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Towards implementing integrated coastal zone management in The Gambia: coastal adaptation to climate change and human impacts in the high risk zone (cell 6)

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TOWARDS IMPLEMENTING INTEGRATED COASTAL ZONE MANAGEMENT IN THE GAMBIA: COASTAL ADAPTATION TO CLIMATE CHANGE AND HUMAN IMPACTS IN THE HIGH RISK ZONE (CELL 6)

By

LAMIN KOMMA

The Gambia

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Declaration

I certify that all the materials in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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Abstract

Title of Dissertation: **Towards Implementing Integrated Coastal Zone Management in The Gambia: Coastal Adaptation to Climate Change and Human Impacts in the High Risk Zone (Cell 6)**

Degree: **Master of Science**

Climate change is a global phenomenon and since the IPCC Third Assessment Report, our understanding of its impacts for a small island and low-lying coastal states have increased exponentially. The impact of climate change is exacerbated by increasing anthropogenic human-induced pressures which have resulted to a dramatic increase of greenhouse concentration.

Coastal states are sensitive to three key drivers related to climate change and human impacts: sea level rise, coastal erosion and storm surges. As climate changes, coastlines are always shaped by these drivers and coastal erosion is regarded as one of the most apparent indicator posing serious global threats to coastal landscapes and communities in the 21st century. Without appropriate responses (mitigation and/or adaptation), the shorelines will continue to retreat.

The coastal zone of The Gambia, a zone of economic, environmental and social importance, is at risk of erosion because of its LECZ. Adaptation measures in the form of conventional coastal engineering (hard and soft) techniques have been carried out to protect infrastructures and ecological sites in this zone but because of anthropogenic activities, these erosion control measures have failed.

Due to the lack of institutional and adaptive capacity to systematically identify and address these challenges in risk pattern, is the need to consider an integrated approach involving all the relevant stakeholders in order to come up with an effective line of action to avoid maladaptation within this zone. The goal of this research therefore, is to develop a blueprint towards implementing an ICZM strategy for cell 6 as a means to adapt to coastal erosion and other human activities as well as promoting Ecosystem-based adaptation via Building with Nature.

In order to gain insight into the diverse stakeholders' perspective, a qualitative research methodology was applied that uses semi-structured interviews. The stakeholders were sourced from the CME Working Group of the NEA with the view to obtaining information on the 3 main themes. The data provided from the respondents formed the basis for a number of policy recommendations for the decision-makers and politicians on ICZM as a case for coastal adaptation to climate change and human activities in this zone. ICZM is the only tool that can craft an equilibrium between the sustainable exploitation of the coastal resources and the effective conservation and management of the ecosystems within this zone.

KEYWORDS: Climate change, coastal erosion, ICZM, coastal cell 6, stakeholders, semi-structured interview, Building with Nature

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List of Abbreviation

ADB	African Development Bank
AVVA	Aerial Videotape-assisted Vulnerability Analysis
BAC	Brikama Area Council
CBO	Community Based Organization
CCLME	Canary Current Large Marine Ecosystem
CME	Coastal and Marine Environment
CMEWG	Coastal and Marine Environment Working Group
CSO	Civil Society Organization
CZM	Coastal Zone Management
DIVA	Dynamic Interactive Vulnerability Assessment
DPWM	Department of Parks and Wildlife Management
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EU	European Union
FAO	Food and Agriculture Organization
GBA	Greater Banjul Area
GCCA	Global Climate Change Alliance
GDP	Gross Domestic Product
GEAP	Gambia Environment Action Plan
GEF	Global Environment Facility
GIS	Geographical Information System
GMA	Gambia Maritime Administration
GTBoard	Gambia Tourism Board
HWM	High Water Mark
ICZM	Integrated Coastal Zone Management
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change

IUCN	International Union for the Conservation of Nature
IUU	Illegal Unreported and Unregulated
LDC	Least Developed Country
LECZ	Low Elevation Coastal Zone
MEA	Multilateral Environmental Agreement
MSP	Marine Spatial Planning
NAPA	National Adaptation Programme of Action
NAWEC	National Water and Electricity Company
NDMA	National Disaster Management Agency
NDP	National Development Plan
NEA	National Environment Agency
NEMA	National Environment Management Act
NEMC	National Environment Management Council
NGO	Non-Governmental Organization
NRA	National Roads Authority
SDG	Sustainable Development Goal
SRDRM	Sea and River Defence Risk Management
TANGO	The Association of Non-Governmental Organization
TAR	Third Assessment Report
TDA	Tourism Development Area
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UTG	University of The Gambia
WABSA	West Africa Bird Study Association
WMU	World Maritime University
WMUREC	World Maritime University Research Ethic Committee

1. INTRODUCTION

Our understanding of the impacts of climate change for a small island and low-lying coastal states have increased exponentially since the IPCC Third Assessment Report (TAR) (Nicholls et al., 2007). There is scientific consensus, based on an overwhelming number of reports and publications that the global climate is changing (Russell & Griggs, 2012) and there is a large potential impacts of continued adverse consequences of hazards related to climate change and human impacts due to global warming (Dasgupta et al., 2007; Drammeh, 2013). Warming of the climate system is clear. The pace and degree of change is considered unprecedented over decades to the millennia (Stocker, 2014). The atmosphere and ocean have warmed (Harvey, L. D., 2018; Hendriks et al., 2015; Kellogg, 2019), the amounts of snow and ice sheets have diminished (Grove, 2019), there are longer and more frequent marine heat waves (Frölicher, Fischer, & Gruber, 2018) and the concentration of greenhouse have increased (Meinshausen et al., 2011).

Likewise, due to an increase in human use on coastal systems and low-lying areas (Nicholls et al., 2007), the impacts of climate change is exacerbated by increasing anthropogenic human-induced pressures. These pressures which include drainage of coastal wetlands, deforestation and reclamation, discharge of sewage, fertilizers and contaminants into coastal waters (Lotze et al., 2006; Scavia et al., 2002) have resulted in a dramatic increase of atmospheric concentration of CO_2, methane and nitrous oxide (IPCC, 2013). Equally, extractive activities such as sand mining and hydrocarbon production, harvest of fisheries including other living resources, the introduction of invasive species etc. also result to consequential impacts on the coastal ecosystem (Nicholls et al., 2007). The goods and services these ecosystems provide are of prime importance to environmental function and sustainability and include (i) providing food, fiber, fodder, shelter, medicines and energy; (ii) processing and storing carbon and nutrients; (iii) assimilating wastes; (iv) purifying water, regulating water runoff and moderating floods; (v) building soils and reducing soil degradation; (vi) providing opportunities for recreation and tourism; and (vii) housing the Earth's entire reservoir of genetic and species diversity (De Groot, Wilson, & Boumans, 2002; IPCC, 1997).

However, they are reduced by a large-scale ecosystem conversion for agriculture, industry as well as urban development (Easterling, 2003; Gedan et al., 2011).

Coastal systems and low-lying states are predominantly sensitive to three key drivers related to climate change impacts. These are (i) sea level rise, (ii) coastal erosion and (iii) storm surges (Nicholls et al., 2007). As climate changes, coastlines are continuously shaped by these drivers and the impacts are progressively threatening coastal properties, infrastructure, cultural and aesthetic assets (Rhode Island Coastal Resources Management Council, 2018). Sea level rise for instance is recognized as a major threat since the issue of anthropogenic global climate change came into focus in the 1980s (Barth & Titus, 1984; Warrick, Barrow, & Wigley, 1993). The 2007 report of the Intergovernmental Panel on Climate Change (IPCC) presented sea level rise scenarios ranging between 0.18 to above 0.80 (Drammeh, 2013; IPCC, 2007) Figure 1.

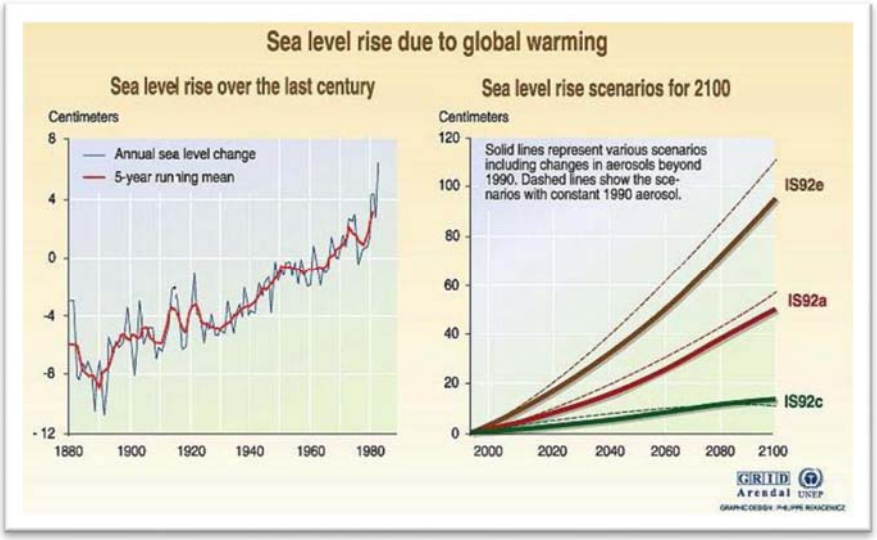

Figure 1: Sea level rise due to global warming
Adapted from (Drammeh, 2013)

Furthermore, in its Fifth Assessment Report 2013, IPCC stated that the rate of sea level rise has been on the increase since the mid-19th century and this scenario of change exceeds the mean rate during the previous two millennia (IPCC, 2013). Additionally, Masson-Delmotte et al. (2018) noted that projected sea level rise will have adverse

impacts on coastal systems and low-lying states resulting to submergence, coastal flooding and rapid spread of diseases and loss of biodiversity (Boateng, 2012).

Many coastal states are experiencing shoreline erosion and ecosystem losses due to intense storm surges, flooding, altered wind patterns, offshore bathymetric changes and/or reduced fluvial sediment input (Pirazzoli et al., 2004; Regnauld et al., 2004). However, few studies have unambiguously indicated that since coastlines are retreating (Zhang et al., 2004), sea level rise is not necessary the primary driver (Nicholls et al., 2007). Coastal erosion is one of the most apparent indicator of climate change and human impacts. It poses serious global threats to coastal landscapes and communities in the 21st century, and expose high concentrations of population and built assets to risk (Brown et al., 2011; Dasgupta et al., 2007). Globally, it is estimated that as many as 20 million people live within the coastal and low-lying areas and over 200 million people at risk of short-term elevated sea level events leading to increased shoreline retreat with the resultant physical, ecological as well as economic damages (Nicholls, 2010). Threats and risks are expected to further increase if the status quo remains business as usual without appropriate responses including climate mitigation (a global response) and/or adaptation (a local response) (Russell & Griggs, 2012).

In a recent study, it has been pointed out that the African continent is among the most vulnerable continents globally to climate change and human impacts (Drammeh, 2013) and The Gambia, for instance, though not a substantial contributor (UNDP, 2012), is cited among the ten main nation's most at risk from coastal erosion because of its Low Elevation Coastal Zone (LECZ) (Amuzu et al., 2018b). Predictions relate this to elevated sea level rise. For instance, Jallow et al. (1996) used the Aerial Videotape-assisted Vulnerability Analysis (AVVA) to predict a 1-meter rise in sea level. He concluded that because of the country's low coastal elevation, 92km^2 of coastal land area will be lost and this corresponds to 8.7% of the total land area of the country. Similarly, Brown et al. (2011) used the Dynamic Interactive Vulnerability Assessment (DIVA) model to project sea level rise scenario for the country. By comparing this with the 1995 levels, he projected a rise in sea level of 0.13m in 2025, 0.35m in 2050, 0.72m in 2075 and 1.23m in 2100 (UNDP, 2012). In the event this happens without suitable protection measures, the capital city is expected to be lost in the next 50 to 60 years and 76,000 people would have to be displaced (Government of

The Gambia, 2007). Moreover, ecologically sensitive sites in St. Mary's Island in Kombo St. Mary (Kanifing Municipality) and those along The Gambia River are also projected to be lost as the shoreline is retreating (National Climate Committee, 2013; Njie, 2007, Jallow et al., 1996). The expected impacts of a meter rise in the present sea level for various parts of the LECZ are shown in the figure below.

