UNIVERSITY OF CAPE COAST

BLUE ECONOMY, SOCIAL RESILIENCE, AND SUSTAINABLE DEVELOPMENT GOALS IN GHANA

BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

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Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis as laid down by the University of Cape Coast.

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ABSTRACT

For years resource economists studied the potentials of the green economy and how to achieve growth and development through it. The blue economy (i.e., the ocean resources) is an alternative that could drive growth and development. Human beings' interactions with the oceans, in terms of exploitation and use of its resource have been changing causing an unsustainable use of the ocean. How to sustainably exploit and use ocean resources has lately come to be known as the blue economy. This study relates the blue economy to social resilience and sustainable development goals in Ghana. The first empirical chapter examines the socioeconomic characteristics of coastal communities and its implications for the blue economy using the Ghana Living Standard Survey round 7, and ordinary least squares regression (and descriptive, charts and tables). The second empirical chapter explores the state of social resilience of fishermen using primary data. The third empirical chapter did a systematic literature review on blue economy link to sustainable development goals. It was found that most marine communities in Ghana have some level of poor amenities that are potential threats to the blue economy. On another note, coastal households enjoy high welfare living, which is good ground for the blue economy principles as livelihood diversification could reduce pressure on fishing. However, rural coastal communities' have appalling socioeconomic characteristics. Fishermen along the coast of Ghana are socially resilient to some extent. Also, the blue economy has a link to majority of the SDGs particularly goal 14. Policy lens should incorporate socio-economic concerns into blue economy strategies.

KEYWORDS

Blue economy

Coastal communities

Fishermen

Social resilience

Sustainable development goals

Ghana

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DEDICATION

To my Children, Falah, Fareeda, Fajr, Fideen, and Etiam

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LIST OF ACRONYMS

AfDB	-	African Development Bank
ATLAFCO	-	Fisheries Cooperation among African States Bordering the Atlantic Ocean
AU	-	African Union
CRC	-	Coastal Resource Center
EEZ	-	Exclusive Ecological Zone
FAO	-	Food and Agriculture Organisation
FAOSTATS	-	Food and Agriculture Organisation Statistics
FICCI-KAS	-	Federation of Indian Chambers of Commerce and Industry-Konrad Adenauer Stiftung
FGD	-	Focus Group Discussion
GLSS	-	Ghana Living Standard Survey
GSS	-	Ghana Statistical Service
GDP	-	Gross Domestic Product
IUU	-	Illegal, Unreported and Unregulated
KII	-	Key Informant Interviews
MPA	-	Marine Protected Areas
MSP	-	Marine Spatial Planning
MoFAD	-	Ministry of Fisheries and Aquaculture Development
PCA	-	Principal Component Analysis

RIMA	-	Resilience Index Measurement and Analysis
SAU	-	Sea Around Us
SDG's	-	Sustainable Development Goals
UN	-	United Nations
UNECA	-	United Nations Economic Commission for Africa
UNDESA	-	United Nations Department for Economic and Social Affairs
UNDP	-	United Nations Development Programme
UNEP	-	United Nations Environmental Programme
UNCTAD	-	United Nations Conference on Trade and Development
USAID	-	United States Agency for International Development
WDI	-	World Development Indicators

CHAPTER ONE

INTRODUCTION

Human interactions with the oceans, in terms of exploitation and use of its resource, keeps changing over the past years. The ocean is not only a source of basic human needs such as food, fodder, and energy, as well as medicines and enzymes, but also the non-market goods and services (air regulation) which are vital for human life and livelihood. Almost 90% of global trade is transported over the ocean (African Development Bank-AfDB, 2018) and about 30% pull of global hydrocarbons are from the ocean which is good for different energy production (United Nations Economic Commission for Africa-UNECA, 2016). The most prominent human engagement with the ocean is fishing, where many people, including the poor, vulnerable, and less advantaged, earn their livelihoods (Sakhuja, 2015).

The channels of human usage and extraction of the ocean resources have been noted to cause unsustainability issues. It is observed that the cost of human uses of ocean resources is on the highest cost to marine ecosystem degradation (World Bank & UNDESA, 2017). Also, the ocean has been polluted majorly by large metric tons (4.4 and 12.7 million) of debris from land-based sources (Jambeck *et al.*, 2015; Schmidt *et al.*, 2017a). Thus, how to sustainably managed oceans resources is on the global agenda in recent times.

There is the need to look at how to understand the oceans in a dichotomy of environmental and social spheres as a new way of managing ocean resources (United Nation Environmental Programme-UNEP, 2015). There are estimations

that, if fisheries are well managed by consciously working to reduce overcapacity and overfishing significantly, could expand world economic benefits from marine for over US$ 80 billion annually (World Bank, 2016).

The sustainable exploitation and use of ocean resource is known as the blue economy (UNEP, 2013; Food and Agriculture Organisation-FAO, 2017). The notion of the blue economy encourages maximizing ocean resource usage without environmental destruction. Its core aspect lies in the idea of integration of socio-economic developments in the realms of environmental sustainability in ocean resource exploitation (AfDB, 2018; UNEP, 2015; UN, 2015).

There are indications that marine policy changes had impacted marine communities, and thus adapting to the impact of marine policy changes and climate change is vital. This thesis discussed the blue economy-social resilience relation to sustainable development goals attainment and surmised that the tenets of the blue economy could enhance the achievability of some of the SDGs. Thus, the social resilience nature of coastal communities plays a key role to achieving a blue economy (Karakara & Dasmani, 2022).

Background to the study

The ocean importance is so great that to say that human beings cannot do without it is almost stating the obvious. Throughout history, the ocean[1] has offered an enormous support to human life. The ocean drives global systems that makes the earth habitable for man. The ocean does this through its regulation of temperature,

[1] In this study the words “Ocean” and “Sea” are use interchangeable as has been referred to in the literature

chemistry, and currents. It is indicated that the ocean regulates the air we breathe, rainwater, weather, climate, and coastlines and provides food, medicines and oxygen for human breath (UN Department of Economic and Social Affairs-UNDESA, 2019). The ocean comprises almost 70% of the earth's surface (Sakhuja, 2015) and 90% of global trade are carried through the ocean (AfDB, 2018; UNECA, 2016). The World Seaborne trade is estimated to have reached 10.7billion tonnes and estimates had it that it would expand by 3.8 per cent rate compounded annually between 2018 to 2023 (United Nations Conference on Trade and Development-UNCTAD, 2018). The global economic output of the oceans as estimated by the Commonwealth (2016) is US$2.4trillion as captured in Figure 1.

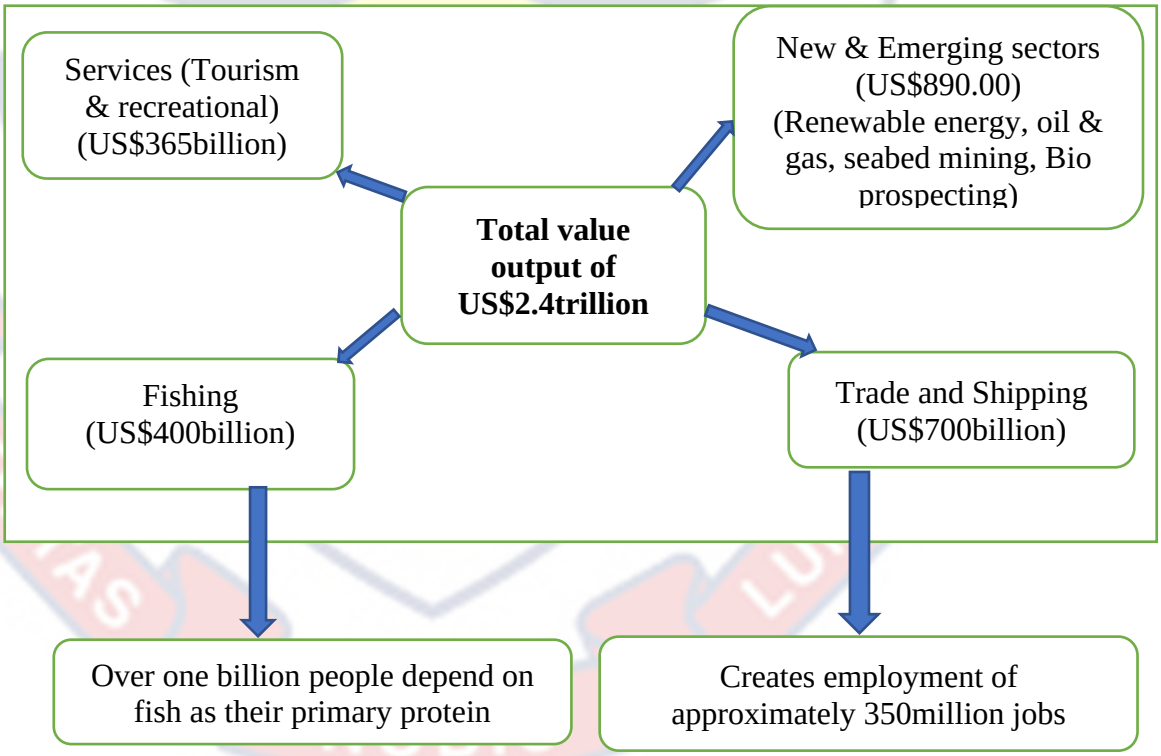


Figure 1: Global economic output of the oceans
Source: Author's own construction based on The Commonwealth (2016).

Aside these benefits of the ocean enumerated in the previous paragraphs, the most prominent human engagement with the ocean is fishing, where many people, including the poor, vulnerable and less advantaged, earn their livelihoods (Sakhuja, 2015). The ocean is a source of work for billions across the globe (FAO, 2020). It is estimated that 97% of fishermen in the world are from developing countries and that fish production at the global scale reached about 179 million tons in 2018 of which 156 million tons went into direct human consumption (FAO, 2020). Marine fish is said to contribute above US$270billion to world GDP annually (FAO, 2020). Ocean resources serving as a good source to economic growth and food security, provides livelihood to about 300million people involved in the sector. It is also a major source of animal protein, essential micro-nutrients and omega-3 fatty acids for more than three billion people globally (FAO, 2016a).

Africa is not left out of its contributory share to global fisheries and aquaculture. The continent (Africa) is rich in varieties of naturally occurring – living and non-living – resources (which includes, but not limited to, water, flora & fauna, fish stocks, minerals and hydrocarbons) and with the 54 countries, 38 are coastal states (Rustomjee, 2018; UNECA, 2016). There are estimates that Africa has about 13 million square kilometers of maritime zone and its territorial seas and exclusive economic zone (EEZ) are approximately 6.5million square kilometer for the continental shelf exist. It is said that freshwater and ocean fish make a vital contribution with over 200million Africans rely on for their source of food and nutritional security and provides income to over 10million people (FAO, 2014a).

The channels of human usage and extraction of the ocean resources, over the years have been changing. The nature of fishing has been regarded as one of the unsustainable exploitations of ocean resources (Sakhuja, 2015). Apart from the large pollutants that the ocean receives from land (Jambeck *et al.*, 2015; Schmidt *et al.*, (2017a) there are estimates that the fish stock that are fully exploited is about 57% of the fish stocks and the stock that are over-exploited or depleted or are recovering consist of 30% (FAO, 2016a). Fish is further exploited by the menace of IUU fishing, causing about 11 – 26million annual loss of tons of fish catch or US$10-22billion that are unlawful or undocumented revenue. While IUU is prevalent along Africa's coastline, West Africa has the worse cases (Daniels, et al., 2016). Several economic sectors now rely on ocean resources causing further exploitations and coupled with climate change issues puts further strain on the ecosystem of ocean.

This has raised concerns as to how to sustainably manage the ocean as development spaces. Globally, the benefits of the ocean to human beings as illustrated in the previous paragraphs, if the ocean is managed sustainably it would continue to support humans forever (Federation of Indian Chambers of Commerce and Industry-Konrad Adenauer Stiftung–FICCI-KAS, 2019; FAO, 1996). For instance, fishing alone can provide global annual economic benefit more than US$80billion (World Bank, 2016) if well managed. Therefore, the issue of dangers of unsustainable approaches or practices should be of concern. Thus, there is the need to understand the oceans, by incorporating issues of the environment and social aspects of the ocean (UNEP, 2015).

This has led us to the issue of ocean governance playing a key role. The ocean governance runs through maritime security, to marine pollution, sustainable blue economy, climate change, marine protection and sustainable fisheries. The concept ocean governance has been defined by different scholars and organisations in different ways. For instance, Pyc (2016; p159) defines it as "*ocean governance means the coordination of various uses of the ocean and protection of the marine environment*". Also, the World Ocean Council (2018; p2) defines it as "*Ocean Governance (OG) is the foundation of rules, institutions, processes, agreements and arrangements based on which economic activities are undertaken*".

Blue economy is integral part of ocean governance and it has been indicated that for the Blue Economy to be an effective and transformative new approach to oceans governance it will need to be; socially supportive, or able to provide tangible and equitable benefits to society, including social wellbeing, environmental protection and economic welfare and; also provides support, through its component sectors, industries and businesses. In the essence, ocean governance and blue economy preaches the trade-offs in resource use and environmental management. Thus, some scholars have conceptualized this as ecological governance. Turton et al (2007) offered some definition of ecological governance to be a process of informed decision-making that enables trade-offs between competing resource users so as to balance environmental protection with beneficial use in such a way as to mitigate conflict, enhance equity, ensure sustainability and allow accountability.

The sustainable exploitation and use of ocean resources has lately come to be known as the blue economy (UNEP, 2013). The blue economy preaches the maximisation of the exploitation and use of naturally occurring ocean resources given ecological constraints, and the integration of socio-economic developments in the realms of environmental sustainability (Sakhuja, 2015; AfDB, 2018; UNECA, 2016; UNEP, 2015; UNDESA, 2014). The components of the blue economy are diverse, from fisheries, through tourism, to maritime transport and renewable energy (AfDB, 2016; Akinyemi *et al.*, 2019). A pictorial representation of the components of the blue economy is captured in Figure 2. It shows that the key things to do are sustainable fisheries, lessen the impact of shipping on the ocean, and protect the ocean ecosystem and renewable energy.

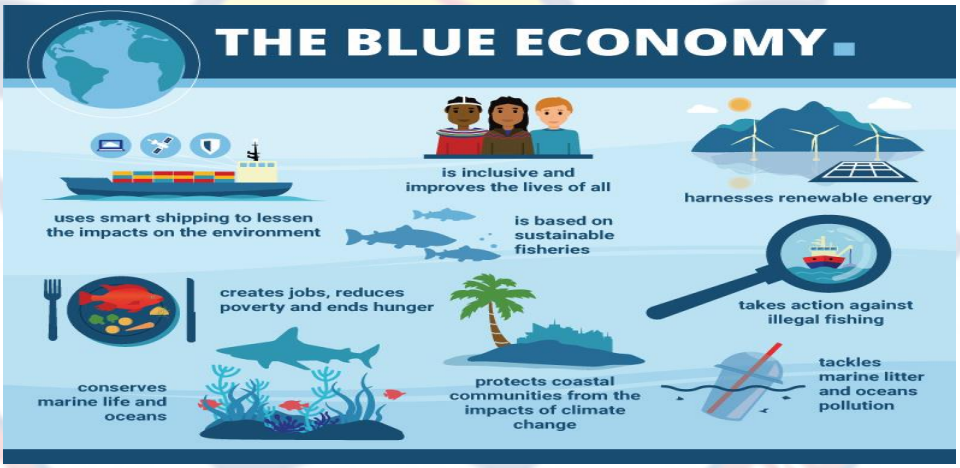


Figure 2: Components of the blue economy
Source: UNDESA (2019)

Integrating the achievements of the triple-hurdle of environmental, economic and social aspects of sustainable development of the ocean is the blue economy's vital aspect. A *prima facia* of the blue economy involves how the already established industries of the ocean are transitioning to practices that are more environmentally responsible. The fisheries industry presents an early case on

this. The Blue Growth Initiative of the FAO of the UN aim to help member countries in their development and implementation of blue economy and blue growth agenda by; (i) help eliminate overfishing and harmful fishing practices, end IUU fishing, improve construction and build sustainable fishing (ii) helping in the area of policy development to tackle food security, poverty levels and sustainable aquatic resources management (FAO, 2017).

Changes in policies to efficiently exploit and use ocean resource is a cornerstone of the blue economy concept. This entails changes in marine policies, rules, regulations and practices available to help conserve marine resources and above all ocean governance is key. Ocean governance that preaches reorientation of rules on marine protected areas (MPAs), Marine Spatial Planning (MSP), discouraging bad fishing habits (ban the use of chemicals), policies to reduce marine pollution, overfishing, and illegal fishing, among others, could help conserve marine resources. MSP helps to achieve the viability of changes in ocean regulations, zoning, management, protection and sustainability of the ocean ecosystem (Meaden et al. 2016).

MSP is a situation of creation of maps of marine areas. These maps capture how, and where marine resources are used, and the kind of habitats and marine natural resources are in the catchment area. An MSP informs which part of the marine environment should be protected (MSP), zoned or forbidden for fishing to help conserve the ocean resource. There are conclusions that if fisheries are regulated and governed well, it can make significant contributions to blue economy in a long-term (World Bank & UNDESA, 2017). Also, Melcher et al., (2018)

indicated that fish stocks are found to be highest in fishing grounds that are protected areas. Hence, regulatory reforms are vital part to a transition towards a blue economy.

The blue economy concept was first highlighted in the 2012 Rio+20 Conference which summarised that conservation and sustainable ocean management, could lead to achievement of a healthy ocean to achieve sustainable development (UNDESA, 2014). The blue economy concept is also known as, "*Blue Green Economy*" or "*Blue Growth, the new maritime Green Economy*" (EU, 2011), "*Green Economy in a Blue World*" (UNEP, 2012), "*Blue Growth*" (FAO, 2017) or "*Green Growth in Fisheries and Aquaculture"* (OECD, 2016) and evolved recently, in support of sustainability of natural marine resources. The concept 'Blue Economy' has been used in different ways by different scholars and organisations across the globe. Some organisations or scholars refer to it as "Ocean economy" or "Marine economy" without a clear-cut definition. the United Nations gave a definition of the "Blue Economy" as an ocean economy that aims at "*the improvement of human well-being and social equity, while significantly reducing environmental risks and ecological scarcities*" (UN, 2014, p.2). Also, the World Bank defined "Blue Economy" as "*the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem*" (World Bank 2017, p.6). Thus, there is no common agreement of what the terms 'Blue Economy' and 'Blue Growth' mean either in principle or in practice, but different actors refer to it according to their main agenda and objectives (Silver et al., 2015; Voyer et al., 2018).

Globally, the drive for adoption of the blue economy is gaining momentum as many international organisations as well as national governments have put together documents as a roadmap to achieving that (Mele, 2014). The UN Sustainable Development Summit, held in September 2015 in New York, adopted the Agenda for Sustainable Development Goals (SDGs) attainable by 2030. Among the goals, Goal 14 is directly in line with the blue economy concept even though the goal never stated explicitly the word blue economy. Again, the UN Conference in 2017 to support the implementation of SDG goal 14 was held. Also, the "Jakarta Concord" reiterates the need to promote the blue economy as a crucial part of efforts of an inclusive economic growth in the Indian Ocean Rim Association (IORA). The Sustainable Blue Economy Conference, held in 2018 in Nairobi, Kenya, where deliberations among other things like achieving resilient coast, managing sustainable marine life and the conservation and sustainable economic activities, people, culture, communities and societies further gave an impetuous to countries wanting to adopt the blue economy principles. UNECA (2016) conceptualized that, there three broad pillars of the blue economy; these are the Environment sustainability, Economic sustainability and Social Sustainability. The environmental aspect is regarded as the blue economy core principle, while economic sustainability and social sustainability are twin issue of being economic and social resilient.

As indicated earlier, the blue economy entails reorienting marine rules, regulations, policies, practices and guidelines on marine resource extractions and usage. However, such changes when taken place could limit the ocean resource use,

and this will in the short term or immediately affects those who depend on the ocean directly (fishers) for livelihood (Beaumont, 1997). Thus, such changes should consider not only biophysical but also socioeconomic concerns. This is because the ocean resource regulations have direct implications on people access to, use and control of the ocean resources. These implications could affect the marine communities' economic and social structures that affect the populace. Thus, enhancing the coping strategies of marine communities is vital to adapting to any possible effects that might emanate from the economic and social spheres of the community. This is the idea of social resilience in marine communities (Keck & Sakdapolrak, 2013; Egbetokun *et al.*, 2018; 2020) as Adger (2000) puts it that social resilience is when individual or group of individuals have the ability to cope with external pressures emanating from social, political or environmental spheres.

Social resilience is strictly connected to economic and environmental resilience. Hence, the adoption process in social resilience involves the dependence of agents on each other through their interrelations with each other, with the changing dynamics of institutions available and with resource on which they depend (blue economy menace) (Adger et al. 2002). In theory, social resilience is found to be related to social capital (Norris et al. 2008; Coleman, 1990) and the literature on social capital (Putnam, 1993; Bourdieu, 1986) recognizes social capital to have influence on the use of natural resources and environmental risk (Adger, 2002). A well-established and functioning sphere of social resilient population heighten the probability of achieving sustainable development in an environment where human livelihood depends much on economic activities related to natural

resource usage (Holling, 2001). To enhance blue growth and achieve sustainable development goals, emphasis could be placed on the social resilience of marine communities to facilitate the success of marine policies (Sarker *et al.,* 2018).

The blue economy can be an impetus to achieving most of the SDGs. Ocean development is one of the key aspects of the UN SDGs. In line with the blue economy, SDG 14 in particular refers to "*conserve and sustainably use the oceans, seas and marine resources for sustainable development*". The concept and cornerstones of the blue economy is found to be associated with many of the SDGs in several aspects. Marine and aquatic resources play a vital role by supporting different sectors of the economy and affects livelihoods by creating employment to end poverty (SDG 1), enhance sustainable food production to achieve food security (SDG 2) and many more. Neumann and Bryan (2015) indicated that SDG 14 supports nine other SDGs (SDG 1, SDG 2, SDG 3, SDG 5, SDG 8, SDG 9, SDG 10, SDG 11 and SDG13) (Neumann & Bryan, 2015; Spalding, 2016). In a similar vein, the UN (2015) indicated that, in theory, fish, fisheries and food and nutrition security are intertwined with several of the SDGs (including SDG1-no poverty; SDG2-zero hunger; SDG3-good health; SDG8-work and growth; SDG14-life below water; SDG16-peace, justice and strong institutions and SDG17-partnership for the goals). The Mauritanian government, upon understanding that ocean living resources have said to be much higher in total value and renewable compared with mineral resources, pushed the government to look at the blue economy as a substitute developmental approach to achieving some of the SDGs (Mele, 2014).

The need to study the blue economy is necessary for some reasons. First, its study could provide understanding on the issues to focus on when drafting policies relating to the blue economy to help achieve sustainable development. Second, an appreciative of the blue economy tenets, nature and likely opposing issues that could affect it will help to achieve negotiations on the way-forward to protection and sustainable use of the ocean (UN General Assembly, 2015; Wright *et al.*, 2018) leading to an attainment of some of the SDG's targets in the long run. Third, there have been different policy documents (not homogenous) by different authorities on blue economy and the fact that the concept (blue economy) is evolving, there is much need to conceptualise this to offer a further understanding on the concept to help policymaking. Most studies on the blue economy are concept notes (Sakhuja, 2015), reports (AfDB, 2016; World Bank & United Nations, 2017), narratives on the concept of the blue economy (Howard, 2018), and literature reviews (Bari, 2016). Also, studies on the blue economy overlooked the social dimension of sustainable development. Hence, these studies on blue economy do not look at blue economy-social resilience link to sustainable development goals. Thus, this study relates the blue economy to social resilience and sustainable development goals in an econometric analysis and conceptualised the issue to help researchers and marine policymakers in analysing the blue economy and coastal communities.

Statement of the research problem

The growth in economic activities of ocean resources (including fisheries and aquaculture) has suffered unsustainable exploitations in recent times. It is noted that, such unsustainable growth in fisheries has led to overfishing, ecosystem

degradation and biodiversity loss that affect fish stocks (Ababouch, 2015). This situation is partly caused by human pressures on the ocean resources (Jambeck et al, 2015). It has been stated that these human pressures have caused long-term and irreversible ecological shifts which have reduced ecosystem resilience. This human pressure has affected the potentials that ocean resources can offer. These pressures are mainly coming from diminishing land resources to meet the growing demand by population (FICCI-KAS, 2019). Thus, the dangers of unsustainable approaches or practices to the ocean resources are apparent and should be of concern.

