDC. The adaptation component in the Timorese INDC allows the country to raise the profile of adaptation planning while at the same time gaining international recognition and support for the implementation. It is built on the momentum of the NAPA process and assists in the implementation of the key priorities (MCIE 2016). The priority adaptation measures elaborated under the INDC was built upon the existing strategies and plans across all priority issues within Timor-Leste, in which coastal management and protection is an integral part of it.

With regards to direction for potential adaptation measures in the country, the three documents focus on improvement of technology (including physical investment) as well as strengthening institutional coordination and capacity as vital for adapting to climate change. Climate change topics, through NAPA, INC and INDC have brought new air for improving cross-sectoral coordination in the context of coastal management, by emphasizing the need for integrated actions. To this end, development of the adaptation strategic plan for the coastal areas shall take into account the directions indicated in these documents.

Table 3.1 Summaries of directions for adaptation strategic plan derived from climate change relevant policies in Timor-Leste

NAPA	INC	INDC
The selected coastal management project emphasizes its focus on rehabilitation and conservation of Mangroves to protect the coastal communities against sea level rise. Five primary components of the project (short-term and long-term) (MED 2010): - policy development - capacity development and planning - physical investment and demonstration - awareness and information sharing - institutional development.	INC prioritizes a number of key adaptation actions relevant for coastal areas. With mangrove protection and rehabilitation as well as improving water management being two priorities. However, INC also emphasizes the need to further (TL-SSE 2014): - enhance research and development of technology for coastal protection. - strengthen capacity of institutions and coordination.	Similar to NAPA, measures to achieve coastal resilience in INDC focus mainly on maintaining and rehabilitating mangroves ecosystem, with a mitigation co-benefit for carbon sequestration. As means for implementation INDC focuses on (MCIE 2016): - mobilization of resources to assure adequate funding for implementation - improving research and technology - capacity development of the institutions - strengthening coordination and engagement
These documents strongly indicate the needs of integrated actions, where the coastal sector will benefit from the measures implemented in other priority issues, such as Agriculture/Food Security, Natural Disaster,		

physical infrastructure as well as development of the national capacity and vice versa.

3.3 Coastal Management Related Policies

The combined physical and socio-economic characteristics have shown that Timor-Leste is extremely vulnerable to the impacts of climate change. Climate change will further aggravate the environmental problems in the country and affect the coastal ecosystems. And therefore, coastal zones in Timor-Leste are especially recognized as areas particularly susceptible to the effects of climate change and of high importance for forest conservation. The Basic Law for Environment, Strategic Development Plan and The Base of Spatial Planning Law currently serve as the main umbrellas for coastal management in Timor-Leste. The Basic Law for Environment 2012 and the Base Law for Spatial Planning 2017 are calling for the need to define integrated management plan of the coast, taking into account the limits of natural processes and long-term equilibrium of the components environmental, economic, social, cultural and recreational services (RDTL 2012). Whereas, the SDP 2011-2030 document conveys a 20-year vision for the country and clearly delineates specific development strategies, including coastal zones.

More detailed examinations of these policies, capturing sections relevant for coastal management and improving the lives of coastal communities are presented in Annex 1. Whereas overview of national regulations and policies relevant for coastal management is presented in figure 3.3.

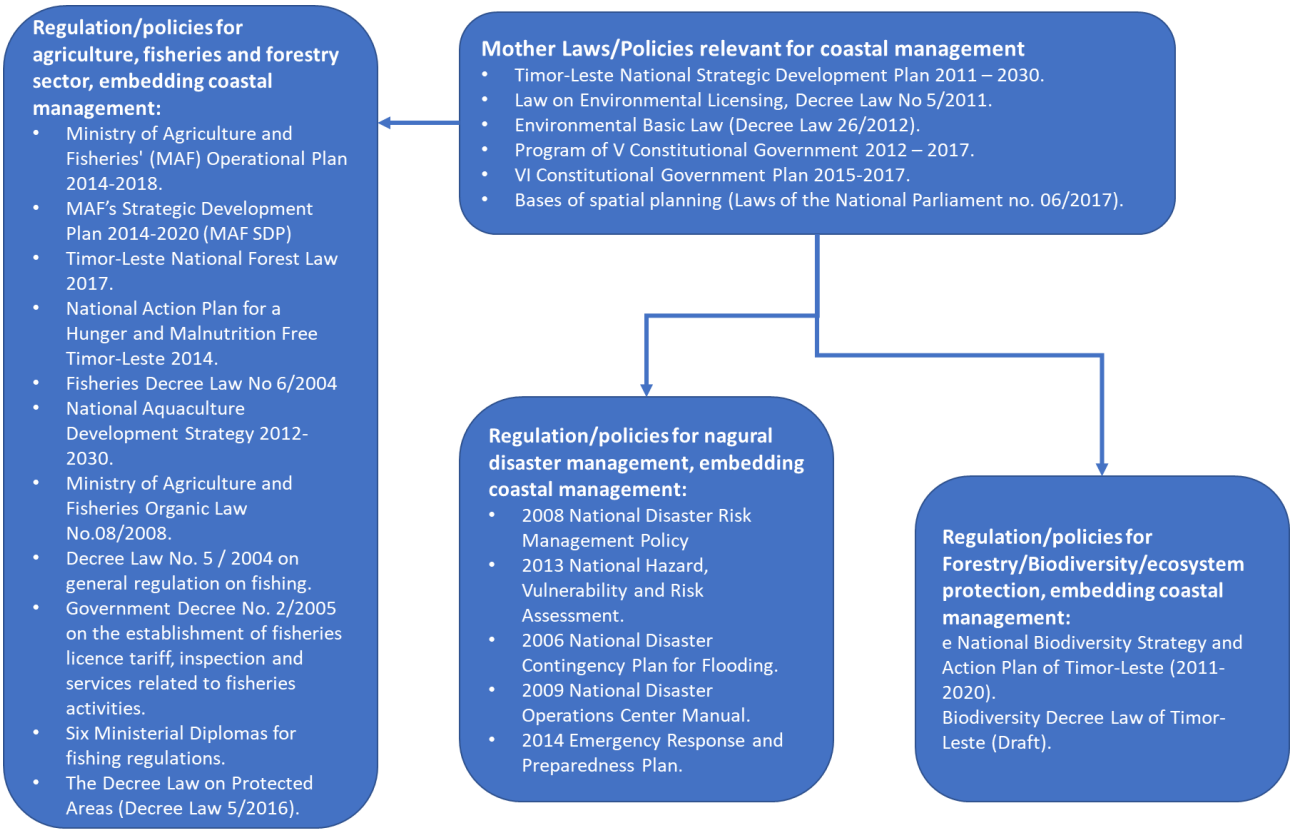

Figure 3.3 Overview of national regulations and policies relevant for coastal management.

The existing policies relevant to coastal management are developed to serve sectors operating along the coastal zones. Coastal zone management is mostly embedded in the agriculture and fisheries related policies. These policies especially emphasized on improving the lives of coastal communities, through an improved natural resources management, watershed management, coastal management, protection of important ecosystems, diversification of livelihoods as well as recovery of degraded forest. Protection and restoration of mangrove ecosystems, as being part of coastal zone management, have been highlighted particularly in the SDP 2011-2030, Programme of Constitutional Government V and VI Constitutional Government Plan, Biodiversity Decree Law and the Operational Plan of the Ministry of Agriculture and Fisheries. With respect to tourism strategies and policies, coastal and marine tourism is recognized as one of the main tourism commodity in the country.

The magnitude of natural disasters, affecting coastal areas and its population, has put coastal management in the heart of the disaster risk management policies of the country. These documents to a certain extent have provided the public with the set of knowledge and awareness on climatic and non-climatic induced disasters. They provide guidance to respond to these disasters and articulate further needs in equipping the coastal communities to deal with disasters.

With the mushrooming infrastructure development along the, the needs for appropriate management of the coastal zone has become the primary attention of the GoTL. Coastal management is embedded in the Basic Environmental Law and the Programme of Constitutional Government, assuring that spatial

planning should take into account the particular needs of the marine and coastal marine ecosystems. The Law of Environmental Licensing (2011) emphasized on the importance of the Environmental Impact Assessments (EIA) and Licensing Procedures for large projects (including those along the coast). Meanwhile, the recent law on Base of Spatial Planning (2017) establishes a general basis for the public policy of regional planning or /land-use planning, including for coastal area/zone. The GoTL is enforcing the implementation of this law in rigorous manner, assuring that the definition of "Seafront"[3] as stated in the Law is adhered accordingly by the public. Furthermore, the the Base of Spatial Planning Law (2017) also presents a definition of Coastal Zone as "portion of land directly and indirectly influenced by the sea, in biophysical terms, which extension land-ward is defined by the regulation. Whereas the boundary sea-ward is measured from the line of maximum sea-bed of equinoctial living waters, and extends to the limit of the territorial sea". This definition, however, has not specified yet the portion of land that extends areas inlands.

The inclusion of coastal management in various national and sectoral policies and regulations indicates that the issue has been well-mainstreamed in the political level. And It is therefore important that implementation of sectoral activities in the coastal zones are done in a coordinated manner to avoid potential negative impacts in the mid to long term. To this end, there's a requirement to develop a specific policy for coastal management. The needs to develop a policy on coastal management was articulated by the country's Strategic Development Plan 2011-2030, National Biodiversity Action Plan, Programme of Constitutional Government V as well as VI Constitutional Government Plan. The manifestation of this policy is currently reflected by the development of National Ocean Policy (NOP) which is currently under formalization. The NOP acknowledges that the coastal and marine areas of Timor-leste are indispensable to the life and welfare of the Timorese people, and therefore must be seen as natural assets to be utilized sustainably and protected. The policy proposes an integrated approach to manage activities in the national coast and ocean territory while addressing national marine issues such as pollution and climate change that involve more than just one government department. In addition, it is also important that the policy articulates precisely the definition of coastal boundary to ensure that legal requirements are fully satisfied and to provide clarification of responsibilities of the various agencies.

Definition of Coastal Zone Boundaries in Sri Lanka (Koralagama 2008)*****

Sri Lanka, is an island country located in South Asia. The country has a 1700 km long coastline. For a small island country like Sri Lanka, the coastal zone forms a significant part of the landscape. Development activities covering the fisheries sector and the coastal zone play a vital role in the economy of the country. For management and conservation purposes of the coastal environment, the coastline is defined as the "Coastal Zone". Definition of Coastal Zone according to the act of coast conservation (1981) is "the area lying within a

[3] According to the Base of Spatial Planning Law 2017, Seafront is defined as "portion of land extending 50 meters to the land from the highest point of high tide and into the water 30 meters of bathymetric level".

limit of 300m landward of the mean high-water level and a limit of 2 km seaward of the mean low water level. In the case of rivers, streams, lagoons or any other body of water connected to the sea either permanently or periodically the landward boundary extends to a limit of 2km measured perpendicular to the straight base line drawn between the natural entrance points. Thereof and includes the waters of such rivers, streams and lagoons or any other body of water so connected to the sea."

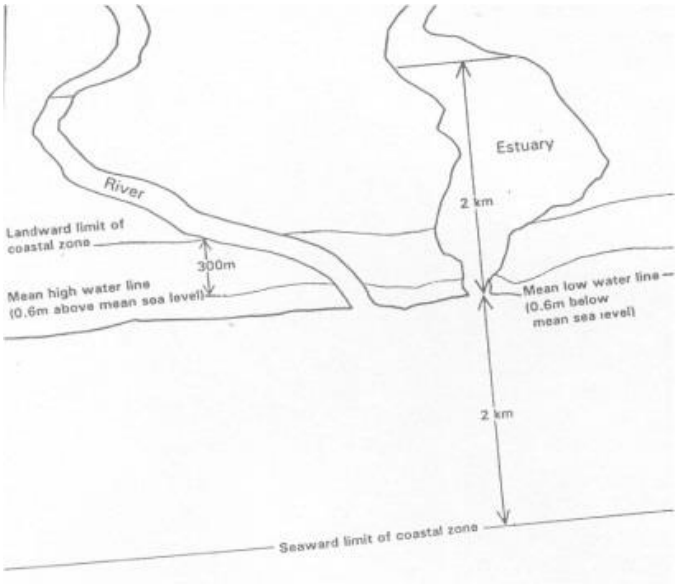

Figure 3.4 Boundaries of the coastal zone in Srilanka

*This information is extracted from "Community Perception towards a set-back area: A Case Study in Galle District, Sri Lanka"

3.4 Institutional Framework

The cross-sectoral nature, diversity, complexity and richness of shoreline protection and coastal management impose the need for an integrated approach involving all stakeholders from different sectors, including those at national and local level. The legal-regulatory framework, however, does currently not define an institution for coordinating coastal management issues in Timor-Leste.

At national level, there are various institutions which missions are directly and indirectly related to coastal protection and management. In addition to the review of policies, sectoral plans, projects and scientific evidence, the institutional arrangement was analysed by interviewing key stakeholders from the national government as well as local and international NGOs. (See Annex 2 for an overview of

interviewees)[4]. Some of the issues that were repeatedly identified by the different stakeholders and in various reports are:

- Competing needs from different institutions for the coastal zone. For example, the tourism sector and the conservation sector compete for different uses of the same space
- Lack or overlapping mandates. There is a large number of institutions and a range of different stakeholders involved in coastal management, each with its own vision and objectives
- There is a weak linkage top-down and bottom-up, as well as laterally leading to confusion (and potentially also conflict) and limited coordination among institutions.

In order to develop a mechanism for ensuring coordination among the different stakeholders, it is essential to be aware of the array of national institutions involved in coastal management / coastal areas. The major areas of responsibility of governmental institutions are summarized as follows[5]:

Table 3.2 Institutions and related missions

Institutions	Related missions
Ministry of Agriculture and Fisheries (MAF)	
National Directorate for Research and Geophysical Information	- Identifying, introducing and multiplying improved seeds varieties. - Conduct exhaustive research on climate changes in Timor-Leste - Conduct data collection, and support to MAF in analysing and developing strategies to overcome climate change variability
National Directorate for Forestry, Coffee and Industrial Plants	- Responsible for promoting agribusiness - Managing forest resources and water basins - Managing national parks and protected areas - Ensuring the protection and conservation of nature and biodiversity
National Directorate for Fisheries	- Responsible for promoting fisheries - Monitoring and supervising fisheries and aquaculture
Ministry of Social Solidarity (MSS)	
National Directorate for Disaster Risk Reduction	- In charge of disaster preparation and response at national and local level - Responsible for designing, implementing, coordinating and evaluating programmes for managing the risk of natural disasters - Assesses issues such as erosion and landslides from the upland areas

[4] Please note, that the institutional framework as well as policies and sectoral plans analyzed were previous to the election in July 2017.

[5] Please note, that the table is not intended to be an exhaustive list and takes into account the key national institutions relevant for this assignment.

Institutions	Related missions
	which affect coastal communities and mangroves
Ministry of Commerce, Industry and Environment (MCIE)	
National Directorate for Climate Change (NDCC)	- Main institution responsible to coordinate all climate change related issues - Promoting, supporting and following-up the strategies to mainstream environmental issues into sectoral policies - Undertaking strategic environmental assessments of policies, plans, programmes and legislation and coordinating the environmental impact assessment of project at the national level
Ministry of Public Works, Transport and Communications (MPW)	
National Directorate for Meteorology and Geophysics	- Responsible for the planning and development of infrastructure, including the protection, preservation and reparation of bridges, roads, river bank and coastal areas as to control flooding issues.
Ministry of Planning and Strategic Investment (MPSI)	
Unit for Integrated Planning	Responsible for the implementation of: - Infrastructure and urban planning - Oil and mineral resources - Territorial planning and management
National University of Timor-Leste (UNTL)	
Centre for Climate Change and Biodiversity (CCCB)	- Conducts research related to climate change and biodiversity conservation in Timor-Leste - Provides policy makers, natural resource managers, and development practitioners with tools and information needed to develop and implement management strategies that address the impact of climate change
Ministry of Tourism, Arts and Culture (MTAC)	
General Directorate for Tourism	- Responsible for designing, implementing and evaluating the policy for tourism - Contributing to the development of the tourism sector and proposing relevant measures and public policies to that effect

4 Adaptation Strategy for Coastal Areas

This chapter presents the process of formulating adaption options for the most vulnerable coastal areas in Timor-Leste. The options were formulated through streamlining integrated coastal management with

approaches to adapt to climate change in coastal areas and protecting the coastal communities. The formulated options will be prioritized and further refined, to develop the national adaptation strategies for the Timorese coast.

