Assessment of the Effects of Keta Sea Defence Project on the Livelihoods of the People in the Keta Municipality, Volta Region, Ghana

Richard Adikah, John Victor Mensah, Augustina Araba Amissah, Justice Mensah

Ministry of Local Government and Rural Development, Accra, Ghana
School for Development Studies, University of Cape Coast, Ghana
Department of Vocational and Technical Education, University of Cape Coast, Ghana
Directorate of Academic Planning and Quality Assurance, University of Cape Coast, Ghana

Globally, coastal settlements experience sea erosion. Lives and property of coastal dwellers are destroyed, livelihood sources jeopardized and hopes ruined. Sea defence has been an option used to deal with coastal erosion. This paper assesses the effects of Keta Sea Defence Project on the livelihoods of people in Keta Municipality, Ghana. A case study design and multistage sampling procedure were used to select 182 household heads and 15 key informants for data collection using interview schedule, interview guide and observation checklist. The Statistical Product and Service Solutions version 20 was employed to analyse quantitative data while transcription and content analysis were applied to qualitative data. Five main findings emerged from the study. First, the sea defence has fulfilled its project components including the construction of road network, flood control structure and land reclamation. Second, the affected communities were provided with services such as pipe-borne water and electric power. Third, the households were satisfied with the provision of livelihood assets. Fourth, people lost holding rights on reclaimed lands. Fifth, the project resulted in reduced fish catch coupled with difficulty of dragging fishing nets offshore. Recommendations made to sustain livelihoods included partnership among stakeholders on various decisions and actions.

Keywords: Sustainable livelihood, coastal erosion, sea defence, land reclamation, resettlement

INTRODUCTION

Coastal erosion is the wearing away of the land by strong waves of the sea. Over 70 percent of the world beaches has been experiencing coastal erosion, which is widely hazardous to human life and properties (Schwartz, 2005). The degree of coastal erosion varies among countries and regions. In Texas, coastal erosion is a severe problem. At the Sargent beach in Matagorda County, sea erosion has left only 600 feet of land between the gulf and the inter-coastal waterway (Krantz, 1999). In Europe, Denmark and Sweden, the west coast of Jyllan and Krane, south of Sweden respectively experience erosion of the beaches due to longshore sediment transport.

West African coastal communities have been currently experiencing increasing threats of climate change induced (CCI) hazards due to natural and anthropogenic forces such as sea level rise (SLR) with its associated salt water intrusion, coastal erosion, flooding and salinization of agricultural lands. The human-induced causes of degradation are mainly observed in the rapid urbanization and the consequent increased pollution in most coastal communities. The livelihoods of coastal communities have been affected by the phenomena such as coastal erosion, increasing population density, loss of property, corrosion of metallic items, land litigations, wetland degradation and other social conflicts (Mensah, 1997). Widespread poverty and CCI degradations have been worsening the living conditions of coastal dwellers.

Corresponding Author: John Victor Mensah, School for Development Studies, University of Cape Coast, Ghana.
E-mail: john.mensah@ucc.edu.gh
Co-Author 1Email: adikahrichardcop@gmail.com
3Email: aamissaharaba@ucc.edu.gh
4Email: justice44mensah@gmail.com
conditions of the coastal communities leading greatly to conflicts in the sub-region. The aforementioned natural and human degradations might increase individual and community vulnerabilities through social, economic and psychological means (Jones et al., 2010).

In Ghana, coastal erosion is a chronic issue along the coastline (Anim et al., 2013). This has affected the coastal infrastructure and valuable beach resorts, and has raised a great concern to the people (Mensah, 1997; Bryant, 2009). About 80 percent of the coast of Accra has been eroding at a rate of about 1.13 metres per year (Appeaning Addo et al., 2008). In the western coast of Accra, 17 coastal inhabitants have lost their homes to coastal erosion within a period of 26 years (Campbell, 2006). The anthropogenic causes of coastal erosion in Ghana include sand mining, poor management of the coastal communities, modification of ecosystems and rapid urbanization while the natural causes include the sea level rise, heavy storm waves and tides.

The conditions at various beaches in Ghana necessitated the construction of sea defence walls to reduce wave energy, curb coastal erosion and prevent the loss of coastal habitats and ecosystem. This construction was necessary because coastal industries (e.g. salt extraction and fishing) were at stake, coastal communities, cultural and archaeological sites as well as future development sites were threatened by the sea-level rise. The construction involves placing large hard boulders including groynes and revetment at sea fronts. Examples in Ghana are Axim Coastal Protection Works, New Takoradi Sea Defence Project, Ada Sea Defence Wall, and Keta Sea Defence Project (Conterra Limited, 2005).