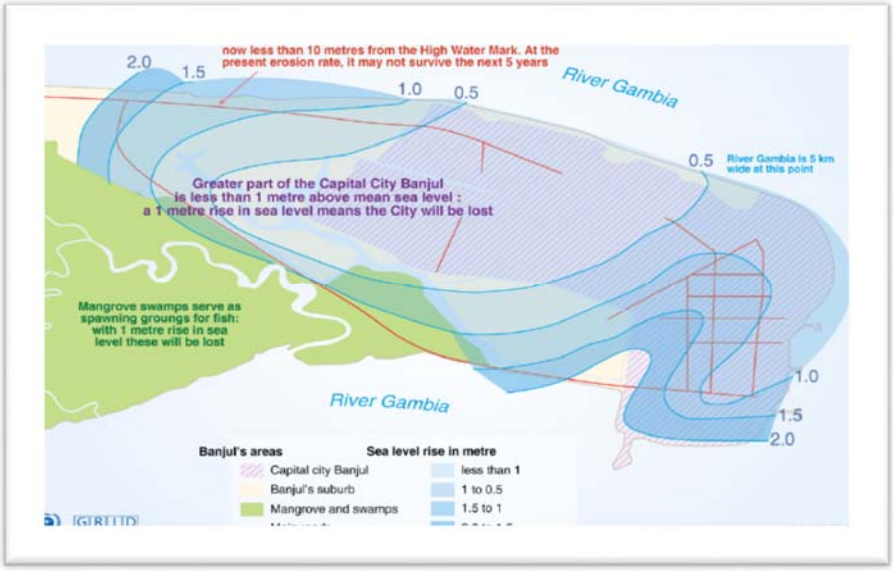

Figure 2: Expected impacts of sea level rise on Banjul
Adapted from (Jallow et al., 1996).

Compounding this challenge is the high rate of poverty within these coastal settlements. In contrast to the rest of the country, coastal occupants in The Gambia are heavily dependent on the natural resources such as forestry and fisheries for their daily sustenance (UNDP, 2012). As a consequence, this makes it challenging to adapt to changing and unpredictable weather patterns as well as respond to and withstand climate change and related human activities (Jaiteh & Sarr, 2010; National Environment Agency, 2010a). Multiple national assessments, for instance the National Adaptation Programme for Action (NAPA) for The Gambia indicates that these impacts on the coastal zone will include increased frequency and intensity of floods and severe erosion, rapid urbanization paralled by clearing of forests and woodlands and overfishing of particular species. As a result, this will lead to loss of livelihoods and biodiversity as well as destabilizing macro-economic growth and food insecurity

thus promoting an increase in internal migration (Government of The Gambia, 2007; UNDP, 2012).

Like many coastal States, the 81km coastal zone of The Gambia serves as a zone of economic importance where its port, majority of tourism infrastructures, artisanal fishing activities as well as cultural and aesthetic practices prevail. However, these structures of economic and social importance as well as areas that support biodiversity (e.g. nesting grounds for marine turtles and migratory birds) are thus threatened by high rates of coastal erosion and other anthropogenic human activities. It is estimated that about 200-300,000m^3 of sediment are being eroded annually by a longshore transport to the south, towards The Gambia river which acts as a sediment trap (UNDP, 2012).

To address these challenges, the Government of The Gambia undertook a beach nourishment programme in 2004 with the objective of reclaiming the lost land pursuance to protecting the tourism industry and other infrastructures as well as preserving ecologically sensitive sites from being lost (Amuzu et al., 2018b). Despite this intervention, there were concerns as to whether this adaptation programme has effectively served the purpose since those reclaimed areas have been lost again (Bijl, 2011). This was due to the fact that there has been massive sand mining from the beach over a stretch of several kilometers in the southern coastline resulting to sand deficit. This problem has increased the natural sand deficit by a factor of 3 to 4 causing erosion rates of the order of 4 to 5m per year in this area (Bijl, 2011).

Given the lack of institutional and adaptive capacity to systematically identify and address these challenges in risk patterns (UNDP, 2012), is the need to consider an integrated approach involving all the relevant stakeholders in order to come up with an effective line of action to avoid maladaptation within the coastal zone of The Gambia. Therefore, the goal of this research is to develop a blueprint towards implementing an Integrated Coastal Zone Management (ICZM) strategy for cell six (6) of the southern coastline of the country as a means to adapt to coastal erosion and other human activities. Mitigation activities that aim to address coastal erosion at the source, though also important to address are beyond the scope of this study and are therefore not addressed in this dissertation.

2. BACKGROUND INFORMATION

2.1. Geographical context

The Gambia, one of the smallest countries in mainland Africa with a total land area of 11,300km^2 is located on the western coast of the continent bordering Senegal to the north, east and south and the Atlantic Ocean to the west (Figure 3). It lies within the tropical sub-humid eco-climatic zone (Jaiteh & Sarr, 2010) and is characterized by the Sudano-sahelian climate that is overshadowed by an alternating dry Harmattan northern winds from the Sahara Desert and south-westerly monsoon winds from the Atlantic Ocean (National Environment Agency, 2010b). As a result, the country experiences distinct wet (July-September) and dry (October-June) seasons (Jallow et al., 1999) with average temperatures varying between 18^{0}C to 30^{0}C in the course of the hot season and 23^{0}C to 33^{0}C in the wet periods (Drammeh, 2013).

The country is dissected by the meandering River Gambia which takes its source some 680km upstream in the Fouta Djallon Highlands in Guinea Conakry, flowing 1,200km through Senegal, The Gambia and then empties in the Atlantic Ocean (Satyanarayana et al., 2012). This river, endowed with abundant and diverse fish species is categorized as marine, brackish and freshwater regimes (Mendy, 2009).

Figure 3: Map of Republic of The Gambia
Adapted from (Mendy, 2009)

2.2. Coastal environment context

The Gambia's coastal zone includes both the area of land subjected to marine influence and the area of the sea subjected to land influence. The UNDP (2012) has given a precise definition of the country's coastal zone:

- The seaward boundary is the limit of the 12nm territorial sea-fishing zone of The Gambia
- The landward boundary is;
    - the line 1000m from the High Water Mark (HWM) along the Atlantic coastline between the River Allahein and a point 1000m south of Cape Point, and between Essau and Jinak along the northern coastline and;
    - the line between the point 1000m south of Cape Point and a point 300m from the south bank of the River Gambia along *Lamin Bolong* and;
    - the line 300m from the banks of the River Gambia between *Lamin Bolong* and *Mootah Point* on the south bank of the River Gambia, and between *Essau and Miniminium Bolong.*

This environment is made up of the catchments of The Gambia, Saloum and Allahein rivers. It filters as well as processes agricultural and industrial wastes, buffers inland and coastal areas against storm and wave intensities. Part of the coast are sheltered from erosion by extensive mangrove ecosystems, mudflats and other vegetation covering about 66,900ha. These mangrove ecosystems, consisting of four major species; *Avicinia Africana, Laguncularia racemosa, Rhizophora racemosa* and *Rhizophora mangle* help stabilize the sediments at the banks of the river from being eroded (Ceesay et al., 2017). They are also an important feeding and nursery ground for juvenile fish species (Laegdsgaard & Johnson, 1995; Sheaves et al., 2015).

The coastal zone has several areas of high ecological importance. Although no comprehensive assessment was conducted to determine their ecological importance (Drammeh, 2013), UNEP (1998) has identified nine (9) sites (see Figure 4) and according to Camara (2012), these sites include:

1. **Toll Point to Cape Creek (Camaloo corner**): A mosaic of habitat types including coastal lagoons, mangrove, saltpan, coastal scrub, grassland and fresh water ponds which form the Camaloo corner.

2. **Oyster creek mangrove swamp to *Mandinari Point***: Mangrove swamps with fringing saltpan and grassland, some relic patches of woodland.
3. **Tanji Bird Reserve:** Coastal lagoons, stabilized sand dunes with woodlands, scrub and grassland components freshwater swamp, river with fringing mangrove and saltpan, dry woodland, offshore Islands with surrounding shallow reefs.
4. **Brufut Wood**: Relic patch of riverine woodland.
5. **Solifor Point**: Coastal woodland/scrub, inshore reef and laterite cliffs.
6. **Tujereng Lagoons**: Coastal lagoon with mangrove saltpan fringe, also stabilized sand dunes with grassland/scrub/woodland complex.
7. **River Kakima Delta Kachuma Forest**: Outflow of the River Kachuma a mosaic of lagoons, mangrove saltpan and stabilized dune vegetation, backed by a relic fringe of high coastal woodland (dominated by rhum palm).
8. **Dua Dula to Kartong**: Coastal forest (rhum palm zone) merging to scrub grassland in stabilized dune complex towards Kartong end.
9. **Kartong Point to Allahen river mouth**: Allahein river mouth, coastal scrub/grassland on stabilized dune system, lagoon complex, river estuary and mangrove fringe.

Figure 4: Areas of high ecological importance along The Gambian coastline

Adapted from (Camara, 2012)

There is compelling evidence however, that the coastal zone of The Gambia is severely under threat due to climate change impacts and other anthropogenic human activities, the result of which are coastal erosion, physical loss of the ecosystem, changes in land use in river catchment, causing less sediment discharge to the coast, sand mining etc. (National Environment Agency, 2010a).

2.3. The study site

2.3.1. Description and significance

The coastal zone of The Gambia (Figure 5) is broken down into a number of relatively uniform sub-systems called coastal cells. There are nine (9) cells all together, defined by their specific criteria of geomorphologic characteristics and vulnerability to climate change and human impacts (see Table 1) (Royal Haskoning, 2000). Some of these delineations are based on the UNEP/OCA PAC Report (Quelennec, 1988). These cells are not isolated features and experience both sediment input and sediment export to neighboring cells. It is the combination of between-cell interaction and the processes within each cell, which determine the morphology of the coastline and its sensitivity to coastal erosion.

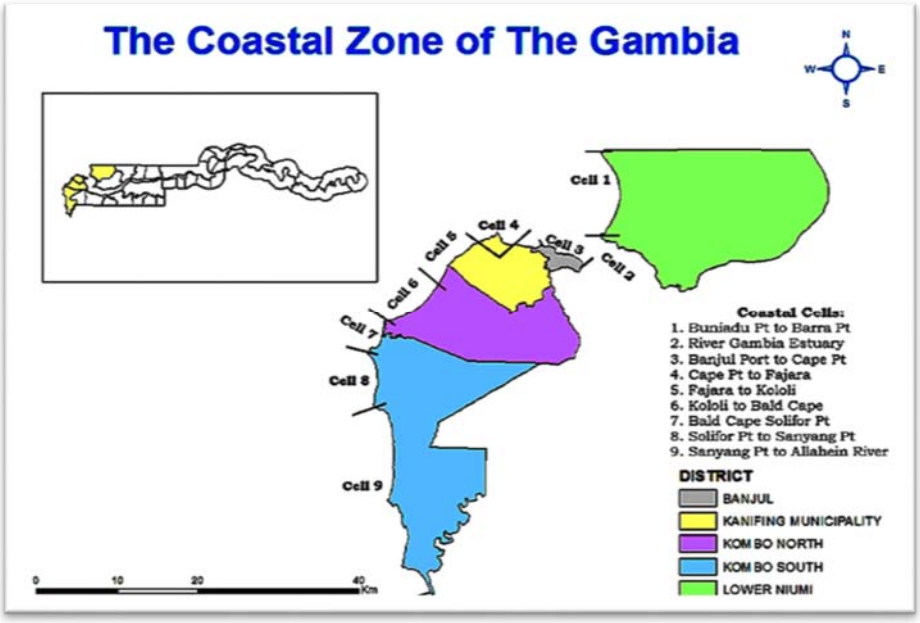

Figure 5: The coastal zone of The Gambia

Adapted from (National Environment Agency, 2010b)

Table 1

Coastal cells and characteristics (Source: Author)

Coastal cell	Location	Description of beach	Trends in shoreline (last decades)	Existing structures
1	Buniadu Point to Barra Point	Low barrier beach	Erosion	-
2	River Gambia Estuary	Sand spit	Accumulation area (growing)	-
3	Banjul Port to Cape Point	Narrow beach, port area	Accretion north, Erosion south	Short groyns but damaged and revetments
4	Cape Point to Fajara	Cliffs with low beach	Erosion (slight)	Revetments
5	Kotu Point to Kololi Point	Beach	Erosion (slight)	-
6	Kololi Point to Bald Cape	Beach	Erosion (severe)	Revetments
7	Bald Cape to Solifor Point	beach	Erosion (slight)	-
8	Solifor Point to Sanyang Point	Beach	Erosion (slight)	-
9	Sanayang Point to Allahein River	Beach	Erosion (slight)	-

However, the scope of this research is centered on cell six (6) which is a narrow strip of beach spanning 11km from Kololi Point to Bald Cape on the southern coastline of the country (Amuzu et al., 2018a). It is regarded as a high risk zone as it is an area essential from an economic, social and environmental standpoint. Significant drivers of existing livelihoods and of future growth in this zone consist of tourism (about 45-50 hotels), nine (9) fish landing sites housing fish processing facilities, sand/gravel mining, nature park as well as agriculture.