4.1 Typologies of Vulnerability

Adaptation to climate change at the coastal area should be strategic and aimed to address the coastal climate change hazards in ways that meet societal objectives (USAID 2009). Accordingly, strategies for adaptation are developed by taking into consideration the level and characteristics of vulnerability as well as the current and planned development agenda. Based on the CVA results, 56 coastal sucos of Timor-Leste are highly and very highly vulnerable (see Figure 4.1).

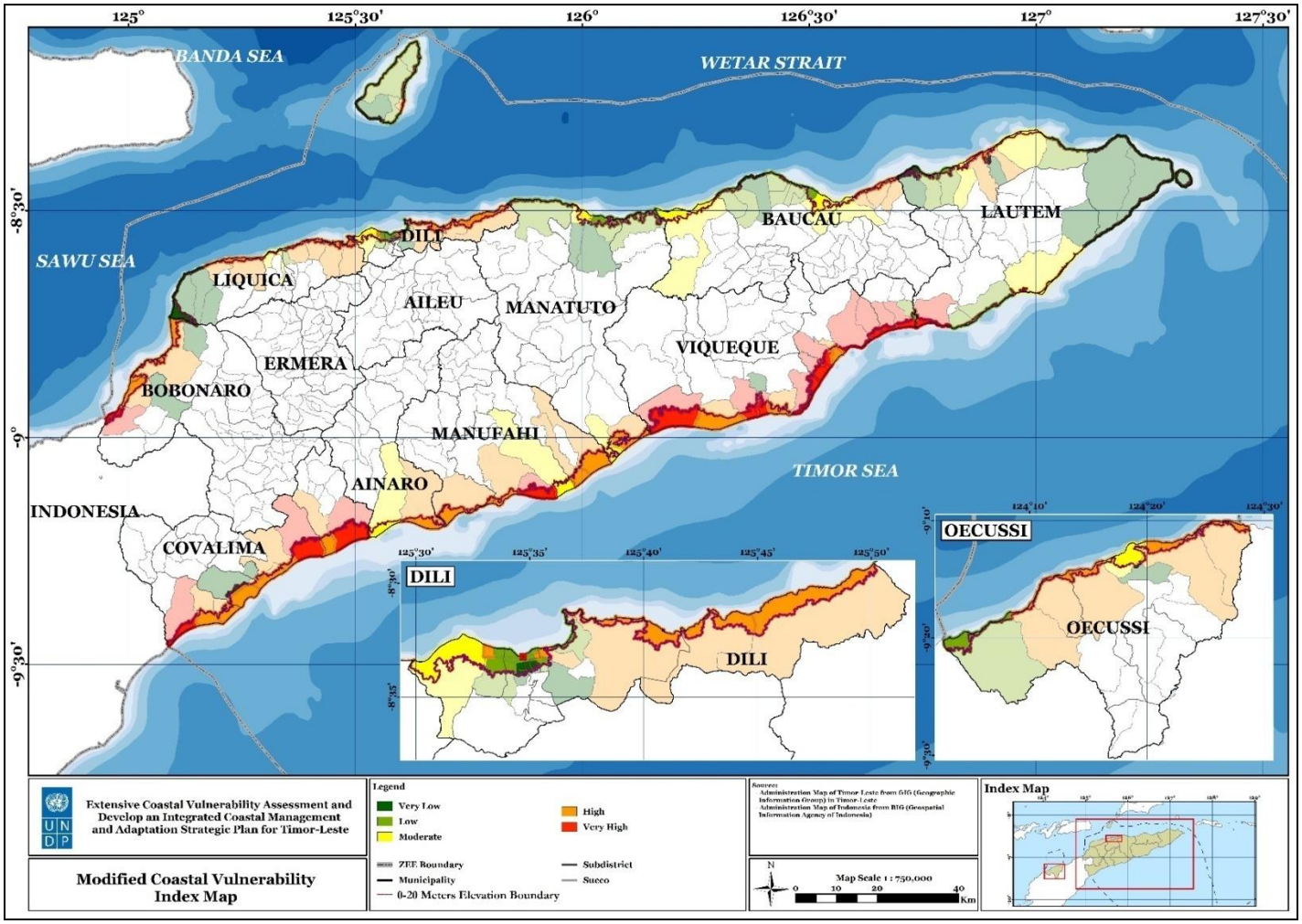

Figure 4.1 High and very high levels of the modified CVI of Timor-Leste

Coastal vulnerability in Timor-Leste is mainly influenced by four indicators: physical, socio-economic, infrastructure and ecosystem vulnerability (see Figure 4.2). These influencing indicators guided the classification of vulnerability types (referred to as typology) of the coastal areas in Timor-Leste.

Figure 4.2 Indicators influencing coastal vulnerability in Timor-Leste

The coastal vulnerability level at the Timorese coast is mainly defined by its physical vulnerability, i.e. instable coastline combined with high rate of sea level rise. As a macro outlook to the typology of vulnerability in Timor-Leste, 53 out of the 56 highly vulnerable coastal sucos are physically vulnerable.

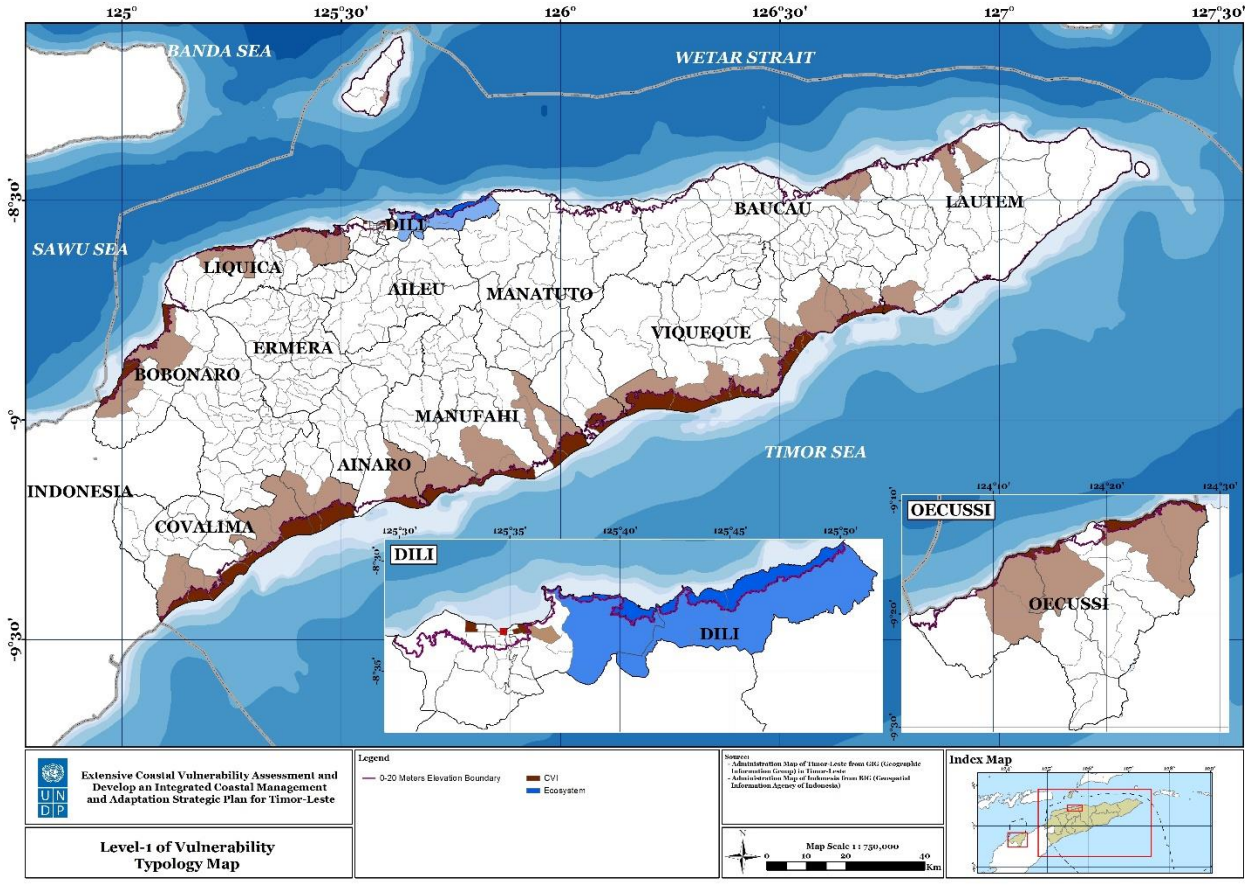

Figure 4.3 Macro Vulnerability Outlook along the Timorese coasts

Only a few coastal sucos experience a condition where vulnerability level is mainly influenced by ecosystem vulnerability (Hera, Sabuli and Duyung in Dili). A more detailed analysis on the identification of the key vulnerability indicators was done to support the process of formulating adaptation strategies. Table 4.1 presents the combination of vulnerability types based on the results of CVA.

Table 4.1 Typology of vulnerability and the respective areas based on CVA

High Influencing Vulnerability Indicators *				Municipality (Suco)
Physical	Socio Economic	Ecosystem	Infrastructure	
-	-	x	-	**Dili** (Hera, Duyung (Sereia), Sabuli)
x	-	-	-	**Ainaro** (Foho Al Lico), **Bobonaro** (Sanirin), **Covalima** (Camenaca, Labarai, Suai Loro, Maudemo, Tashilin). **Liquica** (Lauhata, Motaulun, Vatuvou), **Manufahi** (Mahaquidan, Betano, Caicasa), **Oecussi** (Usi-Taco, Nipani), **Viqueque** (Fatu Dere)
x	-	-	x	**Bobonaro** (Aidabaleten), **Dili** (Atauro Vila/Maumeta, Bidau Santana), **Liquica** (Vaviquinia), **Oecussi** (Costa), **Manufahi** (Uma Berloic), **Baucau** (Nunira), **Lautem** (Pairara)
x	-	x	-	**Covalima** (Lalawa, Beco), **Liquica** (Tibar, Ulmera), **Manatuto** (Aubeon), **Manufahi** (Clacuc), **Viqueque** (Luca, Bibileo)
x	x	-	-	**Covalima** (Casabauc), **Lautem** (Trilolo), **Oecussi** (Suni-Ufe, Taiboco), **Viqueque** (Macadique, Maluro, Matahoi, Uma Quic), **Baucau** (Samalari), **Dili** (Acadiru Hun), **Lautem** (Baduro)
x	x	-	x	**Bobonaro** (Batugade), **Covalima** (Raimea), **Viqueque** (Uma Uain Leten, Babulo, Vessoru), **Baucau** (Soba), **Dili** (Fatuhada)
x	x	x	-	**Viqueque** (Irabin de Baixo, Uaitame)
x	x	x	x	**Viqueque** (Uani Uma)

A combination of physical and ecosystem vulnerabilities is, for example, very apparent in Liquiçá (Ulmera and Tibar) as well as in a number of sucos at the southern coast, such as Aubeon, Luca, Bibileo, Clacuc, Beco and Lalawa. While mangrove forests are very important to the livelihood of the coastal population and therefore deemed as an asset to be protected, its existence is under threat. For example, in Tibar and Ulmera mangrove forests are still relatively intact. However, firewood harvesting and livestock grazing, river sedimentations as well as infrastructure development (i.e. roads and port construction) represent a significant threat to these mangrove forests and could lead to their very quick depletion.

The typology of areas where physical vulnerability is combined mostly with the socio-economic indicator can be found especially in Viqueque, Covalima and Oé-cusse. The situation was confirmed during the field visits, community consultations as well as secondary data collected. The rate of sea level rise, wave

height and level of coastal instability are higher in the south, resulting in a high level of physical vulnerability. Moreover, with regards to the socio-economic indicator, Viqueque and Oé-cusse are among the municipalities with the highest multidimensional poverty index and age-based dependency ratio. Coastal sucos in Viqueque, Oé-cusse and Covalima are among the suco with the highest population density, after the urban areas such as Dili and Baucau.

High vulnerability areas defined by a combination of physical and infrastructure vulnerability are mainly found in the north coast. The findings are apparent as the current infrastructure development is concentrated more in the north coast of Timor-Leste, especially in Baucau, Dili, Liquiçá, Bobonaro and Oé-cusse.

4.2 Designing adaptation strategy

Adaptation strategies consist of a broad plan of actions to be implemented through policies and measures. To ensure efficiency and enhance their impact, adaptation strategy should be formulated in synergy with other national and/or sectoral strategies. The adaptation strategies aim to contribute to:

- ecosystem conservation initiatives including mangrove restoration,
- coastal livelihood development programmes, and
- the development of a national shoreline management and adaptation plan

The Government of Timor-Leste recognized the importance to develop strategies to adapt to the changing climates. In alignment with the agenda of the Timorese Government, the following set of supporting instruments is proposed in the formulation of adaptation strategies:

- Policy development
- Institutional coordination
- Capacity building and awareness raising
- Monitoring and Evaluation

4.3 Selection of Adaptation Approach

Having understood what factors constitute the high level of coastal vulnerability, the interplay among different factors as well as strategic issues and agenda of the country[6], adaptation strategies was developed suited to the country's context.

Given the projected adverse impact of climate change on coastal zones and communities, it is important to streamline climate change adaptation and integrated coastal management. (see Figure 4.2 below). As discussed in chapter 3.2, the streamlining of the two concepts is not only important but also requested by the Government of Timor-Leste. This is reflected in the articulation of their policies.

[6]See Chapter 3.

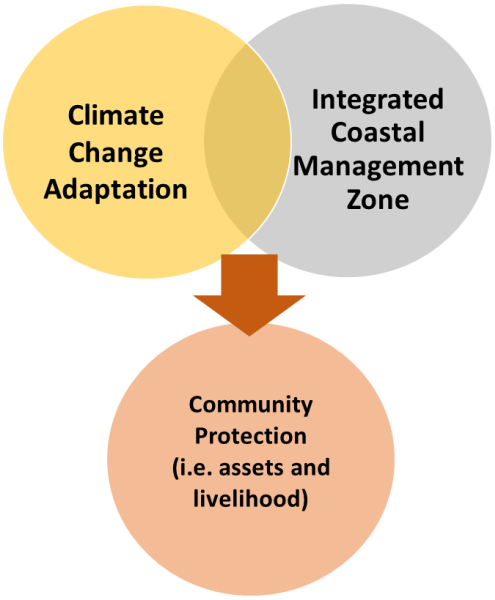

Figure 4.4 Streamlining the concepts of climate change adaptation and integrated coastal zone management

Four concepts of adaptation and coastal zone management which are deemed relevant for the context of Timor-Leste were examined. The four concepts are elaborated as follow:

1. **Intergovernmental Panel for Climate Change- Third Assessment Report (IPCC-AR3), 2001**. In the discourse of climate change, coastal zone is recognized as an area with the highest potential impacts. The zones consist of land subject to marine influence and the area of sea subject to land influence. The three principal objectives of coastal management are (IPCC 2001):
   - Avoiding development in areas that are vulnerable to inundation and instability;
   - Ensuring that critical natural systems continue to function; and
   - Protecting human lives, essential properties, and economic activities

   The response strategies of coastal management fall into three categories, comprising of **retreat, accommodation, and protection by hard and soft measures** (IPCC 2001). The three types of responses are elaborated in table 4.2.