Keta had been battling with the repercussion of rise in the sea and lagoon tides (Boateng, 2009). After a century of continuous sea erosion, more than half of Keta and its surrounding communities were submerged by 1996. The sea and the lagoon were flowing into each other with some communities almost cut off from the main land. The effects were loss of lands and buildings, destruction of infrastructure, decline of fishing, farming and other forms of livelihoods which led to increased poverty in the affected communities. The sea erosion also resulted in people migrating to other urban areas.

As part of the Government of Ghana’s intervention, a US$1 billion Keta Sea Defence Project (KSDP) was vigorously pursued in 1996 and completed in 2004 (Ile et al., 2014). In 1999, the government secured a loan from the US Export-Import Bank (Ex-Im Bank) to purchase US-made equipment to build Keta sea defence wall and other infrastructure. The agreement followed Ex-Im Bank’s approval of US$1.89 million in 1995 to finance feasibility and engineering studies of the Keta project by Great Lakes Dredge and Dock under the Ex-Im Bank Engineering Multiplier Programme. The project involved the building of a defence wall to address erosion, reclamation of land from the sea, re-establishing a road-link between Keta and Atakpamé and the construction of a resettlement housing units. The KSDP was made up of a revetment, six large headland groynes and beach fill to defend a naturally eroding beach, minimize impacts on the down drift through bypassing the historic supply of sand and compensating for part of the sand budget deficit, and to allow for continued seine net fishing (Gularte et al., 1980). The project components included sea defence wall to stop sea erosion; create a safe enclave to revitalize the fishing industry; increase crop production; promote tourism; reduce flooding of communities and farms; and to construct 8.4km asphalt link road through the communities to promote trade and development (Great Lakes Dredge and Dock Corporation [GLDD], 2001). The objective of the study was to assess the effects of the KSDP on people’s livelihoods in the Keta Municipality in the Volta Region.

LITERATURE REVIEW

Literature review covers the nature of human livelihoods, livelihood assets, and livelihood strategies, livelihood outcomes in coastal areas, sea defence project and institutional arrangement of Keta Sea Defence Project.

The Nature of Human Livelihoods

A livelihood is a means of gaining a living or securing the basic necessities of life. It encompasses people’s capabilities, assets, and income required to secure the necessities of life. People’s livelihoods are explained to be the kinds of activities they do for living (Chambers and Conway, 1991). Ellis (2000) explains livelihoods as the activities, assets and access that jointly determine the living gained by the household or the individual person. A livelihood is sustainable when it enables people to cope with and recover from shocks and stresses such as natural disasters and economic or social upheavals, and enhance their well-being and that of future generations without undermining the natural environment (Mensah and Enu-Kwesi, 2018).

Livelihoods can be at different hierarchical levels, the most commonly used is the household, usually meaning the human group which share the same arrangement for cooking under same shelter. These levels of livelihood recognise individual level of wellbeing. The household members, especially women and children, may be central targets. In determining the effects of the sea defence project on livelihoods, it is important to consider the various components and the flows in a livelihood of the people and how the sea defence influence their lives. Figure 1 shows the components and flows in a livelihood.
Livelihood assets may be tangible such as food stores, cash savings, trees, land, livestock and tools or intangible such as assistance and access to materials, information, education, health services and employment opportunities. People depend on these assets to make a living (Chambers and Conway, 1991). This implies that physical access (e.g. road network) would improve the main livelihood sources of the people in Keta including fishing, farming and salt mining.

The effects of the project might be positive and negative. The defence wall was to address erosion, reclaim land from the sea, re-construct the road-link between Keta and Aflao and construct resettlement housing units. The project faced some challenges from the residents. Modern Ghana.com (2006) reported that some residents in the area had been removing the boulders used in protecting the coastline for other purposes. They broke the boulders into pebbles and used them for their private construction works.

Livelihood Assets

The livelihood assets of the people can be classified into five types of capitals (also known as livelihood pentagon) namely; human, social, natural, physical and financial (Figure 1). The study applied the livelihood pentagon as the assessment criteria.

_Human capital_ involves the various skills and knowledge of the people (education), health and ability to work to enhance the standards of living. It also considers labour force (both skilled and unskilled) who can engage in any socially acceptable work that they can depend on. Human capital is a building block and a means of achieving livelihood outcomes. It is the knowledge, skills, attitudes and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being (Chambers and Conway, 1991).