Additionally, the area is in close proximity to Bijilo Forest Park which is one of the three (3) remaining coastal forests and a highly sensitive ecological protected area with

diverse flora and fauna some of which are endangered in IUCN Red List (Dijkstra & Vick, 2004). Further south of the park are twin offshore Islands (Bijol Islands) which have become an extremely important destination for wintering waders and other marine emblematic species who use this area for feeding, nesting and breeding. (Barnett et al., 2004). Some of these species, classified as flagship, keystone and vulnerable species include the rare West African manatee *(Trichechus senegalensis)*, monk seal *(Monachus monachus)*, a variety of cetaceans and marine turtles namely green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*) and olive ridley (*Lepidochelys olivacea*) (Barnett et al., 2004).

2.4. Problem statement

The Gambia is ranked as one of the ten countries affected by coastal erosion due to its Low Elevation Coastal Zone (LECZ) as 50% of it lies below 20m above sea level and a further 30% below 10m above sea level (Amuzu et al., 2018; Jallow et al., 1996). This makes the country and coastal communities including the capital, Banjul, very vulnerable to coastal lost. An analysis of recent environmental challenges (Fatajo, 2010; National Environment Agency, 2010b) shows that the country is characterized by various anthropogenic activities vis-à-vis coastal and land degradation, habitat fragmentation leading to loss of biodiversity as well as ecologically sensitive areas, sand mining (legal and illegal) and pollution of the marine environment from land-based activities, which are likely to also contribute to coastal erosion (Croitoru, Miranda, & Sarraf, 2019; Steiner, 2019).

The area along the southern coastline of the country selected for this study is of prime importance from an economic, social and environmental perspective. It is described as a high risk zone and is densely populated with urban settlements, major tourism facilities, fisheries and agricultural activities. Fishing (artisanal) as well as tourism employ a substantial number of the population and contribute significantly to the country's Gross Domestic Product (GDP). Correspondingly, increase in wave action, coupled with these anthropogenic activities contribute to coastal erosion, the devastation of which is evident especially within the study area where important

cultural sites, infrastructures as well as feeding and nesting grounds of marine turtles and migratory birds are seen.

There is a trend of erosion caused by sediment loss due to a longshore drift and coupled with human activities, this trend is on the increase in this area (Drammeh, 2013). Bijl, (2011) indicated that between 1983 to 1996, 150,000m^3 of sand have been mined from this site and as a result, in 2000, Royal Haskoning conducted a Feasibility Study on the erosion problem. Based on this study, beach nourishment was carried out in this area and 1,000,000m^3 has been nourished (Bijl, 2011). However, within a short period of this nourishment (< 5 yrs.), the largest part of the beach had already been eroded. Therefore, if no short/long term measures are taken to address these challenges through an integrated coastal zone management approach, the beach and the infrastructures within including the ecosystem components along this coastline will disappear resulting to more investments by the Government and its development partners in coastal adaptation.

2.5. Purpose and objective of the research

The purpose of this research is to identify which stakeholders are the key in the development, management and protection of coastal cell six (6) which is regarded as a high risk zone and comes up with an implementable blueprint for the policy/decision-makers and politicians on Integrated Coastal Zone Management, a case for coastal adaptation to climate change and human activities. To achieve this, the following objectives are proposed:

1. Identify the major challenges due to coastal erosion faced by sectors operating in coastal zone six (6)
2. Identify perceived consequences of different coastal adaptation options
3. Develop and discuss a resource of past adaptation efforts so that future decisions might benefit from coastal erosion adaptation in The Gambia

3. MATERIAL AND METHODS

In order to gain insight into the diverse stakeholders' perspectives towards implementing integrated coastal zone management in The Gambia as a case for coastal adaptation to climate change impacts and other human activities, the author has used the qualitative research methodology of Long & Long, (1992) and Lopez-Medellin, Castillo, & Ezcurra, (2011) that uses semi-structured interviews based on questions listed in Annex I. The questions were designed to gain insight into the major challenges from coastal erosion and for coastal zone management seen from the stakeholders' perspective, and why those challenges are not addressed.

Following recommendations from Drury et. al. (2011) and St. John et. al. (2014), the author's qualitative research effort follows three main steps, i.e. (i) question formulation, (ii) ethical review and (iii) interviewing. The author has obtained ethical clearance for the questions (Silverman, 2013) through the World Maritime University's Research Ethic Committee (WMUREC). Additionally, Young et. al. (2017) have also identified the basic steps in an interview process (Figure 6), which can be categorized as the initial project design (stages 1-3), data gathering (stages 4-7) and analysis and write-up (stages 8-9).

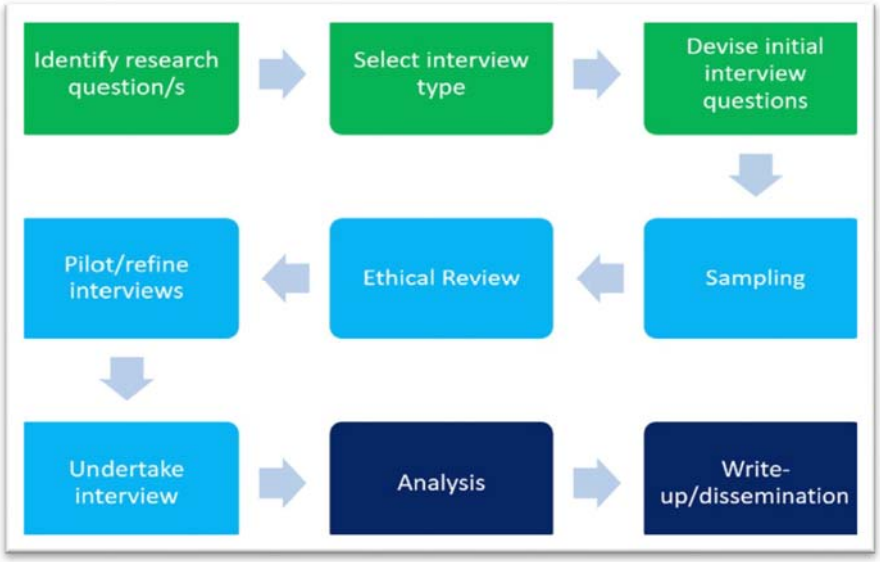

Figure 6: Basic steps in an interview process

Adapted from (Young et al., 2018)

Therefore, in conducting the interview process, the starting point is the identification of research question(s), followed by an analytical reflection to gauge if this interview is the most appropriate approach to apply based on the question(s) as well as whether the interview should be complemented with other methods (Young et al., 2018). Consequently, at this stage, there are important areas to think about which include, among others, if the interview can provide the correct type of data needed for the envisaged outputs or whether other research techniques might be more suitable (Young et al., 2018). For this reason, in order to come up with a decision, researchers could weigh the advantages and disadvantages of the methodological approach in light of their research question(s) coupled with the style to apply vis-à-vis structured or semi-structured (Celliers et al., 2015; Young et al., 2018).

It is against this background that the main technique used in the study was by conducting semi-structured interviews (Celliers et al., 2015; DeWalt, DeWalt, & Wayland, 1998) with relevant stakeholders who were identified from the Coastal and Marine Environment Working Group (CMEWG) of the National Environment Agency (NEA). This approach of qualitative data collection corresponds to the process described by Patton (2002) vis-à-vis in-depth, open-ended interviews, direct observation, collection and analysis of written documents (Celliers et al., 2015; Chism & Banta, 2007).

3.1. Semi-structured interviews

In total, 30 semi-structured interviews were conducted between the months of April and May 2019. The interviewees were selected from the working group highlighted above who have an interest in the development, protection and the management of the coastal zone (Table 2). Other stakeholders were co-opted to participate during the interview though they are not from this working group but have a key interest in the study area. Interviewees included government officials, representatives from the private sector industry (e.g. hoteliers), artisanal fishermen, community-based organizations and environmental concern groups, bird watchers' association within the study site.

Table 2
NEA Coastal & Marine Environment Working Group consulted for the interview

	Institutions/stakeholders consulted
1	Geological Department
2	Department of Forestry
3	Department of Fisheries
4	National Environment Agency
5	Gambia Tourism Board
6	Department of Parks and Wildlife Management
7	National Disaster Management Agency
8	Lemon Creek Hotel and Resort
9	The Association of Non-Governmental Organization (TANGO)
10	National Roads Authority
11	Department of Water Resources
12	Brikama Area Council
13	Senegambia Beach Hotel
14	West African Bird Study Association (WABSA)
15	A Fisherman from Tanji fish landing site

The main interest of this study was to collect information about peoples' perceptions on the challenges facing coastal cell six (6) in terms of coastal zone management and why those challenges are not addressed especially in relation to coastal loss/erosion. Therefore, the interviews were tailored around the following three (3) main themes:

1. Impacts of coastal erosion and how might this challenge affect sectors or other interests operating in coastal zone 6;
2. Develop and discuss a resource of successes or failures of carrying out past coastal defence works as an adaptation measure to control erosion;
3. Coastal adaptation measures in addressing coastal losses, either long term or short term.

The interviews were intended to last for about 30 minutes and before the commencement, respondents were asked for their consent to voluntarily agree to participate in this research study and the information provided would be treated with confidentiality. Similarly, they were asked for the consent to have their voices digitally recorded during the interview and for the answers to the research questions to be written down. At the end of the interview, respondent responses were transcribed manually with codes using a line-by-line review of the texts where groups were generated as they arose from interviews so as to achieve opinions, ideas and interests of the different stakeholders (López-Medellín, Castillo, & Ezcurra, 2011).

3.2. Scenario evaluation

The data collected during the interviews were then collated, reduced to a structured and a manageable format to form a qualitative assessment of the three (3) themes highlighted above for implementing an ICZM as a case for coastal adaptation to climate change and human activities in coastal cell six (6), the narratives/assessments of which are presented in the Results section as well as forming the basis for the final Conclusion and Recommendations.

4. RESULTS

The respondents in this study have been sourced principally from the Coastal and Marine Environment Working Group as indicated previously, and comprised of twenty-nine (29) participants from key institutions who have a keen interest in the study area. A fisherman from Tanji fish landing site, which is within the study area, was also consulted to share his experience based on local knowledge of climate change impacts and other human activities including their perception on the challenges facing coastal cell six (6) and why those challenges were not properly addressed (see Table 3 for the transcribed responses). The respondents acknowledged the environmental risk/hazard of climate change impacts and related human activities to which this zone is subjected, and to as well as the fact that ICZM could regulate some of those risk/hazard. Throughout the reporting of the results, the idea was to present the various perceptions about climate change and anthropogenic human impacts on cell 6 which is regarded as a high risk zone based on an economic, social and environmental perspective.

Noticeably, most of the respondents were males, with only two (2) females from government institutions. Currently, these respondents hold senior management positions and have one way or the other taken part in decision-making processes in their respective institutions. Their length of service and academic qualifications were not factored in during the design of the questionnaire. Notwithstanding, based on my frequent interactions (official) with them, most of the respondents possess a post-graduate academic qualification except for the fisherman from the Tanji fish landing site who did not possess any conventional academic qualification. The questionnaire used for the qualitative analysis allowed them to freely answer the questions based on the 3 themes highlighted in the previous section with regards to the comprehension of ICZM though they are from different institutions, but collectively working towards the common goal i.e. development, protection and management of the coastal zone of The Gambia.