Table 4.2 Type of Response strategies of coastal management according to IPCC AR3

Type of responses	Description	Strategic Options	Compatibility to the Timorese context
Retreat	Abandonment of land and structures in vulnerable areas, and resettlement of inhabitants.	• Preventing development in areas near the coast. • Allowing development to take place on the condition that it will be abandoned if necessary (planned phase out). • No direct government role other than through withdrawal of subsidies and provision of information about associated risks.	For Timor-Leste, as a country under development, retreat strategy may be used in the development of the land use and spatial planning, assuring that future development will not take place in highly vulnerable areas.
Accommodation	Continued occupancy and use of vulnerable areas. The strategy of accommodation, like that of retreat, requires advanced planning and acceptance that some coastal zone values could be lost. It forces people to consider whether risks are worth taking and provides the necessary funds to repair damages and compensate victims.	• Wetland restoration • Flood Warning System • Flood Proofing • Coastal Zoning • Coastal Setbacks	Such a strategy may be applied mostly in urbanized areas of Timor-Leste, or where resettlement will lead to further conflict. According to the community consultations as well as field observation, rural population at the coast have started to flood proof their houses to live side by side with the hazards.
Protection	Defense of vulnerable areas, especially population centres, economic activities, and natural resources. This strategy involves defensive measures and other activities to protect areas against inundation, tidal flooding, effects of waves on infrastructure, shore erosion, salinity intrusion and the loss of natural resources.	• Hard structure, e.g. breakwaters, groynes, jetties, revetments, sea walls, dikes, storm surge barriers and closure dams. • Soft structure, e.g. beach nourishment, dune construction/stabilization, cliff stabilization, mangrove and coastal forest re-planting. They can be applied alone or in combination, depending on the specific conditions of the site.	Currently, a number of spots along the Timorese coast, have been secured by sea walls and revetments. While it may work optimally in some spots, to others it may not. To this end, it must be understood that there is no single or generic "best solution," as each situation must be evaluated and treated on its particular merits. Proposed plans should leave options open for the most appropriate future response. And therefore, further detail studies must be carried out.

2. **Integrated Coastal Zone Management (ICZM), 1996**. The impact of climate change on the coastal area increases overtime. Therefore, Integrated Coastal Zone Management (ICZM) is deemed important in the context of adaptation to climate change. The approach focuses on three operational objectives (Post and Lundin 1996):
   - Strengthening **sectoral management**, for instance through training, legislation, and staffing
   - Preserving and protecting the productivity and biological diversity of **coastal ecosystems**, mainly through prevention of habitat destruction, pollution, and over exploitation
   - Promoting rational development and sustainable utilization of **coastal resources**

3. **Coastal Integrity Vulnerability Assessment Tool (CIVAT), 2013**. The tool introduced "RESTORED" Strategies, which are a set of complementary adaptation options for achieving resilience. The strategies are seeking to promote synergies among the relevant cross-cutting issues, addressing the key thematic areas of habitat and biodiversity conservation, sustainable livelihood (i.e. fisheries), and coastal integrity. The RESTORED Strategies are presented in Table 4.3 (MERF 2013).

Table 4.3 RESTORED Strategies of CIVAT

RESTORED strategies for maintaining coastal integrity and equitable access	RESTORED strategies for restoring resiliency through learning communities
Restoring coastal protection e.g. using appropriate mangrove technologies	**R**epresentativeness with resiliency e.g. expansion to sea grass & other ecosystems
Effective erosion buffers e.g. marine sanctuaries & proper structures	**E**nhancing Marine Protected Areas (MPA) monitoring thru adaptive management e.g. incorporating feedback mechanisms that engage and motivate collaboration and complementation
Sustaining coastal integrity e.g. adjust CLUP based on Vulnerability Assessment lessons	**S**ustaining MPA networks and strengthen capacities through MPA and MPA systems to improve governance and management effectiveness
Thresholds maintained within acceptable limits vis-a-vis coastal erosion, sedimentation and thermal anomalies	**T**hreat reduction on coastal ecosystems
Organizing coast watch e.g. with early warning systems	**O**rganizing knowledge-based communities
Reducing threats and sharing costs e.g. stop illegal settlements and land uses	**R**eplenishing MPA that help continue the source & sink relations
Enhancing equitable access e.g. payments for ecosystem services	**E**nhancing connectedness in network designs to include social & ecological concerns
Disaster risk reduction e.g. integrate disaster risk reduction management& climate adaptation mainstreaming	**D**oing due diligence and good governance e.g. regular state of the coasts reports and partnership forums

4. **Coastal Hazard Wheel (CHW), 2015.** The coastal hazard wheel is developed as a universal coastal classification system that can be used in areas with limited data availability. The universal coastal classification system is developed particularly for decision support and is based on the bio-geophysical parameters determining the character of a coastal environment. This concept is aligned

with the CVI and the modified CVI which is applied to determine the vulnerability level of the coastal areas in Timor-Leste (UNEP 2016). The CHW provided a catalogue comprising 24 management options depending on the combination of hazards. For the purpose of this report, examination of CHW focused on the relevant management options suitable for the context of coastal vulnerability in Timor-Leste. The management options ranging from hard measures such as deployment of sea wall, to the provision of an appropriate information system, as well as ecosystem-based measures such as mangrove restoration.

In accordance with the four concepts of adaptation and coastal zone management, table 4.4 provides a synthesis of adaptation options suited to the needs and context of Timor-Leste.

Table 4.4 Synthesis of strategic options for adaptation and coastal management in the context of Timor-Leste.

IPCC-AR3 (2001)	ICZM (1996)	CIVAT (2013)	CHW (2015)	Synthesized Options for adaptation strategy and coastal management
Accommodation • Wetland restoration • Flood Warning System • Flood Proofing • Coastal Zoning • Coastal Setbacks	• Sectoral management • Preserving coastal ecosystem • Sustainable utilization of coastal resources	**T**hresholds maintained within acceptable limits **O**rganizing coast watch **R**educing threats and sharing costs	Wetland restoration, Early Warning System, coastal zoning, coastal setback	• **Coastal zoning** • **Early Warning System** • **Accommodation by "hard" measures (e.g. lifted house)** • **Wetland restoration**
		Sustaining coastal integrity **E**nhancing equitable access **D**isaster risk reduction	Groundwater management for water resources, fluvial sediment management for beach stability	**Adaptive management on:** • **Management of water resources** • **natural resources management** • **fluvial sediment management for beach stability**
Protection • Hard Structural Option • Soft Structural Option	• Sectoral management • Sustainable utilization of coastal resources	**E**ffective erosion buffers	Breakwaters, groynes, jetties, revetments, sea walls, dikes, storm surge barriers and closure dams	• **Combined protection with pre-dominantly "hard" measures** • **Effective buffers for upland water & sediment fluxes**
		Restoring coastal protection	Beach nourishment, dune construction/ stabilization, cliff stabilization, mangrove and coastal forest re-planting	• **Protection with "soft" measures, such as beach nourishment, dune construction/stabilization and cliff stabilization** • **Restoring mangrove and coastal forest** • **Reforestation in upland**
Retreat • Preventing development in areas near the coast. • Allowing development to take place on the condition that it will be abandoned if necessary. • No direct government role other than through withdrawal of subsidies and provision of information about associated risks.	• Preserving coastal ecosystem • Sectoral management	**R**educing threats and sharing costs		• **Resettlement of inhabitants** • **Preventing/restricting development** • **Provision information about associated risks of development**

4.4 Formulation of Adaptation Options

While formulating adaptation options, two aspects were taken into consideration, namely, 1) the actions shall help to reduce vulnerability to climate risks, or to exploit the potential benefits of climate change and 2) the actions shall create the information, supportive social structures, and supportive governance that are needed as a foundation for delivering adaptation actions (Building adaptive capacity).The following sections will elaborate the different strategies for adaptation in Timor-Leste.

4.4.1 Country-wide adaptation options

Given the agenda of the country in boosting its economic development through procurement of infrastructure and assuring the well-being of the communities, the following options are deemed of high importance:

1. **Coastal zoning** is the division of coastal areas into zones which can be assigned different purposes and user restrictions. For example, it can be used to protect natural coastal areas and nursing grounds for marine fisheries while at the same time allowing some level of economic and recreational activities.

2. **Early warning system (EWS)** is part of disaster risk management, aiming at empowering communities to prepare for natural hazards**.**

   A well-functioning EWS does not only need to ensure the dissemination of understandable warning to the threatened population in case of emergency, it also includes awareness of the risks faced by communities, as well as technical monitoring and warning service. Furthermore, and no less important, it increases the response capability, since warning is useless, if people at risk are not prepared to take the right actions to save themselves.

   Reportedly, there is still a lack of an appropriate EWS in the country, resulting in major losses when disaster strike. However, many sucos in the southern coast, e.g. Aubeon, Luca, Beco, set up their traditional EWS based on local wisdom, which is perceived by the communities as a sufficient makeshift.

4.4.2 Typology specific options

It must be noted that, despite the selection of 14 adaptation options which are based on the context of the country, not all of them may be suitable for the entire coast of Timor-Leste. The adaptation options must be suited to the physical and socio-economic condition in order to respond to the needs and types of vulnerability. In accordance to the typologies of vulnerability of the coastal sucos, the following options are proposed.

Table 4.5: Proposed options of adaptation strategies

		Accommodation options				Protection options					Retreat
Adaptation option / **Typology of Vulnerability**		Accommodation by "hard" measures	Adaptive management of water resources	Adaptive management on natural resources, including fisheries and salt ponds	Adaptive management on fluvial sediment management for beach stability	Combined protection with pre-dominantly "hard" measures	Effective buffers for upland water & sediment fluxes	Combined protection with pre-dominantly "soft" measures, including Mangrove	Restoring mangrove and appropriate types of coastal forest	Reforestation in uphill	Provision information about associated risks of development
Physical Vulnerability	High physical vulnerability				X	X			X		
	High physical + high ecosystem vulnerability			X	X	X	X		X	X	
	High physical + high infrastructure vulnerability	X			X	X	X				X
	High physical + high socio-economic vulnerability	X	X	X	X		X	X		X	X
	High physical + high socio-economic + ecosystem vulnerability	X		X	X		X	X	X	X	X
	High physical + high socio-economic + infrastructure vulnerability	X		X	X	X	X	X		X	X
	High physical + high socio-economic + high infrastructure + ecosystem vulnerability	X		X	X	X	X	X	X	X	X
Ecosystem Vulnerability	High ecosystem vulnerability						X	X	X		

Accommodation options

1. **Accommodation by "hard" measures** refers to actions that allow for continued occupancy and use of vulnerable areas by adapting infrastructure to the new or expected conditions caused by climate change. Flood proofing and climate proofing infrastructure in this context are the most beneficial options to be considered in Timor-Leste.

   - **Flood proofing:** Despite the fact that there are many kinds of hard measures which can be applied, flood proofing is deemed an option for the case of Timor-Leste. With regards to community houses at the southern coast, due to the frequent flood occurrence, the coastal population has started to elevate the houses, securing their assets from floods (see Figure 4.6 for example of flood proofing).

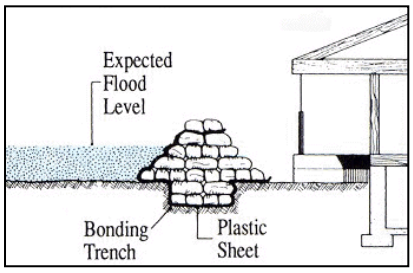

Figure 4.5 Example of Flood Profing Option

   - **Climate proofing infrastructure** refers to the explicit consideration and internalization of the risks and opportunities into the design, operation, and management of infrastructure (UNDP 2011). Such climate proofing infrastructure strategies are especially valuable in the areas of the coast, where important public infrastructure is located. The main objective is to safeguard the function of vital public services when disaster strikes and concomitant the country's ability to pursue its development goals.

2. **Adaptive management of water resources** aims to reduce water scarcity during drought and severe floods during the rainy seasons. It is done by making additional water sources available or by reallocating water distribution. Anticipatory measures include the establishment of "containment areas" or integrating climate change into water system planning. Numerous projects and even programmes specialized on water and agricultural management have taken place all over the country, supported by international organizations. Despite the long list of success stories and best practices shared, recurring cases of water scarcity during drought and severe floods during the rainy seasons are still existing.

3. The **adaptive management on natural resources, including fisheries and salt *ponds*** *seeks to assure maintaining ecosystem integrity, while also building coastal protection (through* mangrove rehabilitation). It can be done side by side with developing alternative livelihood of the coastal communities. This option includes measures such as:
   - Reducing overfishing
   - Enhancing cultivation of fry in refugia[7]
   - Sustainable fisheries based on ABC (Allowable Biomass Catch)
   - Threat reduction integrated with ICM and refugias
   - Diversifying livelihood for fisher and coastal communities

[7] Definition of refugia: "Climate change refugia, areas relatively buffered from contemporary climate change so as to increase persistence of valued physical, ecological, and cultural resources, are considered as potential adaptation options in the face of anthropogenic climate change." Source: https://cfpub.epa.gov.

Promoting Diversification of Livelihood for Fishermen and Coastal Communities*
(Wetlands International 2009)

Coastal communities are highly dependent on mangrove and fish availability as their main source of income. A combination of severe coastal erosion and human activities have destroyed mangrove ecosystems and the coral reef, leading to depleting fish stock and woods availability for sale. It consequently results in a more vulnerable ecosystem and socio-economic condition. An uptake of adaptive management approach to reduce vulnerabilities on natural resources while simultaneously maintaining socio-economic well-being of the people is important, for example through promoting diversification of livelihood.

Bio-Rights agreement for compensation is a concept in promoting diversification of livelihood by providing the corresponding communities with incentives or disincentives. The Bio-right agreement has been successfully implemented in the northern coast of Demak, Indonesia, where severe erosion occurs at muddy coasts and therefore extensive mangrove rehabilitation is required. This also consequently means that coastal communities need to alter their livelihood. Bio-rights implementation starts with an agreement among relevant stakeholders upon the initiation of a project plan with clearly defined goals and objectives. It is then followed by provision of micro-credits to local community groups, which funds can be used for development of all kinds of ecologically, socially and economically sustainable activities as alternatives to harmful practices that pose a threat to the environment. Upon termination of a contractual period and in return for active engagement, the micro-credits can be converted into definitive payments, providing the conservation activities prove successful. Or otherwise, loans shall be paid back.

The approach covers the costs communities face to change their current unsustainable practice into long-term sustainable livelihood strategies, motivating them to take a long-term interest in their conservation work. Legal contractual agreements were set up with community groups and witnessed by the village government, ensuring a greater group cohesion and responsibility in implementing the agreement. As such increasing the project implementation efficiency, contributing to the project sustainability and reducing overhead costs.

*This information is extracted from "Bio-rights in Theory and Practice: A financing mechanism for linking poverty alleviation and environmental conservation"

4. **Adaptive management on fluvial sediment management for beach stability:** The primary objective of fluvial sediment management is to trap sediment that would migrate or reintroduce sediment into systems. It extends the shoreline or creates dunes, encourages sediment transport and reverses losses due to erosion. The importance of fluvial sediment supply becomes even more so when considering its importance in maintaining fertile lands, often in delta areas for agricultural purposes.