Reorienting current marine policies and establishing and strengthening ocean governance are some approaches that can be used to reverse these trends (Weigel et al. 2014). Though the international community has recognized importance of the ocean's contributions to sustainable development (as captured in many agreements such as; Agenda 21, the Rio+20 Outcome document, the 2030 Agenda, AU Agenda 2063 for development), the challenge is in understanding the start point leading to changes that help to achieve a blue economy by strengthening the bonds between social, economic and the environment (The Commonwealth, 2016). Within the blue economy discourse, there seems to be limited experiences and practices to help lead to enhances human and ecological well-being (UNECA, 2016).

There have been many integrated blue economy road maps in Europe, Asia and the America. However, in Africa, many countries are yet to put together an integrated blue economy strategy and road map (Rustomjee, 2018) despite the AU's initiatives such as the 2050 Africa Integrated Maritime Strategy, which is a long-

term blue economy strategic development (AU, 2014). Thus, there is the need for a comprehensive study on the blue economy in Africa to help in policy direction.

Most studies on blue economy are reports (FICCI-KAS, 2019; AfDB, 2018; World Bank and UN, 2017), literature review on the concept definition or narratives of the blue economy (Howard, 2018; Bari, 2016), studies on welfare of fishers and fishing communities (Akpalu, Dasmani & Normanyo, 2015; de Graaf & Garibaldi, 2014; McClanahan, Davies & Maina, 2005), and the importance of the oceans to economic growth and development (AfDB, 2018; de Graft & Garibaldi, 2014; FAO, 2014b). For instance, Abdrabo (2008) studied the socioeconomic conditions in coastal areas of Rosetta in Egypt and Oued Laou in Morocco and found that those communities have poor road network, high illiteracy among fishers and poor health services were evident in the two areas. However, the study neglects the issue of how these socioeconomic factors could affect the sustainability of the coastal resources.

Also, Wijayanti and Pratomo (2016) studied the adaptation of social-economic livelihoods in coastal community. However, their study was done mainly on how fishers respond to natural disasters by building their social and economic resilience or how natural occurring disturbance. To the best of my knowledge there is seldom an econometric study on the blue economy and social resilience across the globe.

In Ghana, the coastal area is the smallest region, but has more than 25% of Ghana's population (Ghana Statistical Service, 2014). Adopting blue economy concepts could help the country to achieve growth and development as well as

resilient communities that can withstand shocks (Karakara et al. 2022). Thus, there is the need to study the prospects of the blue economy in Ghana. Since changes in marine resource use policies will possibly limits marine resource usage, the adaptive capacity of marine communities should be strengthened to overcome any consequences arising out of the limits to their resource usage. Major changes such as loss in income, jobs, welfare and conflicts with cultural groups residing in marine communities, as against government conservation efforts, can affect marine policies that aimed to protect marine resources (Sakhuja, 2015) if the socioeconomic (social resilience) aspect of the policy is not taken into account. Also, there is virtually no study that tries to look at blue economy-social resilience link to sustainable development goals. Thus, this study emphasises that socioeconomic aspect of sustainable development is less-considered in blue economy concept and such should feature prominently in policy planning. Hence, this study also looks at the social resilience capacity of fishers within the coast of Ghana.

This study concentrates on the artisanal fishing sector in Ghana because; it is over 70% of the total fishing sector (see Figure 3) and among those employed in the sector, women represent more than 60%. The sector also serves as a link to many sectors and provides raw material especially such as fish-curring activities (Fisheries Cooperation among African States Bordering the Atlantic Ocean-ATLAFCO, 2012). Despite some importance Ghana drives from coastal resources, the ocean shores of Ghana are bedeviled with some challenges ranging from marine litter (pollution), unsustainable growth in fisheries, ecosystem degradation and

biodiversity loss, to defecation along the sea and shortages of premix fuel for fishermen.

There are estimates that 86 percent of Ghana's waste plastic load, is improperly disposed off resulting in plastics clogging up stormwater drains, rivers, and streams and ending up in the oceans. It is estimated that 250,000 metric tons of plastic waster are dumped from Ghana into the Atlantic Ocean (World Bank, 2020). The quality of marine resources in Ghana has declined rapidly over time, evidenced by the plastic waste littered along most beaches in Ghana, coupled with the drastic reduction in fish catch by local fishermen (Owusu et al., 2016). Pollution poses a health risk to fish. It reduces the productivity of fisheries, by degrading the natural habitat, increasing egg mortality and decreasing egg quality.

Again, it is noted that the small-scale fishers in Ghana is the major source of the national fisheries catch with over 70 per cent of these catch coming from the marine sub-sector (Atta Mills *et al.,* 2004; Marquette *et al.,* 2002) and many of these fishers are self-employed who are directly providing food for their households (FAO, 2014b). Also, in the global development agenda emphasis is now placed on ways to achieving sustainable small-scale fisheries (Courtney & Jhaveri, 2017; Jentoft, 2014; Charles, 2013; Cinner et al. 2013, Kittinger et al., 2013) and the Small-scale Fisheries Guidelines of the FAO encourages states to address human welfare and safety as well as gender equality along the value chain (FAO, 2015).

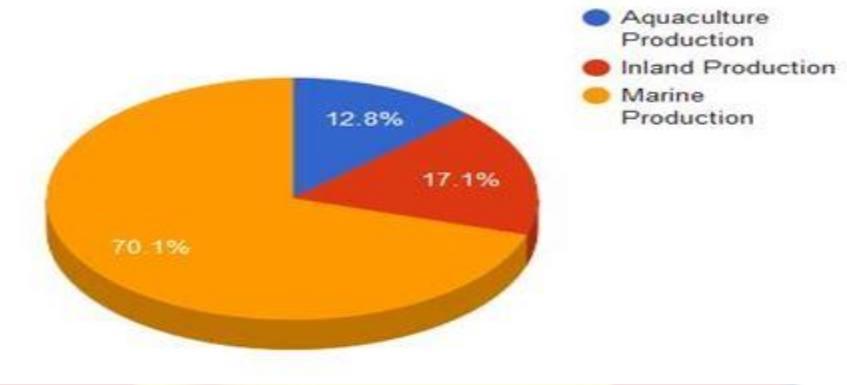


Figure 3: Fish production percentage contribution by sector in Ghana (2017)
Source: Ministry of Fisheries and Aquaculture Development (2018).

This study explores the blue economy link to social resilience and SDGs in Ghana to help researchers and marine policy makers in analysing coastal communities. In social resilience studies, one gap is the lack of studies that analyse social resilience and demographic variables link. Though some literature has explored certain variables (e.g., population growth and other socio-economic variables) effect on resilience of marine communities, it is still not explored in details. Some studies that have attempted to look at this concluded differently. Cinner (2005) and McClanahan *et al.*, (2006) both found lower population sizes to strongly and effectively influence traditional resource management in the villages of Papua New Guinea and Indonesia respectively and marine tenure system were relatively resilient to population growth (Cinner, 2005). These studies were on isolated marine villages. There is need to carry out more research to understand the association between demographic characteristics and social resilience.

It is important to study the link between demographics and social resilience for some reasons; an understanding of how the demographic sphere of a group influences their resilience capacity is an indicator on how to carve out policy to help increase their resilience. Policies on demographics (education, mobility,

population, age structure, family size, and economic status) could easily be drawn to help boost the resilience of communities. Also, tackling demographic discourses could lead to a community that would manage resources as well as behave to preserve its ecosystem. For instance, an educated populace will know how to live an environmentally sustainable life. Thus, demographic studies cum resilience of communities would be an impetuous to achieving blue economy.

As a way of contribution to theory, empirics, method and practice, this thesis dwells on; (i) the econometric analysis adopted (ii) the conceptualisation of the social dimension of sustainable development in the blue economy policy discourse. An econometric analysis tries to develop economic ways to forecast the behaviour to help in policy decisions (Karakara & Osabuohien, 2020a). Thus, the econometric approach this thesis adopts to measure the blue economy tenets could help in theorizing on the blue economy spheres. Also, the conceptual framework adopted in this study offers a guide to marine policy makers and researchers on some of the issues to concentrate in driving research and policy on marine resource use. Finally, the conceptualisation could be a guide on the pertinent things that should be studied and measured the progress of countries on the blue economy parlance. The conceptualisation could also be a means to spark knowledge on what to rely on in trying to measure the blue economy, thus, methods could emerge.

Purpose of the study

This thesis investigates the interrelationships between the blue economy, social resilience and sustainable development goals in sub-Sahara Africa (SSA) and Ghana in particular in an objective manner. The study contributes an understanding

to add to academic literature on blue economy-social resilience-sustainable development goals discourses to influence policy making on blue economy in Africa and Ghana in particular.

As said earlier, many African countries have not yet developed integrated blue economy strategies and road map (Rustomjee, 2018) despite the African Union's (AU's) 2050 Africa Integrated Maritime Strategy (African Union-AU, 2014). Also, within the blue economy there is limited experiences and practices that can be used to lead this transition that enhances human and ecological well-being (UNECA, 2016). Therefore, an encompassing study on blue economy, especially in Africa, will help inform policymakers on how to develop a road map document on blue economy in Africa.

In achieving the study's purpose, three affairs, as stated in the objectives of this study, are examined; (1) examination of the socioeconomic characteristics of fisheries-dependent communities in the context of the blue economy (2) fishermen social resilience to marine policy changes and (3) exploration of the link between blue economy and sustainable development goals.

Objectives of the study

This study's main objective is to explore the blue economy and its interrelations with social resilience of fishermen and the sustainable development goals in Ghana. Thus, the specific objectives are to:

1. Analyse the socioeconomic characteristics of fisheries-dependent communities in the context of the blue economy.

2. Examine the state of social resilience of fishermen along the coast of Ghana and assess the link between social resilience and demographic characteristics.
3. Explore the link between blue economy and sustainable development goals and the social aspect of sustainable development in the blue economy policy discourse goals.

Hypotheses of the study

1. Ho: The socioeconomic characteristics of fisheries-dependent communities are not conducive to ocean resources conservation in Ghana
2. Ho: Fishers along the coast of Ghana are not socially resilient to institutional change
3. Ho: The blue economy concept does not have any link to sustainable development goals.

Significance of the study

Achieving continuous economic development, sustainability of the environment, and social inclusion is the three hurdle that the international community is grappling with. Blue economy has been hailed as a new approach to tackle these three hurdle dimensions of human activities. Blue economy is a way of promoting economic growth, social inclusion and the preservation of the environment of the oceans and seas (World Bank & United Nations, 2017). This study serves as one of the earliest studies to spark academic debate on the blue economy discourse and policymaking on the blue economy.

There is some literature on the blue economy. However, as stated earlier, the challenge is in carving out an understanding of the starting point in order to change current governance arrangements to achieve a blue economy (The Commonwealth, 2016). This study is germane as it adopts an all-inclusive approach to study blue economy discourse by looking at the social resilience and sustainable development goals intertwined with it. Both the academia and ocean policy makers can gain an understanding on how the blue economy could be achieved through building the social resilience of coastal communities and how the blue economy drives the achievement of some of the SDGs.

The study is of benefit in directing strategies aimed at achieving blue economy, with fishers and coastal communities' social resilience being a key policy icon. The study provides an in-depth understanding of the connection between blue economy, social resilience and sustainable development goals. Thus, the study documents how taking into consideration the social resilience of fishers and coastal communities could help to achieve the benefits of the blue economy which subsequently drives the achievement of many of the SDGs. This study offers as a vital document for countries (especially Ghana) to consider in putting together their blue economy strategy papers.

Delimitations of the study

The boundaries set for this study as well as the rationale behind the choices of objectives and focus of the study are highlighted in this section. This boundary refers to the study's coverage area and how literature was reviewed on the subject matter of blue economy, social resilience and sustainable development goals.

This study focuses on coastal communities and fishermen along the coast of Ghana. The Ghana Living Standard Survey round 7 (commissioned by the Ghana Statistical Service) and primary data collected were used for the analysis of objective one. For the objective two, a primary data is use for the analysis. The primary data was collected from fishers along the coast of Ghana between December 2021 and February 2022, using interview-administered questionnaire and key informant interviews. For the objective three, a literature is sourced from search engines such as Google Scholar which was reviewed and conceptualised blue economy, social resilience and sustainable development goals for the analysis. Hence, these datasets support generalizing the findings of this study in Ghana. Giving the issue of the concept of the blue economy being new and many African countries are yet to drive the initiative on it, studies on the issue is sparse for policy drive. Thus, the literature reviewed to support this study is based on availability of relevant literature that help to put the study in a perspective.

The concept of the blue economy is an indistinguishable concept and many definitions and approach have been suggested as to how to go about it. Even though this study makes reference to the sustainable use of ocean resources as blue economy, it does not incorporate what other researchers have defined blue economy to be (such as Silver et al., 2015) who carefully provided the contestations in the use of the term blue economy and have grouped this into four competing discourses regarding human-ocean relation). Again, the link between the blue economy and the SDGs outlined in the study are non-exhaustible and should not be regarded as

a straight-jacket. The relation between the blue economy and the SDGs might go far than the only ones the study purported to be.

Limitations of the study

This study serves as a means to understanding the concept of blue economy and how it's interrelated with SDGs through social resilience of fishermen and fishing communities. Though the study is importance to academia and policy environments, there are some limitations in the methods of analysis adopted that could not solved during the course of this study.

The analysis of the results for the first objective was based on cross-sectional analysis of the socioeconomic characteristics in the context of the blue economy. Using a cross-sectional data for a study may miss an understanding of changes in the variables of interest over time. Again, the cross-sectional data was not mainly dedicated to coastal communities alone and relevant issues might not be covered. Again, the analysis of the second objective was based on primary data gathered from the field by questionnaire administration to sampled fishers along the coast of Ghana. The respondents might not accurately respond to questions thereby reducing the quality of the information gathered as vital information might not be given. The third objective was based on literature review on the issue of social dimension of sustainable development which is missing in blue economy policy discourse. The conceptualization realized from this may not be generalized.

As far as these limitations enumerated are concern, they do not detract the research findings, but indicates that studies in these avenues are worth conducting.

Definitions of Terms

***Artisanal fishing*:** this is a type of fishing system practiced in an open beach with the use of basic fishing tools (such as dug out boats/canoe, fishing gears, hooks and lines, seine nets, gill nets), which are often powered with outboard motors. Such fishing system is usually small-scale because it is solely dependent on local resources.

Aquaculture: this is the cultivation of aquatic animals (e.g. fishes or shellfish) including plants (such as seaweed) in a controlled and enclosed body of water. The term includes use of either salt or fresh water. It is a form of agriculture referred to as "*aqua-farming"* which involves cultivating freshwater and saltwater populations under controlled conditions.

Blue economy: the concept dwells on sustainable exploitation and use of ocean resources. The idea is on how to maximise marine resources giving ecological constraints, and the integration of socio-economic development in the realms of environmental sustainability. Thus, the concept blue economy reflects economic growth achievement amid environmental sustainability. The components of the blue economy are diverse, from fisheries, through tourism, to maritime transport and renewable energy.

Capture fisheries: the term refers to all forms of harvesting of naturally occurring living resources in both marine and freshwater environments. Thus, it is the capturing of aquatic animals (like fin fish and shell fish) from the natural water bodies like sea, river, lake, pond, estuary etc. In capture fisheries production, there

is no control over the breeding, spawning and recruitment of young ones to the fisheries stock.

Exclusive Economic Zone (EEZ): it is a concept adopted by the Third United Nations Conference on the Law of the Sea (in 1982), whereby a coastal state assumes jurisdiction over the exploration and exploitation of marine resources in its adjacent section of the continental shelf, taken to be a band extending seaward to distance no more than 200 miles.

Marine Protected Area (MPA): a marine protected area is a portion of the ocean where it is '*forbidden*' to exploit marine resources. Usually this is an instruction of a government placing limits to human activity in the area and only allows people to the area in ways that do not damage the environment. The idea is to help protect the management of natural marine areas according to pre-defined objectives to conserve marine resources.

Marine Spatial Planning (MSP): the term refers to the general comprehensive mapping of a marine area by identifying what natural marine resources exist, where they exist, how and where the ocean is being use and habitats that exist. An MSP informs which part of the marine environment should be protected (MPA), to help conserve the marine resource.

Contributions of the study

This thesis investigated the concept of the blue economy, social resilience of fishers and SDGs in Ghana. The study makes contributions to academia, methodology and policy discourses in the following ways:

Academically, this study contributes to the literature on blue economy, social resilience and sustainable development goals in Ghana. It represents the first study linking the blue economy to social resilience and sustainable development goals by analysing this in the Ghanaian context. Also, the study adds to the blue economy literature by arguing that socioeconomic aspect of marine communities and fishers have been less considered in blue economy policy discourses. The study suggests that to harness the benefits that blue economy might bring, there is the need to consider the social resilience of marine communities. Again, the study surmises that if the blue economy is well pursued its achievement will be in tandem with many of the SDGs.

Though there are studies on the blue economy, this current thesis provides an insight into how the blue economy is related to social resilience of fishers and coastal communities and how that influences the achievement of some of the SDGs. Thus, this gives an empirical insight in an objective perspective. The findings of the study suggest that blue economy principle strives well in a social resilient coastal environment and this further serves as an impetus to achieving many of the SDGs. Therefore, a clear established course of how to make coastal communities socially resilient and the socioeconomic dimensions to concentrate to achieve this as far as the Ghanaian coastal region matters.

From a methodology perspective, different econometric estimations are used to analyse the objectives of the study. For instance, using a Principal Components Analysis-PCA estimation technique to achieve objective two gives clear information to understand subsets of statements that are independent from

others. This helps to define and assess how individuals respond to prospective policy change. One reason that the individual scale used here is that it is hardly addressed in literature and individual responses drives an understanding of resilience at broader scale (Manfredo & Dayer, 2004; Adger *et al.,* 2002; Meffe, 2001). Thus, focusing on individuals increases the generalizability of findings to other social-ecological systems (Bradley & Grainger, 2004; Smith *et al.*, 2003). The study also makes policy recommendations for policy direction on the blue economy by focusing on the socioeconomic characteristics (social resilience) of coastal communities and fishers. Costal communities' social resilience must be incorporated into blue economy policy making.

Organization of the study

The thesis is structured in to eight chapters. The next chapter is chapter two and it considers the overview of resource governance, particularly fishes, issues around the globe and Africa and narrows down to Ghana. The chapter highlights the extent of fishing structure across Africa and Ghana in particular. A critical examination of related theories of resource governance (and fishing as a resource) and its implications on marine communities and empirical literature on economics of marine and blue economy are presented in chapter three. The chapter three also gives the contestations in the definition and discourses of the blue economy and the fact that the concept has no one widely accepted definition. Again, the chapter

(Chapter Three) gives the broad conceptual or analytical framework (connecting the blue economy, social resilience and sustainable development) of the thesis.

Chapter four captures the research methods of the study. The study area, study philosophy and various measurements and techniques used in estimations are discussed in that chapter four. Chapter five captures the first empirical chapter analyzing empirical results of the socioeconomic characteristics of coastal communities in the context of the Blue Economy. In the sixth chapter, empirical results on whether fishers in marine communities are social resilient to institutional change and an understanding on the link between social resilience and demographic characteristics of coastal communities are presented. The seventh chapter focuses on the relationship between the blue economy and sustainable development. The final chapter (Chapter Eight) gives the summary, conclusion and recommendation of the study. A broad structure of the thesis is captured in appendix "A".

CHAPTER TWO

OVERVIEW OF OCEAN, MARINE RESOURCE EXPLOITATION AND FISHING ACTIVITIES

Introduction

The importance of the ocean to human life is so great and has served humanity for centuries. The ocean throughout history has aided human beings by providing their essential needs, and if human beings can take care of the ocean in a sustainable manner, it would continue to support humans forever. Therefore, this chapter provides an overview of ocean importance, marine resource and fishing activities at the global level and narrows down to West Africa and Ghana in particular. The global overview highlights the ocean as means of support to global transport and subsequent realization that the ocean has greater resource than just support to transport. The West Africa overview provides among other things fishing practices and menace of fishing in the sub-region. The Ghana overview presents the fishing activities in Ghana and fishermen engagements in the fishing industry.

Overview of Economic Importance of Ocean and Marine Resource

Global overview

Historically, the ocean was far seen as an enabler of global transportation. Hence, for centuries, efforts were geared towards securing and freeing the ocean's surface for transport and communication. This was closely associated with global "*patterns of power, competition and trade*" (O'Connell, 1982). Before the 16th century (i.e., the years before 1500s), African was relatively isolated in this arena with the exception of east African coastline, which had some "contact with the

Islamic world and middle east" (Hilborn, 1992). Subsequently, marine territorial claims by civilization (empires) began to sprung up (as a similar case of the way land was occupied by civilizations) and with European interest dominating (Steinberg, 2001; Colombos, 1967). Thus, the Europeans began to explore the world by focusing on securing the sea to ease transportation to help them amass global wealth.

Around the fifteenth century, the Portuguese were the sea travels dominators and controllers, which prompted the Dutch to call for all nations' access to navigate the sea in 1608. Groutius (1916: 28) stated that "*the Sea is common to all, because it is so limitless that it cannot become a possession of anyone and because it is adapted for use by all whether we consider it from the point of view of navigation or fisheries*". This call for the right of access to all seas coupled with technology breakthrough in transport and shipping in Europe gave the Europeans advantage to dominate the world economy as at the time (Hugill, 1993). This was mostly seen in slave trade which felt mostly in the West African coast.

In early 20th century, the view of the ocean changes as it was seen as significant, because further improvement in technology made it possible to exploit deep-sea fish stocks (Steinberg, 2001). Also, the first offshore oil well discovery in USA in 1937 further led to view the ocean not only as avenue for transportation but important environment for extraction and exploitation of naturally occurring resources for economic purposes (Schrijver, 2008). This greatly shifted the importance of the ocean space as enabler of transport towards a port of naturally occurring resources to be exploited and this later raised concern over conservation

issues leading to issues of national jurisdiction over natural resources driven by the United States of America-USA concerns to secure oil and fish stocks (USA, 1945). Subsequently, the UN decided the Exclusive Economic Zone-EEZ of 200 nautical miles as a "space within which coastal states have exclusive rights to living and non-living resources" (United Nations-UN, 1982, Steinberg, 2001). DeLoughrey (2017: 32) remarked that the "*most significant, and yet largely unremarked, 20th century remapping of the globe is the establishment of the 200 nautical mile EEZ*".

However, the sea's role as means of transportation still remains great. The World Seaborne trade is estimated to have reached 10.7 billion tonnes and to expand at a compound annual growth rate of 3.8 percent from 2018 to 2023 (UNCTAD, 2018). Aside the ocean aiding trade, fishing turns out to be the most prominent human activity with the ocean, as many people across the globe, earn their livelihoods (Sakhuja, 2015). It is estimated that in 2018, about 59.51million persons (with Asia having the highest numbers) are engaged in fishing and aquaculture's primary sectors. Out of this number, women consist of 85% (FAO, 2020). That stress the fact that small-scale fishers contribute about half of global fish catch (FAO, 2014a; HLPE, 2014).

Global fish production is estimated to have reached about 179million tonnes in 2018 of which total of 156million tonnes went into direct human consumption. Global total captured fisheries production reached 96.4million tonnes which is an increase of 5.4% over previous 3 years (see Table 1). This increase is derived by marine capture fisheries. The top seven capture producers (China, Indonesia, Peru, India, Russia, USA and Viet Nam) accounted for almost 50% of global capture

production while inland waters catches have reached over 120million tonnes in 2018.

Table 1: World fisheries and aquaculture production, utilization and trade (in million tonnes)

Fish Production, Utilisation and Trade	1986-1995	1996-2005	2006-2015	2016	2017	2018
	Average per year					
Fish production						
Captured						
Inland	6.4	8.3	10.6	11.4	11.9	12.0
Marine	80.5	83.0	79.3	78.3	81.2	84.4
Total Captured	86.9	91.4	89.8	89.6	93.1	96.4
Aquaculture						
Inland	8.6	19.8	36.8	48.0	49.5	51.3
Marine	6.3	14.4	22.8	28.5	30.0	30.8
Total aquaculture	14.9	34.2	59.7	76.5	79.5	82.1
Total World fisheries and aquaculture production	101.8	125.6	149.5	166.1	172.7	178.5
Fish Utilization						
Human consumption	71.8	98.5	129.2	148.2	152.9	156.4
Non-food uses	29.9	27.1	20.3	17.9	19.7	22.2
World Population (in billions)	5.4	6.2	7.0	7.5	7.5	7.6
Per capita apparent consumption (kg)	13.4	15.9	18.4	19.9	20.3	20.5
Fish Trade						
Fish exports (quantity)	34.9	46.7	56.7	59.5	64.9	67.1
Share of fish exports in total production	34.3%	37.9%	37.9%	35.8%	37.6%	37.6%
Fish exports in value (USD billion)	37.0	59.6	117.1	142.6	156.0	164.1

Source: FAO, (2020)

Between the periods 1986 to 2017, it is observed that food fish consumption increased averagely by 3.1% which is more than average population growth of 1.6% (as per capita fish consumption estimated at 20.5kg in 2018 which is an increase over the years from 1961). This increases in fish consumption are driven by production increases and a number factors including technology advancements, increases in incomes globally, and a increases in the awareness of the benefits of

maintaining healthy fish products. Fish trade in terms of export show that the volumes of export has seen growth from 34.9 million tonnes in 1986 to 67.1million tonnes in 2018. In the same period the value of fish export increased from US$37.0billion to US$164.1billion.