_Social capitals_ are informal networks, members of formalized groups and their relationships of trust to facilitate co-operation and economic opportunities that contribute to the livelihood of the people. Social capital deals with intangible assets that count most in the daily lives of people: namely goodwill, fellowship, sympathy, and social intercourse among individuals and families who make up a social unit. Social capital is a means of social resources on which households draw their activities of livelihood objectives. It is developed through networks and connectedness, membership of more formalized groups and relationships of trust, reciprocity and exchange (DFID, 1999).

_Physical capital_ deals with infrastructure facilities or services such as roads, water and sanitation, schools, market facilities, industries, and equipment to enhance production of commodities, affordable energy and access to information and communication systems.

_Natural capital_ includes land, soil, forest and fisheries which when utilized can go a long way to promote the livelihoods of the people. It deals with issues of landlessness and access to common property resources.

_Financial capital_ covers facilities such as income from employment, savings, trade and remittances to build up the capacity of the people for living. It encompasses flows and stocks that can contribute to production and consumption. The financial capital is derived from two main sources: available stocks (cash, bank deposits, remittances, pensions) and inflow from the state. Financial capital is essential in poverty reduction because it can be used directly to achieve livelihood outcomes and to influence political decisions (DFID, 1999).
Livelihood Strategies

Livelihood strategies represent the collection of activities that are available for people to make a living. They include productive activities, investment strategies, and reproductive choices people make and undertake to achieve their livelihood goals. Livelihood strategies vary across geographical areas, sectors and within households over time (DFID, 1999). They depend directly on asset status, policies, institutions and processes involved. Strategies adopted by a household might have a positive or negative impact on the strategies of another household and these may bring about competition for jobs and markets to secure better prices to improve the standard of living (GLOPP, 2008). Scoones (1998) classified livelihood strategies into three main categories namely; agricultural intensification, livelihood diversification and migration. These livelihood options are open to the rural people. Rural people may intensify agriculture by cultivating more crops per unit area or practising other types of fishing through capital investment. They may also increase labour input, diversify to off-farm income earning activities, migrate temporarily or permanently elsewhere or perform different kinds of activities.

Livelihood Outcomes in Coastal Areas

In coastal areas, there are economic activities such as farming, fishing, industry, commerce, educational and health services that people pursue for living. The outcomes are the gains people make from those livelihood activities they pursue. Livelihood outcomes are the effects on incomes of the people, the well-being, and low level of vulnerability from sea erosion, effect on livelihood improved food security, and sustainable use of natural resource base in the area. Achievement of these outcomes does not depend solely on the people but also a combination of factors that makes it possible (DFID, 1999). The strength of a given livelihood is not only measured by its productive outcomes, but also its resilience to shocks, seasonal changes and trends (Chambers and Conway, 1991). Shocks might include natural disasters and external agents. Fishermen are mainly located along the coast with their families. Their lives are vulnerable to sea level rise and this is associated with rainy season and roughness of the sea. As a result, fishermen try to abandon their livelihood activities and migrate to look for alternative means of survival. According to Campbell (2006), coastal communities are affected by severe erosion resulting in damage to local property, social and economic life disintegration, migration, threats to cultural heritage and tourism development.

Sea Defence Project

Sea defence project is a way of protecting the low-lying coast and coastal neighbourhood against flooding which are caused by the combined effect of storm surge and extreme astronomical tides. Sea defence often consists of dikes or seawalls of some kind, or in the form of artificial dunes (Doody, 2004). It often involves building structures to protect the land and infrastructure from erosion and to prevent destruction of coastal properties such as lands, lives and flooding. Various types of materials used in the construction of the sea defence wall include groynes, gabions and revetments. The Keta Sea Defence Project is one of the most phenomenal in Ghana in terms of impact on livelihoods (Ministry of Water Resources, Works and Housing, 2001).

Institutional Arrangement of Keta Sea Defence Project

Processes and structures are used by institutions, organizations, policy makers and legislators to shape livelihoods of the people. These institutions, organizations, policies and legislations, operate at all levels within the household and international domain, and in all aspects of life. They determine the access to various types of capital, the terms of exchange between different types of capital and economic return to any given household (DFID, 1999). Ghana has a number of environmental policies in existence. These policies include: the National Environmental Policy, National Wetland Policy, Agricultural Policy, National Health Policy, Tourism Development Policy, Land Management Policy, Energy Policy, Mineral Policy and Wildlife Conservation Policy. However, the country has no specific policy to infrastructure provision. These policies were to some extent the basis of many infrastructure developmental projects in Ghana. They also formed the framework for the construction of the sea defence project. Integrated Coastal Zone Management and Sustainable Development was the key policy under which the KSDP was constructed (Amlalo, 2006).