Protection options

5. **Combined protection with pre-dominantly "hard" measures:** "Hard" measures or many times also referred as structural measures include hardening techniques such as constructing bulkheads, seawalls, revetments, breakwaters, or reinforcing dikes and headlands. This adaptation mostly aims to preserve

Figure 4.6 Example of Coastal Sea Wall

existing or planned development and infrastructure. See figure 4.7 for an example of coastal sea wall.

It can also be applied when coastal erosion and/or the impact of sea level rise is severe, or the existing natural green belt of the areas cannot keep pace with the deterioration rate.

Combined protection in Tarakan Island, Indonesia

Tarakan Island is one of the major cities in northern Borneo, Indonesia. The eastern coast of Tarakan suffer for coastal erosion, due to daily high wind waves and inundation exposure aggravated by the changing climate. Meanwhile, the development plan designed the eastern part of Tarakan as a marine tourism center of the island. To assure the realization of this plan, anticipatory efforts were taken by combining hard measure protection, i.e. seawalls with coastal forest. The combined measures were proven to be highly cost effective. Moreover, the existence of coastal forest now provides added value to the tourism activities.

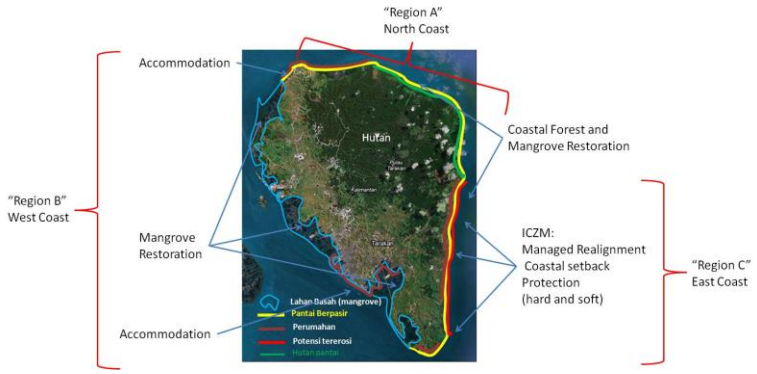

Figure 4.7 Example Case Study of Tarakan City Mixed Protection

6. **<u>Applying effective buffers for upland and sediment influx</u>**[8] addresses sediment transported by rivers. The objectives of this measure are the reduction of sediment, organic material, nutrients and pesticides in surface run-off, the reduction of nutrients and other chemicals in shallow groundwater flow, the stabilization of eroding stream banks and the reduction of scour erosion in the floodplain. See Figure 4.9 for illustration of effective buffer.

Sediment transported by rivers contributes to 95% of the sediment entering the ocean (UNEP 2016). Smaller river basins tend to have a relatively higher sediment supply to the coast as they have a smaller flood plain where the sediment can be deposited. The sedimentation process from the rivers in Timor-Leste has been identified as a natural cause of mangrove depletion and could even have damaging effect to coral reefs. Furthermore, the

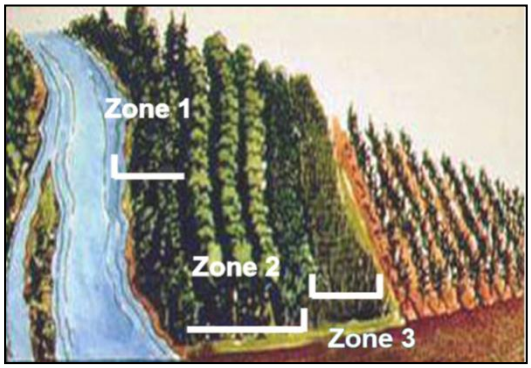

Figure 4.8 Example of Effective Buffer

[8]Source figure: Iowa State University, Riparian & Upland Forest Buffers 2013.

common practices of land clearance for agriculture as well as mining results in an even higher sediment load.

7. **Combined protection with pre-dominantly "soft" measures** aim to develop living shorelines through beach nourishment, planting dune grasses or stabilising cliffs.

Figure 4.9 Example of Beach Nourishment

   - **Beach nourishment** is a measure to rebuild and maintain the original shoreline. It is achieved by adding beach material to the beach. Beaches are usually nourished with sand, but eroded material can also be replaced by shingle or even cobblestone, as long as the nourishment material is compatible with the original beach material. (see Figure 4.10)
   - The **plantation of dune grasses** helps to keep the soil from eroding away and therefore reduces coastal erosion. Dunes protect from flooding in adjacent coastal lowlands.
   - **Cliff stabilization**is useful where cliffs are in danger of collapse or landslip. It may help to maintain the amenity value of these areas which can be important for recreation and tourism. The objectives of this option are to prevent erosion of valuable land, maintain the current coastline and improve public safety. Cliff stabilization can be a useful management option for coastal stabilization in densely populated areas. Measures such as the construction of revetments to prevent further erosion has been taken in a number of spots in Timor-Leste, for example in Manatuto.

8. **Restoring mangrove & coastal forest**

Restoring mangrove forest aims at reducing the erosive power of waves and helps to reduce coastal flood risk by diminishing the height of storm surges. The restoration of mangroves also helps to protect coastal communities against storms and to reduce drought. A sustainable restoration of mangroves is not achieved merely by mangrove planting, but it requires an environment that enables mangroves to grow naturally. Figure 4.11 shows mangrove seeding in Liquica.

Figure 4.10 Mangrove restoration effort in Timor-Leste

The objectives of **coastal forest re-planting** are similar to the ones of restoring mangroves. The restoration of coastal forest may be easier to achieve since it has a higher rate of survival than mangroves. The MAF through its national forest policy is focusing on a reforestation program in the country.

9. **Reforestation uphill** addresses land erosion which is affecting the settlement of the Timorese coastal population. Local communities believe that reforestation uphill and at the coast would be the solution against the various hazards that they are currently facing, from flood to erosion to drought.

Retreat options

10. **Provision information about associated risks of development:** In this option, the government does not play a direct role other than through withdrawal of subsidies and provision of information about associated risks.

The following two retreat options are not included among the recommended typology specific options. They are only appropriate in very specific cases and should be the very last option to choose because they potentially have significant social and cultural implications.

11. **Preventing/restricting development:** Future settlements and infrastructure will not be developed in areas that are vulnerable to inundation and instability. Development will only be allowed to take place with the condition that it will be abandoned if necessary (planned phase out).

    During the consultation, stakeholders expressed the need to identify areas with high vulnerability in order to avoid planning future infrastructure development in those vulnerable areas.

12. **Resettlement of inhabitants:** In the case where the level of risks is intolerable and predicted to take a significant toll, resettlement of inhabitants may be a cheaper and the safest option. The challenge however lies in the cultural setting, in which communities refuse to move due to the special bonding with the area**.** Ultimately, the strategy as such must be accompanied with appropriate **provision of information about the associated risks** and adapting the delivery of information into the context which is not only understandable but also acceptable for the communities.

4.4.3 Instruments to enable conditions for climate change adaptation in coastal areas

A successful implementation of the adaptation strategies can only be guaranteed if an enabling environment is created. Supporting instruments deemed suited for Timor-Leste are listed as follow:

1. **Policy Instrument:**
   a. *Mainstreaming coastal management into the country's development plan.* An important factor for the selection of strategies has been the synergy with the Strategic Development Plan (SDP) of Timor-Leste. The selected strategies will either contribute directly to the targets of the SDP (such as restoration of mangroves and coastal forests), create favorable conditions for the achievement of the SDP targets or assure the sustainability of the achievement.
   b. *Creating legal foundations.* A successful implementation of the previously identified climate change adaptation strategies requires legal foundations (e.g. policies, law, etc) for coastal management in Timor-Leste, including the corresponding responsible stakeholder.

2. **Institutional coordination**

   a. *Strengthening inter-institutional capacity.* As elaborated in the CVA report Vol.1, the coastal area is interrelated with other sectors highly important to the country. To assure sustainable development and coastal protection, the institutions responsible for each of the sectors need to increase their coordination capacity.

3. **Information and Knowledge**

   a. Strengthening institutional capacity in conducting vulnerability assessment. Developing adaptation strategies is an iterative process: Things which are uncertain at this point may

become more certain in the future and thus strategies must be adjusted. To do so it would require institutional ability to conduct vulnerability assessment, identifying impacts and risk as well as appropriate strategies to assure appropriate mobilization of available resources.

b. *Enhancing Information and knowledge management.* Furthermore, data and information management, monitoring of climate change impacts, as well as public awareness rising contribute positively to the successful implementation of the adaptation strategies.

4. Monitoring and Evaluation

Monitoring and Evaluation (M&E) in adaptation to climate change is particularly important, to assess the implementation of adaptation strategy (at the national level) and effectiveness of adaptation measures (at the local level). M&E allows a continuous learning process in adapting to climate change, as it provides information of what does and does not work, and why.

5 Prioritization of Adaptation Options

5.1 Introduction

The adaptation strategies have been selected with the objective to move towards coherent approach in addressing potential climate change impact in Timor-Leste, rather than individual activities. It suggests a long-term and continuous process. Since resources and capacity are limited, it is important to assure that the most appropriate adaptation strategies are implemented first. And therefore, a prioritization process is undertaken.

Selected adaptation strategies shall be relevant for addressing the reduction of vulnerability across the country, respond to the urgent climatic hazards as well as consider the availability of capacities and resources for implementation in the country. Moreover, to assure accuracy, political buy-in as well as sense of ownership, it is preferable that the prioritization of adaptation strategies is done in a participatory process together with the relevant national stakeholders in Timor-Leste, primarily with government agencies relevant for coastal management and its cross-cutting sectors. To this end, this chapter presents the framework and results of the prioritization process carried out with the Timorese authorities on-site.

5.2 Rationale of selection of prioritization tool

For the selection of a prioritization tool the most commonly used assessment approaches for assessing the costs and benefits of adaptation options (UNFCCC 2011) have been considered: Cost-Benefit Analysis (CBA), Cost-Effectiveness Analysis (CEA) and Multi Criteria Analysis (MCA).

The decision for most appropriate approach mainly depends on three factors:

- the single or multiple objectives and criteria for the selection of adaptation options,
- the possibility to measure impacts,
- the availability of data to calculate costs and benefits in monetary terms.

In Timor-Leste, multiple vulnerabilities have been identified and therefore more than one adaptation objective has been formulated. In the case of sea level rise for example, not only people and their livelihoods are affected but also ecosystems and infrastructure. There is not sufficient data available to measure the benefits of all selected adaptation strategies in monetary terms. Consequently, multiple criteria for prioritization need to be considered.

Based on these considerations and following the decision-making tree of possible approaches for assessing the costs and benefits of adaptation option (See **Error! Reference source not found.**), the optimal prioritization tool for this framework is the Multi-Criteria Analysis. MCA is a multi-step analysis, which allows assessment of different adaptation options against a number of criteria. MCA can consider monetised and non-monetised costs and benefits together.

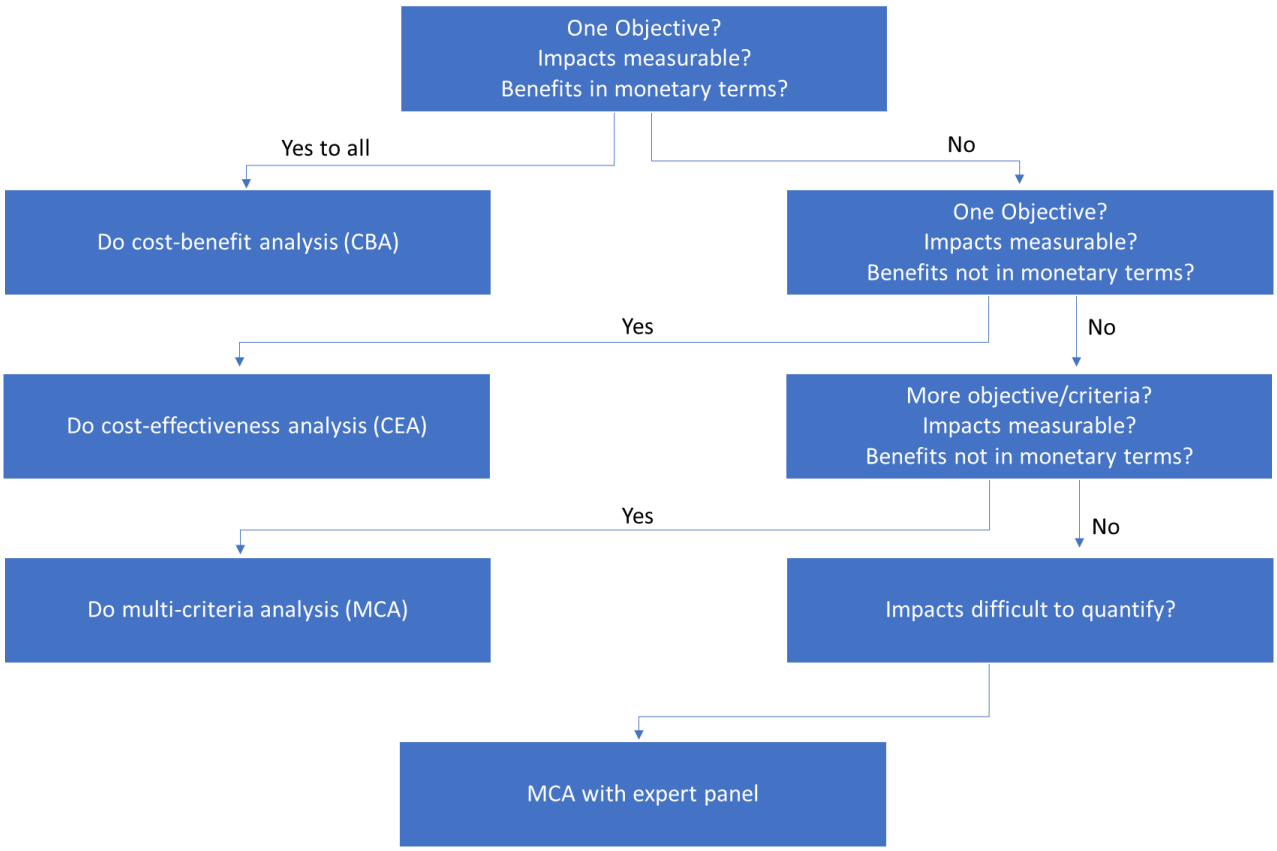

Figure 5.1 Decision making tree tool in assessing the cost and benefit of adaptation options.
Source: UNFCCC in 2011 on Assessing the Cost and Benefit of Adaptation Options (UNFCCC 2011).

Generally, vulnerability assessments, and the identification of adaptation options in particular, are based on variables that are difficult to quantify. However, this does not mean that the variables are any less important in the decision-making process. A MCA provides the necessary tool to be able to consider all of the important parameters and variables, both quantitative and qualitative.

5.3 Application of a Multi-Criteria Analysis

Based on available data and information, a Multi-Criteria Analysis was conducted to develop the national adaptation strategy with special emphasis on the most vulnerable locations. The results from this analysis assist the decision-making process in choosing the best adaptation strategies. The application of the Multi-Criteria Analysis was carried out together with the national stakeholders, in the context of a capacity building workshop on adaptation planning. The event took place in the first week of October 2017 in Dili.

The purpose of this analysis is not to assess vulnerability anew, but to bridge the gap between existing scientific knowledge and the decision-making process based on available information.

The following sections provide a summary of the MCA process carried out.

5.3.1 Criteria for prioritization

Having previously defined adaptation objectives and developed the adaptation strategies, criteria for the prioritization of the strategies must be identified and defined. They are essential for the ranking of strategies in the MCA, as the ranking of the options may change depending on the criteria selected. The three main criteria selected for the prioritization of adaptation strategies are:

1. …which address the majority of the countries vulnerable population and areas.
2. …which address the most urgent climatic risks to ensure timely planning and implementation.
3. …for which resources can likely be mobilized to avoid implementation gaps and delays.