The Asia sub-region dominates in world aquaculture production. The FAO (2020) indicated that in 2018, the estimated tons of fish traded globally was 67million tonnes which is about 38% of total fish catch globally and with a total export value of. US$164billion representing about 11% of agriculture products export value.

An estimated 59.51million persons were said to have been employed in fisheries and aquaculture sectors of which 14% of this figure are women. Overall, 20.53million were engaged in aquaculture while 38.98million in fisheries. Asia has the highest numbers of persons working in fishing and aquatic industry (see table 2) who represents 85% of global total people employed in fisheries and aquaculture. There are correspondingly more women (19%) in aquaculture than there are in fisheries (12%). The global distribution of fishing vessels also saw majority to be in Asia. It is estimated that in 2018, out of the 4.56 million global fishing vessels, Asia is home to 3.1 million vessels. Out of these global total vessels, motorized vessels are estimated to be 2.86million (FAO, 2020).

Table 2: World employment for fishers and fish farmers, by region (in thousands)

Region/Year	1995	2000	2005	2010	2015	2018
Africa	2,812	3,348	3,925	4,483	5,067	5,407
Americas	2,072	2,239	2,254	2,898	3,193	2,843
Asia	31,632	40,434	44,716	49,427	49,969	50,385
Europe	476	783	658	648	453	402
Oceania	466	459	466	473	479	473
Total	**37,456**	**47,263**	**52,019**	**57,930**	**59,161**	**59,509**

Source: FAO, 2020

In fisheries and aquaculture productions, some 35% of the world harvest is said to either lost or washed every year (Jambeck et al. 2015). FAO (2016a) estimated that full exploitation of fish stocks represents 57% and some other stocks which represent 30% are over exploited, depleted or recovering. The menace of IUU further exploits fish stocks to the tune of an estimated figure of 11 to 26 million tons of fish catch annually. While IUU is prevalent along Africa's coastline, it's most acute in Western African coastline in particular (Daniels, et al. 2016).

West Africa overview

West Africa's coastal area is said to be the most fertile fishing region globally (Henrichs, 2013). West African coastal line along the Atlantic Ocean is huge and has varieties of fish species that attracts many fishers including foreign industrial vessels. The coastline spreads over 3,057,820km^2 area spawning over 14 nations from Senegal in the west to Nigeria in the south. The region has about 413million human population with average growth rate of about 3%. The region

also has a large mangroves and estuaries reserves covering about 18,303km^2 coast line and an EEZ of 2,016,900km^2 with abundant fish stocks (Ndiaye, 2013; Merem, 2017). Figure 5 shows the map of the coastal zone of West Africa stretch and Table 3 presents the various West African countries and their land coverage as well as human population as at 2018.

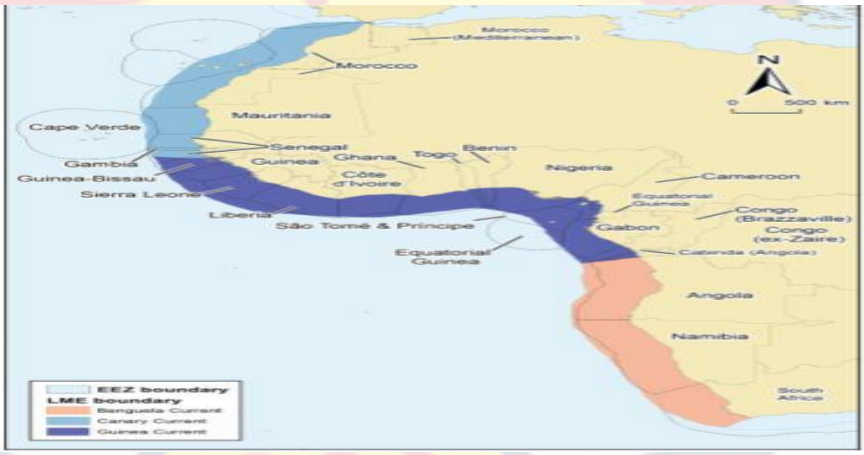


Figure 4: West Africa marine ecosystem and exclusive economic zone
Source: Belhabib et al. (2016a)

Table 3: The coastline of coastal West African countries

Country	Coastline (km)	Area km^2	Human Population	Growth rate (%)
Benin	153	112,760	13,053,964	2.79
Cape Verde	1,121	4,030	587,925	0.9
Cameroon	1,799	472,710	28,351,931	2.62
Ghana	758	227,540	32,833,031	2.22
Gambia	503	10,120	2,602,459	2.5
Guinea	1,615	245,720	13,531,906	2.47
Guinea Bissau	3,176	28,120	2,015,494	2.41
Ivory coast	797	318,000	26,378,274	2.58
Liberia	842	96,320	5,193,416	2.08
Mauritania	1,268	1,030,700	4,619,743	2.59
Nigeria	3,122	910,770	213,401,323	2.44
Senegal	1,327	192,530	16,876,7209	2.68
Sierra Leone	1,677	72,180	8,420,641	2.27
Togo	154	54,390	8,644,829	2.4

Source: Merem et al. (2019) & Worldometers (2023)

In West Africa, measuring the value of fisheries is often the landed value and fees paid by both local and foreign vessels for accessing local fishing grounds

(Belhabib et al. 2014). The artisanal fishing sector in West Africa is labour intensive and the sector mainly provides fish for local markets for direct consumption (Belhabib et al. 2019).

The artisanal sector in West Africa is said to have engaged about one million workers and about 3.6million US dollars is generated as income in the African economy (Belhabib et al. 2015). West African small-scale fishermen work either full or part time (Teh & Sumaila, 2013) and even though is increasingly being motorized, they have less access to modern technology as the industrial sector do (Belhabib, 2019). The number of artisanal fishing boats increased over the period 1950 to 2010 from 32,000 (with 14% being motorized) to 252,000 (with 50% being motorized). Nigeria leads in terms of number of artisanal fleets in West Africa, while other countries like Senegal, Morocco and Ghana followed (Belhabib, et al. 2019). Climate change is found to be one of the challenges faced by the West African artisanal sector. This climate change induces fish to migrate out of the West African coast making small scale fishermen travels long distances for fishing (Belhabib et al. 2016b) which contributed to increasing fishing costs such as fuel. It is said that the cost incurred by artisanal fishermen who uses motorized fleet have up to 40% of their total costs on fuel (Belhabib, et al. 2015).

Capture fish production trend in West Africa shows that three major producers (Nigeria, Ghana and Senegal) have been leading in the sub-region. The rest of the countries hovers below 200,000 metric tonnes production (see Figure 5). Merem (2017) indicated that Benin Republic showed that in years 2010 to 2015, total production fell from 39,791 tonnes to 36,477 tonnes. Ghana saw a different

account as overall fish production between the years 2000 to 2010 saw a drastic yearly increase to 550,000 from 380,000.

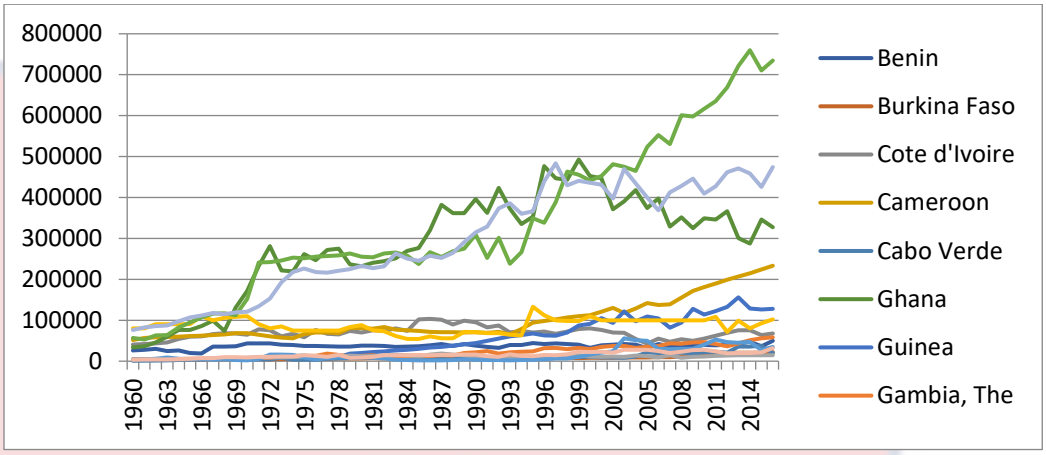


Figure 5: Capture fish production in West Africa Countries, 1960-2016 (in metric tonnes)
Source: Author illustration based on World Bank – WDI data, 2020

West Africa faces the highest levels of IUU fishing activities (NOAA, 2017; Doumbouya, 2017). About 50% of decline in West Africa fish stock is attributed to overfishing and intense exploitation (Robb, 2016; Alfonso, 2016). It is reported that fishing vessels that engaged in IUU off the West African coastline goes on all year round (Bora, 2015; Dahir, 2017) putting pressure on the region's fish stock (World Bank, 2013a). Ocean Data and Information Network for Africa (2019) reports that illegal fishing in West Africa represents 40% of all fish catches. Throughout 2010 to 2015 an estimated value of US$12,317billion IUU fishing cases were recorded with illegal value of US$10,267billion and unreported activities amounting to US$2,020billion (Merem, 2017). West Africa IUU accounts for close to 57% of total tons of unreported catches in Africa (Merem et al. 2019) followed by North Africa of 30% IUU.

With this magnitude of IUU in West Africa, marine communities in West Africa endures countless impacts of IUU at different scales that have environmental and socio-economic implications. This menace is made possible by the presence of weak institutions in the region and the lack of effective and efficient fish management system in the region (Anyimadu, 2013; Africa Progress Panel, 2014). Merem et al. (2019) indicated that the fundamental drivers of IUU in West Africa is mixed. These are several socioeconomic factors; physical as well as environmental factors.

In terms of ecosystem activities risk, there is evidence (Merem, 2017) that increases in fishing grounds and volume of catch affects the health of the ocean. The evidence of ecological effects is such that when commercially priced fishing stocks undergo uncontrolled exploitation, other marine resources found in the same eco-zone are impacted. Merem et al. (2019) indicated that Liberia, Sierra Leone, Ivory Coast and Ghana are the countries in West Africa that are mostly affected by unauthorized fishing. Some factors said to be responsible for IUU in West Africa includes; physical and environmental elements (lack of capacity to monitor their coastal fishing waters), ineffective and contradictory policies on fishing, and unethical practice by foreign trawlers.

Ghana overview

In Ghana, fishing is majorly done in marine, inland-freshwater and aquaculture (Dovlo et al. 2016). Ghana marine coast line is nearly 343.8 miles and total continental shelf are of about 24000 km^2 that supports a marine fishing industry (Dovlo et al. 2016). ATLAFCO (2012) indicated that Ghana has 550km

coastal stretch. Ghana's coastal area stretches over 6.5% of land area and inhibited by a quarter of the population who depend mainly on fisheries resources for their livelihood.

Geomorphic units of Ghana coastline are in three units. The west coast (approximately 95km with 49 lagoons) which starts from the Ghana-Cote d'Ivoire border to the Ankobra river estuary. The central coast (approximately 321km) extends from Ankobra estuary to Tema with a rocky headlands and sandbars and the east coast stretches from Tema to the Ghana-Togo border (Ly, 1980). Ghana's Exclusive Economic Zone is 200 nautical miles off the Atlantic Ocean.

Ghana has about 90 lagoons (Mensah, 1983) with rich coastal ecosystem. This biologically rich coastal ecosystem has made Ghana to be considered as one global priority areas for biodiversity conservation. The coastline of Ghana is covered by four administrative regions. The recent Fisheries Canoe Frame Survey 2016 showed that there are 26 administrative districts along the coastline of Ghana. Two districts in the Volta[2] Region; nine districts each in the Greater Accra and the Central regions and six in the Western region. Figure 6 shows the number of fishing communities/villages and landing beaches across the four coastal regions.

[2] There are now three districts in the Volta Region, as one coastal district was created in 2019. However, that was after the canon frame survey in 2016.

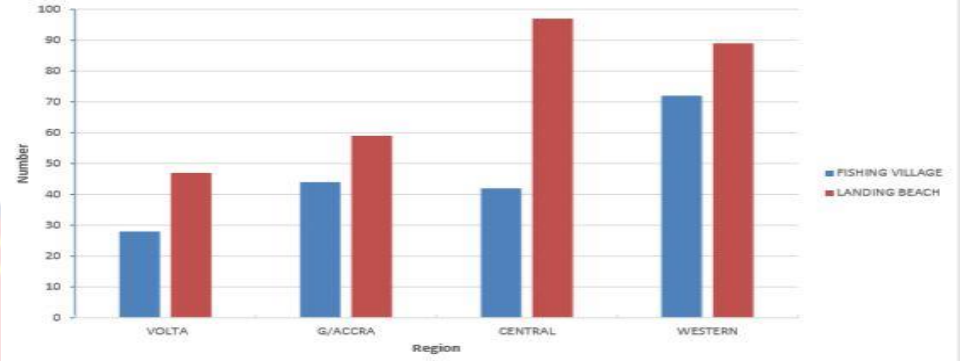


Figure 6: Number of fishing villages and landing beaches along Ghana coastal zone. Source: Dovlo et al., 2016

Ghana has a diverse fisheries sector (marine, freshwater and aquaculture sub-sectors). The largest being the marine sub-sector which supplies about 70% (see Figure 5) of the total recorded domestic fish catch (Lauria et al. 2018). Ghana's capture fish production from both marine and inland is shown in Figure 7. The Figure 7 indicates that marine capture production saw a decline beyond the years 2000 which has been attributed to overfishing and overcapacity (Lazar et al., 2017). The overfishing and overcapacity are due to lack of vessel control (number of vessels at a time, gears use days, vessel size etc.) coupled with ineffective management of fisheries is said to have accounted for this. Another reason is the seasonality and rainfall dependent nature of marine fish production in Ghana (Biney et al. 1995). The upwelling (major) period witnesses increases in biological activities that help increases the stock of marine fish which creates a tendency for exploitation in that period. Thus, bumper harvests are usually seen in the major season (July-September) and a lean harvest is usually witnessed in the minor season (December-January/February).

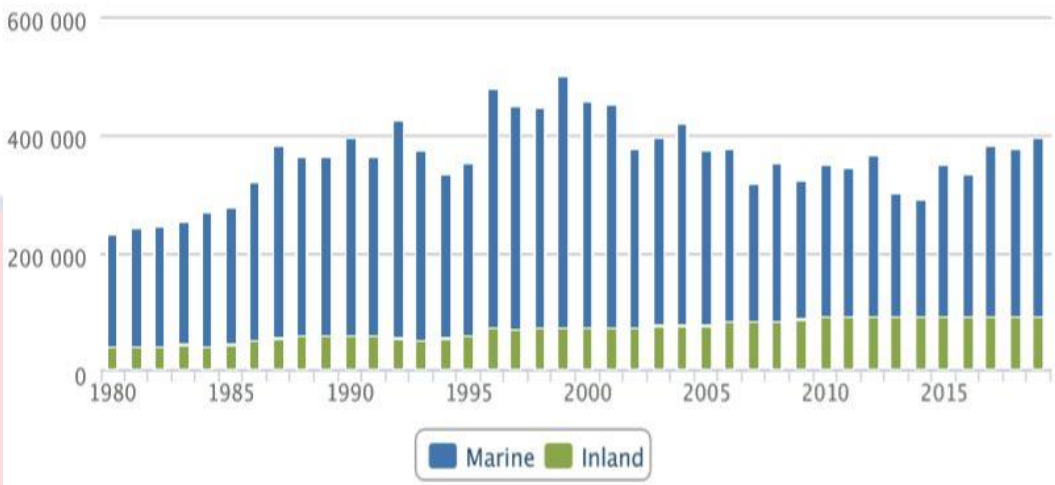


Figure 7: Captured fish production from inland and marine waters in Ghana (1980-2019). Source: FAO, (2020)

In Ghana, the small-scale fisheries sector, dominates the marine fishing sector. These small-scale fishers have about 73% of them being motorized (Akyeampong et al. 2013). It is estimated that, in 2014, about 500 billion US dollars in value was marine fish landed in Ghana (Sea Around Us-SAU, 2015) and 350 million USD in fish imports (FAO, 2018). Notably fish species in Ghana's marine waters include; Cunene horse mackerel (*Trachurus trecae*); anchovy (*Engraulis encrasiedus*); Atlantic chub mackerel (*Scomber colias*); Sardine (*sardinella aurita*) and other small pelagic fish (see Appendix B).

Inland fishing, which represents about 17% of domestic catch (see Figure 3), is mainly carried out on the Volta Lake and its feeding rivers (FAO, 2016b). The aquaculture sector supports the capture fish sector. However, the aquaculture sector is relatively recent in Ghana though it is operated all over the country (Kassam & Dorward, 2017). The main outlet for Ghana's fish production is the domestic market, chiefly because the domestic market is easily accessible to many small-scale fishers and processors and larger operators (Gordon & Pulis, 2010).

Clupeid (*Sardinellas Scombridae – club-markerels*) and Engraulidae (*anchovies*) are the main commercial species in Ghana's waters (Dovlo *et al.*, 2016).

Fishing is the main activity of most rural and semi-urban dwellers along the coast of Ghana. According to FAO (2016b), Ghana's marine sector employs 135,000 fishers while 500,000 affiliated workers are engaged in the processing (drying, smoking, canning), distribution and marketing throughout the country. The recent fisheries canon survey indicated that there are 107,518 fishers along the coast of Ghana (Dovlo et al. 2016). Adding the families of those gaining a livelihood in this sector, it is estimated that approximately 2.6million people rely on the marine fisheries sector and another 300,000 individuals rely on inland fisheries sector (FAO, 2016b).

The main law that regulates and governs the fisheries sector in Ghana is the Fisheries Act 2002 (Act 625). The Act has provisions that seek to harmonise, consolidate and streamline all existing fisheries rules to address fisheries related issues. The Act application is supported by the Fisheries Regulation, 2010 (L.I. 1968) and MoFAD acting as the prime institution to ensuring a healthy fish value chain in the country (Republic of Ghana, 2014). Relevant sections of the Act include; section 60, which outlines how license for aquaculture and recreational fishing is obtain.

Section 93, subsection (1) requires that the Fisheries Commission be inform prior to commencement of any project that seem to have an impact on fishery resources in Ghana. The commission, under subsection 2, then prepares or commission a report and recommendations on the supposed activity to be carried

out. The Act has missed the issue of legal rights, ownership, protection against users and tenure system and has no reference statement on fish health, quality assurance and product safety.

The country also has fisheries development plans being implemented by various governments over the years. Some of these plans includes; Ghana Sustainable Fisheries Management Project; the Fisheries Strategic Development Plan; National Fisheries Management Plan; Fisheries Medium-Term Development Plan; National Aquaculture Development Plan; and Coastal Sustainable Landscapes Project. These plans are there to help restructure and rebuild fisheries to ensure sustainability and also help small-scale fishers.

For instance, the fisheries strategic development plan of Ghana stressed the importance of small-scale fishing in the industry (CRC & GSO/URI, 2013). Also, the Government of Ghana in collaboration with the USAID under the programme Sustainable Fisheries Management Project is working to rebuild fish stocks by; allowing local community-based fisheries plans to work; strengthen capacity of fisheries producers and processors; improve local capacities to assess fish stocks. Again, the Coastal Sustainable Landscapes Project is advancing coastal habitat protection including mangrove areas needed as nursery grounds and addressing problems on forest depletion for fish smoking.

Despite these plans and policies coupled with the efforts of governmental and non-governmental organisations in the fisheries sector (USAID, 2012), marine communities' socioeconomic and welfare is appalling relative to other communities in Ghana. Aseidu et al. (2013) found poverty headcount index to be

in the range from 60% to 80% for inland fishing communities and 50% to 72% for coastal fishing communities.

Ghana's fishers are among the lowest to earn low income in Africa (Belhabib et al. 2015) as evidenced by canoe fishers' income dropping by 40% in the last decade (World Bank, 2013b). Among fishers along Ghana coastal regions, few of them own land to farm and there is a high illiteracy rates that limit their chances of engaging in alternative livelihoods aside fishing (CRC, 2018). Figure 8 indicates that apart from fishing, majority of the fishers does no any other job. Thus, with fishing being their main occupation, any change in fishing policy or directive that limits their fishing effort could affect their livelihood and that of their families.

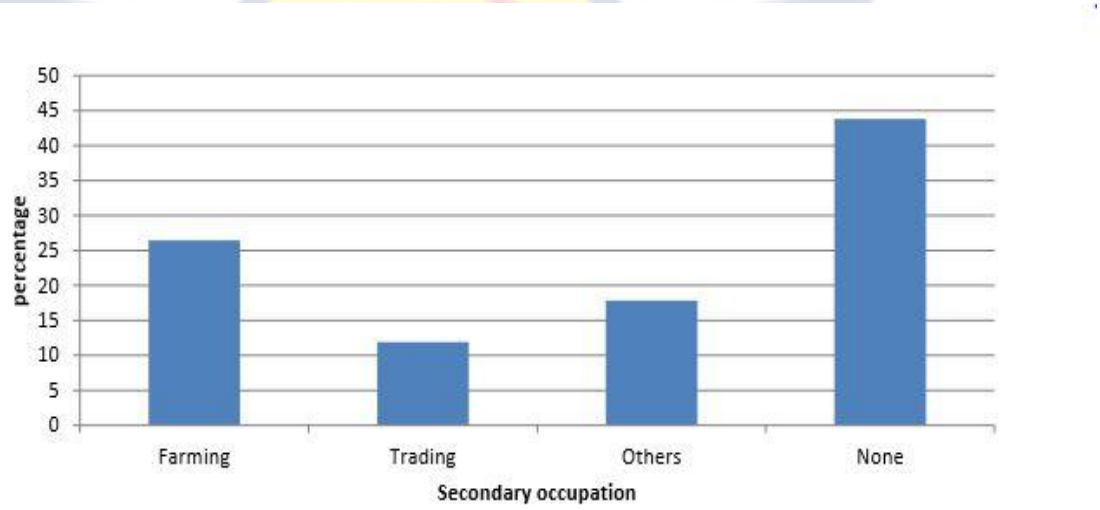


Figure 8: Secondary occupation of fishers along the coastal zone of Ghana
Source: Dovlo et al., 2016

Karakara et al. (2022) studied the socioeconomic characteristics of marine communities in Ghana and how that could serve as a good factor to achieving a blue economy. They indicated that fisheries are a vital resource for humans and are

very much linked to and affect human (social-ecological system) existence, and human interactions with fisheries also affect fisheries' availability and distribution. Studying this in the context of Ghana, they indicated that sanitation conditions in coastal areas are appalling. That majority in coastal areas disposes off household waste indiscriminately and also has no toilet facility and thus resort to open defecation. They summarized that this poor sanitary condition could compound the problem of polluting the ocean and undermine objectives of a blue economy.

Chapter Summary

The chapter dwelled on the overview of ocean, marine resource exploitation and fishing activities across the globe, in West Africa and Ghana. The chapter revealed that human interactions with the ocean from history, was seen as an enabler of global transportation. With technology, humans viewed the ocean not only as avenue for transportation but also a place where natural resources (fisheries and oil & gas and lately renewable energy) sit.

The chapter further revealed that fishing is the most human interaction with the ocean. The West African coastal region is said to be the most fertile fishing region in the world and the most IUU reported cases as well. It is further revealed that the marine sector is the largest and supplies approximately 70% of the recorded domestic catch in Ghana.

CHAPTER THREE

LITERATURE REVIEW

Introduction

The chapter discusses theories and empirical studies on natural resources exploitation and use, blue economy (ocean sustainability – fisheries exploitation), social resilience and sustainable development goals.

Three broad sections are covered in this chapter. Theoretical literature on natural resource exploitation (fisheries in this case), social resilience and sustainable development goals are captured in the first section. The second section presents empirical literature that relates to the study and the third section comprises the conceptualization of the study to link blue economy, social resilience and sustainable development goals.

Theoretical Literature Review

Theoretical context of the study is situated here. The first sub-section looks at theories of natural resource exploitation and fisheries in particular (i.e. economic theory and natural resources). The second sub-section dwells on theory of social resilience and the third sub-section talks about sustainable development and the conceptual frameworks of the empirical chapters.