METHODS

Study Area

The study was done in the Keta Municipality (Figure 2), which has a total surface area of 753.1 square km. Keta, the municipal capital, is located to the east of the Volta estuary, about 160 km from Accra, the capital of Ghana. The Municipality lies within Longitudes 0.30°E and 1.05°E and Latitudes 5.45°N and 6.05°N. It shares borders with Akatsi South District to the north, Ketu North and Ketu South districts to the east, South Tongu District to the west and the Gulf of Guinea to the south. It is one of the administrative districts in the Volta Region. The topography of the Municipality is a flat land with a large area of lagoon along the coast. Keta, Kedzi and Vodza-Adzido townships have the lowest point of about 1-3.5 metres below sea level. The highest point of the Municipality is about 53 metres above sea level around Abor in the northern part. The municipality has three main geographical belts namely; narrow coastal strips, the lagoon basin in the middle belt and the plain in the northern
belt. It has Keta, Angaw, Agbatsivi Logui, Nuyi and Klomi lagoons as the main drainage basins. The Keta lagoon with 12km width and 32km length is the largest drainage basin and serves as one of the major livelihood sources for the inhabitants.

Figure 2: Map of Keta Municipality showing the study communities
Source: Cartographic Unit, University of Cape Coast

Sample Areas

This research was conducted in two communities along the coast of the Municipality namely; Kedzi and Vodza-Adzido where the sea and the lagoon were the main sources of livelihoods. The communities were eroded by the sea, which rendered almost every household homeless. Plate 1 shows the Keta Sea Defence Project in the Vodza-Adzido and Kedzi communities.

Plate 1: Keta Sea defence wall
Source: Ghana News Agency, 2010
Research Approach

The study adopted the case study design to allow for an in-depth assessment of the Keta sea defence project on the livelihoods of the people. Using the mixed method approach, both qualitative and quantitative data were collected. Both probability and non-probability sampling techniques were adopted to select respondents for data collection.

Sampling Procedure

A multistage sampling procedure was adopted. At the first stage, communities which were directly affected by the sea tides before the construction of the Keta sea defence wall were purposively sampled. The most affected were Kedzi and Vodza-Adzido, with a total population of 5468, specifically 2099 and 3369 respectively (Ghana Statistical Service, 2014). Due to inadequate data on the total number of households, the total number of houses was used as a proxy to determine the total number of households.

The populations were projected to 2016 as the current population for the study as shown in Table 1. Although the total number of houses for each community was not established, the average persons per house of 4.5 (Ghana Statistical Service, 2014) was used to calculate for the total number of houses. The total number of houses was then used to calculate for the sample size. To reduce the cost of data collection, a confidence level of 93% indicating an error margin of 7% was used to calculate the sample sizes of the communities in the formula below:

\[ n = \frac{N}{1 + N(\alpha)^2} \]  

(1)

Where, \( n \) = sample size, \( N \) = sampling frame, \( 1 \) = constant, \( \alpha \) = margin error.

Using houses as a proxy for households, Vodza-Adzido has a total of 1116 houses and Kedzi has 540 houses. Thus, the total number of houses in the two communities was 1656 houses. The houses sampled using the above formula gave 182 questionnaires for the study. The total number of houses in each community was then used to proportionally distribute the sample between the two communities.

Table 1: Population projection and sample size of selected communities

<table>
<thead>
<tr>
<th>Community</th>
<th>Population 2010</th>
<th>Population 2016</th>
<th>Total houses (calculated)</th>
<th>Proportion of sample size (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vodza-Adzido</td>
<td>3369</td>
<td>3907</td>
<td>1116</td>
<td>67</td>
</tr>
<tr>
<td>Kedzi</td>
<td>2099</td>
<td>2434</td>
<td>540</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>5468</td>
<td>6341</td>
<td>1656</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field Work, 2016.

At the second stage, the systematic sampling technique was applied to determine the interval based on a random starting point and fixed periodic interval. This was to ensure that the research followed a fixed interval in selecting the households (houses) for the administration of questionnaire as presented in Table 2. Every 9th house from the initial house was selected for interview.

Table 2: Systematic sampling procedure of selected communities

<table>
<thead>
<tr>
<th>Community</th>
<th>Total Houses</th>
<th>K&lt;sup&gt;th&lt;/sup&gt; Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vodza-Adzido</td>
<td>1116</td>
<td>9&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Kedzi</td>
<td>540</td>
<td>9&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Source: Authors’ Construct, 2016

At the third stage, convenience sampling was adopted where the respondents were selected based on their availability and easy access. This was important because of the time frame within which data was to be collected. At the fourth stage, purposive sampling was used in selecting the key informants for the interview. It helped to interview more people who were relevant to the study. The 15 key informants were officers of stakeholder institutions such as Community Water and Sanitation, Department of Town and Country Planning, Municipal Assembly, Health Directorate and the Traditional Authority.