For further description please see Table 5.1 below

Table 5.1 Main criteria for the prioritization of strategies

Criteria	Description	Rationale
Relevance	Is the strategy relevant for reducing vulnerability across the coastal area of the country?	Selecting the most relevant strategies across all coastal sucos/municipalities will allow to formulate a strategic plan at national level to address the majority of the vulnerable population and area.
Urgency	Does the strategy respond to an urgent climatic hazard?	Selecting strategies that address the most urgent climatic risks will ensure timely planning and implementation.
Capacity / Resources	Is the institutional capacity sufficient and can resources (financial, human, technical) for the implementation of the strategy be mobilized?	Selecting those strategies for which resources can likely be mobilized will avoid implementation gaps and delays.

5.3.2 Scoring and Weighing

It is important to dedicate sufficient time and attention to the development of a scoring and weighing system, because it guides the prioritization process and has a considerable impact on the future coastal management. Once the prioritization criteria were decided, a score for each criterion and for each adaptation option was defined. Table 5.2 presents the matrix for scoring criteria used for the prioritization process. Options were ranked by their average score. The score for each adaptation is calculated by multiplying the score for each criterion. Consequently, considering the three criteria for prioritization, the highest possible score for each option was 3 x 3 x 3 = 27 and the lowest one was 1 x 1 x 1 = 1. (see Table 5.2 below)

Table 5.2 Matrix for criteria scoring

Criteria	Score		
	Low (1)	Medium (2)	High (3)
Relevance	Relevant for a few sucos	Relevant for some sucos	Relevant for the majority ofsucos
Urgency	Hazard expected in the long term	Hazard expected in the medium term	Hazard is already occurring or expected in the short term
Capacity / Resources	Implementable only with additional capacity and resources	Implementable with existing capacity but additional resources are needed	Implementable with existing capacity and available resources

With respect to weighing the score of each criterion, it was agreed upon that all three criteria have the same level of importance, and therefore equal weighing was applied. The full results of prioritization process done in Timor-Leste are presented in Annex 3.

5.4 Results of Prioritization of Adaptation Options

The prioritization of adaptation options was done based on typology. As elaborated in sub-chapter 4.1, combinations of indicators that defined the high level of vulnerability in different areas resulted in 11 typologies. And it is acknowledged that among these typologies the same adaptation options may be applied. To this end, the prioritization process which was carried out together with the Timorese stakeholders was done only based on the major influencing indicators, i.e. High physical indicators, high ecosystems indicators and combination of high ecosystems, infrastructure and socio-economic vulnerability.

The results are presented in table 5.3 below.

Table 5.3 Results of Prioritization of Adaptation Options (based on the Training event October 4th, 2017)

Typology	Prioritized options
High Physical Vulnerability (and its combinations)	**Highest priority** • Effective buffers for upland water & sediment fluxes • Reforestation in upland • Provision information about associated risks of development **High priority** • Restoring mangrove and coastal forest • Coastal zoning • Early Warning System • Management of water resources • Wetland restoration • Preventing/restricting development • Resettlement of inhabitants
High Ecosystem Vulnerability	**Highest priority** • Effective buffers for upland water & sediment fluxes • Reforestation in upland • Provision information about associated risks of development **High priority** • Restoring mangrove and coastal forest • Coastal zoning • Early Warning System • Management of water resources • Wetland restoration • Preventing/restricting development
Combination of High physical ecosystems, infrastructure and socio-economic vulnerability	Highest priority • Restoring mangrove and coastal forest • Effective buffers for upland water & sediment fluxes • Reforestation in upland High priority • Coastal zoning • Early Warning System

Results show similar results of prioritized options for all typologies.

6 Adaptation Strategies

Climatic changes aggravate old issues and bring new threats to coastal areas of Timor-Leste. Adaptation strategies in Timor-Leste aimed at addressing potential damages caused by the changing climate. They are developed based on the options prioritized by the relevant national stakeholders (during the capacity building on October 4th, 2017), and were validated by wider group of stakeholders on October 5th, 2017. In accordance with the prioritisation of options, alignment with the existing national policies and recommendations from the national stakeholders, three strategic directions were developed and presented in the sections below.

6.1 Strategic direction 1: Country-wide options for coastal adaptation

This direction for coastal adaptation proposes strategic options which deemed necessary to be carried out nationally. These options can serve as fundaments for adaptation to climate change at coastal areas, and are not necessarily site-specific. They are also important to support the government agenda in assuring protection for coastal communities as well as continuing infrastructure development.

6.1.1 Strategic Option 1.1: Implementation of Coastal Zoning

Implementation of coastal zoning along the coast of Timor-Leste means assigning different purposes and user restrictions to coastal areas. The strategy shall serve as a mean to protect natural coastal areas and grounds for marine fisheries, while at the same time allowing some level of economic activities, including aquaculture, agriculture and tourism. Coastal zoning will support better infrastructure planning and development, avoiding development at vulnerable coastal areas. It requires high level of coordination and public participation, and therefore shall be regulated at different administrative levels.

Priority actions to pursue this strategy are:

1. Development of a precise national definition of the costal zones for Timor-Leste
2. Provision of information on land and property rights
3. Integration of coastal zoning into the existing development plan/strategies and spatial plan

Alignment with National Policies:

- The strategy is aligned with the 2017 Law on Base of Spatial Planning, and can be supplementary to the draft national spatial planning (developed by MPSI).
- It would support the implementation of the strategic- and operational- plan of MAF to assure management and protection of “Forests, Biodiversity and Coastal Ecosystems”, as also prioritized in the NAPA document.
- It would support the implementation of the National Tourism Strategy, assigning areas to be developed as centres for coastal and marine areas
- It is aligned with the Biodiversity Decree Law of Timor-Leste, in supporting the management of protected areas, with mangrove ecosystems as one priority including coastal areas (Article 22).

Potential stakeholder/s involvement:

Leading institution: Vice Minister of Development for Housing, Spatial Planning and Environment

Members of the taskforce:

- Ministry of Agriculture and Fisheries
- Ministry of Tourism, Arts and Culture
- Ministry of Justice; Ministry of Public Works
- Minsitry of States and Admisnitration
- Sub-national authorities (from municipality level to Aldeia Level)

6.1.2 Strategic Option 1.2: Early Warning System

Early Warning System (EWS) shall become an integrated part of the disaster risk management at the coastal areas in Timor-Leste. The strategic option shall aim at empowering coastal communities to prepare for natural hazards occurring at the coasts. The implementation of EWS shall be done in the most effective and efficient way, especially in the delivery of information followed by actions to respond. Additionally, it must be tailored to the local circumstances and capacity.

Priority actions to pursue this strategy are:

1. Improvement of meteorological, oceanographic and geological data availability, assuring accurate and timely information update.
2. Selection of appropriate technologies for the implementations of Early Warning Systems in different coastal areas and communities, assuring its effectiveness and efficiency.

Alignment with National Policies:

- The strategy is aligned with the 2008 National Disaster Risk Management Policy. It serves as a manifestation of risk management measure, equipping coastal communities to respond to tsunami, lowland, marine flooding and sea level rise.
- It is aligned with the 2009 National Disaster Operations Centre Manual. It will support the implementation of Standard Operating Procedures (SOPs) for communications and information management protocols for the National Disaster Operations Centre, and for the Ministry's Disaster Risk Management Teams.
- It is aligned with the 2010 Law on National Security, assuring the protection of civil society by allowing a more effective resolution of crises, in cases of natural catastrophes or disasters.

Potential stakeholder/s involvement:

Leading institution: Minister of Development for Public Works–Minister of Social Solidarity

Members of the taskforce:

- Ministry of Defense and Security
- Ministry of State Administration
- Sub-national Authorities
- Private sectors operating at the coast
- Representation of Coastal communities

Note: The vice Minister of Development for Housing, Spatial Planning and Environment as the responsible body for all climate change related matters shall oversee the implementation of this strategies nation-wide.

6.2 Strategic direction 2: Priority options for adaptation in highly vulnerable sucos

The strategic option provided in this section are those which have been prioritized specifically for highly vulnerable sucos. In accordance with the results of the prioritization process, the options for all typologies are identical and presented as follow:

6.2.1 Strategic Options 2.1: Application of effective buffers for upland water & sediment fluxes

Buffers can be defined as corridors of permanent vegetation, which are designed to reduce water runoff, filter sediment, and remove sediment-borne chemicals leaving the upland ecosystems. Application of effective buffers for upland water and sediment fluxes to improve watershed and coastline protection from climate change impacts. It is recommended that the buffers are established between agricultural lands and water bodies, in perpendicular to the direction of water and wind flow, to assure effectiveness of reducing sediment fluxes. The strategy will contribute to:

- Protection and conservation of biodiversity in forest and coastal areas, including mangroves and coral ecosystems.
- Development and management of watershed areas

Priority actions to be pursued are:

1. Implementation of a pilot project for the selection of the right type of vegetation to be used as buffers to avoid further erosion as a negative side effect
2. Site-specific evaluation of the effectiveness of the applied riparian buffer systems.

Alignment with National Policies:

- Aligned with the SDP 2011-2030 on the development of a policy for managing watershed areas and coastal zones, including the creation of buffer zones on river banks and around dams, lakes and coastlines to aid water resource conservation and floodplain control. This was adopted by the Program of V Constitutional Government 2012 – 2017 And VI Constitutional Government Plan 2015 – 2017.
- Aligned with the Revised National Forest Policy 2017 on the restoration of degraded land and forest to improve watershed and coastline protection
- Aligned with the operational plan of MAF 2014-2018, on the operational plan relevant for coastal communities, focused on “maintaining and restoring mangrove and forests and promoting the protection of coastal ecosystems and forests from climate change impacts”. The strategy will contribute to the following pillars of actions:
  - protection and conservation of biodiversity in forest and coastal areas;
  - establishment of management regimes for degraded coastal areas

  Proposed investments in natural resource management includes:
  - development and management of watershed areas

Potential stakeholder/s involvement:

Leading Institutions: Ministry of Agriculture and Fisheries

Members of the taskforce:

- Vice Minister of Development for Housing, Spatial Planning and Environment

- Sub-national authorities (from municipality level to Aldeia Level)

6.2.2 Strategic Options 2.2: Reforestation in upland

Reforestation and restoration of forests in the upland, including those of degraded areas, to improve watershed and coastline protection. Strategy for reforestation shall be done in a consistent manner, streamlining economic agenda, i.e. improved timber supply, sustainable employment and incomes for rural communities, with efforts to achieve far-reaching environmental benefits for the society.

Priority action as an integrated part of the reforestation program shall include:

1. Detailed study on identifying appropriate types of activities and vegetation to avoid mal adaptation.
2. Provision of community extension to:
    - positively participate in the national reforestation programm
    - increase awareness of forest protection
    - improve knowledge and awareness on sustainable utilization of the forest

Alignment with National Policies:

- The strategy is aligned with the Revised National Forest Policy 2017 on the restoration of degraded land and forest to improve watershed and coastline protection
- It is aligned with the operational plan of MAF 2014-2018, on the operational plan relevant for coastal communities, focused on "maintaining and restoring mangrove and forests and promoting the protection of coastal ecosystems and forests from climate change impacts". The strategy will contribute to the following pillars of actions:
    - protection and conservation of biodiversity in forest and coastal areas;
    - establishment of management regimes for degraded coastal areas
    - Proposed investments in natural resource management includes:
        - Development and management of watershed areas
        - Recovery of degraded forest

Potential stakeholder/s involvement:

Leading Institutions: Ministry of Agriculture and Fisheries

Members of the taskforce:

- Vice Minister of Development for Housing, Spatial Planning and Environment
- Misnitry of States and Administration
- Sub-national authorities (from municipality level to Aldeia Level)

6.2.3 Strategic Options 2.3: Restoring mangrove and coastal forest

Rehabilitation of mangroves will restore their essential functions in terms of coastal protection from floods and erosion. Mangroves will dissipate wave and tidal energy and stabilize shore sediments. This strategy includes protection and monitoring of mangroves. The strategic option of "Application of effective buffers for upland water & sediment fluxes" will be benficial in enabling environment for mangroves to grow.

Priority actions to pursue as an integrated part of the restoration of mangrove and coastal forest entails:

1. Development of a hydrological, ecological, and biological study to select the right type of mangrove in specific areas and enable conditions for mangrove to grow naturally.
2. Provision of a legal framework for mangrove utilization, including restrictions for mangrove harvesting (when deemed necessary)
3. Continuation of community-based mangrove rehabilitation programs, accompanied by:
    a. Provision of support for coastal communities, including women empowerment, to create values from mangrove in a sustainable manner, e.g. utilization of mangrove fruits
    b. Provision of support to communities for Silvo-fishery and bio-filter fishery concept for fisheries activities
    c. Socialization of livestock management and bio-right

With regards to **restoration of coastal forest**, MAF through its national forest policy is focusing on reforestation program in the country.

Alignment with National Policies:

- The strategy is aligned with SDP 2011-2030, particularly on the management of watershed areas and coastal zones, which include rehabilitation and protection of mangroves in coastal areas.
- It is aligned with the National Biodiversity Strategy and Action Plan of Timor-Leste (2011 – 2020) on "Building climate resilient ecosystems through effectively managing protected areas and reducing threats to biodiversity". The action focused on the implementation of Integrated Coastal Management (ICM) program focusing on sustainable livelihood development, including sustainable fishery management.
- It is aligned with the vision of the National Aquaculture Development Strategy, emphasizing on the introduction of types of marine or brackish-water aquaculture to coastal communities by 2020
- Aligned with the Revised National Forest Policy 2017 on the restoration of degraded land and forest to improve watershed and coastline protection
- Aligned with the operational plan of MAF 2014-2018, on the operational plan relevant for coastal communities, focused on "maintaining and restoring mangrove and forests and promoting the protection to coastal ecosystems and forests from climate change impacts". The strategy will particularly contribute to the following pillars of actions:
    - protection and conservation of biodiversity in forest and coastal areas;
    - Recovery of degraded forest

Potential stakeholder/s involvement:

Leading Institutions: Ministry of Agriculture and Fisheries

Members of the taskforce:

- Vice Minister of Development for Housing, Spatial Planning and Environment
- Sub-national authorities (from municipality level to Aldeia Level)

6.2.4 Strategic Options 2.4: Adaptive management of water resources

Implementation of an adaptive management of water resources is crucial to deal with the uncertainty of complex climate change events. The strategy aims at addressing water scarcity and quality issues at the coastal areas, which is crucial for domestic and agriculture use. In this context, adaptive refers to a management framework based on implementation, monitoring, and periodic reassessment of adaptation measures.

Priority actions to pursue as an integrated part of adaptive management of water resources entails:

1. Selection of coastal areas designated for the implementation of adaptive management of water resources, followed by collation of lessons learned and best practices from the current water resources management.
2. Develop measures against climate change suited to the specific characteristics of an area, supplemented by measurable goals and carefully planned monitoring-systems, allowing for a learning process. Measures could involve:
    a. Modification of natural environment of the embankments, e.g. by increasing the height and conduction of regular maintenance to reduce the risk of salt water intrusion.
    b. Adoption of new and/or adapted practices and engineering solutions, e.g. promotion of rainwater harvesting, use of aquifer storage and recovery (ASR), solar-powered desalinisation.