Economic theory and natural resources

Scholars' interest in natural resource extinction, which is brought about by modern environmental problems, caused by the quest for industrialization, is relatively a recent phenomenon. In the latter part of the 18th Century, Malthus (1798) hypotheses that resource scarcity would be experienced, particularly food

and this will limit human population growth. Malthus indicated that food supplies were increasing arithmetically and population was geometrically being increased. The result would be war, famines and pestilence in order to control population growth not to lead to shortage of food supplies. In another breadth, Ricardo (1817) later added that this scarcity of natural resources would eventually limits economic growth. Ricardo's argument was that a stationary state of growth would be experienced brought about by the use of low-grade resources because high-grade resources would have been exhausted leading to rising cost. Also, Pigou (1929) wrote on environmental economics (within the context of fish, coal and soil fertility) emphasizing that accumulated generational effect of resource depletion would lead to resource extinction. Pigou suggested government intervention (through taxes) as the best way to safeguard resources for future generations.

However, neoclassical economics model, in the wake of the 19th Century, saw no connection of the economy to the environment. Natural resources are said to be unlimited, and if wastes are generated, that would not have impact on environment. Thus, the neoclassical assumes that the use of nature creates no special problems. The neoclassical view was seen as oversimplified and needed revision in the 1950s and 1960s when environmental problems raise developmental concerns.

Attention was drawn from resource scarcity towards environmental pollution in the 1970's. Thus, the Brundtland Report (WCED, 1987) acknowledged that resource depletion and the environmental effects of resource usage are both important. This sparks the idea of sustainability in natural resources exploitation

and use, biodiversity conservation and ecosystem maintenance (Kula, 1994). Thus, the issue of sustainable development (defined as "*development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs*") came to play.

Sustainability in natural resources requires that future generations shouldn't face greater limitations than current generation on the use of these natural resources. Resources are traditionally categorized into renewable and non-renewable. Renewables are able to regenerate within time, thus exploiting such resources would not lead to extinction. Non-renewables take a long period to be created and are thus regarded as fixed stock of resources and exploiting such resources overtime leads to its depletion.

A note on the economics of non-renewable resources

Non-renewable resources take longer time to be created and their total quantity readily available is not known and thus they could get to extinction at any time depending the nature of exploitation. The works of Gray (1914) and Hotelling (1931) are often referred to as one of the earlier theories on the economics of non-renewable resources. Hotelling theorize on the nature of depletion of exhaustible resources using mineral resource as a case. Hotelling thinking was sparked by the conservationist view, at that time that was concerned about mineral resource and timber supplies dwindling. Hotelling argued that when a society expects the price of a non-renewable resource to rise as high as the prevailing interest rate, then the society stands to gain when they conserve such resource. Thus, the price changes

of a resource should be at least equal to the social discount rate (rate that is the society's valuing of welfare of future generation) is known as Hotelling principle.

As argument against Hotelling Principle says that there is little indication that prices of non-renewables are rising and few of such resources reach complete depletion. Reasons mentioned are that bad market signals may not feed non-renewable resource prices thus consumer would not be able to see that. Some tax incentives such as depletion allowance in the USA, Canada and UK may also not allow consumer to see the price rise.

In economics of non-renewable resources, as the resource becomes depleted, its exploration cost rises and the marginal cost would also rise creating scarcity. However, studies (Barnett & Morse, 1963; Barnett, 1979) found no such evidence of increasing scarcity for the period 1870 to 1957. They explained that resources seemed to becoming plentiful suggesting this is the result of discovery of new deposits, resource substitution and technical and innovation in exploration, extraction and processing.

Studies (Geever et al. 1986; Cleveland, 1993) on scarcity of natural resources discusses the cost of extraction in terms of energy use. The argument here is that more energy is need to extract low quality resources if we want to upgrade them to useful stage. For example, to refine a copper metal from low grade ore to high grade needs more energy and to pump oil from a deeper and small oil field requires more energy. These studies indicated that the energy cost of extracting oil, gas and coal in the 1970 to 1990's increased, which shows a significant increase in scarcity of natural resources. However, depletion may not be the only concern,

because exploitation of non-renewable resource leads to polluting the environment, which is not usually reflected in the market prices.

There are quite a number of economic theories that looked at renewable resources. However, per this thesis domain, theories on fisheries as a renewable resource were reviewed.

The economics of fisheries

In the realm of fishing resources, scholars have theoretically studied and had some varied conclusions as to the management of fisheries and fishers. Gordon (1954) and Schaeffer (1957) both studied the connection between the rate multiplication of fishes and the size of fish population by proposing the bio-economic model that aimed at maximizing returns from fishing. The issue of property rights regarding fishing resources was studied by Scott (1955) when the author explored common versus private property rights. Again, Copes (1972) and Clark (1973) both discussed how discount rates could be applied to the theory of fisheries and forests.

Other scholars (Christy, 1973; Brown, 1974) looked at fisheries management methods considering depletion of fish stocks. Scholars (Bell, 1986; Munro, 1982) have also discussed the ways to mitigate the tragedy of the commons in the realm of open access fisheries activities. Thus, recent fisheries management studies generally adopted an approach by looking at the bio-economic model in the face of open access and discount rate. Fisheries and forests are prone to over-exploitation. Thus, there is the likelihood of these resources being exhaustible if the over-exploitation goes farther than the rate of recovery. Schaefer (1957) indicated

that if the smallest threshold conservation of fish population is not achieved, the available fish stock for fishing could become a depleted resource. Hence, the need to sustainably manage this stock of resource in a way that only additional stock (sustainable yield) is harvested is the way forward.

Literature on renewable resources lies heavily on Gordon's (1954) study on fisheries as a common property resource and Schaefer's (1957) work on the relation between growth and size of fish stock. In doing so, Schaefer pioneered the bio-economic model that emphasized returns from fishing given constraints. Burkenoroad (1953) said that "*the management of fisheries is intended for the benefit of man, not fish; therefore, effect of management upon fish stocks cannot be regarded as beneficial per se*"

Throughout history, fisheries are seen to be inexhaustible. When there were restrictive laws on fishing, there was argument that these laws have often been followed by increases in fish stocks. Huxley (1881) puts it that the different kinds of fish and probably all the great sea fisheries are inexhaustible and that nothing we do seriously affects the number of fishes. Any attempt to regulate these fisheries seems consequently, from nature of the case, to be useless.

Gordon's economic theory of common-property resource: The fishery

Gordon (1954) touched on the theory of optimum utilization of fishery resources and defined optimum degree of utilization of any fishery ground as ground that which maximizes the net economic yield, which is the difference between total coast and total receipts. The cost is a function of fishery effort (fishing intensity). The relation between fishing effort and total fish value is positive up to

a point and then rises at a diminishing rate. Thus, as fishery effort expands the catch of fish increases at a diminishing rate.

Fisheries resource is not regarded as a private property and hence its rent cannot be appropriated by one person. This goes to mean that no individual holds a legal title to any part of the ocean. Thus, this means all fisherman are free to fish any part of the sea as long as he/she can move there. This feature leads to competition among fishermen increasing the margin of exploitation of fisheries.

Gordon cited a scenario of two different fishing grounds of different location and fertility. Given the differences in these fishing grounds, any fishing effort devoted to the second ground yields smaller total product if devoted to the first ground. The optimum will be a point where we have equal marginal productivity in both grounds. If the individual fisherman can fish on any of the grounds, this brings disequilibrium in fishing effort allocation as it may lead to negative productivity for some grounds. Due to this misallocation of fishing effort, the rent of fishing ground is dissipated. Gordon summarized that this causes the reason why fishermen are poor though they engaged in a sector that has the richest resource to man. That the plight of fishermen and the inefficiency of fishing production stem from the common-property nature of the resources of the sea as such case is found in other open access resources.

Schaefer theory of bio-economic model

The basic concept is that to every value of magnitude of population of fisheries of commercial sizes, there corresponds, on average, a certain ability of the population to increase in weight (the rate of natural increase) for all population

magnitudes between zero and the maximum population which this sea area will support under average environmental conditions. The natural rate of increase is, of course, zero for zero population and also zero, on average, when the limiting population size has been reached. If at any level of population, the fishery takes exactly the natural increase, there will be no change in the population. If the fishery takes more than the natural rate of increase, the population will diminish by the amount of the natural increase. Similarly, if the fishing takes less than the amount of which corresponds to the annual rate of natural increase, it is termed the equilibrium catch, because the harvest of the fishery is in equilibrium with the growth potential of the population.

In Schaefer's narrative, certain assumptions about fish multiplications, which are to some extent unrealistic, have to be made before the law that relates the rate of natural increase in fish population to fish size. The two implicit assumptions Schaefer made includes; i) that the rate of natural increase responds immediately to changes in population density. ii) the rate of natural increase at a given weight of population is independent of the age composition of the population. These assumptions ignore the time lag between spawning and recruitment of fish progeny into the catch stock available.

Studies (Gulland, 1955; Watt, 1956) have criticized Schaefer assumptions by indicating that Schaefer's assumption has neither been witnessed in fish population nor any other organism that share similar characteristics with fish. Certainly, there is some time allowance between a stage of egg and the age of entry of a fish into the catchable stock. Also, there may be some delayed effects of

population density on mortality and growth among individuals of catchable sizes. With respect to the second assumption, it is known that the factors of fecundity, growth, and mortality are all, to some degree, age-specific as well as density-dependent. The fact that fingerlings enter the fishery at only one year of age, reached sexual maturity early and has a very short average life span, imply that the time-lag between spawning and recruitment is small. The natural rate of increase of fish population is also determined by many environmental factors aside the magnitude and age structure of fish stock. However, Schaefer assumed that the effects of environmental factors on fish population are random or are not correlated with fish population changes.

Other authors have recently theorized on the economics of fisheries and fish resources. Jensen (1991) theoretically indicated that to conserve fisheries there is the need to understand well the responses of fish growth to exploitation. Using simulation model of fish growth where a ration relating to fish population and growth-related ration with a constant number of eggs per kg, Jensen theorized on the economics of fisheries.

Jensen wanted to establish (i) how a fish population would survive exploitation and attain a stable new population level; (ii) the relations generated between fishing mortality and yield; (iii) fishing mortality and recruitment, and stock size and recruitment. Jensen conclusions were that with increases in fish mortality, fish growth compensates the population with growth in individual fishes. Again, as fishing mortality increases, the new spawners and recruits decrease exponentially and the population becomes dominated entirely by new recruits that

sustain the stock. Low fish mortality comes with fluctuations in fish populations and high mortality comes with low fluctuations.

Also, Grafton, Kompas and Hilborn (2007) theoretically revisited the economics of overexploitation and indicated that the depletion rate of world fisheries is about 25% which has occurred in a way that the current bio-mass (Bc) is less than the bio-mass that maximizes the sustainable yield (Bmsy). They showed that if comparison is made between the current bio-mass (fish population) and the bio-mass that gives the largest economic benefits (i.e. discounted profits from fishing) many fish stocks would be considered overexploitation. This could lead to the maximum economic yield be either greater or smaller than the maximum sustainable yield. However, this depends on the rate of discount, how cost and revenue are sensitive to growth and harvest of fish and the marginal fish growth.

Grafton et al. (2007) modeled fish population dynamics with age-structured model using a spawner-recruitment model in the prawn fishery. They demonstrated that under a condition of realistic prices, costs and rate of discount, it is not economic to exploit fisheries to extinction. Thus, the overexploitation of fisheries, the more society would spend on stock rebuilding. In practice the maximum economic yield is greater than the maximum sustainable yield. This implies that conservation efforts promote both larger fish stocks and higher profits. When the economic yield is greater than the current stock, focus will shift to how fast stocks should be rebuilt. Hence, rebuilding to economic yield is faster for a fast-growing species than slow-growing species.

In environmental economics, the second most crisis that may be a disaster is how fast renewable resources (like water, soils, forest, fish) are being depleted and biodiversity loss (UNDP, 2013). Hence, in ecological economics is it noted that the global ecosystem harbours production and consumption of human needs (Faber, Manstetten & Proops, 1996). Thus, theoretically, if there is a sense of responsibility attached to ownership, environmental resources would be sustainably managed. However, in practice, where such ownership would work there is the need for a regulatory and fiscal instrument availability on such resource usage. Either than that, the open access nature of such environmental goods (fisheries in particular) would likely lead to over-exploitation.

Marine resource conservation policies result in major changes, such as, restrictions on resource exploitation and usage. A marine community that is resilient, an opportunity for employment, novelty and innovation for development would be created to withstand the shock that such changes might bring (Olsson, 2003). For any blue economy effort including marine conservation initiatives to work out, it should be circumspect about the marine communities or fishers' response to change (e.g., conservation policies). This entails enhancing the social resilience of fishing communities. Hence, this study reviewed social resilience theories to link that to marine/fish conservation (blue economy principles).

Social resilience theory

The art of resilience is looked at in two different origins, one coming from ecology studies and the other in sustainable livelihood. In ecology, two dimensions of resilience are well known, that is, the ability to bounce back quickly after a shock

and the ability to withstand disturbance (Alexander, 2013). For instance, resilience is understood, in the bio-physical sciences, to be *"the capacity of a material or system to return to equilibrium after a displacement*" (Norris et al. 2018: 1) or a material or system being able to return to homeostasis. Thus, the concept of resilience, came in originally from ecological process and was later brought into analyzing social problems. This resulted in its use in social sciences and subsequently became a theory (Rohring & Gailing, 2010). In the 1940's, the usage and meaning attached to the term resilience gained prominence and became relevant to social psychologist (The Young Foundation, 2012) and gained further popularity when Holling (1973) conceptualized resilience in ecology. Hence, the concept significance grew and it uses expanded to a variety of academic areas like social sciences, economics and engineering aside ecology (The Young Foundation, 2012). In psychology and ecology studies, the concept refers to the ability to cope with adverse events and then bounced back and returned to a functional state (Surjan, Sharma & Shaw, 2011).

The adoption of resilience from ecological resilience into socio-ecological resilience comes from studies indicating that ecological system(s) are directly linked to humans and social systems. That is, ecological system sustains humans by provision of food, fuel, water, jobs etc. and certain human behaviours affects the ability of this ecological system to provide these human sustaining items (Berkes & Ross, 2012). Extending the work of Holling (1973), Vayda and McCay (1975) made us to understand that the concept of resilience is more useful when we study and understand human adaptation to environmental changes than stability and

resistance. They summarized that the concept of resilience discards the equilibrium view and advocates that the individual and society could adjust as a response to environmental challenges. This view sparks studies concentrating on examining the relation between people, society and the environment trying to establish a link between social resilience and ecological resilience.

The 3-D resilience framework

Bene et al. (2012) proposed that three capacities explained what resilience is: absorptive, adaptive and transformative capacities. Each capacity leads to a different outcome or transformational responses. They indicated that resilience could be strengthened by these three capacities.

The salient point of their conclusions is that all these three capacities, each leading to different outcomes, collectively explains resilience. Thus, these different responses can be linked to various intensities of change. The lower the intensity of the initial shock, the more likely the individual or community will be able to overcome it effectively, i.e., to absorb its impacts without consequences for its function, status or state.

However, when the absorptive capacity is exceeded, the individual will exercise their adaptive resilience (Cutter et al. 2008). This is the various incremental changes (adjustments) that a person undergoes to enable him/her functions continuously without significant changes in his/her identity. These changes or adjustments takes different forms (such as diversifying livelihood, adopting new techniques etc.). These adaptations may be at a larger scale or smaller scale and at a multi-stage (household, group, community etc.). Thus, adaptation in

this case is difficult to track as it is incremental and continuous phenomenon that is not a zero-sum game.

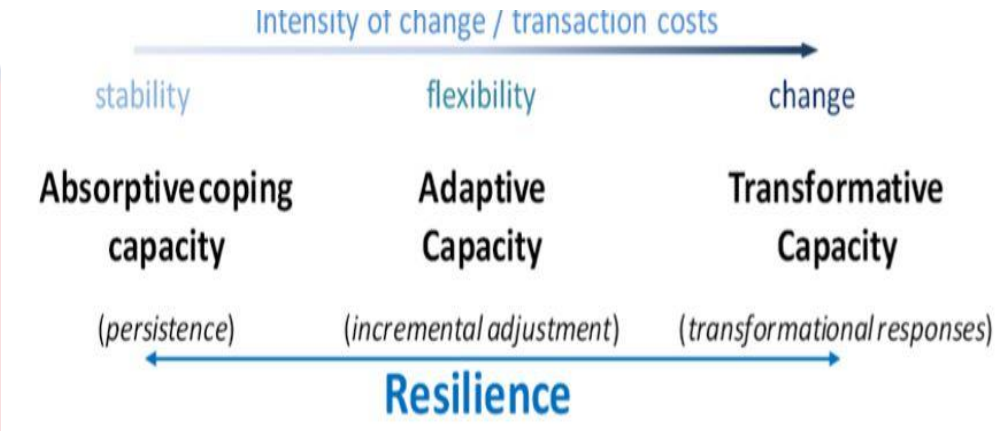


Figure 9: The 3-D Resilience Framework
Source: Bene et al. (2012), updated version in Bene et al. (2016)

The framework added that when a change required for a system to function is large and overwhelms the individual or community adaptive capacity, then transformation would take place. Hence, changes are no more incremental but transformative, leading to alterations in the individuals or community's primary structure and function. This transformation involves shifts in the nature of the system, by introducing new forms and possibly loss of other forms of the structure. Example, a household may change and adapt to a new course of living or a society moving to an extraction economy from an agriculturally based economy. These changes could be intentional or deliberate attempts by people or a forced phenomenon that brings changes to the environment or socioeconomic conditions or institutional changes like resource rules/policies. A study by O'Brien (2011) indicated that such shifts or changes might be an institutional reform, a behavioral shift and changes in cultural practices, and technological innovations that often

involve the challenging of assumptions, questioning of values, and a close examination of fixed beliefs, identities and stereotypes.

The framework is understood in a linear way suggesting that building resilience requires a system of resistance in a period of small disturbance, adoption in times of great disturbance and transformability when conditions become unsustainable. This linear explanation is simply in nature, because it doesn't recognize that vulnerability is a multi-stressor, i.e., different shocks and stressors occurs together, with different intensities that requires integrated levels of resistance (O'Brien et al. 2004).

Resilience Index Measurement and Analysis (RIMA)

The FAO (2016c) composed resilience measurement called RIMA. The RIMA was applied to empirical data and was later modified by FAO to RIMA II. To provide a comprehensive understanding of resilience, the RIMA measures resilience directly and indirectly. The direct measure looks at resilience capacity of household in terms of asset base, access to basic services, social safety net and how they adapt to changes. The indirect measure looks at changes in resilience capacity and recovery. It tries establishing a causal association between observed variables and wellbeing indicators. Thus, direct approach uses as its measures, the Resilience Capacity Index (RCI) and Resilience Structure Matrix (RSM) while indirect measure looks at the determinants of food security loss and recovery.

The RIMA I could not help understand dynamics in resilience and thus causal inferences with latent variables presented a structural limitation. This led to revising RIMA I, and adoption of RIMA II which is based on psychometric theories

(Crocker & Algina, 1996; Nunnally & Bernstein, 1994) and more modern measurements references (Preacher et al. 2013; Alinovi et al. 2008).

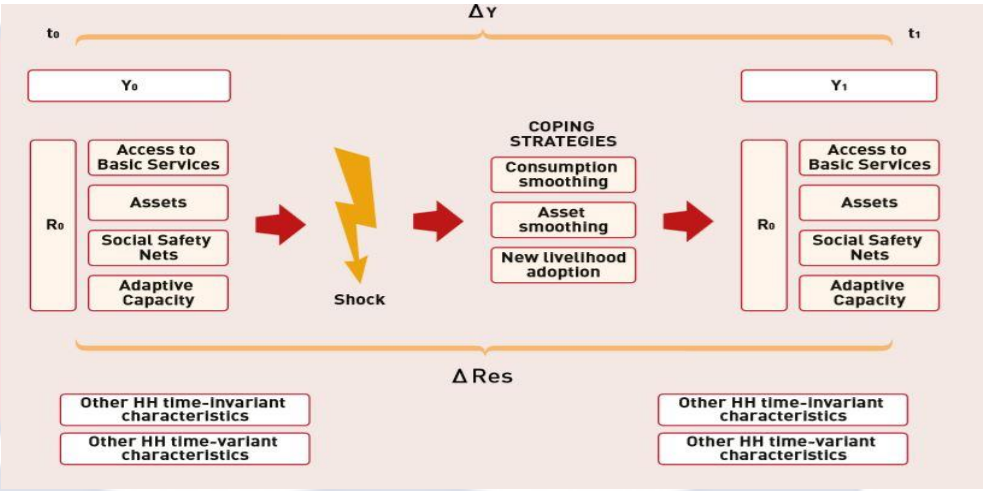


Figure 10: Resilience Index Measurement and Analysis (RIMA) Framework
Source: FAO (2016c).

In the figure, Y_o (which measures time zero food security) is attained based on certain household characteristics that may be time-variant and invariant. For instance, when there is a shock occurring, coping strategies are adopted, e.g., smoothing of consumption or adaption of new livelihood strategies. These strategies help to bounce back and thus result in changes (increase or decrease) in Y which in tend affect resilience capacity to react to shocks.

Fundamental pillars as captured by RIMA II, are; basic services access; accumulation of assets; availability of social safety nets; how sensitive and adaptive is the individual. Access to basic services includes; schools, health facilities, water, electricity, nearby market, waste disposal systems, safe houses etc. Assets includes productive (livestock/land inputs) or non-productive (house, car, motorcycle, etc.), human capital, physical and financial capital. Social safety nets include access to transfers, both formal and informal or cash or in-kind. Access to finance (formal or

informal) is safety net. Safety net also looks at whether the community has credit groups, microfinance institutions, health insurance system or not. Sensitivity is how one is exposed to risk and how well the person persists or resist the shocks and the level at which a household/individual livelihood is affected by a risk is referred to risk exposure. This pillar is treated as an exogenous variable and thus included in regression analysis to capture shocks real impact on resilience capacity. Adaptive capacity is being able to reconfigure without significant reduction in crucial functions.

Community resilience framework – USAID feed the future learning agenda

Frankenberger, Mueller, Spangler and Alexander (2013a) offer a community resilience framework under the auspices of USAID through its programme on "Feed the Future Learning Agenda". The framework identifies determinants of vulnerability and resilience at the community level. With constant changes in natural, social and economic environments, there is need for a framework to model resilience taking into consideration heterogeneous nature of society (Constas & Frankenberger, 2013). This framework includes socioeconomic context, shocks, stresses, community livelihood assets, and social capital and community social dimensions. The framework helps us understand the reason why some communities may be resilient than others.

The framework incorporates three approaches (livelihood, disaster risk reduction-DRR and social capital & collective action) in its measurements (Aldrich, 2012; McCreight, 2010). The livelihood approach concentrates on the usefulness of assets belonging to community and institutional and livelihood

strategies. The DRR approach focuses on being prepared, taking preventive measures, and responding appropriately to potential disasters and recovery activities involved.

The framework maintains that socio-ecological system should have certain key capacities to maintain resilience as reflected in the work of Bene et al. (2012). The framework explicitly explains resilience to be a process and not something static. This means resilience is determined by a constantly changing process within the context of the environment, economic and social spheres (Frankenberger & Nelson, 2013). The three types of capacities (drawing from Bene et al. 2012) are; (i) absorptive capacity, which dwells on ability to use preventive measures to minimize exposure to shocks and stress; (ii) adaptive capacities, that is making active and conversant choices concerning livelihood strategies; and (iii) transformative capacity, which is the governance mechanism, policies/regulations, infrastructure, community networks, social protection etc. that constitute the enabling environment for systemic change. These capacities are interconnected, mutually reinforcing and exist at multiple levels (individual, household, community, state and ecosystem) (Bene et al. 2012; Frankenberger et al. 2012). This is because individuals form a household which together forms a community that is within a larger governance unit (district, region) (Barret & Constas, 2012).

The framework modeled four broad components of community resilience measurement. The first component is on community assets (social capital); the second is customary institutions' capacity; the third is the social aspect of community and the fourth is collective action at community level. Community

assets (e.g., social, natural, physical, human, etc.) enables the community to attain a level where the basic needs of members are met. Diversification of these community assets reduces the likelihood of vulnerability and increases likelihood of absorptive and adaptive capacity of the community to withstand shocks (Frankenberger et al. 2007). Social capital, as part of community asset, is the quantity and quality of social resources (e.g., networks, membership groups, social relations etc.) upon which people draw livelihoods. Scholars (Magis, 2010; Elliott et al. 2010) demonstrated that social capital is vital in determining resilience at community level.