Table 3
Transcribed responses from the stakeholders based on the 3 themes

Themes							
Code	**Institution**	**Gender**	**Major challenges facing coastal cell 6**	**Respondents' awareness of the impacts of coastal degradation within cell 6**	**Coastal adaptation measures preferred to mitigate degradation from climate change impacts & human activities**	**Proposed key stakeholder**	**Required data needed for long term solution in CZM**
1	Dept. of Fisheries	m	Coastal erosion Lack of commitment from key stakeholders (poor stakeholder engagement) Inadequate funding	yes	soft engineering (beach nourishment/replenishment)	NEA Geological Dept. Dept. of Lands & Survey GTBoard Gambia Fire & Rescue Services Ministry of Petroleum	Environmental data (economic, ecological, cultural & existence values)
2	Dept. of Fisheries	m	Erosion Pollution Sand mining	yes	both hard and soft engineering solutions (revetments and nourishment)	NEA Dept. of Fisheries Dept. of Forestry DPWM	Basic data (baseline data)
3	Dept. of Fisheries	f	Coastal erosion Sand mining	yes	hard engineering (revetments and breakwaters)	Dept. of Fisheries Dept. Water Resources DPWM	-

4	Dept. of Geology	m	Coastal erosion Pollution from point source Lack of knowledge in coastal dynamics	yes	hard engineering (revetments & groynes)	Ministry of Works Geological Dept. NEA Dept. of Physical Planning Ministry of Tourism	Morphological data (bathymetric survey, grain size distributions of beach sand and foreshore)
5	Dept. of Geology	m	Costal erosion Sand mining Tourism	yes	soft engineering (beach nourishment)	Geological Dept. NEA Dept. of Lands & Survey GTBoard	Baseline & morphological data
6	Dept. of Geology	m	Erosion Poor stakeholder engagement	yes	hard engineering (revetments)	Geological Dept. NEA Ministry of Lands GTBoard CBOs CSOs DPWM UTG	Morphological data (bathymetric survey of the coastal strip and foreshore & sea floor and river mouth
7	Lemon Creek Hotel	m	Erosion Pollution from point source Inadequate resources/funding	yes	hard engineering (revetments & breakwaters)	Office of the President BAC Ministry of Local Government & Lands NEA DPWM Dept. of Geology	Basic data

						Ministry of Finance GTBoard Ministry of Tourism	
8	NEA	m	Coastal erosion	yes	hard engineering (seawalls)	NEA GTBoard WABSA Ministry of Information	Morphological data & environmental data
9	NEA	m	Coastal erosion Inadequate funding Lack of understanding of coastal dynamics Inadequate resources	yes	hard engineering (revetments and breakwaters)	GTBoard Hotel Association NEA Dept. of Physical Planning Dept. of Fisheries Dept. of Geology Dept. of Lands & Survey GMA	Basic data Morphological data Environmental data
10	NEA	m	Coastal erosion Pollution from point source Sand mining	yes	hard engineering (revetments and breakwaters)	GTBoard Hotel Association NEA Dept. of Physical Planning Dept. of Fisheries Dept. of Geology Dept. of Lands & Survey DPWM	Basic data

11	NEA	m	Coastal erosion Inadequate funding Tourism activities	yes	hard engineering (revetments and breakwaters)	GTBoard NEA Dept. of Physical Planning Dept. of Fisheries Dept. of Geology Dept. of Lands & Survey Coastal communities	Basic data
12	NEA	m	Coastal erosion Land degradation & habitat fragmentation Pollution Lack of understanding of coastal dynamics Funding problems	yes	soft engineering (nourishment)	Key Government institutions Coastal communities Environmental groups CBOs NGOs Ministry of Environment Office of the President	Basic data Morphological data Environmental data
13	GTBoard	m	Coastal erosion Pollution	yes	hard engineering (revetments and breakwaters)	Ministry of Environment NEA	-
14	GTBoard	m	Coastal erosion Pollution Poor stakeholder engagement Land degradation	yes	hard engineering (revetments and breakwaters)	Dept. of Fisheries Ministry of Environment Dept. of Physical Planning	Baseline & morphological data

						Dept. of Forestry DPWM Ministry of Works Ministry of Energy National Assembly Select Committee on Environment	
15	DPWM	f	Increased human pressure including sand mining Lack of understanding of coastal dynamics	yes	both hard and soft engineering (revetments, breakwaters & beach nourishment)	NEA DPWM Dept. of Fisheries Dept. of Water Resources Dept. of Geology GTBoard WABSA	Basic data Morphological data Environmental data
16	DPWM	m	Coastal erosion Sand mining Habitat fragmentation	yes	both hard and soft engineering (revetments, breakwaters and beach nourishment)	NEA DPWM Dept. of Fisheries Dept. of Water Resources Dept. of Geology	Basic data Morphological data Environmental data
17	DPWM	m	Coastal erosion Increased human pressures (tourism and sand mining)	yes	Soft engineering (beach nourishment)	NEA DPWM Dept. of Fisheries Dept. of Water Resources Dept. of Geology	Basic data Morphological data Environmental data

18	DPWM	m	Erosion Land degradation Sand mining Limited resources	yes	hard engineering (revetments & breakwaters)	NEA DPWM Dept. of Fisheries Dept. of Water Resources Dept. of Geology GTBoard NDMA GMA	Basic and environmental data
19	Dept. of Forestry	f	Sand mining Land degradation & habitat fragmentation Limited funds	yes	both soft and hard engineering (revetments, breakwaters combined with beach nourishment)	Dept. of Forestry Dept. of Fisheries Dept. of Water Resources Ministry of Tourism & Culture	Environmental and baseline data
20	NDMA	m	Over exploitation of living resources Human pressure (tourism, mining & pollution)	yes	both hard and soft engineering (revetments, breakwaters & combined with beach nourishment)	Dept. of Forestry Dept. of Fisheries Dept. of Water Resources DPWM UTG WABSA	Basic data Morphological data Environmental data
21	Dept. of Fisheries	m	Coastal erosion Over-exploitation of living resources		hard engineering (revetments & breakwaters)	NEA Dept. of Fisheries Coastal communities	Morphological data
22	Dept. of Fisheries	m	Coastal erosion Land degradation	yes	hard engineering (revetments & breakwaters)	NEA Dept. of Fisheries	Basic data

			Over-exploitation of fish Inadequate capacities among stakeholders			Coastal communities	
23	Dept. Water Resources	m	Coastal erosion	yes	hard engineering (seawalls)	Dept. of Forestry Dept. of Fisheries Dept. of Water Resources DPWM NEA Coastal communities	Basic data Morphological data Environmental data
24	NDMA	m	Erosion Human pressure within coastal zone Poor stakeholder engagement	yes	hard engineering (revetments & breakwaters)	Dept. of Forestry Dept. of Water Resources DPWM Dept. of Fisheries NEA Private sector Coastal communities	Basic data Morphological data Environmental data
25	BAC	m	Coastal erosion Sand mining Lack of coastal understanding Pollution of the marine environment	yes	hard engineering (revetments & breakwaters)	Coastal communities CBOs CSOs Government institutions Private sectors	-

26	NRA	m	Coastal erosion Land degradation Sand mining Pollution of the ecosystem Lack of maintenance of infrastructures	yes	hard engineering (revetments & breakwaters)	NEA NRA DPWM NDMA Ministry of Works CBOs	Basic data Morphological data Environmental data
27	Senegambia Hotel	m	Coastal erosion Loss of hotel properties along the beach Pollution from sewage facilities	yes	hard engineering (revetments & detached breakwaters)	Hotel Association Private sector Government institutions Communities	Basic data Morphological data Environmental data
28	TANGO	m	Coastal erosion Poor stakeholder engagement Inadequate resources	yes	both hard and soft engineering (revetments, breakwaters & beach nourishment)	TANGO CBOs Coastal communities Key government departments	Basic data
29	WABSA	m	Coastal erosion including loss of Bijol island Mangrove dieback Loss of coastal forest cover Habitat destruction	yes	both hard and soft engineering (revetments, breakwaters combined with beach nourishment)	CSOs CBOs Bird watchers' association Private sector Hotel association Dept. of Forestry Dept. of Fisheries NEA DPWM	Environmental data Morphological data (bathymetric survey of the coastal strip and foreshore & sea floor and river mouth

			Pollution to Kotu creek Lack of coastal dynamics understanding				
30	Tanji fisherman	m	Coastal erosion Habitat destruction Exploitation of the living resources	yes	Soft engineering (beach nourishment)	Government institutions Coastal communities	-

For confidentiality purposes, each respondent was represented with a code number which ranged from 1 to 30 and the study primarily relied on their opinions and viewpoints. At the end, the author has the conviction that the potential biases among the participants were minimized through the collection and reporting on the information provided, as well as the knowledge of coastal adaptation from a wide range across diverse stakeholders with a keen interest within the study area. In the subsequent reporting of the results obtained from the table above, the author summarized the number of respondents who made reference to the three (3) themes (see Table 4 for a summary on the themes).

Table 4
Summary of the number of respondents who made reference to the themes

Themes	Findings	
Major challenges facing cell 6	• coastal erosion; • lack of understanding of coastal dynamics; • inadequate resources/funds; • poor stakeholder engagement including their lack of commitment towards coastal zone management; • increased anthropogenic human activities (e.g. coastal tourism, sand mining and pollution of the marine environment); • land degradation and habitat fragmentation; • over-exploitation of fisheries resources.	
Coastal adaptation measures to mitigate degradation	Soft engineering solution	5
	Hard engineering solution	18
	Both solutions (soft & hard)	7
	Building with Nature	-
Required data needed for long term solution in CZM	Basic data	
	Morphological data • Bathymetric survey of the coastal strip and foreshore • Grain size distributions of beach sand and foreshore • Borings and soil samples (sea floor) • Spatial extent and volumes of sand deposits (sea floor and river mouth)	
	Environmental data • Economic values • Ecological values • Cultural values • Existence values	
Respondents' awareness of the impacts of coastal degradation within cell 6		All

At the time that the interviews took place coupled with information gathering, all the respondents in the study are cognizant of the impacts of coastal degradation within cell six (6). They have indicated the major challenges facing this area with respect to those impacts (see Table 4 above).

The respondents have also gone further to highlight past and present conventional coastal engineering techniques (i.e. both hard and soft) carried out within this zone as erosion control measures. A new concept of coastal adaptation measure (Building with Nature) was introduced to them with the view to seeking their knowledge and perception. However, from Table 4 above, it is quite obvious that the respondents are not aware of this concept.

Therefore, as an urgent need for alternative coastal adaptation strategy, the author is promoting this new concept in the country as Ecosystem-based adaptation measure. This will help in addressing coastal losses either long or short term. A detailed explanation of these challenges as well as a resource of the successes and/or failures of conventional coastal engineering techniques is discussed in the next section.

5. DISCUSSION

5.1. Major challenges facing coastal cell 6

5.1.1. Coastal erosion

It should be noted that with regards to their awareness of the impacts of coastal degradation, all the 30 research respondents indicated they were aware of these impacts because of the country's Low Elevation Coastal Zone (LECZ), thus, making the study area very vulnerable to coastal erosion and other anthropogenic human activities. Similarly, these impacts have negative consequences on the beach and the adjacent fore dunes which forms an important link in the coastal sediment budget (Arens & Wiersma, 1994) including protecting the inland areas from coastal water intrusion, high energy storm surges and flooding. Coastal erosion within this area has resulted to sinking and receding of the beach/shoreline causing risk to properties, cultural sites, fishing grounds and other ecologically sensitive areas.

Ecologically, coastal cell six (6) serves as a unique environment for species that have adapted to this ecosystem. Many important migratory birds, reptiles and other animals nest and breed on the open beach and the fore dunes including feeding and resting. For instance, it was mentioned that marine turtles, especially the green turtles (*Chelonia mydas*), come ashore during the breeding periods to lay their eggs in the dry beach and the fore dunes. Also, at Bijol Islands, wintering waders arriving from European breeding grounds use this spot to lay their eggs on the beach during breeding periods (see Figure 7). Insofar erosion of the beach/shoreline has negative cumulative effects on these species, including their respective breeding and nesting grounds, it is believed that these impacts will have consequential impacts on "nest site location, digging behavior, clutch viability and hatchling emergence" (Grain, Bolten, & Bjorndal, 1995). In order to address this catastrophic scenario therefore, is the need to develop an integrated coastal zone management approach involving all stakeholders as a case for coastal adaptation.

Figure 7: Negative cumulative impacts of coastal erosion on cell 6

(a) destruction of hotel properties due to erosion (Senegambia beach);

(b) impacts of erosion on nesting spots for green turtles on the beach and fore dunes;

(c) destruction of breeding spots for wintering waders at Bijol Islands.

Source: Author

5.1.2. Lack of understanding of coastal dynamics

One of the most essential principles of understanding coastal dynamics is based on the assessment and understanding of the environmental, social and economic aspects of the area in question at a relevant spatial scale (Benassai, 2006). Thus, before carrying out interventions along a coastline, it is important to first understand its impacts on the neighboring cells since these cells are not isolated features.

Experience from other coastal countries where erosion control measures have been applied without knowledge of the understanding of coastal sedimentary processes have resulted in poor performance and/or early failure (Alemaw & Sebusang, 2019). Poor consideration of interactions between interventions and neighboring cells have also been shown to exacerbate coastal erosion challenges in one area or move them to another area (Benassai, 2006).