Alignment with National Policies:

- The strategy is aligned with the SDP 2011-2030, focused on the development of a policy for managing watershed areas and coastal zones. It includes strategies to rehabilitate and protect mangroves in coastal areas, regulate sand exploration in various rivers, and create buffer zones on river banks and around dams, lakes and coastlines to aid water resource conservation and floodplain control.
- Aligned with the Basic Law of Environment 2012. The Article 18 on Spatial planning stated the ordering and planning of inland areas must meet the need for the management of integrated water resources taking into account the potential that they may have on coastal areas.

Potential stakeholder/s involvement:

Leading Institutions: Ministry of Agriculture and Fisheries

Members of the taskforce:

- Vice Minister of Development for Housing, Spatial Planning and Environment
- Ministry of Health
- Vice Minister of Development for Public Works
- Sub-national authorities (from municipality level to Aldeia Level)

6.2.5 Strategic Options 2.5: Combined protection with hard and green measure

This combined measure focused on the protective response to the coastal hazards, while responding to the need to stabilize the shoreline movement which is due to the coastal instability, exacerbated by the sea level rise. It shall be applied when coastal erosion and/or the impact of sea level rise is severe, or the existing natural green belt of the areas cannot keep pace with the deterioration rate. Construction of appropriate hard structures such as sea walls (revetments) or storm surge barriers and closure dams shall be targeted in vulnerable areas, with structure suited to the needs and circumstances of each spot. The protection measures to reduce the risk of coastal flooding and erosion result in an increased sense of security, which is desirable.

Priority action as an integrated part of the reforestation program shall include:

1. Conducting detailed feasibility study and cost effectiveness analysis to assure the most appropriate selection of the hard and green measures to be implemented.
2. Conducting detailed engineering design of the selected measures

3. Provision of community extension to improve their awareness and thus ensure cooperation with the project.
4. Construction of the selected measures.

Alignment with National Policies:

- The strategy is aligned with the 2010 Law on National Security, assuring the protection of civil society by allowing for a more effective resolution of crises, in cases of natural catastrophes or disasters.
- It is aligned with the SDP 2011-2030, which focused on the management of coastal zones, taking into account rehabilitation and protection of mangroves.
- It is aligned with the NAPA in responding to the vulnerability of the coastal and marine ecosystem, by developing appropriate physical infrastructure (sea walls, jetty etc) in target vulnerable areas to defend against impacts of sea level rise (loss of land, seawater intrusion, etc).

Potential stakeholder/s involvement:

Leading Institutions: Ministry of Public Works / Misnitry of Agriculture and Fisheries

Members of the taskforce:

- Vice Minister of Development for Housing, Spatial Planning and Environmen
- Sub-national authorities (from municipality level to Aldeia Level)

6.2.6 Strategic Options 2.4: Provision of information about associated risks of development

The national government of Timor-Leste shall ensure provisioning of full knowledge and information about the risk of sea level rise and its associated uncertainties for development in highly vulnerable areas. This information shall be delivered to the respective stakeholders, entailing sub-national public authorities, private sectors operating in the areas, and most importantly, coastal communities. Moreover, the government possess the right to take necessary actions to ensure public safety.

Priority actions to pursue the appropriate provision of information entails:

1. Provision of information on the exact location and extension of highly vulnerable areas that have associated risks of development.
2. Effective dissemination of knowledge to stakeholders
3. Analysis and update of the conditions of these areas on a regular basis

Alignment with National Policies:

- The strategy is aligned with the 2009 National Disaster Operations Centre Manual. It will support the implementation of Standard Operating Procedures (SOPs) for communications and information management protocols for the National Disaster Operations Centre, and for Ministry DRM Teams.
- It is aligned with the 2010 Law on National Security, assuring the protection of civil society by allowing for a more effective resolution of crises, in cases of natural catastrophes or disasters.

Potential stakeholder/s involvement:

Leading Institutions: Ministry of Social Solidarity

Members of the taskforce:

- Vice Minister of Development for Housing, Spatial Planning and Environment
- Ministry of Defense and Security
- Sub-national authorities (from municipality level to Aldeia Level)

6.2.7 Strategic Options 2.7: Preventing/Restriction of development

The national Government of Timor-Leste possess the right to limit development in specially protected areas (including mangroves and coral ecosystems) and highly vulnerable areas. This right involves land acquisition, prohibition of reconstruction of property damaged by coastal hazards, reduction of subsidies and incentives for development. Designation of highly vulnerable and protected areas shall adhere the national coastal zoning document.

Priority actions to pursue this strategy are:

1. Alignment with coastal zoning strategy
2. Provision of information on land and property rights

Alignment with National Policies:

- The strategy is aligned with the 2017 Law on Base of Spatial Planning and the 2017 Law on Special Regime for the Definition of Ownership of Real Estate, especially concerning the definition of Seafront.
- It is aligned with Basic Law of Environment 2012. The Article 18 on Spatial planning stated that spatial planning should take into account the particular needs of the marine and coastal marine ecosystems.
- It is aligned with the Law of Environmental Licensing, Decree Law 5 / 2011, focused on the implementation of the Environmental Impact Assessments and Licensing Procedures for large projects.

Potential stakeholder/s involvement:

Leading Institutions: Vice Minister of Development for Housing, Spatial Planning and Environment

Member of the task force:

- Vice Minister of Development for Public Works
- Vice minister of State Administration
- Sub-national Authorities
- Private sectors operating at the coast

6.2.8 Strategic Options 2.8: Resettlement

Resettlement of inhabitants, or arranging migration for coastal inhabitants, may need to take place when hazards in certain sections are too severe, and thus risk to the coastal communities becomes intolerable. Government, in this case, shall be prepared to take the necessary actions to ensure public safety.

Supporting actions required:

1. Improvement of institutional capacity as well as legal authorities in managing potential transboundary implications for the resettlement process, both on a temporary or permanent basis.

2. Provision of the adequate support system to assuring proper integration of the migrated communities in the new resettlement.
3. Establishment of institutional capacity in subsequently dealing with the sue of the abandoned land.

Resettlement of Ecosystems, in this case, means allowing mangroves to adjust to increased levels of the sea through a slow landward migration. This strategy may be opted when excessive environmental impacts and/or economic implications for protection strategy deemed too excessive.

Alignment with National Policies:

- Aligned with the SDP 2011-2030 on the development of a policy for managing watershed areas and coastal zones, including the creation of buffer zones on river banks and around dams, lakes and coastlines to aid water resource conservation and floodplain control. This was adopted by the Program of V Constitutional Government 2012 – 2017 And VI Constitutional Government Plan 2015 – 2017.
- Aligned with the Biodiversity Decree Law of Timor-Leste. It would support the manifestation of the management of protected areas, with mangrove ecosystems as one priority including coastal (Article 22).
- It is aligned with the 2010 Law on National Security, assuring the protection of civil society by allowing for a more effective resolution of crises, in cases of natural catastrophes or disasters.

Potential stakeholder/s involvement:

Leading Institutions: Vice Minister of Development for Housing, Spatial Planning and Environment

Member of the task force:

- Minister of Social Solidarity
- Vice minister of State Administration

6.3 Strategic direction 3: Supporting instruments for enabling conditions

The strategic direction 3 focuses on enabling environment, which is essential to guarantee successful implementation of the adaptation strategies. It includes enabling legal foundation, institutional capacity, information and knowledge management as well as monitoring and evaluation. Supporting instruments for enabling conditions integrate inputs from various stakeholders in Timor-Leste and are presented in the following section.

6.3.1 Strategic Direction 3.1 Provision of Legal Foundation

To assure implementation of the strategies**, the following four important steps are suggested:**

1. **Formalization of Coastal Adaptation Strategies.** The formalization of these strategies will respond to the Strategic Development Plan 2011-2030, The Basic Law of Environment 2012, the National Biodiversity Action Plan for the development of an integrated coastal management policy. In addition, this document can be supplementary to the National Ocean Policy (NOP), which is currently being formalized. The NOP propose an integrated approach to manage activities in their national coasts and ocean territory while addressing national marine issues such as pollution and climate change that involve more than just one government department.

2. **Development of national definition of coastal zone, including a precisely defined boundary. The national definition of the coastal zone shall be an integral part of the Coastal Adaptation Strategies.** This definition is instrumental in clarifying areas of responsibility in the context of coastal management and adaptation.

3. **Mainstreaming of Coastal Adaptation Strategies into the Government Plan** (and other existing policies in the country). The strategies will provide a framework for the national and sub-national government to assure that coastal management and adaptation are considered when a development plan is developed and/or implemented.

4. **Formalization of Tara Bandu to support the implementation of the Coastal Adaptation Strategies.** The highly respected Tara Bandu serves as an important element in enforcing the implementation of the strategies, especially at the local level. The Directorate General of Environment has developed a draft guideline/manual for Tara Bandu implementation in the context of Climate Change, including for coastal areas.

6.3.2 Strategic Direction 3.2 Institutional Arrangement and Capacity

In addition to provision of legal foundation, pursuing appropriate institutional arrangement to oversee the implementation of the Coastal Adaptation Strategy, coupled with enhancing their capacity, is imperative. It can be done through:

1. **Advocating the establishment of Coastal Management Committee.** The implementation of the Coastal Adaptation Strategies calls for coordinated efforts of stakeholders from the central level to the local level. In this context, the Vice Minister of Development for Housing, Spatial Planning and Environment, particularly the Directorate for Climate Change, in collaboration with the Ministry of Agriculture and Fisheries will play a vital role in overseeing, coordinating and implementing activities that are directly related to the management of Forests, Biodiversity and Coastal Ecosystems. In addition, a number of other stakeholders including the government, non-governmental organizations and the private sector are expected to play important roles in the implementation of the aforementioned strategies as well as creating an enabling environment. In the absence of a responsible entity to coordinate issues related to coastal management, there is a need to advocate the establishment of national committee for coastal zone management, to be endorsed and formalized by the Council of Ministries; and establish task forces for specific issues. Under the current circumstances, the most effective measures to establish the committee are, for example, by:
    - Making use of the already existing Climate Change working group under the coordination of the National Directorate of Climate Change to ensure effective communication, cooperation and sustainable & effective intervention.
    - Utilizing of the Coral Triangle Initiative Working Group, led by the Ministry of Agriculture and Fisheries, in collaboration with the National Directorate of Climate Change.
    - Utilizing the existing taskforce for Coastal Management. The Minsitry of Agriculture and Fisheries, the Vice Minister of Development for Housing, Spatial Planning and Environment, the Minsitry of Justice and the Minsitry of Public Works are members of this task force. They are currently being assigned to enforce the manifestation of the Seafront area along the coast of Timor-Leste. Given the scope of the Coastal Adaptation Strategies, it is important to expand the roles and responsibility descriptions, and even membership, of this Task Force suited to the needs of the strategies.

- Utilizing of the upcoming Technical Committee for coastal sector, under the Climate Change Committee who will oversee the implementation of the National Climate Change Policy.

2. **Strengthening stakeholders' engagement and coordination.** The establishment of the Coastal Management Commiittee will allow for a cross-sectoral partnerships in implementing adaptation actions. Clear assignment of roles, responsibility and operation area are highly imperative to avoid overlaps. Moreover, it is also important to engage sub-national institutions, representatives of civil societies, private sectors and international organizations in overall coordination activities.

3. **Strengthening Institutional Capacities.** Capacity of the national stakeholders for climate data analysis and management in different ministries and institutions is one key to adapt to the changing climate. Building national capacity shall include:

   - Capacity for mainstreaming: This shall include enhancing capacities for the integration of climate change adaptation into the existing national policies as well as local development planning.
   - Capacity to conduct Vulnerability Assessment: Building capacity for VA can be done through participation in VA trainings as well as development of methodology guidebook for vulnerability assessments in the country
   - Close Collaboration with national and regional universities (as centres of excellence) to support informed decision making, through harnessing academic research.

   Moreover, to prevent dependency it is suggested to:

   - Facilitate training of trainers to be able to continue capacity building and multiply capacity with in-house trainers.
   - Continue and deepen capacity building on vulnerability assessment, formulation of adaptation strategies and its prioritization

6.3.3 Strategic Direction 3.3 Information and Knowlede

This chapter focuses on information knowledge options that represent a vital prerequisite for effective coastal management. The options can be clustered knowledge generation, knowledge sharing and dissemination, and knowledge resources.

1. **Improve data management system.** Research and monitoring of climate change impacts can be conducted on a regular basis by a climate change research institution. In the process of data collection, a best practice is to target at university and school level. This way the community can participate in the process and is at the same time informed about the adaptation strategies under implementation. This combines community participation and public awareness and contributes to data availability with little resources.
   Moreover, to maintain an appropriate data management system, the following is recommended:
   - Improve data accessibility and information sharing between different sectoral departments (adapt the legal framework to facilitate this).
   - Develop a central repository for all data and information relevant for climate change adaptation in coastal zones
   - Develop a data usage protocol

2. **Enhance awareness raising and education for communities.** Enhancing awareness raising and education play an essential role in increasing adaptation capacities of communities. It is important that awareness raising and educations are received and perceived well by the vulnerable groups, e.g. especially women and children. This can be done for instance through suco and/or aldeia level women organizations. As for children, inserting climate change relevant topic into school subjects would help to increase their awareness and information on climate change and its impacts.

3. **Fostering knowledge exchange.** Numerous projects and programmes relevant for climate change have taken place in the country, it is important that best practices and lessons learned of these activities are documented and being accessible to public. An establishment of an exchange platform or a climate change adaptation clearing house could, for instance, be an option. In addition, benefitting from the existence of many international organization in the country, it is important to reap the international knowledge brought with them and tailor it to the local conditions.

6.3.4 Strategic Direction 3.4 Monitoring and Evaluation

Monitoring and evaluation are essential parts of an iterative adaptation process. There are three important elements to be considered in developing an M&E system for the Coastal Adaptation Strategies, namely:

1. Defining the objectives of the M&E. At this stage, the objective of a monitoring and evaluation system of the Coastal Adaptation Strategy for Timor-Leste shall mainly aim at the implementation of the strategy and building national adaptive capacity. Nevertheless, given that M&E systems have now become a prerequisite in tapping international funds, it may be wise to set up an M&E system to report accountability of the implementation of the adaptation strategy.
2. Selection of indicators. There is no universal set of indicators for coastal adaptation strategy, and therefore selection of indicators shall then be selected based on the M&E purpose and context. And given the novelty of the coastal adaptation strategy, definition of indicators for the M&E system may consider the process-based indicators, such as; 1) National definition of coastal zone and its boundary is developed, 2) Formally endorsed Coastal Management Committee is established, 3) Coastal Zoning document is available,4) awareness for climate change impacts has been increased, etc.
3. Institutional setting of the M&E. Given the wide coverage of stakeholders to be involved in the implementation of Coastal Adaptation Strategies, it is important setting up a governing body to carry out the M&E system. And prior to do so, it is then important to conduct a thorough institutional analysis of the relevant organisations and actors covering their interests, potential roles and contributions is important because adaptation in most cases involves a variety of sectors and stakeholders.