On collective capacity of customary institutions, the framework posits that to tackle idiosyncratic shocks, traditional systems tend to function best and, in a covariate, shocks, formal institutions are more effective (Frankenberger et al. 2013b). It is found that certain customary mechanism or community togetherness are quite effective in helping to individuals in terms of protecting them and to recover from shocks and stresses, such as community-based savings groups (Karakara et al. 2021; Osabuohien & Karakara, 2018) and local pastoralism (Pavanello & Levin, 2011). For example, in Somalia, it is found that in remote area where they lack state welfare, the local family-based economic activities and the informal way of resource allocations and transfers have been keeping their local economy (Sexsmith, 2009).

Community social dimensions through which a community could collectively withstand shocks and stressors are important for building resilience at the community level. These dimensions as proposed by Oxley (2013) are; how

community is prepared for shock, how they respond to shock, their learning and innovation in times of stresses, their self-organisation and diversity in the community. Community preparedness hinges on relevant, accurate and timely knowledge on how to cope with shocks. A community response to shocks could be formal and informal, which are shown in their absorptive capacity (when changes become institutionalized) (Berkes & Ross, 2012). Community collective actions on security and well-being of its members is vital in building community resilience.

Principles for building social resilience

Folke et al. (2002) hypothese that there are four critical elements that interact each other and these elements are required when dealing with social-ecological system dynamics in times of change. These factors are referred to as "*principles for building resilience"* which interact with each other and are interdependent.

Principle 1: learning to live with change and uncertainty (adaptability)

This factor underscores the need for individual/community to accept change and live with risk or uncertainty. The factor advocates that when there is crisis the social system should be able to withstand it and make an opportunity out of it for development, thus, adapting to change is key. In this principle, community leadership and vision are one of the contributing factors. Good leadership strengthens social capital to increase adaptability. Walker et al. (2006) said that to achieve resilient community, dynamics leadership in a multiple role is necessary because good leadership serves as catalyst in advocating and mobilizing community members in collective action and to participate in community resource

management (Lebel et al. 2006; Olsson, 2003). Olsson et al. (2004) indicated that a good leadership observed in Kristianstad, Sweden, was the cause of good governance structure that ensures adaptive co-management of wetland being witnessed.

Aside leadership being vital, social capital building plays a key role to building social resilience in natural resource management. Social networks build social capital (Adger et al. 2005) in achieving community cooperation which is important for community communication (Davidson-Hunt & Berkes, 2000) leading to readily information to help increase adaption capacity. Such communication leads to a system of feedback among stakeholders and community, which enhances adjustment behaviour. For social resilience to be enhanced in marine community there should be balanced social networks, which can build trust, facilitates information flow and help solve problem and enhance decision making (Moberg & Galaz, 2005; Tompkins & Adger, 2004).

Principle 2: Nurturing diversity for reorganization and renewal (diversity)

The second principles dwell on how to nurture diversity to be resilient. Being diverse safeguard one against uncertainty and surprises in life. Berkes et al. (2006) noted that this diversity involves being diverse in knowledge, institutional diversity, and the opportunity of alternative economic activities which in all contribute to sustainability and adaptability. For social-ecological systems, diversity could be a functional diversity, where there are groups in a system or response diversity, where individuals' response to disturbance in the system (Walker et al. 2006).

Diversity enables a community to spread risk, innovate and develop because the community would be able to manage their resources well. For instance, diversity of livelihood provides a means of coping with pressure from marine resource restrictions because individuals could rely on other jobs or means of livelihood sustenance when marine resource restrictions are in place (Luttrell, 2001). Marschke and Berkes (2006) indicated that when there is a decline in resource in Kompong Phlik, Cambodia, the affected fishing communities switched to other livelihood options, by operating small businesses. Where community relies heavily on natural resource that are not in abundance, livelihood could be affected because of lack of diversification (Adger, 2000). Adger's (2000) study found that there was a low resilience at the household level in Quang Ninh Province, Vietnam, because the community mainly depend on mangroves for livelihood and that mangroves was converted to private use. This has also increased conflicts, at the community level, over remaining resource.

Principle 3: combine different knowledge for learning (learning & knowledge)

This factor regards the knowledge and understanding that people have about ecosystem in the local communities and traditional societies as significant in building resilience. Local communities accumulate knowledge based on how they relate and respond to the environment changes (Drew, 2005). Hence, there are traditional resource management knowledge (e.g., traditional fishing patterns and practices, customary marine tenures, etc.) that evolved through this traditional knowledge system that helps build the adaptive capacity of communities over time (Berkes, 2004). These traditional system knowledges are sometimes embedded in

local institutions and value systems and are effective in resource management (McClanahan et al. 2006). Olsson et al (2004) asserted that in Cree and Inuit communities, in James Bay, Canada, locally studied their environment (e.g. changing sea-ice patterns) and used it as baseline for resource management.

Principle 4: Creating opportunity for self-organisation (self-organisation)

Social resilience could be built by increasing the likelihood of flexible and adaptive resources or behaviour among stakeholders during periods of crisis, reorganization or uncertainty. For instance, a multi-level governance and accountability, harmonizes governance controls in a decentralized-centralized system (Olsson, 2003) which helps builds social resilience through power sharing and ensure institutions cross-level interactions.

Other scholars have studied and presented methods to identify resilience in marine communities. Bennett (2003) developed the scenario development model for determining resilience in social-ecological system. This model ensures that scenarios are stories and noted events that can affect the future and these noted events helps in decision making. Scenarios development is a filtration process which involves many narratives, taking note of driving forces and indicators, and revisions together within community/user groups. The scenarios can be used to analyse policy alternatives. Thus, scholars may study resilience by looking at scenarios that could possibly show a link between human dependence on ecosystem services (e.g., fishing activities) and human welfare (e.g., health).

Walker et al. (2006) conceptualized a resilience framework to study resilience in social-ecological systems in marine environments. Four steps are

involved in their framework, which includes close involvement of marine stakeholders. The first step is to develop a conceptual model led by stakeholders and to assess the factors that are key ecosystem suppliers. Next step entails identifying an array of erratic and uncontrollable factors, including stakeholder visions for the future. Third step involve the use of the outputs of the first and second step to develop a simple model of the system's dynamics. The last step is to look at management implications by assessing the process and outcomes.

Empirical Literature

There are some studies on blue economy, social resilience and sustainable development goals. This section reviewed empirical studies on coastal communities (blue economy), social resilience and sustainable development goals. The review is in three thematic aspects of the thesis; (1) socioeconomic characteristics of fishing-dependent communities' and blue economy concept; (2) social resilience in coastal communities and sustainable development and (3) blue economy and sustainable development goals.

Socioeconomic characteristics of fisheries-dependent communities in the context of the blue economy

The socioeconomic characteristics of coastal communities and fishers have been studied and discussed in various ways across the globe. For instance, Abdrabo (2008) comparatively studied the similarities and differences in socioeconomic conditions of two coastal areas (Rosetta in Egypt and Oued Laou in Morocco) in Southern Mediterranean by conducting interviews of 516 and 40 fishers in Rosetta and Oued Laou respectively. The author found that some similarities exist in terms

of dependence of the economic structure on natural resource, inadequate infrastructure and services, rural nature of the communities, and low level of environmental perception by fishers.

Poor road network, high illiteracy among fishers and poor health services were evident in the two areas. The study (Abdrabo, 2008) even though established that there are similar socioeconomic characteristics across these two different coastal communities, it neglects the issue of how these socioeconomic factors could affect the sustainability of the coastal resources which the community members depend the most. Abdrabo (2008) also, pointed out that there are appalling socioeconomic conditions in the studied communities. However, the study did not make effort to highlight how such socioeconomic conditions could jeopardize efforts of attaining sustainability in the study areas. This current thesis moves further by analyzing the socioeconomic characteristics of coastal communities in the context of the blue economy (sustainability of coastal resources) as addressed by the objective one of this study.

Nchimbi and Lyimbo (2019) examines the socioeconomic determinants of mangrove exploitation and sea grass degradation in Zanzibar and its implication for sustainable development. They used Participatory Rural Appraisal (PRA) and household questionnaire to obtain data and analysed the data by using multiple regression and descriptive statistics. They summarized that all the socioeconomic variables studied were statistically significant and had influence on exploitation of mangrove. The major drivers of the exploitation of natural resources include;

livelihood needs, population growth, level of education, lack of alternative source of livelihood among others.

A related study (Konoyima & Johnson, 2020) on the social and economic conditions impact on mangrove loss, indicated that the key constraints in coastal communities includes; inadequate health centers, educational facilities, lack of basic material assets, illiteracy, multiple households in one building, which has impacted on mangrove loss in those communities. These studies were done on mangrove exploitation and not fishery in general. Fishery turns out to be the main economic activities in coastal areas and with mangrove as a subsidiary, which is where there are mangrove resources. Thus, a study on fishing and fishers would be more inclusive regarding coastal resource exploitation. Majority of people living in mangrove area are fishermen, driving their livelihood from fishing and its related activities (Walters et al. 2008).

Ray et al. (2021) studied the socioeconomic elevation of coastal communities of Southern Bangladesh by investigating shrimps' farmers' financial and perceptual reactions impacts on socioeconomic status, sustainability, resilience and the cultural environment. A random sample of 50 respondents were interviewed and two focus group discussion, the authors found that shrimp farmers saw a substantial increase in income, improvement in their housing construction quality and overall improvement in socioeconomic status. Farmers are engaged in diverse source of livelihood aside the farming to leverage on the shrimp farming. Alternative livelihood sources are important to living a sustainable life.

The study is done on shrimp farmers' socioeconomic status using descriptive statistics, tables and charts to analyse the issue. The study is limiting as it considers only shrimp farmers to neglect of fishers in general. Again, the study concluded that shrimp farmers are concern of their income or community improvement to the neglect of environmental issues. To really appreciate the debate on how improvement in socioeconomic status of coastal communities could affect the sustainability of ocean resources, there is a need to carry out a comprehensive study on fishers and fishing coastal communities. This thesis therefore looked at the coastal communities' socioeconomic characteristics in the context of the blue economy in Ghana using econometric approach.

Studying the social and economic characteristics of coastal communities in Papua New Guinea and Indonesia, Cinner (2005) explore the characteristics of the communities that employ exclusive marine tenure and how it helps in conservation of marine resources. To gather data, 954 respondents respond to semi-structured questionnaires. Using Mann Whitney U-test, Fisher's exact test and effect size to analyse the data, the author found communities that were farther from markets were strong marine tenure communities which has low migration but depend highly on fishing that leads to conflicts over marine resources. Thus, the author said that community's distance to market, immigration factor, dependence on fishing and conflicts are related in a highly exclusive marine tenure system. The author concluded that exploring these relationships will help conservation practitioners better understand how future social changes may influence the foundation of conservation. This study offers recommendation that an understanding of these

social changes will help in policy making concerning marine resource conservation, but did not actual analyse that.

Branch et al. (2002) carried out case studies on the socioeconomic characteristics and lifestyles of subsistence fishers in South Africa. The authors indicated that in the management strategy for informal fishers, a necessary step is information about the nature of these fishers, their number and their socioeconomic status. Demographic analysis revealed that; poverty was prevalent, unemployment high, low education (only about 33% of people aged less than 20 have completed primary) and migration is high in rural area. The authors asserted that an understanding of the changing dynamics of the socioeconomic characteristics of fishers is a step-in management and conservation of marine resources.

Social resilience of coastal communities and sustainable development

Studies have been carried out on social resilience of coastal communities and how they adapt to changing environmental, economic and social spheres. For instance, Wijayanti and Pratomo (2016) studied the adaptation of social-economic livelihoods in coastal community of Mangunjarjo Sub-district in Semanrang City focusing on the modifications of social economic livelihoods brought about by the sea level rise which damaged the coastal environment. Using a purposive sampling and interviews with descriptive qualitative analysis and evaluation of the interview excepts the authors found that fish pond and aquaculture are the main livelihood source and decreased in livelihood was evident after the sea level rise. The authors further noted that fishers adapted to this change in two ways – socioeconomic adaptation based on natural resource and non-natural resource. Some fishers still

engaged in fishing but with change in the fishing practice from non-traditional practices like use of chemicals, industrial feed etc. to traditional practices like silvo-fishery. Other fishers (majority) left the fishing and are engaged in other jobs like industrial labour, taxi drivers, traders and construction workers.

This work done was mainly on how fishers respond to natural disasters by building their social and economic resilience or how natural occurring disturbance affects the socioeconomic conditions of coastal community. The natural occurring disturbance, in most case, comes with a physical destruction of the source of livelihood (fishing grounds) that would ultimately push fishers out of the fishing business. This would surely affect their socioeconomic conditions immediately. In another breadth, institutional changes (like policies, rules and regulations) could limit the fishing grounds, sometimes even completely, and this affects the livelihood of fishers since that is their main source of livelihood. Thus, there is the need to study a situation where there is a change in fishing policies, practices, rules and regulations (to achieve blue economy) and how that affects the socioeconomic livelihoods of fishers. In order to comprehensively deal with this issue, this thesis studied the social and economic resilience of coastal communities to institutional change (marine policies) in the blue economy principles and changes in natural occurring disturbance (climate change) in Ghana. The analysis is addressed in the objective two of this thesis.

Amevenku, Asravor and Kuwornu (2019) studied fishing households' livelihood strategies in the Volta Basin in Ghana to ascertain how they respond to prevalent vulnerabilities they face. Using a multistage sampling method to sample

households to respond to questionnaires and adopting multinomial logit regression, the authors surmised that majority of the households have alternative livelihood aside fishing. Demographic factors are found to influence the alternative livelihood strategies of households. Human capital, financial capital and natural capital are seen as important determinant as that of socioeconomic variables. Despite the contribution of this study to our understanding of livelihood diversification, the study overlooks the sustainability of the fishing activities along the Volta Basin. In particular, the study ignores how the livelihood diversification enhances or impinge on sustainability of fishing should resource regulation issues come in to curtail their fishing activities. How resilient would the fishers be to this regulation is out of the analysis of the study. This current thesis moves the Amevenku et al. (2019) study by examining socioeconomic characteristics of fishers and their social resilience to changes as reflected in the objectives the thesis.

Blue economy and sustainable development goals

There are studies that attempt to link the blue economy and sustainable development goals. These studies argue that efforts in harnessing the blue economy will help in achieving some of the UN sustainable development goals. For instance, Rickels, Weigand, Grasse, Schmidt and Voss (2019) studied European Union coastal states in the Baltic and North Sea, and the Atlantic Ocean to ascertain whether they have achieved the UN sustainable development goal 14. They summarized that there are countries which have managed to achieve sustainable development while other countries failed to achieve sustainable development. The authors surmised that unsustainable development is in particular driven by

increasing fishing mortality and reduced willingness to set total allowable catch in accordance with scientific advice.

Lee, Noh and Khim (2020) examined the scientific evidence of the connection between the blue economy and the UN sustainable development goals paying attention to the role of stakeholders in this between the blue economy and the SDGs. Conducting a literature survey between 1998 and 2018, the authors surmised that majority of the literature on the association between blue economy and the SDGs asserts that the blue economy is highly associated with SDGs 14 to 17 with the top five SDGs (in descending order) linked to blue economy being SDG 14, SDG 17, SDG 16, SDG 15 and SDG 12. Despite the contribution of this study (Lee et al. 2020) to our understanding of the blue economy and SDGs, the study overlooked the issue of social resilience of fishers or coastal communities and how that affects the blue economy effort and subsequently the SDGs. This current thesis tried to link the three facets (blue economy, social resilience and SDGs) and argue that the social dimension of sustainable development is often neglected in the blue economy policy discourse. This is addressed by the third objective of the thesis.

Okafor-Yarwood et al. (2020) conducted a literature review of case studies and observational data to study the blue economy-cultural livelihood-ecosystem conservation triangle in Africa and summarized that large-scale blue economy initiatives in Africa prioritise economic gains at the expense of environmental degradation and the exclusion of local communities. The authors further assert that successful blue economy initiatives considered ecological, economic, socio-cultural and institutional objectives.

Neumann and Bryan (2015) indicated that SDG 14 supports nine other SDGs (SDG 1, SDG 2, SDG 3, SDG 5, SDG 8, SDG 9, SDG 10, SDG 11 and SDG13) (Neumann & Bryan, 2015; Spalding, 2016). In a similar vein, the UN (2015) indicated that, in theory, fish, fisheries and food and nutrition security are interlinked with several of the SDGs (including SDG1; SDG2; SDG3; SDG8; SDG14; SDG16 and SDG17).

Conceptual frameworks of the thesis empirical chapters

This section captures conceptual frameworks of the objectives of the thesis. The first conceptualization is on the objective one that looks at socioeconomic characteristics of fisheries-dependent communities in the context of the blue economy. The second conceptualization is on the state of social resilience of coastal communities and how that relates to sustainable development in marine/coastal areas (blue economy). The third conceptualization is presented in chapter seven of this thesis. It argues that social dimension of sustainable development is less considered in blue economy policy discourse. Thus, it links blue economy-social resilience-sustainable development goals in its discussion.

Conceptualizing first objective (socioeconomic characteristics & blue economy)

Based on the objective of the study and literature reviewed, the study conceptualised the first empirical results (chapter) of the study as presented in Figure 11. In the figure it is surmised that socioeconomic characteristics of marine communities can be a vital tool in moving towards a blue economy. This is because the marine communities are interconnected with fisheries and marine resources. In the figure, it is revealed that we have two different marine communities, notably, a

robust socioeconomic community and non-robust socioeconomic community. In the robust community, there are livelihood diversification such as jobs and other employment avenues. Thus, citizens of such a robust community can find themselves working in other sectors and not rely heavily on fishing (or other marine resource) directly or indirectly for livelihood. This will lessen the pressure that could have been put on marine resources and hence no over-exploitation could be seen. On the other hand, a non-robust community where such livelihood diversification lacks, majority of citizens rely heavily on fishing and other marine resource for livelihood, which could lead to over exploitation. This will intend thwart the effort of a blue economy achievement.

Also, a robust community where there are amenities such as toilet facilities, pipe-borne water, electricity and good sanitation system (waste disposal, drainage, *inter alia*), minimizes the rate of pollution from land-based activities into the ocean. This atmosphere is therefore a good candidate towards keeping a sustainable and healthy ocean leading to an achievement of blue growth. In the other non-robust community where it lacks such amenities, open defecation (bush/around beaches) indiscriminate refuse dumping and land destruction could be rampant leading to increases in the rate of pollutants moving from land to the ocean. This affects the health of the ocean unsustainably and hence undermines a blue economy effort.

A robust community where education and healthcare are readily available and majority are well educated and lives a healthy lifestyle is a *sine qua non* to achievement of blue growth strategy. An educated person could find job elsewhere rather than rely heavily on fishing alone. Also, an educated person may know the

dangers of living an environmentally unsustainable life and may act to conserve environmental resources than someone who is not educated. Again, a community where there are cultural practices on marine resource extraction such as prohibition of fishing in certain days or periods, or certain rate or zone is a panacea to achieving blue growth.

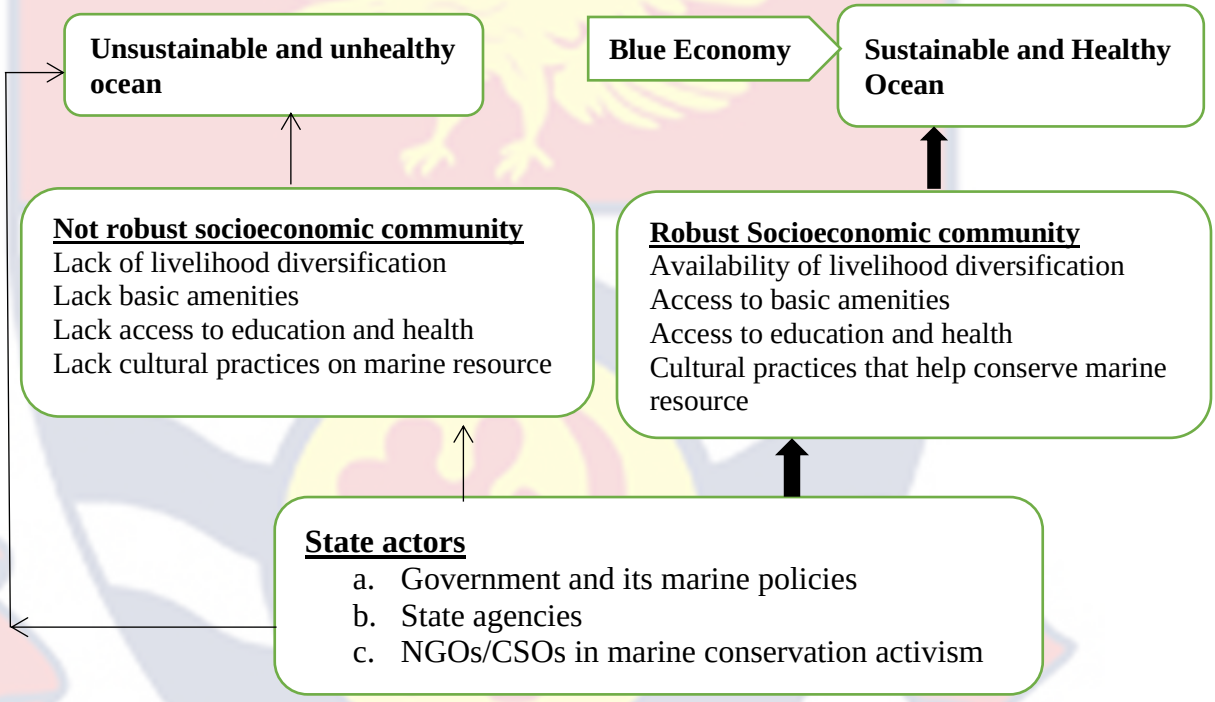


Figure 11: Conceptual framework of the first objective of the study
Note: *NGOs means Non-Governmental Organisations, CSOs means Civil Society Organisations;* **Source:** Author's own conceptualization

Still on Figure 11, a robust community's affluence is backed by strong state actors where there are government marine rules/regulations and laws that are implemented by state agencies. Also, state agencies help to implement programmes in marine communities that are geared towards blue economy achievement. A robust community may also be achieved by the involvement of NGOs and CSOs working in marine sectors of interest. In the figure, the black broad arrow indicates

that all these positive moves from state actors are available to help built robust socioeconomic marine communities. The thin arrow in the figure indicates that such state actors' activism is lacking coupled with non-robust socioeconomic living will lead to unhealthy and unsustainable marine resource exploitation that could subsequently lead to the '*tragedy of the commons'*. However, with an unsustainable and unhealthy ocean, state actors could intervene with policies, rules and regulations couple with state agencies programmes and NGOs/CSOs activism towards blue growth/blue economy principles to reverse the trend of an unsustainable and unhealthy ocean. Thus, the thin line connecting the box of 'state actors' to the box of 'unsustainable and unhealthy ocean' indicates that.

Thus, this study submits that the socioeconomic characteristics of marine communities are interconnected to sustainable marine resource exploitation. Hence, the fisheries sector is vital towards transition to a blue economy/blue growth strategy as summarised by Ababouch (2015). Conceptualization of the first empirical study can be linked to the theoretical works of Christy (1973) and Brown (1974) that elaborated on ways of fisheries management amidst depletion of fish stock. In the conceptual figure, a non-robust community faces open access problem of fisheries that may be exposed by private property right rather than common property right (Scott, 1955). Thus, in such non-robust community and unsustainable and unhealthy marine ecosystem, the possibility is that marine resources become exhaustible.

Conceptualizing second objective (social resilience and SDGs)

The conceptualization of the objective two of the study is presented in Figure 12. In the figure the study conjures that a coastal community that is socially resilient acts as a bridge to achieving sustainable development cum the blue economy principles. In the figure, we have two different coastal communities, notably, a socially resilient community 'A' and non-socially resilient community 'B'. If the two communities are confronted with shocks and other related issues from social, economic, political and environmental changes, it affects the communities' advancements. Giving that community 'A' is socially resilient, it would be able to bounced back from the shock and this promotes sustainable development and subsequently achievement of the blue economy.

For instance, community 'A' being socially resilient means it can withstand a shock caused by changes in fishing practices, rules regulations, or ban on fishing which might limit their catch rate and thereby affects their income and livelihood. Being resilient means community members (mostly fishers) would be able to have alternative livelihood support to survive the storm of income limitation from fishing. Also, a resilient community would be able to withstand climate change effect emanating from environmental changes. Thus, this social-climate resilience would help the community to attain the SDG 11 (sustainable cities and communities) and SDG 13 (climate change) and subsequently the blue economy.

Again, a social resilient community might be able to withstand disturbance coming from economic changes like a boom harvest that drastically reduces fish price and leads to low incomes, or an environmental change that swipe away their

fish species leading to a very low catch. Being socially resilient in alternative livelihood could help withstand such shock and hence help achieve SDG 1 (end poverty) and SDG 8 (decent work and economic growth).

In the other hand, a community 'B' that is not socially resilient, is prone to disaster as it might not be able to withstand shocks coming from social, political, economic and environmental changes. This thus affects its effort to live a sustainable live and might lead to unsustainable exploitation of marine resources in the community.