Data Collection and Analysis

Data collection instruments used were interview schedule, interview guide and observation checklist. Interview schedules were administered to household heads while the interview guide was used to interview the key informants. Observations were made using a checklist. The use of mixed methods approach was to achieve complementarity by using the strengths of one method to enhance the other (Creswell, 2009). Data collection instruments covered issues such as background information on the respondents, livelihoods before and after the sea defence project, capabilities and access to livelihood assets, institutional mechanisms that affected the project implementation, resettlement of the households, livelihood strategies and livelihood outcomes. The field-work was conducted from 4<sup>th</sup> to 27<sup>th</sup> March, 2016. The household was the primary unit of analysis. Data editing was done to check consistency in responses to questions. The Statistical Product and Service Solutions (SPSS) version 20 was employed to analyse quantitative data using descriptive statistics. Transcription and content analysis were applied to qualitative data. Responses to open-ended items were analysed through the categorization of emergent concepts and comparison of these concepts in order to identify common themes.

RESULTS AND DISCUSSION

The findings and discussion focus on the background characteristics of the household heads, the condition of sea defence project and livelihood source before and after sea defence project.
Background Characteristics of Household Heads

The study analysed the background characteristics of the sampled households in order to put the study into context. The characteristics included: sex, age, educational level, marital status, place of birth, duration of stay in the community and household size.

About 55 percent (100) and 45 percent (82) of the household respondents were males and females respectively. The majority (90.6%) of the respondents were within the active labour force (less than 60 years old). The dominance of the male respondents over their female counterparts could be observed within all age cohorts except within the ages of 35-44 years as shown in Figure 3.

![Figure 3: Sex and age structure of respondents](source: Field Survey, March, 2016)

Educational Level and Type of Occupation

From the analysis, the highest level of education attained was Junior High School representing 62.2 percent, followed by Primary 13.8 percent, Tertiary 12.2 percent, Senior High School (SHS) 7.9 percent, and none representing 3.9 percent. Even though the household heads had some level of education, the majority of the people lacked the technical skills for any formal occupation. About 60.3 percent of household heads who had JHS as their highest level of education were engaged in fishing activities. Household heads with tertiary education were employed in formal sectors of the economy. Thus, the level of education attained influenced the choice of livelihoods of the people. The results indicated that 74.1 percent of the respondents were born in Kedzi and Vodza-Adzido, followed by 9 percent in Keta, six percent in other communities within the Volta Region, 6.4 percent in other regions and the remaining 4.5 percent in other countries. All the respondents had lived in the sampled communities for at least 10 years and therefore, had enough knowledge on the issues under investigation.

Condition of the Components of the Sea Defence Project

The project has four components. First, the construction of defence wall comprises six groynes, revetment at Keta, beach fill and flood protection along the coast from Keta to Kedzi. Second, the construction of asphalt road between Keta and Havedzi. Third, the Flood Control Structure comprises 20 number gates of total length of 80.5m designed to maintain the lagoon level below elevation of 0.8m. This has provided the inhabitants around the Keta Lagoon relief from flood condition and maintained a good level of water to support the fishing industry. Plate 1 shows the groynes used in the construction of the defence walls into the sea. Findings from the field indicated that the six groynes of average length of 180 metres into the sea were intact. The groynes were put into the sea to reach the sea shore at Vodza-Adzido. The sea would leave the groynes along just at the mouth of the sea. From the field, the measurement taken between the mouth of the groynes and the sea was 15.24 metres. At high tide, the roughness of the sea only stopped at the mouth of the groynes. All the sampled respondents indicated that the sea defence had solved the problem of coastal erosion during high tides.

The fourth component relates to the land reclaimed from the lagoon between Keta and Havedzi. About 272.5 hectares of land was reclaimed out of which 213 hectares constituted land for habitation and industry. The creation of nine bird habitats as breeding grounds for rare bird species and eco-tourism promotion was part of this component. Moreover, the reclamation of low-lying inhabited areas would necessitate the relocation of the inhabitants of affected communities (Ministry of Water Resource, Works and Housing, 2001). Field observation showed that the land reclaimed from the lagoon between Keta and Havedzi served as areas by which the inhabitants of Vodza-Adzido and Kedzi had been resettled.