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Annex 1 Overview of national policies relevant for coastal management and improving the lives of coastal communities

Policies	Content relevant to coastal management	Stakeholder/s	Cross-cutting sectors
Timor-Leste Strategic Development (2011 – 2030)	The SDP focused on the development of a policy for managing watershed areas and coastal zones will be developed that will include strategies to rehabilitate and protect mangroves in coastal areas, regulate sand exploration in various rivers, especially the Comoro River, and create buffer zones on river banks and around dams, lakes and coastlines to aid water resource conservation and floodplain control.	National Government of Timor-Leste	Water management Ecosystems Climatic and non-climatic induced disaster Infrastructure
Basic Law of Environmental 2012	The Article 18 on Spatial planning stated the ordering and planning of inland areas must meet the need for the management of integrated water resources taking into account the potential that they may have on coastal areas. Furthermore, spatial planning should take into account the particular needs of the marine and coastal marine ecosystems. The Article 25 on Marine Coast emphasized on ensuring the integrated management of marine coast as the basis for the conservation, protection and sustainable use of marine resources, ecosystems and marine species. Furthermore, the definition of an integrated management plan of the sea coast must take into account the limits of natural processes and long-term equilibrium of the components environmental, economic, social, cultural and recreational services.	The (formerly) Ministry of the Economy and Development	Water management Ecosystems Socio-economic Infrastructure Tourism
Program of V Constitutional Government 2012 – 2017 And VI Constitutional Government Plan 2015 – 2017	With respect to coastal areas, the program focused on developing a policy for managing watershed areas and coastal zones. It will include strategies to rehabilitate and protect mangroves in coastal areas, regulate sand exploration in various rivers, especially the Comoro River, and to create buffer zones on river banks and around dams, lakes and coastlines to aid water resource conservation and floodplain control. With regards to fisheries, the government will enhance its exploitation of the country's 735 km coastline, providing nutritional and economic benefits to each of the 11 coastal districts in the country. The government also plans to expand aquaculture activities such as seaweed, prawn, abalone, crab and oyster farming.	National Government of Timor-Leste	Ecosystem, Fisheries, Socio-economic Climatic and non-climatic induced disaster Water management

Policies	Content relevant to coastal management	Stakeholder/s	Cross-cutting sectors
Law of Environmental Licensing, Decree Law 5 / 2011	The law focused on the implementation of the Environmental Impact Assessments and Licensing Procedures for large projects. Despite the fact that the law does not specify anything special on coastal areas or coastal management, it is assumed that it applies for all areas in the country.	The (formerly) Ministry of the Economy and Development	Ecosystems Infrastructure
National Biodiversity Strategy and Action Plan of Timor-Leste (2011 – 2020)	The document presented concrete action in the Priority Strategy (PS3) on "Building climate resilient ecosystems through effectively managing protected areas and reducing threats to biodiversity". The action focused on the establishment implementation of Integrated Coastal Management (ICM) programmes focusing on sustainable livelihood development, including sustainable fishery management.	National Biodiversity Working Group coordinated by the (formerly) Ministry of Economy and Development	Ecosystem, Fisheries, Socio-economic
Biodiversity Decree Law of Timor-Leste	The law focused on the management of protected areas, including coastal (Article 22). Mangroves and coral ecosystems are prioritized. The law emphasizes on the importance of management committee, plan, and a collaborative management agreement to guide the management of each protected area and regulate activities permitted and prohibited in each protected area.	The Ministry responsible for the environment and the Ministry responsible for biological resources shall be jointly responsible for the administration of this Decree Law	Ecosystem
Law N°6/2017 Base Law of Territory Planning	This law establishes the general bases for the public policy of regional planning or /land-use planning. The law includes rules on the legal status of soils (for example: spaces and infrastructures for public use and State public domain) and also on the territorial planning system. Also, a definition for the concept of "Seafront" and "Coastal Zones" is provided. Article 5 stipulated the need of an integrated management of coastal zones.		Socio-economic, climatic, Ecosystem and Tourism
2008 National Disaster Risk Management Policy	As a manifestation of risk management measure, coastal communities shall be equipped with hazard specific survival skills. This includes recognition and responding to tsunami, lowland, marine flooding and sea level change.	Ministry of Social Solidarity	Climatic and non-climatic induced disaster Socio-economic
2013 National	As a national document for vulnerability and risk assessments, the document	Ministry of Social Solidarity	Climatic and non-

Policies	Content relevant to coastal management	Stakeholder/s	Cross-cutting sectors
Hazard, Vulnerability and Risk Assessment	thoroughly elaborated all kinds of hazards, impacting the country. However, only little information are available on how to manage these risks.		climatic induced disaster Socio-economic Infrastructure
2009 National Disaster Operations Centre Manual	The document elaborated the Standard Operating Procedures (SOPs) for communications and information management protocols for the National Disaster Operations Centre, and for Ministry DRM Teams. It also provides guides to support the collation of information related to disaster risk and planning for addressing priority risks.	Ministry of Social Solidarity	Climatic and non-climatic induced disaster Socio-economic
Revised National Forest Policy 2017	The policy objective is reforestation and restoration of degraded land and forest to improve watershed and coastline protection, maintain and expand wood resources for energy production, for building construction, furniture and craft manufacture, for fruit and other non-wood products, to complement agricultural and horticultural land uses and for enhancing landscape values.	Ministry of Agriculture and Fisheries	Socio-economic Ecosystem Water management
Strategic Plan for MAF (2014-2020	As stated in the Specific objective 1.6 on "Accelerating production of selected strategic enterprises on the basis of specialization and agro-zoning", Component 3, the goal of this program is to lead the development of the nations' aquatic resources in a sustainable manner. At the same time, it should still provide opportunities for coastal and inland communities to benefit from such developments including improved nutrition. Morover, the SDP proposes the introduction of at least three types of community-based aquaculture activities to coastal communities by 2020.	Ministry of Agriculture and Fisheries	Socio-economic Fisheries
National Aquaculture Development Strategy (2012-2030)	The vision of the National Aquaculture Development Strategy is for aquaculture to contribute in improving food and nutrition security, diversification of livelihoods of inland and coastal communities, and economic growth in Timor-Leste. The plan gives emphasis to the introduction of at least three types of marine or brackishwater aquaculture to coastal communities by 2020	Ministry of Agriculture and Fisheries	Socio-economic Fisheries
Operational Plan 2014 – 2018 MAF	The section of operational plan relevant for coastal communities refer to the call of NAPA on the priority adaptation measures, "Forests, Biodiversity and Coastal Ecosystems: Maintain and restore mangrove and forests and promote awareness rising to protect coastal ecosystems and forests from climate change impacts". The pillars of actions are: - protection and conservation of biodiversity in forest and coastal areas;	Ministry of Agriculture and Fisheries	Ecosystems Water management Climatic and non-climatic induced disaster

Policies	Content relevant to coastal management	Stakeholder/s	Cross-cutting sectors
	- establishment of management regimes for degraded coastal areas proposed investments in natural resource management includes: - Development and management of watershed areas - Establishment of appropriate management for coastal areas - Recovery of degraded forests		
National Action Plan for a Hunger and Malnutrition Free Timor-Leste 2014	The outcome 3.3 focused on pursuing the cross-sectoral policy coherence, encompassing inter-alia food security, industry, trade policy, tourism, energy, land use, water and climate change. One of the most important requirements of sustainability in addressing food and nutrition issues is that there needs to be coherence across many sectors and institutions to harmonize policies, programmes, and implementation of various actions. To date, agriculture, food and nutrition policies are lacking of coordination between ministries and development partners. Future focus will include linking agriculture, food and nutrition policies to rural development policies, trade, commerce, tourism, private sector development for small and medium size enterprises, and management of maritime and its resources. Priority outputs which need to be pursued urgently are: - Implementation of integrated approaches to natural resource management - Promotion of integrated participatory coastal natural resource management	Nutrition in Timor-Leste (KONSSANTIL) -	Socio-economic Ecosystems Agriculture Water Management Tourism
Fisheries Decree Law 6/2004	The Article 82 on Marine Facilities stated that in the seafront up until 100 meters from the coastline, or in hydrographical basins subjected to fishing or aquaculture activities, as well as the extraction or utilization of any material or still-life resource from the continental shelf of the country or from the hydrographical basins. Whereas the Article 81 on Protection of Aquatic Environment, stated that Factories or companies, as well as any person or entity established along the coastline or hydrographical basins shall be prohibited from throwing used water originating from industrial or commercial activities into national waters if these are susceptible to stun, poison or provoke the destruction of fishing resources or any other aquatic species.	Ministry of Agriculture and Fisheries	Fisheries Infrastructure

Annex 2 Overview of interviewees for institutional framework analysis

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
4. Mai. 2017	MAF - Director General for Forestry, Coffee and Industrial Plants of MAF	Mr. Manuel Mendes	78592711	lai_luhat78@yahoo.com	- First Priority is to stop deforestation through the implementation of protected areas - Project on adaptation: Participatory land-use planning. Aspects of Tara bandu and local knowledge is considered. The project has been implemented in 6 villages (420 sucos). Cooperation with JICA and FAO - Problems: enforcement of law; forest and mangroves are housed in two different institutions - regarding coastal areas, there are different interest in different institutions and very little coordination

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
5. Mai. 2017	UNTL - CCCB	Mr. Marcal Gusmao	77894147	marcalgusmao@gmail.com	- UNTL-CCCB provides information to different insitutions on the national level - Collaboration with the single institutions is considered succesful. However, from their position they observe a need to foster more collaboration across institutions - Carried a vulnerability assessment in Hera. Promised to provide detailed report on methodology, especially regarding identification of influence areas of coastal zones - Mentioned need for capacity building in the area of mapping, modelling, projections, etc.

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
5. Mai. 2017	MAF - Secretary General	Mr. César José da Cruz	77253156	cejocruz@yahoo.com.au	- Main challenge for the ministery is the drought conditions in certain areas and provision of food. - Vision is to reach food safety by 2030 . - Regarding coordination the ministry sees the decentralization process as a problem, as municipalities do not have the capacity to take over many issues. - Collaboration with development organisations is considered very strong and productive. However, communication and cooperation accross nationals institutions can be improved. - Cross-sectoral issues is left to the Council of Ministers.
5. Mai. 2017	MAF - National Directorate for Research and Geophysical Information	Mr. Claudino Nabaes	77693222	claudino_nabais@hotmail.com	- Department in charge of research to provide information to MAF. - Information stays mostly within the the ministery and is not shared with other departments. - Interview was carried out together with the Secretary General which seemed to influence on the responses of the informant.

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
5. Mai. 2017	MAF - Director of Fisheries	Mr. Acacio Guterres	77233208	guterres_acacio@yahoo.com	

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
8. Mai. 2017	Rede Hasatil	Mr. Gil Horácio Boavida	77287429	railulik@yahoo.com	- Local NGO working in the area of sustainable agriculture and food security. - Contains a network of 28 NGOs working across the country - Advocacy especially with KONSANTIL - According to the organisation the areas affected by CC are mostly in the South. Main problem: sea level rise - sees the necessity of creating a coordination organism between institutions - sees the necessity of more community consultation for big projects - there is a great problem of law enforcement in the country

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
9. Mai. 2017	La'o Hamutuk	Mr. Mariano Ferreira Mr. Maximus Tahu		asoihana@gmail.com maxitahu@gmail.com	- Local NGO monitoring laws/strategies and plans related to Development. Therefore overlapping with climate change issues especially in coastal areas - mentiones problems of big infrastructure development lacking EIA and public consultation (example: Suai) - For Tibal an EIA was carried out, but not public - ZEESM Project (Oecussi) where no master plan has been published and people have already been relocated - Sees collaboraton across institutions only for big projects such as SDP, but not in local projects

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
9. Mai. 2017	Santalum	Mr. Adalberto Higinio		santalumlum@yahoo.com	- NGO working in the areas of Agroforestry / Silvopastural system, Agrofishery / Mangroves and Forest reforestation - Still one of the main causes of deforestation is firewood although everybody is provided with electricity. but cost of electricity is very expensive - Works very closely with the government, espcially MAF - Mentioned the ZEESM Project in Oecussi as quite sentisitve, but did not want to comment on it - Implemented a number of projects with development agencies such as JICA - Projects in the area of adaptation and forestry

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
9. Mai. 2017	OXFAM	Mrs. Kathy Richards	77230831	kathyr@oxfam.org.au	- Provided information on many projects regarding adaptation to climate change - Does work in different sectors such as agriculture, forestry, climate change protection - More focus on the implementation of participatory projects and consideration of local practices such as tara bandu - confirms that there is little coordination not only across the institutions, but also within the institutions - there is a great gap in vertical communication ministries - sees decentralization as an opportunity to empower local communities
9. Mai. 2017	JICA	Mr. Yoji Mizuguchi	77722436	mizuguchi-yj@n-koei.jp	- Implementation of project on upper watersheds of Lacio and Comoro

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
		Mr. Manoj Kumar Pattanaik	77025946	manoj2005_p@yahoo.com	- Together with MAF: Participatory land-use planning - Advisory to MAF for National Forest Conservation Plan - Shares insight on delineation of coastal areas. No strict methodology for defining coastal areas. Definition depends on the time of the project - Considers that the laws and strategies of the country are good, but coastal areas are housed in too many different institution - Enforcement is a greater problem than creating new plans and laws - Sees also little coordination and communication across institutions
10. Mai. 2017	MSS - Directorate for Disaster Risk Reduction	Mr. Xavier Lourenco Cosme	78141715	xavier.lorenco2797@gmail.com lourenco.xavier@mss.gov.tl	- Interviewee was not aware of the project - Did not receive information for the inception workshop - main recommendation: Advocacy inter and intra ministerial - follow-up meeting was cancelled

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
10. Mai. 2017	MoF - Directorate General for Statistics	Mr. Elias dos Santos Ferreira	3311348	elias_ferreira2003@yahoo.com	- Provided information collected from the las census of the country
10. Mai. 2017	Ministry of Health - National Directorate for Public Health	Mr. Pedro Canizio	77546544	mileradho@yahoo.com	- Provided information on the link between nutrition, dengue and malaria and climate change - There are clear numbers that show the increase of health issues in areas where the impacts of climate change are stronger - State that the issue of health is important for everybody and therefore working with other ministeries is not a problem

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
11. Mai. 2017	MCIE - Chief Department for Climate Change	Mr. Nelson Madeira & Mr. Abrao Joaquim	77327533 (Nelson) & 77295906 (Abrao)	nelsonmadeira72@yahoo.com (Nelson) & aquem69@gmail.com (Abrao)	- Very relevant for the assignment - Did mention many projects which have already been implemented or are currently being implemented in coastal areas related to adaptation to climate change, but did not share any documents - Did not share the draft climate change policy - During the meeting Agusto Pinto declined to share information with regards to policy document and CC acitivities in coastal areas. - States decentralization more like a future problem and not as an opportunity - Capacity building should first be carried out before communities can participate

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
11. Mai. 2017	Ministry of Tourism Arts and Culture - General Directorate for Tourism	Mr. Aquilino Santos Caeiro	77327398	aquilino.santoscaeiro@yahoo.com	- Shared the recently published National Tourism Policy - Explained the emphasis on Eco-tourism, but still companies are granted permission to build big resorts even in protected areas - Sees the potential in eco-tourism to protect coastal areas, but also states differences in interests with many politicians - Many regulations are ignored - Hopes that Timor does not develop to the next 'Bali'
11. Mai. 2017	MPSI Ministry of Planing and Strategic Investment - Head of Advisors Unit for Integrated Planing	Mr. Pedro Lay and Mrs. Brigida da Silva	77230032 (Mrs. Brigida)	bdasilva@mpie.gov.tl	- Were not aware of the project - Showed some disconform that letter of support was 'only' signed by MAF - Did not show any type of willingness to cooperate with the project - Explain that the directorate is very young and therefore not much data available to them

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
12. Mai. 2017	FAO	Mrs. Paula Lopez da Cruz	77423368	paula.lopesdacruz@fao.org	- Expressed her satisfaction with the laws, regulations and plans of the country. Especially taking into consideration the development status of the country - Now more time should be invested in enforcement - Regarding coastal areas, she sees the main problem in the fact that the issues are housed in too many institutions - Either it should be the mandate of one institution (preferable) or work should be aligned across institutions (more difficult) - shared documents on different approaches and projects implemented in climate change adaptation in coastal areas - shared national documents which were not shared by officials
12. Mai. 2017	MPW Ministry of Public Works - National Directorate for Metereology and Geophysics	Mr. Terencio Moniz	77230218	tfmoniz.moniz@gmail.com	- Expressed the importance of the projects and kindly provided the contact of the people from other institutions to acquire data - Promised to provide data relevant to the project - Will be joining community consultations