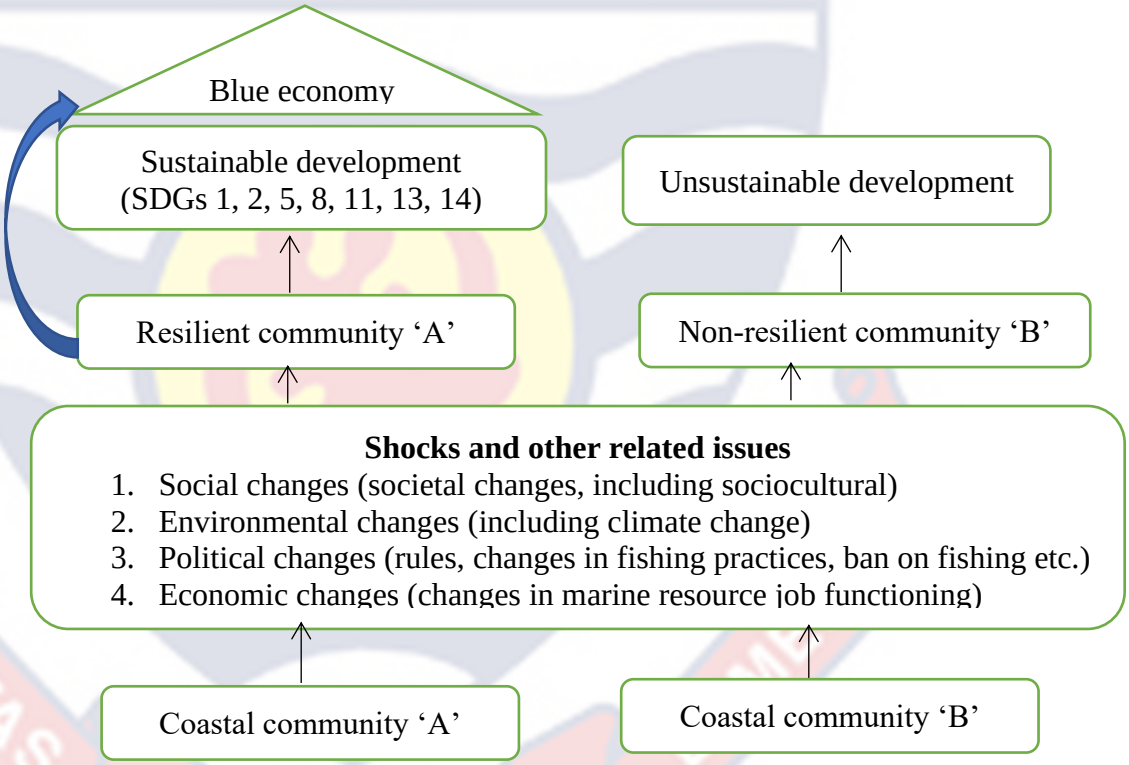


Figure 12: Conceptual framework of the second objective of the study
Note: *SDGs means Sustainable Development Goals;* **Source:** Author's own conceptualization

Chapter Summary

As a complex developmental issue, examining the blue economy would align to several theoretical postulations and methods to explain the concept. As a

new paradigm of development across the globe, the blue economy and social resilience and sustainable development goals remains important as much as persistent problems of development and how to sustainably managed coastal resources are on the global agenda. The chapter captured theoretical and empirical studies on the blue economy, social resilience and sustainable development goals as well as conceptualization of the study. Theories such as the Hotelling principles, Gordon (1954) and Schaefer (1957) Bi-economic model of fisheries, and social resilience theories and frameworks were reviewed in the theoretical review aspect of the work. Empirical literature was presented under three thematic areas: (a) socioeconomic characteristics of fisheries-dependent communities and the blue economy concept (b) social resilience of coastal communities and sustainable development and (c) blue economy and sustainable development goals. The review indicated how various authors have studied and conceptualized the blue economy and sustainable development goals by employing different methods of analysis. Gaps in the literature were highlighted, and based on that this thesis tried to fill the gaps identified. Again, the conceptual frameworks of the empirical chapters of this thesis were presented in this chapter.

CHAPTER FOUR

RESEARCH METHODS

Introduction

This thesis is on blue economy and its interrelation to social resilience and sustainable development goals using Ghana as a case. The study dwells on three thematic issues: (a) socioeconomics characteristics of fisheries-dependent communities in the context of the blue economy; (b) the state of social resilience of fishermen in coastal communities and assess the link between social resilience and demographic characteristics; (c) explore the link between the blue economy and sustainable development goals and the social aspect of sustainable development goals. The chapter is organise as follows; the next section to this introduction is on an overview of the research paradigm adopted in this study followed by reasons justifying the mixed method (quantitative and qualitative approach) adopted in the study. Description of the data sources, hypothesis tested, models specified and estimation techniques then follows. The last sections look at the limitation and chapter summary respectively.

Research Paradigm

A paradigm is a way of understanding how the world functions. Thus, paradigm serves as a reference point to understand a phenomenon (conduct research) by using assumptions, standards, does and don't and methods (Jankowicz, 2005; Guba & Lincoln, 1994) and specifies the ontology, epistemology and methodology underlying the study (Anaman, 2014). Morgan (2007:47) defined a paradigm as "*the set of beliefs and practices that guide a field*" which can be used

to summarise the beliefs of researchers. Paradigm is a world view that is defined by distinct elements including epistemology (how we know what we know), ontology (nature of reality), axiology (values) and methodology (the process of research) (Hanson et al. 2005).

Broadly speaking, two paradigms (constructivism and positivism) are used in research (Guba & Lincoln, 1994). The first paradigm sought to understanding a phenomenon based on facts gathered through data collection (or observations) and objective interrogations is considered a positivism way of researching (Hovenkamp, 1990). It dwells on the fact that the researcher has no influence whether direct or indirect on the data observed and therefore no normative judgment exists (Friedman, 1953) because logical reasoning is at the center stage which derives theory (Crowther & Lancaster, 2012). Hence, in positivism research, hypothesis is formulated and tested through observation, thus, a scientific approach is used as it gives objectivity using facts in a systematic process.

The second paradigm, constructivism research, is basically a theory or understanding gain through observation and scientific interrogations about peoples learning. Constructivism says that people understand the world based on their own knowledge about it. Such knowledge is gained through personal experiences and reflections on such experiences. When a person is confronted with something new, he marries that with what he already knows and experienced and then either change what he believes and know or discard the new knowledge as irrelevant. Thus, people are their own knowledge creators as they explore, ask questions and assess what they already know. Thus, constructivism is a qualitative method as it preaches

knowledge building based on perceptions about human phenomenon based on personal and social experiences (Guba & Lincoln, 1994). The constructivism research says that people construct meaning about a phenomenon by relying on their personal experiences. Constructivism is a qualitative method of research which is idiosyncratic and susceptible to individual value judgments, which affects objectivity (Friedman, 1953).

The third paradigm of research is the mixed method (use of both positivism and constructivism) to better understand a phenomenon in a more detailed way in both facts and personal experiences. Thus, both qualitative and quantitative methods are used to understand a phenomenon or the functioning of the world. The emergence of mixed method was in response to the limitations of using either only quantitative or qualitative methods (Doyle et al. 2009). Thus, mixed method is a "*research in which the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches and methods in a single study*" (Tashakkori & Creswell, 2007:4). This study adopts the mixed method approach.

Justification of research design – A mixed method approach

The positivist research approach is been used by economist for a longer time period before constructivism emerged. There are calls for a combination of the positivist and constructivist (mixed method) in one research analysis. However, the nature of the research problem and objectives would determine the choice of appropriate research design.

The purposes for conducting mixed methods research design as identified by Greene et al. (1989) includes' triangulation, complementarity, development, initiation and expansion. Triangulation allows for greater validity in a study by seeking corroboration between quantitative and qualitative data. Another good reason for mixed method approach is offsetting weaknesses and providing stronger inferences by neutralizing the limitation of each approach (Bryman, 2006; Creswell et al. 2003). Again, mixed method helps to answer the research questions that cannot be answered by quantitative or qualitative methods alone (Creswell & Plano Clark, 2007).

This study adopts mixed method for some reasons; mixed method research helps to gain a more complete understanding of research problems (Creswell & Plano Clark, 2007). Giving the complex nature of the study (blue economy-social resilience-sustainable development goals) to really understand this needs a research approach that can enable researcher to capture the complexity of human phenomena (Sandelowski, 2001). Thus, mixed method can be ideal technique to assess complex research issues (Hosmer et al. 2008). Given the complex nature of the study and limited data on the issue, there is the need for the study to give a voice to study participants and ensure that the findings are grounded in participants' experiences.

As indicated earlier that the nature of the research and objectives determines the choice of research design, this study uses objective perspective to build an academic understanding on blue economy, social resilience and sustainable development goals in Ghana, hence the choice of mixed method approach. A nationally representative dataset and primary data collected on fishermen along the

coast of Ghana are data for the analysis of the objectives of the thesis. Hypothesis were tested to illustrate how the study achieve the objectives. For each of the three empirical chapters, the study justifies the method chosen as below sentences illustrates.

On socioeconomic characteristics of fisheries-dependent communities, the variables needed included; food consumption, non-food consumption (including health, education and other non-food items), housing expenditures (including rent and utilities) and other household socioeconomic variables to estimate the welfare of coastal households. The GLSS dataset captures information on the variables of interest. The GLSS is used in estimating the results of the first objective. Thus, the GLSS, which is a nationally accepted data, is representative enough for this analysis. In addition, primary data was gathered to complement the GLSS in achieving the first objective. The purpose of using both GLSS7 and primary data for this chapter is to help ascertain the results of the GLSS7 and to triangulate those findings. The GLSS7 is a household dataset on coastal communities and the primary data is on individual fishermen in the coastal communities. This allows the study to ascertain the findings from the GLSS7.

The second empirical analysis focuses on an objective analysis of social resilience at individual level and at community level. Objective study would require data that captures questions relating to social resilience and collected through observational data gathering. This information is captured by the primary data gathered through questionnaires, key informant interviews and focus group discussions.

Given that there have been different policy documents (not homogenous) on the blue economy and the fact that the concept (blue economy) is evolving, there is much need to carry out a comprehensive study to offer a further understanding on the concept to help policymaking. Such comprehensive study could provide understanding on the issues to focus on to make the blue economy principles work to help achieve sustainable development. Also, an appreciative of the blue economy tenets, nature and likely opposing issues that could affect it will help to achieve negotiations on the way-forward to protection and sustainable use of the ocean (UN General Assembly, 2015; Wright *et al.*, 2018) leading to an achievement of some of the targets of the UN sustainable development goals in the long run. In order to achieve this objective of conceptualisation, systematic literature review and conceptual analysis that included two key constructs (i.e., blue economy and sustainable development goals) was done.

The mixed method approach is used in this study because, the secondary data helps to capture a nationwide scope on households for the study and a primary data on households would have been restricted due to financial constraints. However, samples of fishers were interviewed to gather data for the second objective. The fishers were met at the site of fishing for the data gathering. The reason for adopting the mixed method in this study is reflected in the problem under study, the objectives of the study, data availability and capacity to collect primary data and estimation techniques adopted.

The study concentrated on the coastal areas of Ghana. These study areas are chosen basically because they have the highest numbers of fishers in the country

and have different ethnic groups. Diversity in customs and tradition on resource conservation could be learned in these diverse communities. In obataning data for the quantitative analysis (Kothari, 2004), a structured interviews are conducted on individuals' fishermen and Key Informant Interviews on leaders of fishermen (chief fisherman) and Focus Group Discussions with fishermen in the marine communities.

The quantitative method includes econometric estimations of the data that is gathered. This is used basically to provide estimates, forecast, numbers and figures to help explain well the issue investigated and the qualitative method will add value to the findings of the study through explanation from the respondents. The qualitative aspect of this study, uses verbal expressions, observing and words to express a reality, or behaviour or actions in a given situation (Golafshani, 2003). The qualitative method is used basically because of the need for a complex and detailed understanding of the issue from the perspective of the fishermen in the communities. The study obtained detailed information by talking directly to the fishermen in an interview and carried out Focus Group Discussions (FGDs for the Volta region alone) and Key Informant Interviews (KII) which allow respondents to give information pertaining to their experiences as living in the communities and engaging in marine activities.

Data and data sources

The objectives of the thesis informed the data sources employed for analysis. The first objective examined the socioeconomic characteristics of coastal communities in the context of the blue economy using the Ghana Living Standard

Survey round seven (GLSS 7) which has the variables of interest. To complement it, a field data was gathered to ascertain the results in a mixed method analysis. The second empirical chapter uses a primary data collected on fishers for analysis. The data was gathered through a sample of fishers along the coast of Ghana (the study area). However, since the third objective is to conceptualize blue economy-social resilience-sustainable development goals, a systematic academic literature review was done to help achieve that objective.

Ghana Living Standard Survey round seven – GLSS 7

The GLSS is nationally representative household survey dataset that is comprehensive and carries information on households living conditions in Ghana. It is a nationwide representative household survey on household welfare and living conditions in Ghana. The survey collects detailed data on households relating to their demographic characteristics, household member education and health and their related expenses, consumption patterns of households, employment and time use, migration, housing characteristics and household agriculture engagements.

The GLSS since its inception (1987/88) have collected data for the seventh round (2016/17) being the recent. Except for the first two rounds of the data, most of the rounds have identical questionnaires and this makes their results easily comparable. The data has sufficient information and have estimated the total consumption (both food and non-food items) of each participating household. This food and non-food consumption could be explicit (direct purchase) or implicit (acquired through other means like own production). In addition, the GLSS contains questions on socioeconomic and health access including environmental

and sanitation issues at the household or community level and this is appropriate for the analysis the of the first objective. Within the dataset (GLSS 7) the coastal sample was carved out since the study deals with coastal communities.

Sampling procedure

Sampling for field data collection for the GLSS 7 started in October 2016 and lasted 12 months. This involved selecting Enumeration Areas-EAs, and then list households in all selected EAs. The listing of households was visiting one after the other of the 1,000 selected EAs to capture record of all structures and households in the EAs with the household address and heads of household information using a computerized system (computer assisted personal interview-CAPI). Thus, the sampling frame was the listed households for the selection to the main survey using systematic sampling method. Two stage stratified sampling design was used for the current survey (GLSS 7 – 2016/17) with a sampled of 15,000 households in 1,000 Enumeration Areas (EAs) consisting of 561 (56.1%) rural EAs and 439 (43.9%) urban EAs across the ten administrative regions[3] of Ghana. The data collection lasted for a year (22nd October, 2016 to 17th October, 2017).

A response rate of 93.4% was achieved as 14,009 households were interviewed successfully out of the total 15,000 households selected for the survey. The coastal households carved out for the analysis is 2,172. As indicated earlier, the information captured GLSS 7 and nature of the objective of the first empirical

[3] Ghana now has 16 administrative regions as six new regions were created by referendum in February 2019. However, this data captured 10 administrative regions as it was collected (2017) before the referendum (2019).

investigation of this thesis allows for the examination of how fisheries-dependent communities' socio-economic characteristic in the context of the blue economy in Ghana using experience-based method. Variables used in this study include household food and non-food consumption items and socioeconomic characteristics such as household membership size, gender of head of household, employment status of head of household, poverty status of household, residence nature (rural/urban) where household stays, age of head of household as well as ownership status of the housing they stay in. The current wave (GLSS 7) of the data was used for regression analysis and the last three waves for tracking household welfare issues over time.

Data validity and reliability

Ghana Statistical Service (GSS) is at the forefront of the GLSS data collection and have done this since 1987. The GSS have made frantic efforts in improving the quality of the data (GLSS) collected over the years. The GSS adopts an internationally accepted measurements and specification for data collection in developing countries. Thus, the data is a nationwide data for analysis and generalizations. The first thing was an initial data inspection carried out variable description to certify that the existing data codes were valid. An independent examination and validation of the variables of interest were validated using the data description codebook. To achieve accuracy and succinctness, some variables were recoded to follow the objectives of this study and to cross examine to help eliminate outliers that may cause bias in the finding of the study.

Primary data collection

Primary data was collected and used for the analysis in achieving objective two of this thesis. The study design, sampling, instruments and data collection procedure as well as the test of internal and external validity of the data collected are explained below.

Sampling selection, instruments and data collection procedure

The study used purposive sampling techniques as respondents are those who are engaged in marine economic activities (mostly fisheries). Actual respondents were selected using simple random sampling technique. The first stage is to identify fishers and the second stage is to randomly interview them to get the required sample in each region/community. Overall, a random sample of 491 fishermen respondents across the coastal stretch of Ghana, who are engaged in marine economic activities from each of the marine study communities, responded to the structured questionnaires. The sample of respondents was carved out of the total of 107,518 fishermen that operates along the coast of Ghana (Dovlo et al. 2016). Following Yamane (1967) the sample is determined as follows;

Sample size is $n = \frac{N}{1+N(\propto)^2}$ Where N = sample frame (population); n = sample size and α = margin of error = 0.05

According to the 2016 Fisheries Canoe Frame Survey conducted by the MoFAD and the Ghana Statistical Service, the total number of fishers along the coast of Ghana is 107,518. Hence, the population or frame is 107,518.

Hence sample size is $n = \frac{107,518}{1+107,518(0.05)^2}$ = 399.996 = 400

The 400 respondents were further distributed according to each region's total (weight) number of fishers. That is regional samples were done according to proportion to size as captured below;

Regional samples (proportions)

Volta Region (total fishers = 14699) = $\frac{14699}{107,518} = 13.67\%$ of 400 = 55

Greater Accra (total fishers=25844) = $\frac{25844}{107,518}$ = 24.04% of 400 = 96

Central Region (total fishers=33373) = $\frac{33373}{107,518}$ = 31.04% of 400 = 124

Western Region (total fishers=33603) = $\frac{33603}{107,518}$ = 31.25% of 400 = 125

Total sample = 55+ 96 + 124 + 125 = 400

However, to collect good data and regarding the principle of large numbers, a large sample is better than a smaller one. This is because larger samples are nearer to the whole sample than smaller ones. Owing to this the study adjusted the sample size of 400 respondents to 530. This was also done to cater to a situation of having incomplete responses and respondents not willing to respond. With the adjusted sample of 530, the actual respondents who responded to the questionnaires was 515. However, after data collection and data management and cleaning the actual respondents was 491. This gave a response rate of 92.6%.

An interview administered questionnaires was used to collect the quantitative data, while key informant interviews and focus group discussion were used to obtain qualitative data. The study used an interviewer-administered questionnaire mainly because of the expectation that illiteracy among the respondents is high (could not read nor read). The questionnaires were read out to

the respondent in their local language, and their responses recorded. Some of the questions in the questionnaires were related to their demographic characteristics such as age, gender, income from fishing, marital status, number of children, migration for fishing, whether fisherman belongs to fishermen association, etc. as well as questions relating to their social resilience state. In the Volta region two coastal fishing districts are represented as indicated in the Ghana Canon Frame Survey 2016. In total 78 respondents responded to the interview-administered questionnaires in the Volta region. In the Greater Accra region, a total of 83 respondents were captured and a total of 169 in the Central region while 161 respondents were from Western region. The breakdown of the number of respondents in each regional and district fishing communities and the fish species landed is captured in Appendix "B".

Ten (10) research assistants were trained on data gathering procedure and administration of questionnaires on 15 – 16 November 2021. These research assistants have field work data collection experience. Majority (six out of ten) of them have been engaged by the School of Economics, University of Cape Coast in donor funded field work data collection. The other research assistants have been previously engaged in field work data collection such as the 2021 Population and Housing Census in Ghana. The questionnaire administration (field data collection) for this study was done in December 2021 to February 2022. The respondents were duly informed that their responses are solely for research purposes and assured of the confidentiality of their identities and responses. The data gathered is subjected

to validation checks and crosscheck to maintain the chronological responses. The edited quantitative data is analysed using STATA.

For the focus group discussions, an approximate of 9 respondents were selected to participate. An explanation on the purpose of the study was given to respondents for them to consent to be part of the study. The respondents for the FGD were gathered at one place and the questions are posed to them for their responses. The respondents were made to respond to questions one after another. Responses were audio recorded by the permission of the respondents. The audio recording was transcribed to generate results for the study.

Key Informant Interviews (KIIs) was also conducted as well as field observation was undertaken. For the KIIs, individuals interviewed were those deemed to have sufficient knowledge and information relating to fishing and fishermen in the communities. The respondents for the KII were the fishermen group leaders (chief fishermen) in the communities. The KIIs and FGDs allowed the respondents to speak freely on other concerns about their fishing activities, welfare issues, knowledge of the environment and the general fishing activities in the communities. Texts from the qualitative data were transcribed, identified, and analysed through thematic analysis. The thematic analysis focuses on the respondents' perception of their resilience nature, environmental knowledge, fishing activities and marine conservation concerns in the communities.

Pretest of questionnaires

To validate the instruments for this study, a pre-test of the questionnaires was done in Adina (in the Volta Region) on 10 respondents. This pre-test showed

that some questions seem repeated as same responses where been given by the respondents. Again, on the question of whether all the respondents' children are in school was reworded and keep in mind that some respondent children might not be in school currently but have all completed schooling. This was revealed when a 76-year-old fisherman (a retired teacher) indicated that all his children have completed school. Also, at the pretest, some respondents indicated that they are not married but they are cohabiting/living together for ages. This was combined and revision of the questionnaire was done accordingly. There were other insights gained and revision of the questionnaires was done and the finalized questionnaire for collection where necessary was done for the data collection.

Internal and external validity

The data collected was subjected to validity checks. In confirming the external validity, a tabulation of basic variables from the data collected and compared with similar variables from known and public existing data (i.e. the GLSS and the Canon Frame Survey) as done as captured in table 4. The table shows the basic statistics on these variables. In the table, average age of fishermen is 45 years in the primary data collected while it is 44 for the canoe frame survey conducted by the Ministry of Fisheries and Aquaculture Development. Again, majority of the fishermen are married as shown in all the data collection sources. This trend shows that primary data collected for this study is externally validated by other public data in existence. The internal validity checks were done in chapter six when the study run the PCA analysis and use the Chronbach's α statistics. For

reliability, the Cronbach's α analysis was done. A figure of 0.7 Cronbach's α value is accepted as a reliable scale (Chen & Popovich, 2002).

Table 4: Testing internal validity of the primary data collected

Variable	Primary data	Canoe Survey	GLSS – 7
Average age of fishermen	45	44	46
Average educational level of fishermen	Senior High School (Primary)	Senior High School (Primary)	Primary – BECE (Primary)
Marital status of fishermen	(Married)	(Married)	(Married)
Average number of children fishermen have	3 (4 & above)	4 (above 4)	6 (above 6)
Secondary occupation	(Farming)	(Farming)	(Trading)
Fishing holidays or non-fishing days	(Tuesdays& Sundays)	(Tuesdays)	-

Note: responses for the GLSS-7 data are household head responses; responses in brackets indicates the majority response. **Source:** Author's compilation, 2022

Theoretical modelling

The theoretical basis for analyzing the blue economy in terms of coastal communities' household socioeconomic characteristics in this study rests on Becker's microeconomic model of individual/household production (Becker, 1981). In this model, households allocate goods and time to the production of commodities that are either sold on the market, consumed at home, or for which there is no market. Becker (1981, IX) "*assumes that individuals maximize their utility from basic preferences that do not change rapidly overtime, and that the behaviour of different individuals is coordinated by explicit and implicit markets*".

In traditional microeconomics theory, there is assumption that relates the individual desire and taste to his/her rationality. That is the individual is rational consumer and behaves rational. Thus, individual consumption preference is represented by fixed utility, that makes the consumer studies reduced to a kind of

maximization of that utility given his/her constraint or budget that have alternative uses (Pollak, 2002; Banks *et al*, 1997; Barten & Bohn, 1982).

At some point in time, if the household preferences correspond with that of one individual, it fits well in explaining the utility model. The standard theory of consumer behaviour is an example *par excellence* of the economic problem: individuals (or households) have needs and desires that they want to satisfy. But they have to make choices, since they are limited in their possibilities.

The central idea here is that individual fishermen make a rational decision over their life cycle to enhance their welfare. Thus, fishermen in coastal communities maximizes their welfare by Pareto optimal allocation of their consumption, work and leisure given their constraints. In this model it is assumed that the individual inherits an initial stock of welfare that depreciates over time. Also, the individual may positively influence his or her stock of welfare via gross investments (affected by socioeconomic characteristics of coastal communities). Given the initial welfare, gross investments in welfare can be made through the combinations of the individual's own time and market goods, and stock of welfare enhancing issues, all of which is assumed to be inherited from their parents and the environment (coastal communities in this case). It is assumed that the individual maximizes his or her utility subject to a budget constraint that limits the amount of welfare he can attained or enjoy in a coastal environment.