Most interviewees cited examples where coastal engineering interventions were carried out without understanding or considering the processes and how such measures can alter coastal changes and in neighboring cells, such as those on the down drift side which receive transported sediment. Coupled with this, there was mention of poor construction materials used for such intervention works. Since the country does not have quarries for basalt rocks which are best for the construction of groynes, revetments and gabion baskets as erosion control measures, the only material option used is lateritic rocks (see Figure 8) which are poorly suited as coastal construction materials due to their low resistance to abrasion, thus disintegrating easily in water.

Figure 8: Lateritic rocks used as coastal construction materials at Tanji bridge
Source: Author

5.1.3. Inadequate resources for effective adaptation measures

From the interview, most of the respondents highlighted the inadequate economic resources to invest in effective coastal adaptation, resulting in the failure of many projects. They mentioned that before the enactment of the NEMA, 1994 and the subsequent establishment of NEA as the competent authority for coastal zone management in the country, the design, construction and maintenance of erosion control measures was carried out by the Department of Technical Services (formally Public Works Department). However, this was not effectively executed, as funding was a challenge for coastal adaptation.

They also indicated that before the 2004 beach nourishment project, some private individuals, particularly hotel owners, took it upon themselves to use unsustainable intervention methods in order to protect their properties from the catastrophic impacts of shoreline erosion. These included the use of sandbags on the beachfronts of their hotels and the erection/construction of a seawall. Despite these ad-hoc intervention works, these structures did not serve the purpose of controlling erosion (see Figure 9) as the Government of The Gambia rarely funds such works on massive scale. This is due to the downturn in the national economy coupled with radical reductions in funds and budget constraints for effective adaptation measures. In addressing such, they most often rely on international organization/donor funded projects to addressing coastal adaptation. Yet, their sustainability becomes a big challenge when these projects' life-cycle elapse and as a subsequence funding for maintaining them becomes a daunting task. Thus resulting in the negative implications on the maintenance of such adaptation structures.

Figure 9: Unsustainable adaptive measures for erosion control

(a) sandbags and (b) seawall used as coastal defence work at the study site (Senegambia-Kololi beach stretch)

Source: Author

5.1.4. Poor stakeholder engagement

Public consultation/awareness and stakeholder participation and engagement for equal representation of interests is a prerequisite for an effective integrated coastal zone management approach. Most often, relevant stakeholders from the Government, private sector, Non-Governmental Organizations (NGOs), Community-Based Organizations (CBOs), environmental concern groups and the public in general are poorly consulted and/or misrepresented during the coastal adaptation planning and decision-making processes. One of the most clearly identified problems highlighted by the respondents with regards to coastal zone management within the study area is the capacity of the relevant and key stakeholders. One important aspect is at the government level since the multiple tasks of focal points at various institutions (i.e. too much work for too few people). To this end therefore, is the need to establish strong institutional and regulatory frameworks, which clearly identify their responsibilities with regards to coastal governance, sustainability and management in order to plan for and implement coastal adaptation measures through an integrated approach. Furthermore, there is also a need to strengthen the institutional capabilities

of the Coastal and Marine Environment Working Group members which is spearheaded by the NEA.

Another problem identified from stakeholder perspective is at the community level. The full participation and engagement of local stakeholders for equal representation is a precondition to building adaptive climate resilience capacities through an integrated manner so as to control, minimize and/or halt coastal/shoreline erosion, including other anthropogenic human activities. Effective consultations are required to raise their awareness in the development, management and protection of the coastal zone in addition to identifying and prioritizing issues of concern especially in dealing with coastal erosion which has a negative impact on their lives and livelihoods.

Additionally, some of the stakeholders show a lack of commitment towards effective coastal zone management because of the caliber of those people consulted/co-opted in the decision-making process. Therefore, without their effective representation in the process, the coastline will keep on deteriorating forcing individuals and business owners to embark on short-term and small-scale unsustainable interventions in protecting and preserving their properties.

To this end, the respondents in their opinion have identified key stakeholders who will:

1. Support decision making by advising NEA and Government Agencies regarding the sustainability, protection, development and monitoring of the coastal, marine and fluvial environment
2. Provide overall guidance on CME programmes
3. Promote the sustainable and integrated management of the coastal and marine environment
4. Support the implementation of strategic environmental and social assessments
5. Support the setup and operation of thematic networks and coastal community groups for advocacy on coastal zone conservation and integrated management
6. Convene and guide task forces on issues that may arise relating to coastal and river bank erosion, the marine and fluvial environment, sand and gravel quarrying as well as contingency planning for oil spills, marine pollution among others.

Correspondingly, these stakeholders identified by the respondents (Table 5) are more or less the same stakeholders from the CME working group of the NEA and comprise of the following:

Table 5

CME working group members identified by the respondents

1. Office of The President
2. Ministry of Environment, Climate Change & Natural Resources
3. Ministry of Works, Construction and Infrastructure
4. Ministry of Petroleum & Energy
5. Ministry of Information & Communication Infrastructure
6. Ministry of Finance & Economic Affairs
7. Ministry of Tourism & Culture
8. National Environment Agency
9. Gambia Fire & Rescue Services
10. National Disaster Management Agency
11. The Association of Non-Governmental Organization (TANGO)
12. Gambia Maritime Administration
13. National Roads Authority
14. Gambia Tourism Board (GTBoard)
15. Department of Physical Planning & Housing
16. Department of Fisheries
17. Department of Forestry
18. Department of Water Resources
19. Department of Geology
20. Department of Parks & Wildlife Management
21. Local Government Authorities
22. University of The Gambia (UTG)
23. Gambia Hotel Association
24. National Assembly Select Committee on the Environment
25. West African Bird Study Association (WABSA)
26. Coastal communities

5.1.5. Land degradation and habitat fragmentation

From the interview, the respondents indicated that the coastal zone has seen considerable infrastructural developments and the way this is taking place is not environmentally friendly. These developments (planned and unplanned) include the expansion of hotels for tourist accommodation, road networks, electrification and water expansion programmes by National Water and Electricity Company (NAWEC) and the establishment of housing estates. The demand for land for housing and other uses has significantly increased in recent times due to urbanisation, resulting to conversion of woodlands and forests to residential and other uses. All these contribute to, among other things, land degradation causing disruption to the rich biological and ecological diversities as well as food insecurity. The pace of urbanisation coupled with lack of proper drainage and storm water systems has also resulted to an increase in climate related human hazard.

Similarly, there is also considerable habitat fragmentation within this zone. due to rapid developments, some of which do not follow the coastal zone management guidelines. For example, it was highlighted that Tanji Bird Reserve and Bijol Islands was dissected during the coastal road project which resulted to loss of some valuable ecosystems. The mangrove ecosystems of the Tanbi Wetland Complex (a Ramsar site and an extension of Tanji Bird Reserve) has also experienced considerable fragmentation by industrial developments.

Rapid infrastructural developments and industrial activities aside, this zone is also experiencing physical alteration by anthropogenic human activities. Disruption of wetlands and mangrove ecosystems are becoming a major issue. Because terrestrial land cover is disappearing, people have switched to the use of mangroves for fuelwood and other domestic uses (e.g. fish smoking, construction poles etc.). These anthropogenic human activities have led to the worsen of deforestation and erosion problems.

5.1.6. Over-exploitation of fisheries resources

The fisheries waters of the country extend to 12 nautical miles with an Exclusive Economic Zone (EEZ) of 200 nautical miles. Its waters are located where two major oceanic currents meet. One is the highly productive upwelling zone of the Canary Current Large Marine Ecosystem (CCLME) which is sustained by cold and nutrient-rich upwelling and the other is the warm Guinea Current (Njai, 2000). The effects of these currents coupled with the Harmattan northern winds from the Sahara Desert towards the Atlantic generate intermittent upwelling along the coast of The Gambia. These powerful upwelling coupled with the outflow of the River Gambia provide a tremendously productive food chain that fuel a bountiful marine ecosystem (Mendy, 2009). As a result, the people depend on the fisheries sector for their daily sustenance and is the single most important contributor to the GDP as well as socio-economic development.

While the sector plays an important role in the socio-economic development of the country, operations within result to some negative impacts. From the results gathered during the interview, the respondents indicated that the status of the marine resources is dwindling due to some anthropogenic human activities. They blame this on the type of fishing practices that prevail as well as competition for the limited resources between artisanal fishing boats and foreign (European and Asian) vessels.

Most often, because of weak enforcement of fisheries regulations, it was observed that certain artisanal and industrial operators resort to adopting unsustainable and destructive fishing techniques and gears to maximize their catches and sometimes this results to conflicts between them. For example, it was mentioned that poaching and other forms of Illegal, Unreported and Unregulated (IUU) fishing practices such as the use of beach seines (though banned in 1989), mono-filament, bottom trawling, stow nets for shrimps and shark fishing are responsible for habitat destruction and/modification and contribute to ghost fishing and over-exploitation of the resources. It was also mentioned that since some fish species are rarely seen in fish landings, they are now categorized as "*commercially extinct*".

Furthermore, the respondents have intimated that in recent times, the country has seen the proliferation of fish meal factories. Within a period of three years (beginning

2017), the government has granted fish meal processing permits to three factories to operate. At the time of this research, another one is under construction at Denton bridge. All the three (Golden Lead, Nessim and JXYG) factories are located in this study area. They compete for the scarce resources to produce large quantities of fish meal for export. However, it was highlighted that these factories are causing negative impacts on the environment (i.e. air pollution, resource depletion, sewage disposal into the marine ecosystem and destruction of the mangrove habitat). Due to these anthropogenic impacts, there is a decrease in fish availability for local consumption which in turn has caused a rise in the price of fish in the local markets.

5.1.7. Increased anthropogenic human activities

At the time the interviews took place, another major challenge highlighted by the respondents, which is a common concern facing the study area with regards to coastal zone management, is the increase of anthropogenic human activities. These activities, for instance, range from coastal tourism and its related activities, sand mining to pollution from land-based sources causing mangrove diebacks at Kotu creek and the clogging of drainage channels.

5.1.7.1. Coastal tourism and its related activities

The study site is within the Tourism Development Area (TDA) and therefore an economic resource hub of the country. The area has been exposed to planned and unplanned development projects so as to foster economic growth for the Government in terms of revenue generation. New hotels are being built every now and then and presently, there are about 40 to 50 hotels along with other tourism related activities (beach bars, small scale businesses, bird watching, yachting etc.) some of which are already threatened by coastal erosion. It is a well-known fact that tourists coming to The Gambia are essentially enticed to the sunny and sandy beaches, but most of these hotels are built within the 150m setback zone as postulated in the coastal zone management handbook, thus causing threats to those structures because of coastal erosion.

Figure 10: New hotels being built within the study area (> 150m buffer zone)
Source: Author

5.1.7.2. Sand mining

It has been mentioned that the study area is very rich in terms of high sand deposits including other natural resource minerals (e.g. zircon and ilmenite). This has resulted in many people venturing into sand mining (both legal and illegal) for commercial and construction purposes (see Figure 11). Sand has been mined within this area in the 1980s but because of its negative impacts on the fragile ecosystems alongside a sand budget deficit, it has been moved to another location with the result that its effects have spread to neighboring and adjacent cells causing overall changes in the coastal geomorphology.

Figure 11: Legal and illegal sand mining spots within the study site
Source: Author

5.1.7.3. Pollution of the marine environment from land-based sources

While it cannot be disputed that coastal and wetland reserves, together with coastal tourism, provide useful services, waste disposal/pollution from point source leaves much to be desired. Within the study site, there is a waste water treatment facility called Agua Gambia Ltd waste water treatment facility. Here, untreated sewage and human waste from hotels and the communities within the Greater Banjul Area (GBA) are supposed to be treated before discharge. However, it should be noted here that this facility is not effectively functioning as designed and therefore, raw sewage from the facility is discharged directly into the nearby mangrove ecosystems which is designated a conservation area and a popular spot for ornithologists. This anthropogenic human activity has resulted in serious mangrove diebacks at Kotu creek and other environmental problems like unpleasant smell from the facility causing air pollution, clogging of drainage channels to foams of raw sewage on the beach (see Figure 12).

Figure 12: Pollution of the marine ecosystem from land-based sources

(a) truck discharging raw sewage at Agua Gambia Ltd waste water treatment facility;

(b) mangrove diebacks at Kotu creek;

(c & d) raw sewage on the beachfront of Sunset hotel

Source: Author

5.2. Various adaptive responses (past and present)

The selection and timing of adaptive measures in response to coastal zone management depends on physical, social, economic, political and environmental factors of the affected area (Duxbury & Dickinson, 2007). In as much as such measures could be executed on a case-by-case bases, population growth coupled with conflicting demands in those sites call for an integrated and systematic approach (Clark, 2018; Duxbury & Dickinson, 2007). In his study, Duxbury et. al (2007) identified three principal objectives for coastal zone management and these include:

1. avoiding development in areas that are vulnerable to inundation
2. ensuring that critical natural systems continue to function
3. protecting human lives, essential properties, and economic activities against the ravages of the seas.