Livelihood Source Before and After Sea Defence Project

About 62 percent and 33 percent of the sampled household heads were engaged in fishing activities as their main source of livelihood before and after the sea defence wall respectively. However, the percentage of respondents in farming, trading and artisanship increased from 5.9%, 14.2% and 6.6% to 23.9%, 20.9% and 10.5% respectively after the construction of sea defence wall as shown in Table 3.

<table>
<thead>
<tr>
<th>Livelihood Source</th>
<th>Before (%)</th>
<th>After (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishing</td>
<td>61.9</td>
<td>33.3</td>
</tr>
<tr>
<td>Trading</td>
<td>14.2</td>
<td>20.9</td>
</tr>
<tr>
<td>Farming</td>
<td>5.9</td>
<td>23.9</td>
</tr>
<tr>
<td>Civil/Public Service</td>
<td>11.4</td>
<td>11.4</td>
</tr>
<tr>
<td>Artisanship</td>
<td>6.6</td>
<td>10.5</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

n = 182

Source: Field Survey, March, 2016
After the construction of the project, fishing activities became difficult and therefore declined considerably; the reason being that the groynes had occupied space used by fisher folks to drag their nets offshore. Another reason reported by a household head was: “Our major problem is that we are unable to catch fish because the tree stumps and the concrete stumps left in the sea after the sea had destroyed our houses were in the sea and whenever we cast our nets, these concrete blocks and tree stumps damaged them. The situation has reduced the quantity of fish caught and has affected the life of fisher folks”.

Effects of Sea Defence Project on Livelihood Assets of the People

The sea defence projects often have positive and negative effects on the livelihood assets of the affected people. The results of the study are presented and discussed in the following sub-sections.

Effects on Physical Capital Assets

The observation checklist revealed that infrastructure provided for the people in Kedzi and Vodza-Adzido communities after the sea defence project included improved road condition, housing units for the affected people, water and sanitation facilities, schools, reclaimed land and electricity. According to DFID (1999), physical capital is an essential element in building and supporting livelihoods of people. The project has brought about changes in the environment and the necessary facilities that help people to meet their basic needs and be more productive. The improved road network (Plate 2) has reduced travel time. All the household heads interviewed revealed that, they were satisfied with the nature of road.

![Plate 2: Road network before and after sea defence project](image)

Source: Field Survey, March 2016

About 95.6 percent of them testified that, travel time and waiting time had reduced. A respondent (driver) reported that:

“Before the project, I used to take my vehicle to the mechanical workshop every three days in a week due to the bad nature of the road. But now the maintenance cost of the vehicle has reduced as a result of the improved road condition”.

On the contrary, a respondent raised the concern that: “The lagoon and the sea cannot give we fishermen enough catch (fish) for sale to improve our well-being. Hence providing only good road condition cannot enhance our standard of living.”

A cadastral survey report indicated that the project involved the demolition of 824 structures and properties of the people in Kedzi and Vodza-Adzido. This was done to enable the Government of Ghana to properly compensate individual property owners and ensure that the provision of physical capital is an essential element in building and supporting livelihoods of people. The project has brought about changes in the environment and the necessary facilities that help people to meet their basic needs and be more productive. The improved road network (Plate 2) has reduced travel time. All the household heads interviewed revealed that, they were satisfied with the nature of road.
The study also revealed that households that had not received new housing units tried to build their own self-constructed thatch houses with iron sheet. One household head had this to say:

“We are exposed to all weather conditions such as heavy rains, thunder waves, strong winds. We are also denied of land to build our own permanent houses so we plead with the authorities to grant us the permit to build our own houses.”

Loss of housing units leads to a severe drop in living standards. However, Cernea (1998) observed that payment for demolished dwellings at replacement value would enable the affected families to set up their new houses. Table 4 shows that 45 houses were to be constructed but 38 were ready in the two Vodza-Adzido and Kedzi communities in 2014. Primary data for the table was collected from National Disaster Management Organisation (NADMO) office in Keta during field survey.