The analysis in this study follows Samuelson (1957). In this model a fisherman’s welfare is embedded in a utility maximizing behavior of himself by

assuming that the decision of ensuring good welfare is the responsibility of himself. The fishermen utility is characterized by a welfare index of the form:

$$W\{U^1(C,H,A,L),U^2(C,H,A,L)\ldots\ldots\ldots\ldots\} \quad (1)$$

Where C is consumption, H is level of health, A is asset accumulation (including housing) and L is leisure enjoys.

The individual fisherman's welfare maximization involves; increase in consumption, affordable healthcare, asset accumulation, improvement in housing condition, enjoyment of some leisure etc. Thus, a fisherman maximizes welfare Subject to the constraints (both environmental and socioeconomic characteristics) and time constraints. The initial stock of welfare (w > 0), Subject to a constraint function such as equation 2

$$St = f\left(C_f, F_s, A_j, M_p B_e\right) = Fi \quad (2)$$

Where I_f is income from fishing, F_s is fish stock, A_j is alternative jobs and $M_l B_e$ is presence of marine rules and regulations-blue economy, respectively. Fi is full income including the value of the time endowment of the fisherman and non-labor income. Implicit in equation (2) above is the constraint relating to the social resilience of a fisherman comprising of the fisherman ability to bounce back when there is changes in marine environment that limits their fishing activities. This is given as

$$S_r = f\left(S_{r(t-1)}, HH_c, C_r\right) \quad (3)$$

Where S_r is social resilience of a fisherman, $S_{r(t-1)}$ is stock of social resilience proxied by the individual inborn characteristics, HH_c is household characteristics

(family background) and C_r is community characteristics (including community infrastructure). Solving fishermen welfare maximization problem yields a reduced form of welfare function (Samuelson, 1957) where all its arguments are exogenous to the individual fisherman.

Setting the lagrangian equations gives equation (6) as follows;

$$L_i = \sum_{i}^{n} f(C, H, A, L) - \lambda_i \sum_{i}^{n} \left[C_i - \left(\alpha C_f + \mu F_s + \partial M_p B_e + \gamma A_j + \delta S_r\right)\right] \quad (4)$$

Taking the first derivatives of the Lagrangian function (equation 4) with respect to cost of fishing (C_f), fish stock availability (F_s), marine policies ($M_p B_e$), availability of alternative jobs (A_j) and social resilience of a fisherman (S_r) until the initial conditions are met and solving these first order conditions associated with this optimization problem produces the reduced form of the Marshallian demand function for welfare given as;

$$L_{C_f} = U_c - \lambda C_f = 0 \quad (5)$$

$$L_{C_f} = U_c - \lambda M_p B_e = 0 \quad (6)$$

$$L_{C_f} = U_c - \lambda A_j = 0 \quad (7)$$

$$L_{C_f} = U_c - \lambda S_r = 0 \quad (8)$$

$$L_\lambda = C_i - \left(\alpha C_f + \mu F_s + \partial M_p B_e + \gamma A_j + \delta S_r\right) \quad (9)$$

Equations 5 to 9 are the maximization equations for the welfare of fishermen. The variables in the equations (particularly equations 1 to 4) are used to measure the welfare state of fishermen households. Welfare studies (Deaton & Zaidi, 2002)

have used and found these variables to affected individual or household welfare. Therefore, in the first objective, which sought to look at socioeconomic characteristics, looks at welfare as one aspect of this socioeconomic characteristics. Thus, the choice of variables is informed by literature.

Socioeconomic characteristics fisheries-dependent communities in the context of blue economy

The first empirical chapter examine the socioeconomic characteristics of fisheries-dependent communities in the context of the blue economy. Ordinary least squares regression techniques were employed. One main hypothesis relating to socioeconomic characteristics of coastal communities and the blue economy was tested in the first empirical chapter;

1. The socioeconomic characteristics of fisheries-dependent communities have significant effects on the sustainability of the ocean.

Multiple regression (Ordinary least squares)

To achieve the first objective, which is on socioeconomic characteristics of fisheries-dependent communities, the study first examines welfare in the coastal communities by using expenditure (consumption) measure of welfare. Welfare issues are deemed to be part of the socioeconomic aspect of individuals. There are different measures of welfare, however, this study adopted the expenditure measure for some reasons. First, individual consumer derives a well-being from actual consumption made rather than the income earned *per se*; hence, consumption is said to be a good way of capturing 'standard of living' (Citro & Michael, 1995).

Deaton and Zaidi (2002) argued that long-term income is reflected in consumption because short-term income is susceptible to fluctuations and consumption is smoother and less variable than income. Income is more likely to be affected by seasonal patterns resulting either in an underestimation or overestimation of real income. Consumption is more stable especially in agricultural societies as it is smoothed over the seasons, therefore better reflecting (or approximating) the real living standard. A comprehensive consumption would be helpful to measure welfare (Deaton & Grosh, 2000).

Consumption usually includes: 1) food consumption, 2) non-food items (including health, education and other non-food expenditures), 3) housing expenditures (including rent and utilities) and 4) consumer durables.

The model used is adapted from Wodon (1999). The determinants of household welfare can be established by a multiple regression as follows;

$$Y_i = \beta_i X_i + U_i \qquad (11)$$

Where logY_i is the log of household real expenditure (consumption) per capita; Xi are variables representing the characteristics of households that are said to affect the expenditure per capita[4] and U_i is the error term. According to Wodon (1999), due to the properties of the linear regressions, the expected consumption levels of households obtained by conditioning on the household's sample mean must equal the actual mean values observed in the sample. This then provides a good way to examine the impact of household characteristics and the return to these characteristics on growth. The

[4] Expenditure is chosen as a proxy for household welfare because it's a good proxy for reflecting permanent income and also for long-term average well-being (Balisacan *et al.*, 2003).

dependent variable (real expenditure) is not normal-shaped and skewed (especially the of the coastal sample), thus it is appropriate to use the log of real expenditure.

In equation 11, *Y* is a column vector (N x 1) vector of dependent variable, *X* is the regression matrix which is (N x K) matrix of explanatory variables, β_i is a column vector of coefficients and U is a column vector of error term for the regression. The model specifies a linear relationship between *Y* and *X*, which refers to the manner in which the parameters and the disturbance enters the equation, not necessarily to the relationship among variables. The explanatory variables have a full column rank; thus, the least squares solution of the estimation is unique and minimizes the sum of squared residuals.

Thus, the empirical model is;

$$\log(Y_1) = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + U_1 \qquad (12)$$

Where X_1 is the gender of household head; X_2 is household member size; X_3 is the residential status of the household (rural or urban); X_4 is the age of household head; X_5 is household wealth quintile; X_6 is employment status of household head; X_7 is poverty status of household; X_8 is housing ownership; X_9 is ecological zone; U_1 is the error term. The variables descriptions, measurements and expected signs are captured in Appendix D3.

Social resilience and demographic characteristics of coastal fishermen in Ghana: implications for the blue economy

Two main hypotheses related to the state of social resilience and its link to demographic characteristics of fishermen and their implication for the blue economy:

1. Examine the state of social resilience of coastal communities and its implications to the blue economy.
2. Assess the link between social resilience and demographic characteristics of coastal communities in Ghana.

Principal Component Analysis (PCA)

To analyse the state of social resilience of fishermen in coastal communities to prospective marine policy change, a Principal Components Analysis matrix of their responses is used. The first Principal Component (PC 1) measures their perception to risk that is related to their ability to absorb and adapt to change. Hence, statements that tells them being able to get alternative work elsewhere aside fishing as well as cope with small changes should something happen to their fishing activities that render them incapable of fishing again. The first component sought to measure their social resilience state relating to them being able to absorb change or shock. The second component (PC 2) test how well the fishermen have the ability to planning, learning and reorganization in the fishing industry. The second component measures their social resilience state regarding them being able to plan for a change, learn out of a change and able to reorganize themselves to withstand any shock that a change might bring. The third component (PC 3) dwelled on the

fishermen ability to cope with changes and at what threshold a coping is reached. The fourth and final component (PC 4) is on the fishermen being able and interested to adapt to change by repositioning themselves in the industry or outside the industry.

In measuring the fishermen response to prospective policy change, statements regarding their well-being, issues that are historic and their adaptive capacity to changes are listed. These statements are informed by literature. Thus, the statement tries to measure the fishermen level of well-being, confidence level and coping ability and adapting to the fishing industry changes. Fishermen were given the chance to do self-assessment of their expected well-being level regarding acceptability, flexibility and willingness to adapt to a requirement of a prospective policy change. Respondents self-rated their attitudes to each of the statements using a five-point Likert scale (strongly agree, agree, don't know, disagree and strongly disagree). Statements that contribute to the internal consistency of the social resilience scale were included in the analysis (Spector, 1992). The reliability analysis was informed by the Cronbach's α figure that was obtained by calculating the correlations among the statements (Chen & Popovich, 2002). A Cronbach's α value of 0.7 or greater is accepted as indicating a reliable scale (Sutton & Ditton, 2001).

The PCA analysis is a technique that helps to determine which statements are subsets and independent from other statement. Statements are combined into factors when they are independent from other statements but correlated among themselves (Tabachnick & Fidell, 1996). The PCA techniques assumes that some

underlying factors, that may be small in number compared to the initial number of statements, could cause co-variation among the responses. This study is on assessing and defining how individual fishermen response to prospective policy change. This is because, the scale (PCA) is hardly use for such analysis of individual responses however, responses from individual could be vital in understanding resilience at a higher level (Adger et al. 2002; Manfredo & Dayer, 2004). Hence, individual data allows analysis of resilience at higher levels without undermining the essential factors that may determine responses to policy change (Freudenberg & Gramling, 2002; Mascia et al. 2003; Trosper, 2004) and increases general applicability of results (Bradley & Grainger, 2004; Smith et al. 2003).

Binary logistic regression

After identifying the social resilience nature of the respondents, the study adopts a binary logit regression to study the socioeconomic and demographic determinants of fishers' social resilience.

In a binary outcome, Let P_i represent the probability that a fisher is socially resilient and the probability that a fisher is not socially resilient is given as 1- P_i. As Y is a latent variable, thus we do not actually observe $P_{i,}$. However, the outcome Y=1 is observed if the fisherman is socially resilient and Y=0 if he/she is not. This is functionally represented as:

$$P_r\ (Y_i = 1) = P_i \qquad (13)$$

$$P_r\ (Y_i = 0) = 1 - P_i \qquad (14)$$

It is possible, however, to reformulate these equations in terms of the odds ratio of the probability of a respondent being resilient and the probability of not as follows:

$$\left[\frac{Pi}{1-Pi}\right] = \frac{1 + e^{(\beta_0+\beta' Xi)}}{1 + e^{-(\beta_0+\beta' Xi)}} \quad (15)$$

$\left[\frac{Pi}{1-Pi}\right]$ is simply the odds ratio in favour of resilience, which is simplified as;

$$\left[\frac{Pi}{1-Pi}\right] = e^{(\beta_0+\beta' Xi)} \quad (16)$$

To get the logit model, the natural logarithms of the equation 6 is taken and observe that the log of the odds ratio, L, is not only linear in X, but also in the parameters; *L* is called the logit**,** and hence the name logit model for equations like (17).

$$Ln\left[\frac{Pi}{1-Pi}\right] = Li = \beta_0 + \beta' Xi \quad (17)$$

The following socio-economic and demographic variables were used as independent variables in the estimation; age of respondent, educational level of respondent, whether migrant or citizen, gender of respondent, marital status of respondent, income level of respondent, duration of being fisher (how long the respondent is a fisher), fish for self or other, household size where respondent is from. The dependent variable is social resilient as measured by the PCA analysis. The choice of these variables is informed by literature (Holling, 1973; Carpenter & Gunderson, 2001; Smith et al. 2003; Gallopin, 2006; Vogel, 2006; Berkes & Jolly, 2001).

Blue economy and sustainable development goals: exploring the social dimensions of SDGs in blue economy policy discourse

The third empirical analysis tests two hypothesis; the relationship between the blue economy and sustainable development goals, and the social aspect of sustainable development in the blue economy context. These hypotheses are;

1. Explore the link between the blue economy and sustainable development goals.
2. Assess the social aspect of sustainable development in the context of the blue economy.

In order to identify the current status of literature that studied blue economy link to the UN SDGs, a systematic literature was reviewed and conceptual analysis on two key broad constructs (i.e., blue economy and SDGs; and the social dimension of SDGs in the blue economy context) was done. Thus, this aspect dwell on those two broad categories of literature reviewed.

Blue economy and sustainable development goals

This search seeks to address the challenges of the link between blue economy and sustainable development goals. A database was developed that captures a compilation of literature that touched on blue economy links to SDGs. These literatures are published peer-reviewed manuscripts in research outlets during the past three decades. The database was a comprehensive and systematic search in identifying and extracting relevant literature that are in the interest area of the study. A content analysis was applied to the database and the results were carved out and presented.

The first step in compiling the database was an identification of the relevant literature by searching the internet. The indicators for the search include; Database was restricted to Scopus indexed publications; and the search conditions were English language journal articles; peer-reviewed journals only (excluding book chapters, conference proceedings and reports). The initial time period used was 1990 to 2020 (30 years), however, the concept of the blue economy was first introduced by Pauli in 2010 and subsequently the UN SDGs adopted in 2015 gave an impetuous to the concept. Thus, the study concentrated on 2010 to 2020 (10 years) in the search. The search strings include (i) "Ocean Economy and/ Blue Economy" and "Sustainable Development Goals" (ii) "Blue economy" and "Sustainable Development". The major search engine was Google Scholar where academic publications are kept and can be traced to the respective journal outlets. Another search did was to type directly the search strings into a browser search engine to retrieve the relevant literature needed.

Based on these search settings, the study conducted a search for keywords within the title, abstract, and keywords of the peer-reviewed papers and repeated the search for the two search strings. Blue economy and Ocean economy are used interchangeable in the literature; thus, it was included in the search strings without resorting to the use of one. Again, "Sustainable Development Goals" was included in one hand and "Sustainable Development" in another hand. Thus, two stages of keyword search were done to really identify those relevant literatures.

In the first search, 45 articles from peer reviewed journals were found, captured in the table in appendix C (some of these articles are Taylor, 2012;

Visbeck, 2014; Carr & Liu, 2016; Ehlers, 2016; Hays, 2016; Yang et al., 2016; Granit et al., 2017; Lent & Squires, 2017; etc.).

Social dimension of sustainable development in the context of the blue economy

This section is a literature review that touched on the extent of the integration of social dimensions of sustainable development into blue economy policy planning. The literature reviewed was sourced from the internet. Google scholar was the main database where the literature was sourced for the review. In sourcing for the literature, search strings like typing direct into the Google scholar dropdown button with strings like "Blue economy"; "Blue growth/economy principles"; "Blue economy policy planning"; "Blue economy as a sustainable development concept" and "The concept of blue economy and its definition". The study downloaded literature based on this search strings and screen the literature into two categories, namely; journal articles and reports (reports include policy briefs) on the blue economy. Further, the literature sourced were categorised into literature that dwell on issues related to marine protected areas; issues that relate to socioeconomic characteristics of fishers and fishing communities and lastly literature that dwell on the blue economy. In total 53 journal articles and 27 reports or policy brief documents were sourced. Efforts was made in reading through every literature to ascertain whether such literature paid heed to social dimension of sustainable development in the blue economy discourse. Thus, a content analysis of the literature sourced was used. The content analysis was on; i) definition discourse of blue economy, ii) the opportunities and threats nations could face in the wake of blue economy adoption, iii) means and ways of financing blue

economy. The content analysis was done by focusing on to what extent the literature advocates the social dimension of blue economy.

Post-estimation test interpretations

Different methods are used to check econometric models' specifications. Some of these methods includes; the Wald test, Likelihood Ratio (LR) test, Link test, Hosmer-Lemeshow and Lagrange Multiplier (LM) (Long & Freese, 2014; Cameron & Trivedi, 2010; Wooldridge, 2010; Stock & Watson, 2007). Estimations of a multiple regression and the logit regression automatically provides results on model fitness (such as the likelihood ratio test and the p-value that test for joint significance of all variables) when the robust option is used. Long and Freese (2014) said that when the robust standard errors are applied the output results of the Wald test is provided.

In the first empirical analysis a post estimation test of the model was done. These tests include; a pairwise correlation matrix, the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity, omitted variable bias test by using the Ramsey Reset test, model specification test and multicolinearity test using the variance inflation factor (VIF). The test results are captured in appendix D.

The post estimations test of the second empirical test was done using the McFadden's R^2, commonly known as pseudo R^2, though the pseudo R^2 does not replicate the linear model R^2, it is ideal for binary outcome models. Thus, the pseudo R^2 does not measure how the model explains the variations of the outcome variable (Long & Freese, 2014). Hence, the Wald test, Likelihood ratio test, and Link test were carried out.

Chapter Summary

The chapter outlined the methods of analysis adopted in the thesis. The chapter gave reasons for the choice of the mixed method and a detail note on all the estimation techniques used in each of the objective was carried out in this chapter. Multiple regression estimation technique (i.e., ordinary least squares) was adopted for the first empirical analysis based on the interest to analyse socio-economic characteristics of communities and not individuals. A qualitative technique based on content analysis was also adopted to add value and understanding to the multiple regression analysis. The PCA technique was adopted to analyse the state of social resilience of fishermen in the coastal areas. The PCA gives factors on what are the most contributing factors to an issue being investigated. A binary probability model (logit) was used to actual ascertain the link between demographic characteristic and social resilience of the fishermen. A qualitative technique was also adopted to confirm the findings of the PCA and the logit models. A literature survey was adopted to analyse the third empirical results. This technique was adopted to ascertain whether the social aspect of blue economy is being incorporated in policy planning. The next chapter (Chapter 5) is on the examination of the socio-economic characteristics of fisheries-dependent communities in the context of the blue economy as the first empirical results presentation and discussion.

CHAPTER FIVE

SOCIOECONOMIC CHARACTERISTICS OF FISHERIES-DEPENDENT COMMUNITIES IN THE CONTEXT OF THE BLUE ECONOMY IN GHANA: IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT

Introduction

The chapter captures the estimations results and discussions on the socioeconomic characteristics of coastal communities in the context of the blue economy. One main hypothesis was tested: (a) the socioeconomic characteristics of fisheries-dependent communities have significant effects on the coastal resources, thereby hampering the ocean sustainability. The study employed multiple regression estimation technique (OLS) and qualitative analysis (FGD, KII) in tackling the issue under consideration. Descriptive statistics of the variables are presented which is followed by discussion of the results generated and final section is on summary of the chapter.

Descriptive statistics and distribution of variables

Table 5 captures the descriptive and distribution of the variables used in the regression analysis. The table captured figures for the different ecological zones in Ghana. From table 5, it is revealed that the mean value of households' total expenditure on non-food is 5.83 in coastal zone as against 3.59 in the savannah zone. This shows that coastal dwellers, compare to savannah homes, have some level of expenditure on non-food, indicating that they have high level of welfare compared to the savannah zone. Household total expenditure on food in the coastal zone is 3.96, which is lower than that of the forest zone at 4.21, indicating that

coastal dwellers spend less on food than forest zone. Meaning coastal dwellers spend less on food compared to forest zone. This implies that welfare might be enhanced in coastal zones as against the forest ecological zone.

Again, household expenditure on other non-food items such as education (5.32) and health (6.92) indicate that coastal households on average spend more on them than other households in savannah zone (4.47 on education and 4.56 on health). In terms of household real expenditure, coastal homes spend more (1.78) than the savannah zone of 1.24, though coastal figure is less than the forest zone (2.25). Average household size in coastal zone is 3.8 and that of savannah zone is 5.24. Thus, coastal zone households have smaller family sizes compared to the savannah zone. Households' heads in the coastal zone are relatively older than those in the forest zone consisting of an average of 46.74 years and the forest zone of 45.5 years.

Relatively, coastal areas have more employed persons (81% on average) than the savannah zone (72.89%) employed persons. Thus, coastal zones have some level of employment avenues than the savannah zones. Also, households headed by females in the coastal zone (40%) are more than those in the forest zone (34.62%) and savannah (22.65%). On the poverty status of households, non-poor households are 86.3% in coastal zone as against a national average of 74.4%. This indicates that livelihood could be higher in coastal zones compared to other zones. A look at house ownership rather indicates a higher percentage of 43.4% of coastal homes who own their place of abode as against a forest percentage value of 41.97% and savannah of 41.06%. About 50% of the households in coastal zone dwell in rural

areas as against about 55% rural dwellers in the forest zone and about 74% rural dwellers in the savannah zone.

Table 5: Descriptive statistics and distribution of variables

Variables	Mean (%)			Standard deviation		
	Coastal	Forest	Savannah	Coastal	Forest	Savannah
Total Expenditure on Non-Food	5.83	8.33	3.59	1.92	7.70	2.50
Total expenditure on Food	3.96	4.21	3.14	6.75	8.60	1.73
Total expenditure on education	5.32	5.02	4.47	2.93	4.91	1.17
Total expenditure on health	6.92	7.21	4.56	18.21	19.13	10.5
Total expenditure on housing	3.33	9.24	2.62	2.15	3.08	6.21
Household real expenditure	1.78	2.25	1.24	3.70	1.01	4.97
Household size	3.8	3.64	5.24	2.41	2.43	3.34
Age of household head	46.74	45.57	47.24	16.10	15.62	16.43
Employment status (employed)*	80.89	83.93	72.89	0.660	0.63	0.74
Gender of household head (Female)*	40.33	34.62	22.65	0.491	0.48	0.42
Poverty status (Non-Poor)*	86.33	87.44	48.02	0.435	0.42	0.84
Housing ownership (Own)*	43.40	41.97	41.06	0.857	0.88	0.78
Residence (Rural)*	49.60	54.96	76.34	0.500	0.498	0.43

Note: *mean figures are in percentages* **Source:** Authors computation from GLSS 7 data (2016/17)

Livelihood Indicators in Coastal Communities in Ghana

In this section, an analysis of some livelihood issues in coastal communities as captured in Table 6. In the table, we found more coastal dwellers (41.3%) to have ever attended school as against the national average of 36% who have ever attended school. Also, there is high literacy rate (50.6%) among coastal dwellers than the national average of 47.4%. Again, more (85.77%) coastal homes have electricity

than the national average of 74.68% who are connected to electricity. Of the 85.77% of coastal homes which have electricity, 84.62% are connected to the national grid whilst the remaining is either connected to mini grid, or private generator, or solar lantern or rechargeable lamps. Thus, access to household amenities in coastal areas is improving as 55.38% has access to pipe-borne water which is more than the national average of 38.97%. Housing or dwelling conditions in coastal areas is encouraging as a higher proportion (95.76%) leave in decent homes (separate house/semi-detached rooms, flats, apartment or compound house) as against the national average of 89.4%. Again, a larger percentage (43.37%) of coastal households owns the house they leave in and others are either renting (26%) or staying in rent-free house (30.29%). All these are more than the national average figures indicating an encouraging housing livelihood in coastal communities.

In Table 6, economic activities seem to be vibrant in coastal communities as over 80% are employed as against the national average of about 79% being employed. Majority (52.76%) of these coastal employed persons are self-employed either in agriculture (23.57%) or non-agriculture (29.19%). This partly indicates that there are opportunities for livelihood diversification in coastal communities as majority (57.32%) are employed in the non-agriculture sector (public or private and non-agriculture self-employed) indicating that there could be livelihood diversification in coastal areas. This means that marine resources in Ghana are a source of livelihood to many. This is similar to what Islam and Shamsuddoha (2018) noted that marine resources are sources of livelihood and income for millions along the coastal area of Bangladesh and beyond. This finding is also noted

by Gordon and Pulis (2010) that in the Western region of Ghana, a majority of those living in fishing communities has a weaker asset base and are likely to find livelihood in micro-enterprise.