In view of these, full consideration should be given to cultural and aesthetic values as well as safeguarding human lives and economic development. Vulnerable areas for instance, could be managed to reduce loss of life and livelihoods through setback lines, limit coastal sprawl and coastal hazard insurance requirements whereas, resilient natural protective features such as beaches, sand dunes, mangroves etc. could also be conserved and well-maintained, thus enhancing biodiversity conservation.

From respondents' perspective, it was highlighted that coastal erosion is probably the most overwhelming environmental hazard/risk destroying properties, cultural and aesthetic sites within the study area. There is a natural trend of erosion mainly due to an annual net sand loss in a longshore transport from the south towards the Gambia river which acts as a sediment trap (Bakurin, 2010; Jallow et al., 1996; National Environment Agency, 2010a). This trend is generally insignificant but because of anthropogenic human activities in other areas of the coastline, including the study site, the trend of erosion is higher and some low scale local erosion control measures were implemented on an ad-hoc basis either by the Government or private sector. Conventional coastal engineering (hard and soft) techniques were used for erosion protection and some of these include palm groynes, revetments, gabion baskets, sea walls, sand bags and nourishment. A brief review of these conventional adaptation measures is elaborated below.

5.2.1. Past conventional coastal engineering

5.2.1.1. Palm groynes and gabion baskets

These are the oldest forms of erosion protection measures for the country. They were used during the colonial periods (i.e. before Independence in 1965) to protect both the Muslim and Christian Cemeteries in Banjul which suffered serious flooding in the 1957 spring tides (Dia Ibrahima, 2012; IUCN, 2010). Within a short period of their construction, these groynes showed a significant success as the sand rapidly built-up in the area but gradually dissipated because of worn-out (Drammeh, 2013).

Subsequently, the UNDP, under its Poverty Alleviation Strategy Programme funded a coastal project where a seawall/revetment was erected at a distance of 160m adjacent to the Muslim Cemetery using gabion baskets filled with laterite and granite stones (see Figure 13). However, due to lack of maintenance, these structures could not serve much longer but remnants of them are still evident along the southern coastline.

Figure 13: Palm groynes & gabion baskets as sea defence measures in Banjul
Source: Author

5.2.1.2. Beach nourishment

To address the erosion problem of The Gambia's coastline in a more holistic approach, a Feasibility Study was executed by the Royal Haskoning in 2000. Based on this study, a detailed design of protection works was carried out at different locations including the study area. These were based on the assessment of economic, social and cultural values (Bakurin, 2010). Also, in 2004, the African Development Bank (ADB) funded the Royal Haskoning coastal protection project embarked on beach nourishment and redistribution of sand along the coastline of the Greater Banjul Area (GBA). An amount of 1,400,000m^3 of sand (Royal Haskoning, 2000) was used to protect a 3km coastal strip including the capital from further erosion.

Further south of the capital, beach nourishment was designed to protect major hotel infrastructures lying behind the beach (this nourished beach should act as an erosion buffer). Adjacent hotels and bars should also benefit from this nourishment as the sand will spread out and feed neighboring coastal cells. The nourishment was designed on the basis of recurrence of 10 to 15 years (Bijl, 2011). Initially, 650,000m^3 of sand was recommended but because of high cost, 1,000,000m^3 was used to backfill a 1.5km stretch in order to safeguard infrastructures including sensitive ecological sites (Bijl, 2011)**.** However, because of sand mining, high erosion rates continued in this area. Bijl, (2011) argued that the life expectancy of this erosion protection measure was not reached. The beach returned to its original state after about 5 years, leading to considerable regrets where approximately US $8,000,000 was spent on this project. One of the main reason for its failure was due to the fact that the type of sand used for this nourishment was not compatible with the area (see Figure 14).

Figure 14: Coastal protection works by Royal Haskoning

(a) coconut plantation on nourished beach in Banjul;

(b) aerial view of the study site during the 2004 nourishment;

(c) the nourished beach, 5 years after the 2004 nourishment.

Adapted from (Drammeh, 2013).

5.2.1.3. Revetments and T-groynes

The beachfront of Cape Point in Bakau also shows coastal defence works in the form of rock revetments and T-groynes (see Figure 15) to protect the hotel industries (e.g. former Sunswing, Cape Point and Ocean Bay hotels respectively) and fish landing sites. The revetments were built with an under layer of basalt rocks weighing between 10-60kg placed on geotextiles and then covered with an armor layer of basalts weighing 100-500kg (Drammeh, 2013). At the same time, T-groynes were constructed in tandem with the revetments to safeguard those structures. However, due to lack of maintenance, most of these techniques became unsuccessful and erosion continued to become a serious phenomenon.

Figure 15: Revetments & T-groynes on the beachfront of Cape Point
Source: Author

5.2.2. Present conventional coastal engineering

5.2.2.1. Coastal protection at Kololi beach and Tanji bridge

At the time of this research, this coastal adaptation measure, under the UNDP supported GEF funded projects titled *"Enhancing Resilience of Vulnerable Coastal Areas and Communities to Climate Change"* is ongoing. It aims to reduce the vulnerability of the country's coastal zone to climate change and its associated impacts by improving coastal defences and enhancing adaptive capacities of coastal communities. It will attain this through the introduction of a new national programme of Sea and River Defence Risk Management – SRDRM) which it hopes to address the flood and erosion problems. (UNDP, 2012).

One of the components (component 2) involves the protection of tourism and fishing industries within the study site through adaptation needs, the scope of which involves:

1. Constructing of four detached offshore breakwaters each with a length of 80m (at crest level)
2. Building of revetments to secure the beach
3. Carrying out beach nourishment to restore the area lost

It is envisaged that 4 detached offshore breakwaters would be positioned in deep water (about 150m) parallel to the foreshore in order to minimize the rate of erosion by reducing the wave energy coming ashore through dissipation, refraction and/or reflection thereby creating sediment deposition (Zhu, Linham, & Nicholls, 2010). The revetments to be used will be made of large boulders (riprap) and heaped in an appropriate design and placed on the beach to provide additional protection. Finally, both the front and back of the revetment will be nourished with offshore dredged sand (app 94,000m^3) to restore the area already lost (Figure 16).

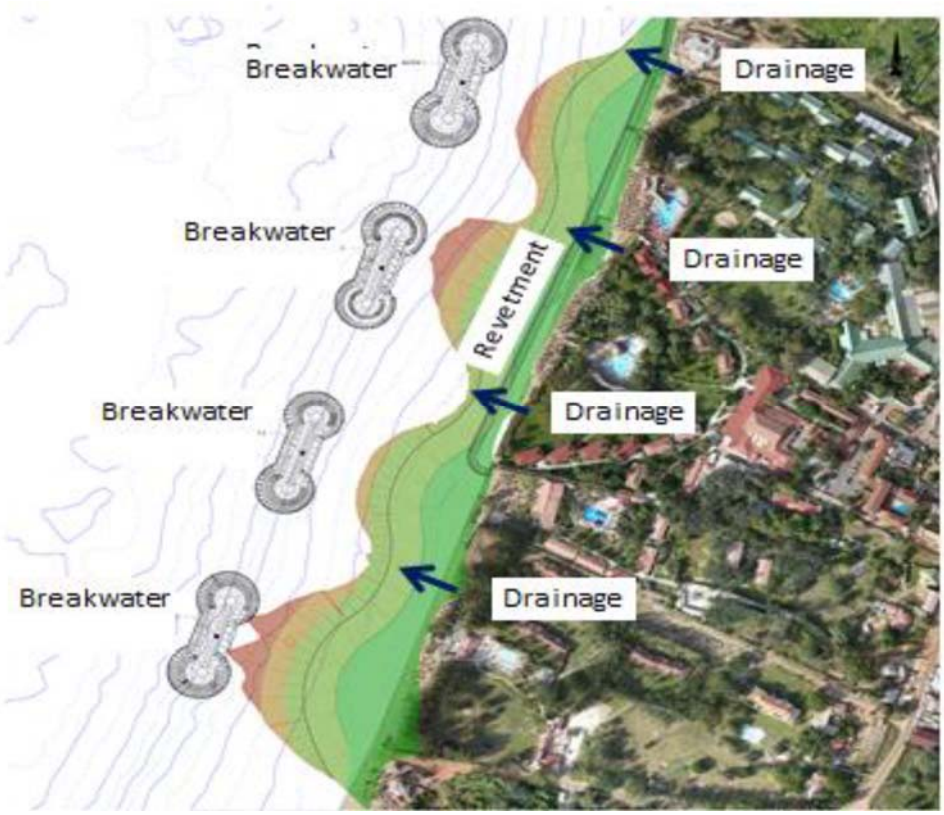

Figure 16: Layout of design for protection work at Kololi beach
Adapted from (UNDP, 2012)

5.3. Potential adaptive response for erosion protection

5.3.1. Ecosystem-based adaptation measures – Building with Nature

There is an urgent need for an alternative coastal adaptation strategy. All the past and existing adaptive responses in the country have focused on conventional coastal engineering techniques to address coastal erosion.

Likewise, in most coastal states, these conventional engineering techniques have become ubiquitous features of coastal landscapes (Hale et al., 2009). For instance, Airoldi & Beck (2007) indicated that in Europe alone, 8,500 square miles of coastal zone are covered in hard structures (e.g. concrete or asphalt) whereas in California, Australia and Japan, hundreds of miles of those coasts have been hardened (Hale et al., 2009). In most cases, these structures change sediment budgets in such a way that yet other hard coastal defence structures are needed, causing a costly negative

feedback loop, leaving less and less room for nature and natural dynamics (Airoldi et al., 2005). These expensive conventional coastal engineering techniques (though necessary in some instance) will not be able to address the full scope of coastal adaptation to climate change impacts and human activities. They cause the destruction of fragile ecosystems for example by preventing sediment transportation to those ecosystems, resulting to increased erosion (Hale et al., 2009; Wamsley et al., 2010). Coasts are becoming less and less resilient.

Therefore, alternative adaptive measures are necessary, that provide more and better opportunities for nature. They are available in the form of ecosystem-based techniques, now called Building with Nature. (see Figure 17).

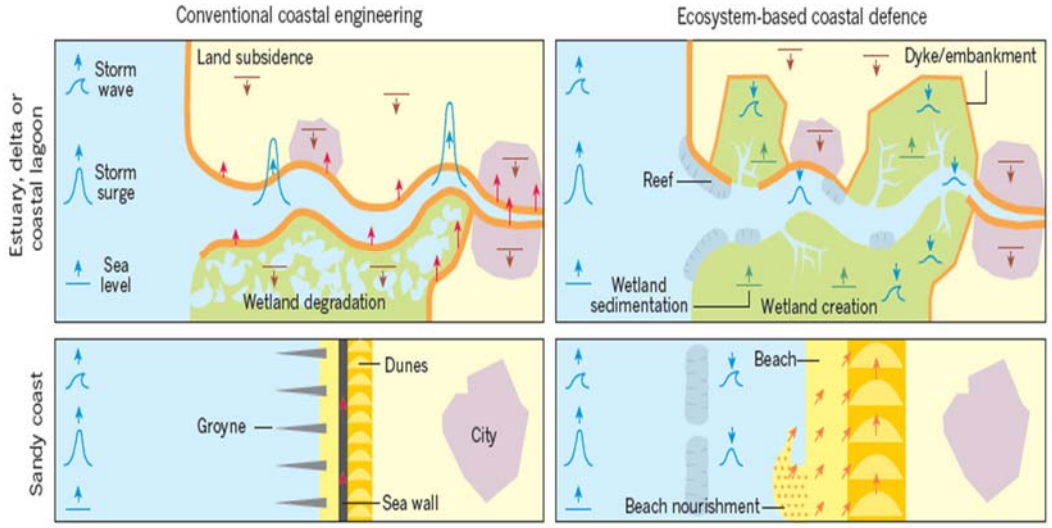

Figure 17: Conventional coastal engineering vs. Ecosystem-based defence

This figure illustrates the increased flood risk due to storm waves, storm surges and sea level rise (blue arrows) in an estuary (top) and at a sandy coast (bottom). Traditional engineering flood defences in estuaries (top left) cause land subsidence and wetland degradation (brown arrows) and the maintenance costs rise (red arrows), due to which the risk of coastal surges increases (blue arrows). On the top right, wetland creation and reefs attenuate storm waves and storm surges while it stimulates wetland sedimentation with sea level rise (green arrows). At sandy coasts, groynes and sea walls can cause dune degradation (bottom left), whereas nature-based sand suppletion (the sand engine) stimulates beach and dune sedimentation with sea-level rise and reefs attenuate storm waves and storm surges (bottom right)

Adapted from: (Temmerman et al., 2013).