Table 4: Completed housing types for affected communities

<table>
<thead>
<tr>
<th>S/No</th>
<th>Project Title</th>
<th>Community</th>
<th>Source of Fund</th>
<th>No. to Construct</th>
<th>No. of Houses Ready</th>
<th>Date Started</th>
<th>Year Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction of 3 No. type A resettlement house</td>
<td>Vodza-Adzido Kedzi</td>
<td>Government of Ghana</td>
<td>3</td>
<td>2</td>
<td>18/10/12</td>
<td>2014</td>
</tr>
<tr>
<td>2</td>
<td>Construction of 9 No. 3-bedroom type B resettlement houses</td>
<td>Vodza-Adzido Kedzi</td>
<td>Government of Ghana</td>
<td>9</td>
<td>6</td>
<td>18/10/12</td>
<td>2014</td>
</tr>
<tr>
<td>3</td>
<td>Construction of 33 No. 2-bedroom type C resettlement houses</td>
<td>Vodza-Adzido Kedzi</td>
<td>Government of Ghana</td>
<td>33</td>
<td>30</td>
<td>18/10/12</td>
<td>2014</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>45</td>
<td>38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey, March, 2016

Before the project, Vodza-Adzido and Kedzi communities were in total darkness. The majority (95.6%) of the sampled household heads expressed their happiness that the greatest positive impact of the sea defence on the communities was the supply of electricity. A respondent said:

“The provision of electricity under the rural electrification programme supplied free metres and this made it possible for us to connect to the national grid without any difficulty and now the whole community has light.”

Another major effect of the project was the total land reclaimed from the lagoon and the sea. The Ministry of Water Resources, Works and Housing (2001) reported that the creation of 272.5 hectares of land has been designated for reclamation. Out of this land, 60 percent was for habitation, 23 percent for industry establishment and 15 percent had been left between the sea and habitation areas as a zone of tidal influence of the sea, and 2 percent for the Bird Island constructed in the lagoon. A key informant at the Town and Country Planning Department revealed that 30 hectares of land in Vodza-Adzido area could not be reclaimed due to reluctance of inhabitants to move out of the area. The total habitable land area was to be acquired by the government. The implication was that before any development on the land, permission needs to be granted by the Assembly.

A household head lamented that:

“I wrote to the Municipal Assembly for a release of our family land to build a house because the housing unit given to us could not accommodate my family and for the past five years, my application has not been considered.”

Provision for water and sanitary facilities forms an integral part of improving the livelihoods of the people in the affected communities. The study indicates that each housing unit provided for the people has toilet facility but
not all the houses have sceptic tank. Nonetheless, the communities were served with public toilets. However, some people preferred to defecate along the coast and on the rocks used for the sea defence. The respondents reported that for the past two years, the pipe-borne water provided had developed a fault, thereby creating irregular flow of water. Hence households had to queue for water.

**Effects on Natural Capital Assets**

Natural capital can be tangible and intangible goods for production (DFID, 1999). The natural capital of the people included the lagoon, sea, salt deposit, and access to land for farming. About 61 percent of the household respondents were fisher folks who depended on the lagoon and the sea for survival. After the project, the fishermen had encountered difficulties in pulling their net offshore because the collapsed buildings and tree stumps left in the sea hooked the nets. Also, the groynes used for the defence had occupied space, thereby making it difficult for fishing.

A household head interviewed at the beach said:

"Since morning around 4am, we cast the net into the sea to catch fish for our survival and we landed offshore at 12 noon because the net had hooked the houses, trees and blocks which the sea had destroyed before the defence, and we had to go to the sea to disentangle the net before dragging it offshore. All these challenges have prevented us from catching enough fish. Look, since morning the little fish we have cannot be enough for us all, some of us have to go home empty handed".

The study indicated that women who smoke fish for sale could not do business because they hardly got enough fish. One of the women interviewed said:

"Since the construction of the sea defence we are not able to smoke as we did, our ‘Agbado-chorkor smoker’ (ovens) are left idle, selling of fish is our only job but now there is no enough fish to smoke and sell."

The fishermen used different methods of catching fish from the lagoon. Some of them resorted to the use of mosquito nets as the latest means of catching small fishes (Plate 4). The main problem the market women faced in selling the fish was lack of ready market. The best they could do was to dry the fish under the sun.

According to Cernea (1998), land is the main foundation upon which people’s productive systems, commercial activities and livelihoods are constructed. Landlessness leads to pauperization of displaced rural people. The respondents argued that the individuals whose family lands are in the hands of the government must be considered by allowing them to have access to their ancestral lands. The study revealed that some individuals have begun backyard garden while others have started preparing the land for farming.

**Effects on Human Capital Assets**

Before the construction of the project, schools and health centres were destroyed by the sea, thereby hindering human capital development. Human capital development involves education of the people, health and ability to work to enhance the living conditions. With the sea defence project, educational and health facilities were provided for the people.
From the survey, the communities were satisfied with the educational facilities. An interviewee reported that:

“I am so much elated with the schools we have in the community now, this will go a long way to produce human resource for the communities and the project has saved our children from travelling long distances”.