Date of Meeting	Name of Institution	Contact Person	Telephone number	Email Adress	Highlights
12. Mai. 2017	CARE	Mr. Peter Raynolds	77311807	peter.raynes@careint.org	
12. Mai. 2017	Conservation International	Mrs. Trudian Dale	3310016	tdale@conservation.org	
	MAF - ALGIS			-	
	Maritime Boundary Office			-	
	IPG				

Annex 3 Results of prioritization process

High Physical Vulnerability – Done by Group 1

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x) *Nilai***	**Score (+) *Nilai***	**Rank (x) *Peringkat***	**Rank (+) *Peringkat***
Accommodation	Coastal zoning / *Pengaturan Zonasi Pesisir*	3	3	2	18	8	4	4
	Early warning system / *Sistem Peringatan Dini*	3	2	3	18	8	4	4
	Accommodation by “hard” measures (e.g. climate proofing of buildings, roads etc) / *Akomodasi dengan konstruksi “keras” (cth. Peninggian rumah)*	2	2	1	4	5	14	14
	Wetland restoration, including restoring mangrove and appropriate types of coastal forest / *Restorasi lahan basah, termasuk mangrove dan hutan pesisir yang sesuai*	2	3	2	12	7	9	9
	Adaptive management in agriculture and water resources / *manajemen adaptif pada agrikultur dan sumber daya air*	3	3	2	18	8	4	4

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Adaptive management on natural resources including fisheries and salt ponds / *manajemen adaptif terhadap sumber daya alam termasuk tambak ikan dan garam*	2	2	3	12	7	9	9
	Adaptive management on fluvial sediment for beach stability measures (beach nourishment, stabilization etc.) / *manajemen adaptif pada sedimen fluvial untuk stabilitas pantai (beach nourishment, dll)*	2	2	2	8	6	12	12
Protection	Combined protection with pre-dominantly “hard” measures (e.g. sea walls, dikes) / *Proteksi menggunakan konstruksi "keras" (tembok laut, dikes)*	2	3	2	12	7	9	9
	Effective buffers for upland sediment influx / *Pembuatan area penahan / penyangga di kawasan hulu*	3	3	3	27	9	1	1
	Combined protection with pre-dominantly “soft” measures (e.g dune construction) / *Proteksi menggunakan non-konstruksi atau "lembut" (cth. Pembangunan gundukan)*	2	1	3	6	6	13	12

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Restoring mangrove and coastal forest / *reforestasi mangrove dan hutan pesisir*	2	3	3	18	8	4	4
	Reforestation in uphill / *Reforestasi di kawasan hulu*	3	3	3	27	9	1	1
Retreat	Resettlement of inhabitants / *Relokasi*	1	1	3	3	5	15	14
	Preventing/restricting development / *Pelarangan atau pembatasan pembangunan*	3	3	2	18	8	4	4
	Provision of information about associated risks of development / *Bantuan informasi terhadap perkembangan resiko terkait pembangunan*	3	3	3	27	9	1	1

High Physical Vulnerability – Done by Group 4

	Adaptation Options ***Opsi Adaptasi***	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
Accommodation	Coastal zoning / *Pengaturan Zonasi Pesisir*	3	3	2	18	8	1	1
	Early warning system / *Sistem Peringatan Dini*	3	3	2	18	8	1	1
	Accommodation by "hard" measures (e.g. climate proofing of buildings, roads etc) / *Akomodasi dengan konstruksi "keras" (cth. Peninggian rumah)*	2	2	2	8	6	7	7
	Wetland restoration, including restoring mangrove and appropriate types of coastal forest / *Restorasi lahan basah, termasuk mangrove dan hutan pesisir yang sesuai*	3	3	2	18	8	1	1
	Adaptive management in agriculture and water resources */ manajemen adaptif pada agrikultur dan sumber daya air*	2	2	2	8	6	7	7
	Adaptive management on natural resources including fisheries and salt ponds / *manajemen adaptif terhadap sumber daya alam termasuk tambak ikan dan garam*	3	2	1	6	6	9	7

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Adaptive management on fluvial sediment for beach stability measures (beach nourishment, stabilization etc.) / *manajemen adaptif pada sedimen fluvial untuk stabilitas pantai (beach nourishment, dll)*	3	3	1	9	7	6	6
Protection	Combined protection with pre-dominantly “hard” measures (e.g. sea walls, dikes) / *Proteksi menggunakan konstruksi "keras" (tembok laut, dikes)*							
	Effective buffers for upland sediment influx / *Pembuatan area penahan / penyangga di kawasan hulu*							
	Combined protection with pre-dominantly “soft” measures (e.g dune construction) / *Proteksi menggunakan non-konstruksi atau "lembut" (cth. Pembangunan gundukan)*							
	Restoring mangrove and coastal forest / *reforestasi mangrove dan hutan pesisir*							
	Reforestation in uphill / *Reforestasi di kawasan hulu*							
tre	Resettlement of inhabitants / *Relokasi*	3	3	2	18	8	1	1

Adaptation Options ***Opsi Adaptasi***		Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Preventing/restricting development / *Pelarangan atau pembatasan pembangunan*	3	3	2	18	8	1	1
	Provision of information about associated risks of development / *Bantuan informasi terhadap perkembangan resiko terkait pembangunan*	2	2	1	4	5	10	10

High Ecosystem Vulnerability – Done by Group 2

	Adaptation Options ***Opsi Adaptasi***	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
Accommodation	Coastal zoning / *Pengaturan Zonasi Pesisir*	3	2	2	12	7	5	5
	Early warning system / *Sistem Peringatan Dini*	3	2	2	12	7	5	5
	Accommodation by "hard" measures (e.g. climate proofing of buildings, roads etc) / *Akomodasi dengan konstruksi "keras" (cth. Peninggian rumah)*	2	1	2	4	5	13	13
	Wetland restoration, including restoring mangrove and appropriate types of coastal forest / *Restorasi lahan basah, termasuk mangrove dan hutan pesisir yang sesuai*	3	3	2	18	8	3	3
	Adaptive management in agriculture and water resources */ manajemen adaptif pada agrikultur dan sumber daya air*	3	2	2	12	7	5	5
	Adaptive management on natural resources including fisheries and salt ponds / *manajemen adaptif terhadap sumber daya alam termasuk tambak ikan dan garam*	3	3	2	18	8	3	3

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Adaptive management on fluvial sediment for beach stability measures (beach nourishment, stabilization etc.) / *manajemen adaptif pada sedimen fluvial untuk stabilitas pantai (beach nourishment, dll)*	2	2	2	8	6	9	9
Protection	Combined protection with pre-dominantly “hard” measures (e.g. sea walls, dikes) / *Proteksi menggunakan konstruksi "keras" (tembok laut, dikes)*	2	2	1	4	5	13	13
	Effective buffers for upland sediment influx / *Pembuatan area penahan / penyangga di kawasan hulu*	2	2	2	8	6	9	9
	Combined protection with pre-dominantly “soft” measures (e.g dune construction) / *Proteksi menggunakan non-konstruksi atau "lembut" (cth. Pembangunan gundukan)*	2	2	2	8	6	9	9
	Restoring mangrove and coastal forest / *reforestasi mangrove dan hutan pesisir*	3	3	3	27	9	1	1
	Reforestation in uphill / *Reforestasi di kawasan hulu*	3	3	3	27	9	1	1
tre	Resettlement of inhabitants / *Relokasi*	1	1	1	1	3	15	15

Adaptation Options ***Opsi Adaptasi***		Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Preventing/restricting development / *Pelarangan atau pembatasan pembangunan*	2	2	2	8	6	9	9
	Provision of information about associated risks of development / *Bantuan informasi terhadap perkembangan resiko terkait pembangunan*	3	2	2	12	7	5	5

High Ecosystem Vulnerability – Done by Group 5

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x) *Nilai***	**Score (+) *Nilai***	**Rank (x) *Peringkat***	**Rank (+) *Peringkat***
Accommodation	Coastal zoning / *Pengaturan Zonasi Pesisir*	3	3	3	27	9	1	1
	Early warning system / *Sistem Peringatan Dini*	3	3	3	27	9	1	1
	Accommodation by "hard" measures (e.g. climate proofing of buildings, roads etc) / *Akomodasi dengan konstruksi "keras" (cth. Peninggian rumah)*	1	1	1	1	3	14	14
	Wetland restoration, including restoring mangrove and appropriate types of coastal forest / *Restorasi lahan basah, termasuk mangrove dan hutan pesisir yang sesuai*	3	3	3	27	9	1	1
	Adaptive management in agriculture and water resources */ manajemen adaptif pada agrikultur dan sumber daya air*	3	3	1	9	7	10	10
	Adaptive management on natural resources including fisheries and salt ponds / *manajemen adaptif terhadap sumber daya alam termasuk tambak ikan dan garam*	3	2	3	18	8	7	7

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Adaptive management on fluvial sediment for beach stability measures (beach nourishment, stabilization etc.) / *manajemen adaptif pada sedimen fluvial untuk stabilitas pantai (beach nourishment, dll)*	3	3	1	9	7	10	10
Protection	Combined protection with pre-dominantly “hard” measures (e.g. sea walls, dikes) / *Proteksi menggunakan konstruksi "keras" (tembok laut, dikes)*	3	2	1	6	6	12	12
	Effective buffers for upland sediment influx / *Pembuatan area penahan / penyangga di kawasan hulu*	3	2	3	18	8	7	7
	Combined protection with pre-dominantly “soft” measures (e.g dune construction) / *Proteksi menggunakan non-konstruksi atau "lembut" (cth. Pembangunan gundukan)*	3	2	3	18	8	7	7
	Restoring mangrove and coastal forest / *reforestasi mangrove dan hutan pesisir*	3	3	3	27	9	1	1
	Reforestation in uphill / *Reforestasi di kawasan hulu*	3	3	3	27	9	1	1
tre	Resettlement of inhabitants / *Relokasi*	1	1	1	1	3	14	14

Adaptation Options ***Opsi Adaptasi***		Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Preventing/restricting development / *Pelarangan atau pembatasan pembangunan*	2	1	2	4	5	13	13
	Provision of information about associated risks of development / *Bantuan informasi terhadap perkembangan resiko terkait pembangunan*	3	3	3	27	9	1	1

Combination of High Ecosystem, Infrastructure and Socio-economic Vulnerability – Done by Group 3

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
Accommodation	Coastal zoning / *Pengaturan Zonasi Pesisir*	3	2	3	18	8	4	4
	Early warning system / *Sistem Peringatan Dini*	3	2	3	18	8	4	4
	Accommodation by "hard" measures (e.g. climate proofing of buildings, roads etc) / *Akomodasi dengan konstruksi "keras" (cth. Peninggian rumah)*	1	2	3	6	6	12	12
	Wetland restoration, including restoring mangrove and appropriate types of coastal forest / *Restorasi lahan basah, termasuk mangrove dan hutan pesisir yang sesuai*	3	3	2	18	8	4	4
	Adaptive management in agriculture and water resources */ manajemen adaptif pada agrikultur dan sumber daya air*	3	2	2	12	7	9	9
	Adaptive management on natural resources including fisheries and salt ponds / *manajemen adaptif terhadap sumber daya alam termasuk tambak ikan dan garam*	2	1	1	2	4	15	15

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Adaptive management on fluvial sediment for beach stability measures (beach nourishment, stabilization etc.) / *manajemen adaptif pada sedimen fluvial untuk stabilitas pantai (beach nourishment, dll)*	3	3	2	18	8	4	4
Protection	Combined protection with pre-dominantly “hard” measures (e.g. sea walls, dikes) / *Proteksi menggunakan konstruksi "keras" (tembok laut, dikes)*	3	3	2	18	8	4	4
Protection	Effective buffers for upland sediment influx / *Pembuatan area penahan / penyangga di kawasan hulu*	3	3	3	27	9	1	1
Protection	Combined protection with pre-dominantly “soft” measures (e.g dune construction) / *Proteksi menggunakan non-konstruksi atau "lembut" (cth. Pembangunan gundukan)*	1	2	3	6	6	12	12
Protection	Restoring mangrove and coastal forest / *reforestasi mangrove dan hutan pesisir*	3	3	3	27	9	1	1
Protection	Reforestation in uphill / *Reforestasi di kawasan hulu*	3	3	3	27	9	1	1
tre	Resettlement of inhabitants / *Relokasi*	1	2	3	6	6	12	12

Adaptation Options *Opsi Adaptasi*		Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
	Preventing/restricting development / *Pelarangan atau pembatasan pembangunan*	3	2	2	12	7	9	9
	Provision of information about associated risks of development / *Bantuan informasi terhadap perkembangan resiko terkait pembangunan*	3	1	3	9	7	11	9

Combination of High Ecosystem, Infrastructure and Socio-economic Vulnerability – Done by Group 6

	Adaptation Options *Opsi Adaptasi*	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x) *Nilai***	**Score (+) *Nilai***	**Rank (x) *Peringkat***	**Rank (+) *Peringkat***
Accommodation	Coastal zoning / *Pengaturan Zonasi Pesisir*	3	3	3	27	9	1	1
	Early warning system / *Sistem Peringatan Dini*	3	3	3	27	9	1	1
	Accommodation by "hard" measures (e.g. climate proofing of buildings, roads etc) / *Akomodasi dengan konstruksi "keras" (cth. Peninggian rumah)*	3	3	2	18	8	8	8
	Wetland restoration, including restoring mangrove and appropriate types of coastal forest / *Restorasi lahan basah, termasuk mangrove dan hutan pesisir yang sesuai*	3	3	3	27	9	1	1
	Adaptive management in agriculture and water resources */ manajemen adaptif pada agrikultur dan sumber daya air*	3	2	2	12	7	10	10
	Adaptive management on natural resources including fisheries and salt ponds / *manajemen adaptif terhadap sumber daya alam termasuk tambak ikan dan garam*	2	2	2	8	6	13	13
	Adaptive management on fluvial sediment for beach stability measures (beach nourishment, stabilization etc.) / *manajemen adaptif pada sedimen fluvial untuk stabilitas pantai (beach nourishment, dll)*	3	3	2	18	8	8	8

	Adaptation Options ***Opsi Adaptasi***	Relevance *Keterkaitan*	Urgency *Mendesak*	Capacity / resources *Kapasitas / Sumber daya*	**Score (x)** ***Nilai***	**Score (+)** ***Nilai***	**Rank (x)** ***Peringkat***	**Rank (+)** ***Peringkat***
Protection	Combined protection with pre-dominantly "hard" measures (e.g. sea walls, dikes) / *Proteksi menggunakan konstruksi "keras" (tembok laut, dikes)*	3	2	2	12	7	10	10
	Effective buffers for upland sediment influx / *Pembuatan area penahan / penyangga di kawasan hulu*	3	2	1	6	6	15	13
	Combined protection with pre-dominantly "soft" measures (e.g dune construction) / *Proteksi menggunakan non-konstruksi atau "lembut" (cth. Pembangunan gundukan)*	2	2	2	8	6	13	13
	Restoring mangrove and coastal forest / *reforestasi mangrove dan hutan pesisir*	3	3	3	27	9	1	1
	Reforestation in uphill / *Reforestasi di kawasan hulu*	3	3	3	27	9	1	1
Retreat	Resettlement of inhabitants / *Relokasi*	3	2	2	12	7	10	10
	Preventing/restricting development / *Pelarangan atau pembatasan pembangunan*	3	3	3	27	9	1	1
	Provision of information about associated risks of development / *Bantuan informasi terhadap perkembangan resiko terkait pembangunan*	3	3	3	27	9	1	1