Building with Nature (Temmerman et al., 2013) will help reduce impacts of coastal erosion and, at the same time, increase coastal resilience (Syvitski et al., 2009). Also, it will ensure ecosystem integrity, maintain water quality, reduce manageable impacts like pollution, restore habitats, control coastal inundation and increase the regenerative capacity of natural ecosystems against some of the threats that result from climate change (Hale et al., 2009; Kirwan et al., 2010). Coastal ecosystems like mangrove habitats, seagrass meadows, salt mash vegetation, oyster reefs and beaches all provide natural shoreline protection (Barbier et al., 2008; Gedan et al., 2011; Millennium Ecosystem Assessment, 2005). This is of prime importance for sustaining natural resources (e.g. fish stocks, clean water, marine biodiversity and tourism) on which vulnerable coastal communities depend for their sustenance. (Barbier et al., 2011).

Ecosystem-based adaptation via Building with Nature requires collaborative actions involving all stakeholders; from government institutions, coastal communities, conservation and development organizations to private individuals to plan and empower actions that will enhance environmental and community resilience. Likewise, it can be an important tool for community-based coastal adaptation where vulnerable coastal communities can be engaged and apply local knowledge for ecosystem-based solutions in a cost-effective manner (Hale et al., 2009).

Some examples where Building with Nature is applied include the sand-Motor at the coast, south of The Hague (www.dezandmotor.ni/en/), Abidjan in the Ivory Coast and Lagos in Nigeria as coastal adaptation measure to combat erosion (Temmerman et al., 2013; Van Slobbe et al., 2013). Correspondingly, since most part of The Gambia's low-lying coastline including the study area has significant coastal ecosystems, the need for integrated coastal zone management via Building with Nature (Waterman, 2008) is a potential solution than the conventional coastal engineering techniques. This approach when implemented through collaborative actions with all stakeholders will help address coastal erosion. It will also serve as a significant coastal adaptation strategy to climate change and human impacts (Temmerman et al., 2013) as well as preserving valuable environmental resources (Miththapala, 2008; Orth et al., 2006; Spalding et al., 2003).

Worldwide examples of Building with Nature and guidelines for designers (like ecologists, engineers, contractors) and organizations that can influence projects (like policy makers, NGOs, financiers) can be found at the website of the Dutch consortium EcoShape (www.ecoshape.org/nl/). A recent publication by the World Bank (2017) is also leading in this new field.

Some benefits gained from this approach include for instance;

1. Conventional coastal engineering techniques (like seawalls and revetments) as opposed to Building with Nature (green infrastructure) are expensive and require ongoing maintenance. Sometimes they can fail catastrophically under severe storm surges. Therefore, ecosystem-based approach can be more cost-effective in protecting the coastline with less maintenance.
2. Mangrove, saltmarsh and seagrass ecosystems are important sediment traps which help in erosion control and sequester of carbon. They play crucial and incremental roles in reducing the overall climate change impacts.
3. Ecosystem-based adaptation via Building with Nature also provide refugia for the lifecycle of (economical) important marine species and maintain their productivity.

Accordingly, and based on the information gathered so far from the interviews conducted thereof, it is against this background that in order to have a better opinion/understanding with respect to the three themes earlier mentioned, is the need to develop a comprehensive and implementable integrated approach for coastal zone management involving all the stakeholders identified in Table 5. Therefore, the importance of this research for the development of a blueprint for the policy/decision-makers and politicians on Integrated Coastal Zone Management cannot be over-emphasized putting into consideration the positive impacts it will have as a long term coastal adaptation measure to climate change including those anthropogenic human activities mentioned.

7. TOWARDS AN ICZM FOR THE GAMBIA

7.1. The need for an integrated plan

Because of the many pressures on the coastal zone of The Gambia, there is a sharp conflict between the need for the use of the resources (living and non-living) and the need for their sustainability (e.g. ecological balance) (Post & Lundin, 1996). These conflicts have reached a level that this zone can no longer sustain the negative anthropogenic activities. If the ecosystems within the coastal zone are to be maintained and restored, effective action is urgently needed (Post & Lundin, 1996). To answer this therefore, is the need for an Integrated Coastal Zone Management (ICZM) strategy involving all relevant stakeholders. Its purpose is thus, taking full advantage of the benefits provided and at the same time reducing the conflicts on the resources and the environment in order to maintain an ecological balance (Clark, 2018). It also provides a major opportunity to address the many issues and challenges of climate change and human impacts (Harvey, N. & Mimura, 2006; Nicholls & Klein, 2005).

In light of these challenges and issues, cognizant of the fact that mitigation alone cannot fully halt the full impacts of these changes (Tol, 2005), adaptive capacity has become a prime element of policy responses for coastal adaptation (Engle, 2011). Enhancing adaptive capacity is an integral part of ICZM which has become a useful tool for integration and sustainability. Typical aspects of ICZM for instance, joined-up approaches to governance (Stojanovic & Barker, 2008), Environmental Impact Assessment (EIA) and data management (Stojanovic, Green, & Lymbery, 2010), and implementation through Marine Spatial Planning (MSP) highlights many benefits that can accrue with regard to climate change adaptation and related human activities (O'Mahony et al., 2015).

In his book, Watson (2008) highlighted that *"ICZM is a process of governance that enhances the legal and institutional framework of coastal management to ensure improved environmental, social, and economic conditions within the planning area with the participation of those affected"*.

For The Gambia, there have been several policy instruments enacted for planning and controlling these anthropogenic pressures, yet, they have collectively failed to address coastal and wetland degradation, pollution of the coastal waters, and the exploitation of the resources (Mendy, 2002). Policy/decision-makers are of the belief that the country can no longer be subjected to compartmentalized sectoral approaches. Therefore, the starting point for addressing this is the establishment of a coordinating mechanism, which includes a high-level policy planning body so as to contribute to strategic policy-making, assimilating policy dissonances and conflicts, catalyze policy reviews and leverage new opportunities emerging under UN Sustainable Development Goals, UNFCCC Agenda, amongst others (United Nations, 1992).

7.2. The political planning process of integration

For an effective and sustainable management and development of the country's coastal zone, there is an urgent need to establish a multi-sectoral policy planning body for ICZM. This body should not only entail government institutions having a mandate in coastal zone management, but also other key stakeholders like the private sector, NGOs and CSOs.

Since there is no inter-agency or inter-ministerial body that is constituted jurisdictionally to implement ICZM programmes and strategy, the control and management of the country's coastal zone fall within the purview and jurisdiction of NEMA 1994 which provides for specific provisions relating to coastal zone management. It has established the National Environmental Management Council (NEMC) as a policy-making body to make regulations and guidelines for the management of the coastal environment, rivers and other wetlands and NEA as the legislative basis for the implementation and coordination body.

The Coastal and Marine Environment programme of NEA serves as a clearinghouse and collection point for coastal and marine environmental issues. Through the programme, institutional partners are brought together to solve problems. They monitor trends and adjust on-going programmes to take these trends into account. The programme coordinates these activities under the auspices of the CME Working Group. The group facilitates coordination of activities related to the management of

the coastal and marine environment and is the advisory body to NEA on such issues. It conducts its affairs in accordance with the powers and procedures laid down in the instrument of their appointment. The working group does not have any decision-making power but facilitates coordination of activities related to the management of the coastal and marine environment. On particular events, coastal communities are invited, if need be, as members of this group, especially when the subject matter has an effect on that particular coastal community. Any policy recommendations from this group are transmitted through the NEA to the NEMC for consideration and adoption.

Therefore, the formulation of a multi-sectoral planning body involving all stakeholders is suggested to implement an ICZM programme so as to avoid conflict and strength coordination among different stakeholders.

7.3. Initiation of the ICZM programme/plan

A major breakthrough to address climate change impacts and other coastal issues for the country was the initiation of the development of an ICZM plan under the FAO project titled *"Integrated Coastal Areas: Training and Development of National Capabilities for Planning and Management of the West and Central African Region"*. Its process was intended to fit within the existing institutional and legislative frameworks and was multi-sectoral in nature with the objective of integrating the activities of all stakeholders within the coastal zone. However, because of the project's short-life coupled with the inadequate institutional capabilities, it has hindered the implementation of ICZM initiation and process.

Similarly, the *GCCA Support Project to The Gambia for ICZM and Mainstreaming of Climate Change*, funded by the European Union (EU) was also initiated to fill the gaps required for the development of ICZM process. A management and strategic plan and an ICZM Bill were crafted in 2015 (still in zero draft) to outline operating policies, processes and procedures of an ICZM coordinating body. This is to lead a new model of shared leadership and management of The Gambia's coastal zone.

At this point, this author does not intend to reinvent the wheel for setting up an ICZM programme for The Gambia from scratch, but rather to build on those plans earlier

mentioned in order to come up with a blueprint that is implementable, effective and operational in addressing coastal adaptation to climate change and human impacts.

However, it is worthy to mention that the initiation of an ICZM plan involves different approaches e.g. resource by resource, region by region or issue by issue approaches respectively (Lamin-Wadda, 1999). For this reason, it is important for The Gambia to consider the latter and start with a few urgent matters and gradually include others on an incremental basis. Secondly, a clear objective must be set in order to achieve an ICZM plan, and these objectives must be in line with the overall objectives of the Sustainable Development Goals (SDG) at all levels, The Gambia Environment Action Plan (GEAP) as well as the Multilateral Environmental Agreements (MEA), otherwise a failure if omitted.

A starting point for implementing a first generation ICZM plan/programme for The Gambia, is to choose a pilot site including limited sets of issues. For this reason, since the scope of this author's research is limited to coastal cell 6, this area is chosen as a pilot area for developing a blueprint for ICZM as a case for adapting to coastal erosion in this zone because of climate change impacts and the numerous anthropogenic human activities taking place in the zone.

7.4. Coordination of an ICZM programme

From the draft documents prepared for the *GCCA Support Project to The Gambia for ICZM and Mainstreaming of Climate Change*, a vision statement has been coined in that:

"*Gambian coastal communities will be places where human activities enhance the natural environment; are resilient to climate change; and where the government, private sector and communities work together to meet basic needs for income, food, shelter, health care and education*" (National Environment Agency, 2015).

It is recommended from these draft documents that a coordinating body (Secretariat) should be established within the existing institutional architecture created by the NEMA 1994 for policy coordination and strategic and action planning with requisite resources needed for the effective implementation of the plan. A detailed organogram

of an enhanced ICZM institutional structure with the main functions is shown in the figure below.