A notable one is the Kedzi Vocational and Technical Institute (KEVOTECH), which is a training institute that offers courses such as carpentry, masonry, dressmaking, hairstyling, electrical engineering, painting and decoration. Many adults have acquired skills and established themselves, thereby improving their livelihoods.

After the sea defence project, the Kedzi Health Centre (Plate 5) was built to provide health care needs for the people. People were exposed to all kinds of water borne diseases, malaria, cholera, diarrhoea among others. About 90.1 percent of the respondents confirmed that malaria was the prevalent disease in their communities. The respondents were satisfied with the health care delivery. Before the sea defence they used to trek to other places to access health care, but with the health centre provided, they only walked for less than 10 minutes to receive health services.

Plate 5: Kedzi Health Centre
Source: Field Survey, March, 2016

**Effects on Social Capital Assets**

Social capital explains the relationship existing between members of corporate organisations, families, formalized groups, and individual friendships to share views, values, trust and to team up together in order to gain human supports, financial support to facilitate economic opportunities as far as livelihood is concerned. The study considered social capital as a means of improving livelihoods after the sea defence project. Kedzi and Vodza-Adzido communities had fishermen association that supported and improved the livelihoods of the members. For example, during coastal erosion, where people lost their nets and boats, the members of the association came together to pool resources to replace the nets.

The household respondents indicated that, they had strong relationships within their families. Some of their family members have migrated to cities and towns. The rural-urban kinship union was weak but the sea defence project has engendered strong relationships among relatives. After the project, some migrant relatives have come back to build new housing units and occupied them.

A household head’s narration is quoted below:

“Before the project, family members were not ready to support you whenever you are in a bad situation, when you ask for help no one is ready to support, and I think life can be better if one does not depend on family for support.”

Individual members of the community belonged to some religious groups, which contributed to the development of livelihoods of the people. Some groups had scholarship schemes for needy but brilliant students. Others who could not make it to school were enrolled as apprentices to acquire skills. The Roman Catholic Church built a basic school at Vodza. All these were possible as a result of the sea defence project.

**Effects on Financial Capital Assets**

The financial capital comprises savings, credit facilities, loans from the banks, investment and personal contributions to improve and have an enjoyable living condition. The study revealed that before the project, savings from household livelihood sources were in the form of “susu” —a mutual saving system whereby a group is formed and members made daily, weekly or monthly contributions, which they took turns to withdraw. After the sea defence, many household heads indicated their inability to save because they had lost their properties. Fishing business has become difficult as women could no longer smoke enough fish for sale.

A household head said:

“We are jobless, we do not have work to do. If you are working it is very easy to save and if you are not working you cannot save. The little we have is spent on food, children school fee and medicine, so we don’t save.”

Individuals often take loans and financial supports from banks and other financial institutions to fuel their business. Before the construction of the sea defence project various household heads owned lands, and other valuable properties that could serve as collaterals for loans. After the project and resettlement of the people, all lands were vested to the Government of Ghana so households have no land to serve as collaterals.

A key informant at the Municipal Assembly reported that all lands in Keta belong to individuals and families and that 213 of 272.5 hectares of the land reclaimed had been demarcated for residential and industrial use. He further indicated that there were plans to give out the remaining land to individuals and families whose lands were lost during the sea erosion.
CONCLUSIONS AND RECOMMENDATIONS

The sustainable livelihood framework provides evidence that the Keta Sea Defence Project had both positive and negative consequences on the livelihoods of the people. The positive effects included the provision of social services and infrastructure development in the Kedzi and Vodza-Adzido communities. The two communities were served with electric power, pipe-borne water, school buildings, health centre at Kedzi, improved road condition and land reclaimed from the lagoon and the sea. The negative effects included inadequate housing units, loss of viable fishing activities, loss of ownership of reclaimed lands to the government, landlessness, inability to save and difficulty to access credits.

Based on the findings, six recommendations are directed to the various stakeholders in relation to the livelihoods of the people. First, the government should negotiate with the affected families on how the lands reclaimed can be utilised effectively and efficiently to benefit both local and national economies. Such lands should be managed under the municipal planning scheme. Second, the Assembly should actively involve the communities in the preparation of planning schemes for the reclaimed lands for sustainable development. Third, the Municipal Assembly should partner with the Ministry responsible for sea defence projects and Real Estates companies to construct more housing units and landing sites. Fourth, Municipal Assembly should partner with Ministry of Fisheries to train the fishermen on modern fishing practices that go beyond seine fishing. Fifth, the Municipal Assembly should allocate houses fairly to the affected households in the community. Sixth, religious organisations should offer their social responsibilities by establishing training institutions to train the youth to acquire knowledge, skills and positive attitudes to become responsible citizens.

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