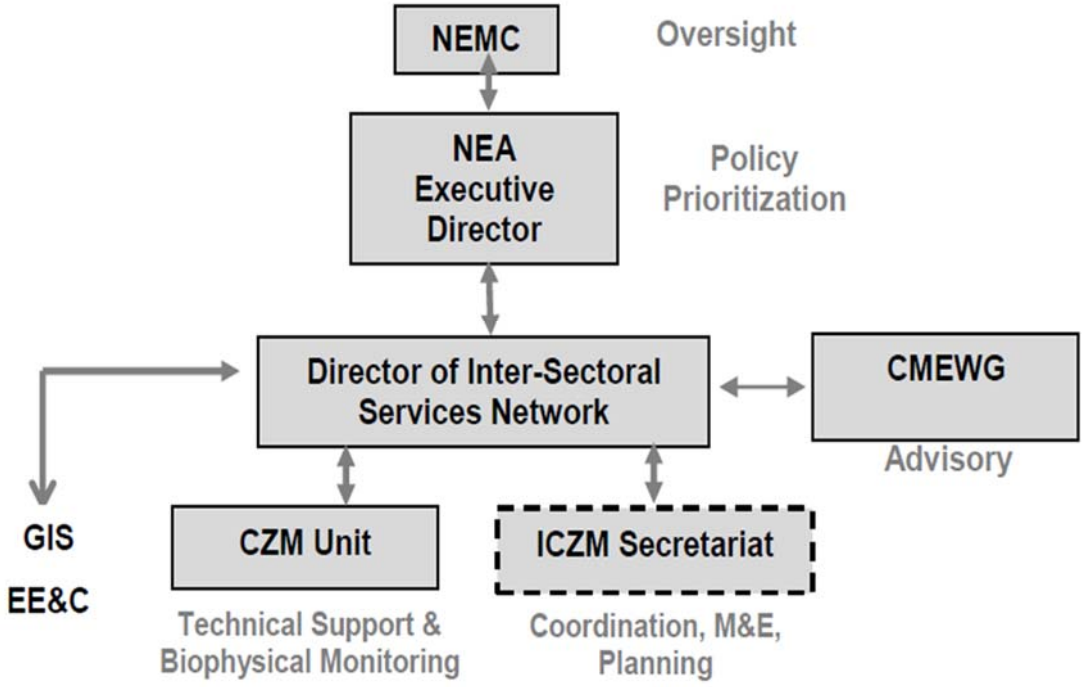

Figure 18: Organogram of an enhanced ICZM institutional structure with the main functions

Adapted from (National Environment Agency, 2015)

When the secretariat is established, it is envisaged that one of its main roles is to promote inter-sectoral coordination on formulating the ICZM strategic plan, thus ensuring progress with its implementation by engaging with key stakeholders on action plan as well as providing periodic ICZM programme reports to inform the management of NEA and NEMC. Its main responsibilities (as adapted from NEA 2015) are thus:

1. Compilation, assessment and reporting on the ICZM programme plans;
2. Supporting domestic and international resourcing to finance ICZM programme delivery;
3. Facilitating CME working group consultations on sectoral activities and budgets for the preparation of annual ICZM Action Plans;

4. Monitoring progress on the achievement of performance measures and targets as set out in the ICZM Strategic Plan;
5. Preparing periodic reports on the implementation of the ICZM Action Plan activities and challenges to NEA and CME working group;
6. Promoting awareness and institutional capacity for the ICZM across the Government, in the private sector and in the general public through targeted communications;
7. Updating the ICZM Strategic Plan at 5-yearly intervals, or at the request of the NEA Executive Director;
8. Facilitating the development of policy instruments linked to coastal management with sectoral organizations;
9. Organizing, facilitating and documenting regular meetings of the CME working group.

7.5. ICZM and NDP

The country has developed its mid-term National Development Pan (NDP-2018-2021) and, has committed itself to ensuring that the environment, as well as the natural resources, are sustainably managed and conserved to increase resilience for the benefit of all. From an economic point of view, incorporating ICZM programmes into NDP is paramount so as to become an integral part of economic development at national and local levels. Nonetheless, in this NDP, there is no mention of an ICZM programme and therefore, this should be changed.

7.6. ICZM and international considerations

Transnational issues relating to coastal and marine environment usually call for an integrated approach of the concerned governments in addressing resource use conflicts, halt the unsustainable use of natural resources, reduce and/or mitigate negative anthropogenic human activities and pollution of the coastal and marine environment. Marine and coastal environmental issues do not have boundaries for environmental problems. However, one problem created by one country may affect its neighbors. For instance, a large polluted river, entering a semi-enclosed sea, may

cause environmental degradation to many countries bordering that sea. Therefore, coastal and marine environmental problems can be dealt only by cooperation between countries sharing the same water bodies.

Therefore, international conventions and agreements to which The Gambia is Party too plays an important role in environmental management. Towards this end is the Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern Africa Region (Abidjan Convention), in which The Gambia has committed itself to boost the national, regional and local initiatives through a coordinated action of promoting, cooperating and partnership with the various stakeholders to foster an efficient governance in the service of ICZM.

8. SUMMARY AND CONCLUSION

The Gambia is among the Least Developed Countries (LDCs) with a fragile economy, which is dependent mainly on tourism, fisheries and agriculture for sustainable economic development. Tourism and fisheries industries are concentrated within the coastal zone and it is evident that these two contribute significantly to the country's socio-economic development. Regardless of their significance, they have adverse effects on this fragile zone, which seriously denies or even destroys the natural values, not to mention the proper management of their resources.

The many negative anthropogenic pressures within the study area in terms of coastal erosion, uncontrolled tourist development, sand mining, pollution and environmental degradation has had their toll on the morphology of the coastline. Therefore, if the status quo remains, business as usual without an integrated approach involving all relevant stakeholders, the Government and its development partners will result to more investments in coastal adaptation.

Consequently, this research aims at identifying the stakeholders that are fundamental in coastal zone management and come up with an implementable blueprint on Integrated Coastal Zone Management, a case for adaptation to coastal erosion.

To achieve this, the author has conducted a qualitative semi-structured interview with key stakeholders from the CME Working Group in order to identify the major challenges of coastal erosion and how might these challenges affect sectors operating in coastal zone six (6). Similarly, from the results obtained, the author has identified the perceived consequences of different adaptation options and drawn a resource of their failures. In this way, the respondents have identified at different levels the most important stakeholders required to be involved in coastal adaptation decision-making and planning processes. It can be concluded from their responses that the lack of effective involvement of relevant stakeholders in the decision-making retards ICZM processes which in effect is central to the overall objectives of the Rio Declaration on Environment and Development especially Principle 10 (Quarrie, 1992) where it states:

"Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided" (Rio Declaration on Environment and Development, 1992).

To conclude, this has given the author an overview to come up with a number of policy recommendations for the decision-makers and politicians on ICZM as a case for coastal adaptation to climate change and human activities in this zone. The blueprint will help address a myriad of challenges facing cell 6 as well as improving both the infrastructure for and the process of coastal zone management. ICZM is a continuous and dynamic process involving everybody from governmental institutions to coastal communities, the private sector, to the general public in managing, developing and protecting the country's coastal zone towards sustainable development of the coast. It is the only tool that can craft an equilibrium between the sustainable exploitation of the coastal resources and the effective conservation and management of the ecosystems within this zone.

9. RECOMMENDATIONS

The following policy recommendations are envisaged:

1. Review of the National Environment Management Act (NEMA) 1994

The NEMA precedes all other environmental legislations in the country. Enacted in 1994, it provides the legal framework for the control and management of the environment and makes provisions for the overall management of the coastal zone and all other wetlands. However, legislations for the coastal zone remains fragmented and occurs in a sectoral way where each Government Department and/or Agency has its own policies supported by their respective legislations. No single institution is charged with coastal zone management but a Technical Advisory Committee (CME Working Group) should be established as an advisory body to the NEA on coastal zone matters. Since the provisions of the NEMA relating to coastal zone management has not been given any legal backing, NEA as the Competent Authority has not formulated a permitting system to regulate and control activities within the coastal zone of the country. For this reason, coupled with emerging environmental issues, there is a strong need to review the existing NEMA and strengthen the section on coastal zone management in order to guide the activities within this zone in an integrated manner.

2. Update the draft ICZM policy documents

Through the GCCA support project to The Gambia for ICZM and the mainstreaming of climate change, three policy documents have been formulated for the implementation of an ICZM in the country. These were the management plan, strategic plan and ICZM Bill 2015. Since then, these documents are in a zero draft and nothing has been done so far. It is therefore of paramount importance that in order to have an effective and operational ICZM, strategic and management plans are essential for the day-to-day running of the ICZM Secretariat that needs to be established. Similarly, the ICZM Bill, with the objective of preserving, protecting and

enhancing the status of the coastal environment needs to be upgraded and passed into law in order to avoid overlapping mandates from Government Departments and/or Agencies which sometimes results into conflicts as there is no interdepartmental policy framework for the management and development of the coastal zone. Therefore, there is a strong need for system-wide coordination of all relevant policy frameworks and harmonized to effectively manage climate change impacts and human activities on coastal areas, thus bringing them under one unified document i.e. an ICZM Act that should:

- Define the domain of CZM;
- Clarify ownership and right to use;
- Empower a lead agency responsible for the implementation of ICZM policy;
- Ensure co-ordination between all agencies involved
- Create the organization, staff and financial means for enforcement and control and
- Delineate set back and exclusion zones.

3. Promotion of public awareness and cooperation (effective stakeholder engagement)

There has been a lot of emphasis on the significance of stakeholder engagement and participation as a key to successful implementation of a blueprint for ICZM. These stakeholders, include government institutions, coastal communities, the private sector to the general public, have a responsibility within the study area and their effective engagement determines the success of an ICZM. For instance, the effective participation of coastal communities in ICZM processes is of the utmost importance as they are at risk and vulnerable to the impacts of climate change issues like coastal erosion, storm surges and intense wave activities. Therefore, their full participation and engagement in the ICZM decision-making processes can bring some meaningful decisions as well as the "political clout" it deserves.

4. **Updating of previous spatial plans to reflect current conditions, risks and priorities**

Coastal erosion leading to the habitat fragmentation as well as destruction of ecologically sensitive sites within the study area, have been caused largely by rapid urbanization and a boom in tourism activities (planned and unplanned developments of infrastructures) and most often people do not adhere to the physical planning regulations. This haphazard development of infrastructures has resulted in the destruction of many vital sites within the study area. Attention must be paid to land-use planning within this zone and an updated spatial plan is needed through an integrated approach to put in place measures to adapt, build resilience and minimize vulnerability to the impacts of coastal erosion. Without this, any initiatives to plan for coastal adaptation measures is expected to be less than effective.

5. **Obtaining reliable data on the coastal environment**

Acquiring reliable data on the coastal zone of the study area is a prerequisite for a successful implementation of ICZM plan. Basic digital environmental data have been collected in the past by Lead Departments and Agencies vis-à-vis:

- Department of Lands & Survey — Topographic data
- Department of Agriculture — Agricultural & land data
- Soil & Water Management Unit — Soils data
- Department of Water Resources — Climate & water data
- Gambia Bureau of Statistics — Demographic data

However, a long-term series of reliable data to support policy decisions in coastal zone management is lacking. Therefore, it is suggested that GIS and other coastal resource databases (e.g. bathymetry, grain-size distribution etc.) are among the tools that can be used for a successful ICZM planning process.

6. Use of Ecosystem-based coastal defence – Building with Nature concept

Because of the challenges faced by conventional coastal engineering techniques as in persistent and costly maintenance, the adoption of Ecosystem-based coastal defence is recommended. Most often, the country depends on donor funding for environmental protection including climate change adaptation, and sometimes not sustainable. Therefore, cost effective measures in the form of Building with Nature (greening the coast) plays a major complementary role in erosion control. This contributes to strengthening ecosystem functions including supporting the goods and services as well as reducing the catastrophic impacts of coastal erosion. Therefore, degraded sites within the study area can be restored by either using; seagrass meadows, greenbelts, artificial reefs, sand fencing, mangroves, coastal plants or dune vegetation in order to protect the area including coastal communities from further erosion.

7. Effective Environmental Impact Assessment (EIA) procedures

EIA is an effective tool for implementing a successful ICZM. A properly executed EIA study can provide the basic information about any proposed development within the coastal zone which in turn would alleviate degradation of the environment therein including adaptation measures. Any development that has to do with land-use planning especially in the Tourism Development Area (within the study site) must fulfil a mandatory EIA process.

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11. APPENDICES

11.1. ANNEX 1

WORLD MARITIME UNIVERSITY

Established under the auspices of the International Maritime Organization
a specialized agency of the United Nations

Semi-structured interview questions

Name:

Organization:

Gender:

Topic: A Blueprint for Implementing Integrated Coastal Zone Management: The Case of Adaptation to Sea level Rise in the High Risk Zone (Coastal Cell 6) of The Gambia

1. Background information (an overview and let the interviewee introduce himself)

2. What are the major challenges coastal cell 6 is facing in terms of coastal zone management and why those challenges are not addressed?

3. Are you aware of the impacts of expected erosion problems within coastal cell 6?

Yes or No

If your answer is Yes, how might erosion affect your sector or other interests?

4. Considering the long term vs. short term solutions in addressing coastal erosion in your opinion, what adaptation measures do you think are required?
    a) Hard engineering solution
    b) Soft engineering solution
    c) Building with Nature
5. Can you tell me what you know about Integrated Coastal Zone Management (ICZM) and how your Ministry or Organization is involved in ICZM?

6. In your opinion, who do you think are the key sectors/stakeholders for the development, management and protection of the Gambia's coastal zone especially for the implantation of ICZM in coastal cell 6?

7. How do activities in your Ministry or Organization interact with ICZM?

8. In the past, there had been coastal defence works carried out to mitigate the impacts of erosion, can you highlight their success or failures?

9. As a key stakeholder in coastal zone management, what kind of data do you think you may need (if you are in charge) in order to have a better opinion/understanding for long term solution

10. Finally, can you please highlight some of the recommendations you think is possible for ICZM

THANK YOU VERY MUCH FOR YOUR TIME