Table 6: Livelihood indicators in coastal communities

Livelihood Indicators	Coastal (%)	National (%)
School attendance (ever attend)	897 (41.3)	5,043 (36)
Adult literacy	1,099 (50.6)	6,640 (47.4)
Employment status		
Employed	1,757 (80.89)	11,088 (79.15)
Not employed/no work/no activity	337 (15.52)	1,746 (12.46)
Others (unpaid trainee, voluntary, own use work)	78 (3.59)	1,175 (8.39)
Forms of employment/work		
Employee (public/private)	611 (28.13)	3,353 (23.93)
Self-employed (non-agric.)	634 (29.19)	3,065 (21.88)
Self-employed (agric.)	512 (23.57)	4,670 (33.34)
Others (unemployed, retired, inactive)	415 (19.11)	2,921 (20.85)
Type of dwellings		
Separate house/Semi-detached/ Flat/Apartment	868 (39.96)	4,930 (35.19)
Compound house (rooms)	1,212 (55.80)	7,594 (54.21)
Huts/building	61 (2.81)	1,306 (9.32)
Tent/improvised home (kiosk, container, room attached to office /shop, uncompleted etc.)	31 (1.42)	179 (1.27)
Ownership of dwelling		
Owning	942 (43.37)	7,282 (51.98)
Renting	565 (26.01)	2,927 (20.89)
Rent-free	658 (30.29)	3,721 (26.56)
Perching	7 (0.32)	59 (0.42)
Squatting	0	20 (0.14)
Source of electricity		
No electric power	303 (13.95)	3,495 (24.95)
Electric power	1,863 (85.77)	10,462 (74.68)
Others	6 (0.28)	52 (0.37)
Source of water		
Pipe-borne/tap	1,203 (55.38)	5,460 (38.97)
Bore hole/well/spring	730 (33.61)	30,669 (47.77)
River/stream/lake/canal/rain	205 (9.44)	1,648 (11.77)
Other	34 (1.57)	41 (0.29)
Observations	2,172	14,009

Note: *Percentages are within brackets* **Source:** Author's computation from GLSS 7 data

Figure 13 shows coastal communities' access to some amenities such as waste disposal methods and toilet facilities. It is revealed that over the period 2005

to 2017, majority of coastal households' resort to public dump site as their main source of waste disposal, though a good number also engaged in self-burning of waste. Also, some households dispose waste indiscriminately and others fall on private waste collectors to collect their waste. On access to toilet facilities, over the years 2005 to 2017, a good number of coastal homes have no toilet facility and therefore resort to open defecation (in the bush or along beaches) while majority either use a pit latrine, KVIP or public place of convenience. Also, other households have access to WC as their source of place of convenience. This shows that in coastal communities, sanitation issues are not much encouraging as a good number still engaged in open defecation and indiscriminate waste dumping. Gordon and Pulis (2010) also found that in coastal communities' sanitation is appalling.

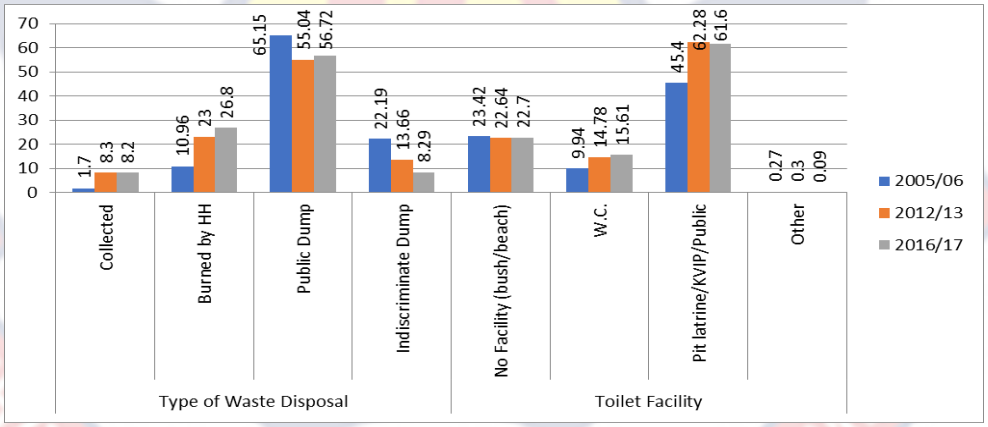


Figure 13: Coastal communities' mode of waste disposal and access to toilet facilities, 2006 – 2017 ***Note:*** *The data shows only coastal communities sampled*
Source: Author's based on datas GLSS 5 (2005/06), 6 (2012/13) & 7 (2016/17)

Comparative analysis of households in coastal zone and other zones

Household expenditures across the ecological zones on rural-urban divide

Figure 14 captures the total annual expenditure of households on food and non-alcoholic items and total annual expenditure on non-food alcoholic items

disaggregated into rural urban divide. Here we compare coastal households with other households in forest, and savannah zones. In the first quadrant of Figure 14A, non-poor coastal urban households have a mean annual expenditure on food and non-food alcoholic items above that of their counterparts (non-poor) in urban forest and savannah zones. This is similarly observed among the poor in urban coastal as against the urban forest and urban savannah, albeit slight changes. The very poor households' mean annual expenditure on food and non-alcoholic items show a marginally higher in favour of urban coastal households compared to urban forest and urban savannah households. However, the opposite is observed when looking at rural homes. The non-poor rural coastal households have an average annual expenditure on food and non-food alcoholic items lower than their counterparts in rural forest and rural savannah. Again, the rural coastal poor homes have a marginally lower average annual expenditure on food and non-food alcoholic items than those rural forest and savannah poor households. This indicates that urban coastal households averagely spend more on food and non-food alcoholic food items than their co-urban households in forest and savannah zones. The finding is in line with Donkoh et al. (2014). This finding could partly be so because most traditional coastal fishing communities are rarely farmers are engaged in fishing and other non-farming activities. Fishing communities seldom engaged in food crop cultivation, thus making food crops a bit higher than the forest and savannah zones (Ghana Statistical Service-GSS, 2019).

The Statistical, Research and Information Directorate-SRID (2010) of Ministry of Food and Agriculture indicated that food crop production is quite low

in coastal areas (Western region), contributing less than 8% to national production. Also, Figure 14 shows that rural coastal homes have less mean annual expenditure on food and non-food alcoholic items than their counterparts in forest and savannah zones. This could partly be attributed to the rolling out of poverty reduction programmes that are specific to the savannah zone (e.g., Northern Development Authourity, Savannah Accelerated Development Authourity-SADA) and forest zone (e.g., Community Forestry Management Project). However, it is recent that the Coastal Development Authority (CODA) was established with similar aim.

In the same vein, figure 14B detailed out the mean annual household expenditure on non-food items in both rural and urban coastal homes compared to savannah and forest homes. The non-poor urban coastal households have an average annual expenditure on non-food items that is slightly higher than their counterparts in savannah zone but slightly lower than that of urban forest households. However, a poor urban coastal home has a marginal higher average annual expenditure than urban forest and savannah homes. It is further observed, as in the case of household expenditure on non-food items, that rural coastal homes have a slightly lower average expenditure on non-food items compared to rural forest households and slightly higher to that of rural savannah households.

Figure 14A **Figure 14B**

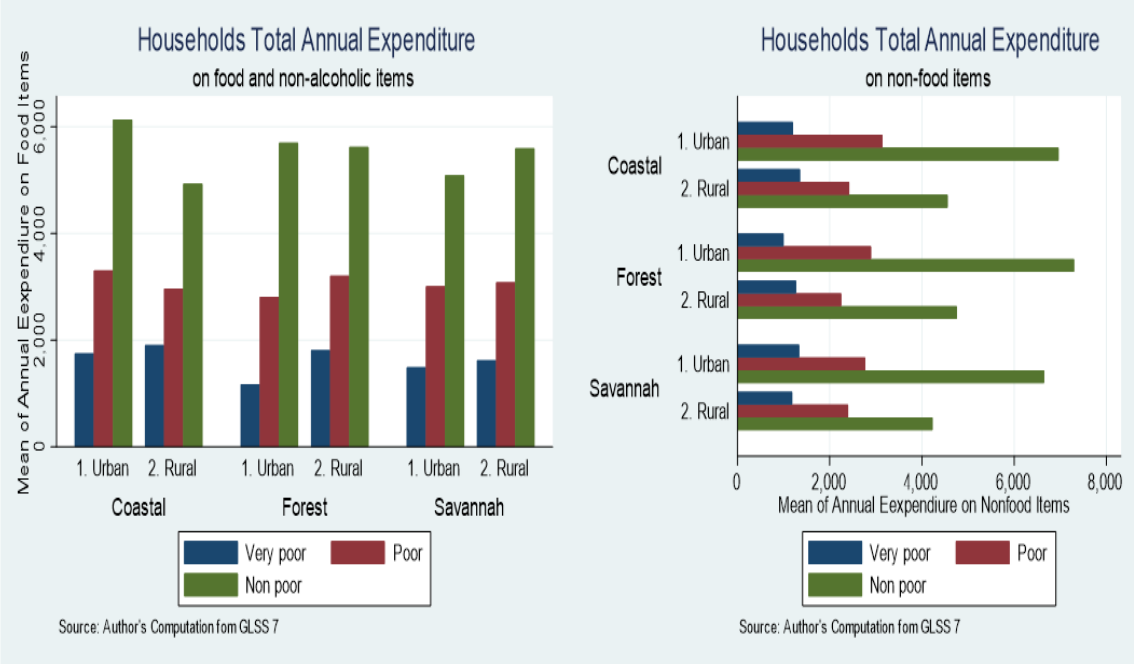


Figure 14: Comparative analysis of coastal households' expenditures with other ecological zones. **Source:** Author's estimation

Figure 15 shows the average real expenditure of households in both rural and urban coastal compared to their counterparts in forest and savannah zones. Non-poor urban coastal homes are slightly below and slightly above their mates in forest and savannah zones respectively in terms of average real expenditure. Again, the poor urban coastal homes have a higher real expenditure than those in urban forest and urban savannah. However, the very poor in urban coastal and urban forest have almost the same real expenditure that is higher than the very poor urban savannah households.

On the rural front, rural coastal homes have real expenditure lower than their co-rural homes in both forest and savannah homes. This is also the case for the rural poor coastal homes compared to the rural poor in both forest and savannah homes. This reiterates the point that rural coastal homes have lower welfare than

rural forest and rural savannah. Further in Figure 15, it is revealed that all the very poor households (whether rural or urban) are within the lowest wealth quintile in all the ecological zones. Also, the non-poor homes in all the ecological zones are within the 3rd to 4th quintile, though urban coastal and urban savannah households are exactly on the 4th quintile. This is also true for the poor households in all the ecological zones that are within the 1st and 2nd wealth quintile.

From the foregoing, it is observed that rural coastal homes have less average annual expenditure on food and non-alcoholic items and non-food items than their rural counterparts in forest and savannah zones. In the reverse, urban coastal homes have higher such average expenditures than their urban fellows in forest and savannah zones. In the light of this, the study looked at households' expenditure components according to ecological zones and across the three waves of the GLSS data as captured in Figure 16.

Figure 15A **Figure 15B**

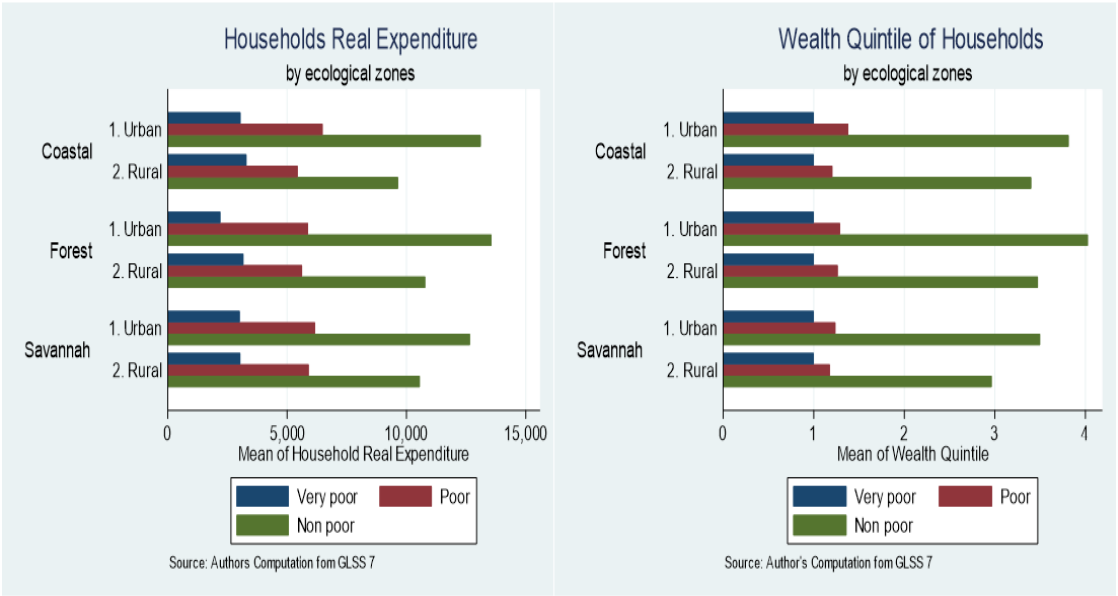


Figure 15: Comparative analysis of coastal households' real expenditure and wealth quintile with other ecological zones. **Source**: Author's compilation, 2021

To track household welfare based on expenditure lens, the study disaggregates the data into household expenditure components based on three major expenditures[5] (food, housing and other non-food items – education & health as a % of total expenditure) across the three waves of the GLSS data (2005 to 2017). The figure (i.e., Figure 16) reports only rural household sample to allow us tracks the rural poverty dynamics of the coastal zone and compares it with other zones. Also, as GAMA is part of the coastal areas and not a rural setting, I deemed it well to exclude GAMA and other urban areas and deal with rural households as poverty is said to be more prevalent in rural settings (Jayasinghe et al. 2016; International Fund for Agricultural Development-IFAD, 2011). Again, most of the coastal fishing communities in Ghana are rural (Marquette et al. 2002).

In Figure 16, it is revealed that, the percentage share of food expenditure from total household expenditure reduces over the period for all households in all the ecological zones. Significant reductions are seen in the rural coastal and rural savannah homes. Also, housing expenditure saw a rising trend in all the rural ecological homes, with a significant rise witnessed among the rural coastal especially from 2012 to 2017. For expenditure on other non-food items, a rise is observed in rural coastal and rural savannah while a declining trend is the case in rural forest homes. The Figure 16 further revealed that coastal rural households' expenditure on food (as a % of total expenditure) keeps reducing over the years

[5] The classification of household expenditures is based on the United Nations Statistical Classification System – Classification of Individual Consumption According to Purpose (that classified consumption into food and non-food groups).

2005 to 2017 while their expenditure on housing and other non-food items (education & health) keeps increasing. That means welfare is increasing as coastal communities' increases expenditure on other non-food items indicating that coastal dwellers have adequate food consumption. This is similar to the conclusion made by the World Food Programme, Ministry of Food and Agriculture and Ghana Statistical Service (2012) that in Ghana households that fishing supports their livelihood were more likely to be food secured. A similar trend of reduction in food and increases in housing and non-food expenditures is observed in rural savannah homes but for rural forest dwellers a reduction in food, an increase in housing and reduction in non-food expenditures is observed across the three waves of the data. It can be observed that changes in this trend are sharp for rural savannah households', however that of rural coastal is also encouraging.

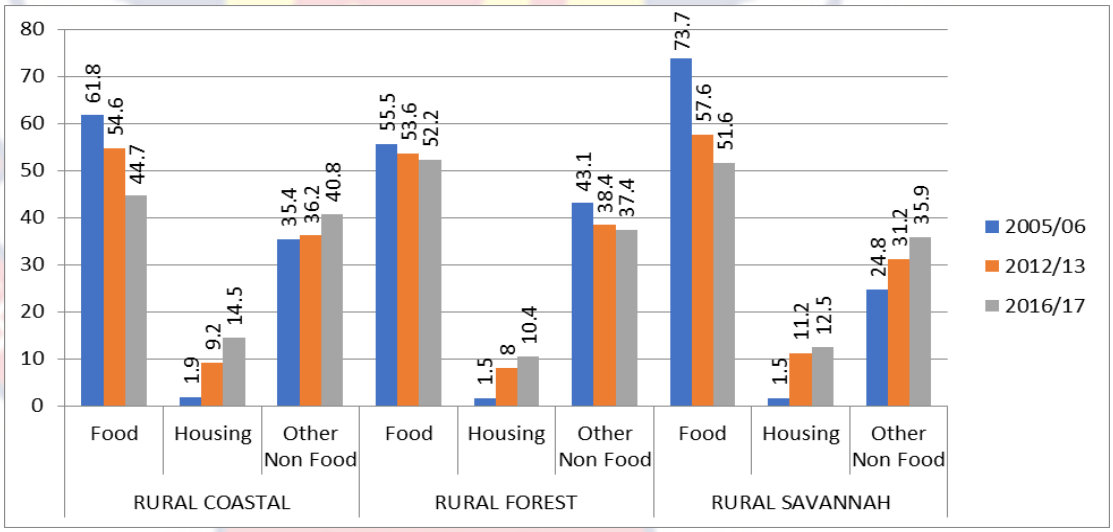


Figure 16: Components of household expenditure by rural ecological divide (% of total expenditure). **Note:** the sample here is rural households' samples alone
Source: Author's estimations using data GLSS 5 (2005/06), 6 (2012/13) & 7 (2016/17)

Still on Figure 16, the GLSS 5 (2005/06) shows that a typical rural household in a coastal area spends about 61% of their total expenditure on food; 19% on housing and 35.4% on other non-food items respectively. These figures keep changing (decrease for food expenditures and increases for both housing and other non-food items expenditures) over the years. Likewise, for the previous waves of the GLSS data such as GLSS 6 (2012/13) indicates that rural coastal homes spend 54.6% of their total expenditure on food and the remaining is spent on housing (9.2%) and non-food items (36.2%). This is an increase in the shares of total expenditure for housing and non-food items compared to the percentages in the GLSS 5 (2005/06).

This indicates that the percentage share of food expenditure reduces over the years, which means households are able to enhance their welfare by spending on other welfare essentials like housing, education and health. This indicates that welfare is improving in the coastal zone. This similar to what Umeh and Asogwa (2012) indicated that a household expenditure share on housing, clothing and education and health increases as income rises and this shows improvement in standard of living. According to the GLSS 7 (2016/17) data, a typical household in rural coastal spends 44.7% of their total expenditure on food and 14.5% on housing and 40.8% on non-food items (education and health). This figure shows that in rural coastal welfare is improving as expenditures on housing (14.5%) and other non-food items (40.8%) are higher than those of rural forest (10.4% for housing and 37.4% for other non-food items) and rural savannah (12.5% for housing and 35.9% for other non-food items). This means that the poorer homes spend larger portion

of their incomes on food than the richer home do. This finding is in line with Engel (1857) and Umeh and Asogwa (2012) who summarised that a large proportion of poorer households' income goes into necessities, including food. Again, Donkoh et al. (2014) assert that higher food expenditure means that a household is poorer, *ceteris paribus.*

The study also looked at poverty status of households across the ecological zones over the three waves of the GLSS data (2005/06; 2012/13 and 2016/17). In the figure (i.e., Figure 17), coastal zone has registered very low percentages of the very poor (extreme poor) households over the period 2005 to 2017. Out of the total number of very poor households (1,522) for the 2016/17 data, 3.75% are from coastal zones, while 9% and 87.25% are from forest and savannah zones, respectively with no single household from Greater Accra Metropolitan Area (GAMA) being very poor. Likewise, for the poor households (2,060) only 11.65% dwell in coastal areas and 27.33% and 60.44% leave in forest and savannah zones. A similar trend is found for previous waves of the data (waves 5 and 6). However, the forest zone has the highest percentage of non-poor homes across the three waves of the data. Of the total number of non-poor households (12,758) for the GLSS 6 (2012/13) data, 46.32% are from forest zone while 25.15% and 15.57% are savannah and coastal dwellers respectively and the remaining 12.96% are from GAMA (not reported in the figure 17). It must be noted that across all the waves of the GLSS, the percentages of very poor and poor households from coastal zone are below the national average while the reverse is observed for both forest and savannah zones.

Again, while the percentages of the very poor and poor household's decreases over the years in coastal and forest zones and that of savannah zone witnessed an increase. However, even though both coastal and forest zones have decreases in very poor and poor households over the years, coastal zone have in absolute terms witnessed more reduction than forest zone. For the very poor and poor households in coastal registered a 55.36%[6] and 41.62% reduction over the years 2005 to 2017, while forest zone correspondingly registered 47.98% and 29.5% reductions, respectively.

In Figure 17, the number of coastal very poor households keeps reducing (marginally) over the years 2005 to 2017 as against an increasing trend observed among the very poor home in the savannah zone for the same period. A similar decreasing trend in the number of poor households is observed in the forest zone over the same period. Also, a similar reduction trend is seen for the number of poor homes in both coastal and forest zones; however, savannah zone saw an increase in such households over the period (2005 to 2017).

[6] I computed this figure from dividing the difference between the percentage changes from 2005 data to 2017 by the 2005 figure and multiply by 100%. That is for very poor households in coastal zone $\frac{8.4-3.75}{3.75} \times 100 = 55.36\%$

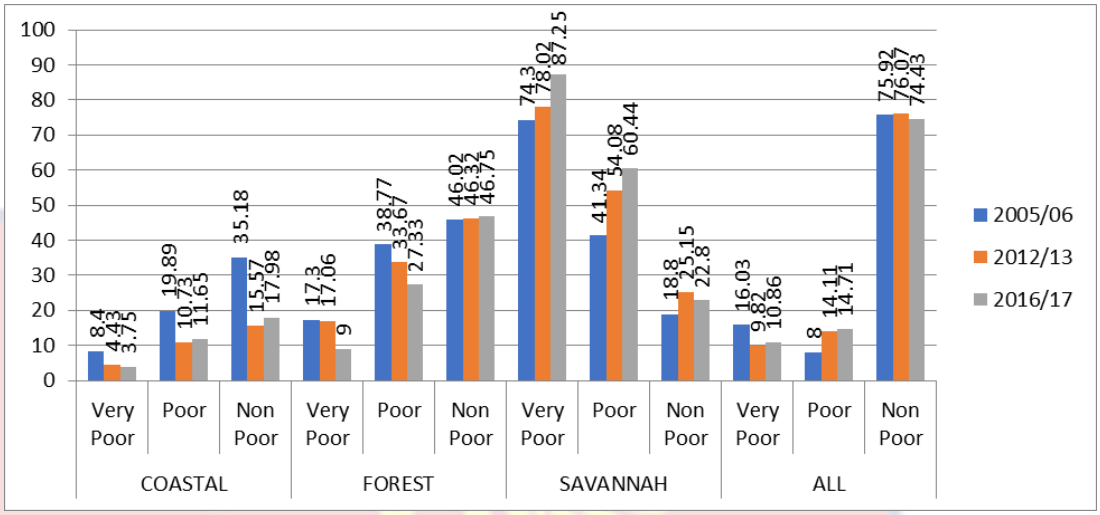


Figure 17: Poverty status of households across the ecological zones in Ghana, 2006 – 2017. ***Note:*** *'All' refers to all the households in the data sampled (Ghana).*
Source: Author's estimation using data from the GLSS 5 (2005/06), 6 (2012/13) & 7 (2016/17)

Econometric analysis

Table 7 presents the results of the econometric analysis of household welfare in coastal communities as well as the national level sample. In the table, we have the coastal sample and the full Ghana sample. In the table, a female headed household in coastal zone has 35.9% less real expenditure than a male headed household (to the tune of GH₵1,079.27 in real monetary terms). On a similar note, the national average difference between female headed households and that of male headed homes is 39.1% less for female headed homes (i.e., GH₵946.81 in monetary value). This finding is contrary to Donkoh et al. (2014) who indicated that households headed by females in Ghana have higher expenditures than male headed ones, however, this was contrary to a *prior* expectation. Thus, our finding confirms that of Rodriguex (2000) that poverty is a feminine matter. An increase in household membership will lead to 17.7% increase in real expenditure in coastal

homes (GH₵2,312.00 in monetary terms) and about 96% at the national level (i.e., GH₵2,011.00 monetary value). If the membership of household increases, this means the household would now have to increase its expenditure to cater for the increase membership in terms of food and non-food expenditures. Umeh and Asogwa (2012) and Donkoh et al. (2014) both argued that larger households are forced to reduce share of food expenditure to get allowance for their children education or seek medical attention. Again, coastal rural homes have real expenditures lower than coastal urban homes by about 30%. However, this difference closes as we consider the national average (12.2%).

Further, Table 7 revealed that increases in the age of household head relate to increase in real expenditure by about 47% in coastal zone and about 19% at the national average. This finding is so because, as one ages, their health status might be deteriorating and need for healthcare increases. Also, older persons have special need relating to caretaking. Donkoh et al. (2014) also had a similar conclusion in their study. Also, as a household transition to a higher welfare quintile from a lower welfare quintile, there are increases in the real expenditure by 22% in coastal zone and 12.7% at the national level. A home where the head is unemployed, real expenditure is lowered by 29.2% compared to an employed headed home. In a different breath, a non-poor household has increase in real expenditure of 86% than a very poor home. Likewise, a poor home has about 33.5% more real expenditure than a very-poor household.

Table 7: Econometric estimation results of socioeconomic effect on real expenditure in coastal communities in Ghana

Variables	Coastal sample	Full sample
Gender of household head (Female)	-0.359*** (1.30)	-0.391*** (1.47)
Household size	0.177*** (2.84)	0.963*** (2.64)
Residence (rural)	-0.229***(1.33)	-0.122*** (1.5)
Age of household head	0.473* (1.70)	0.185*** (4.56)
Welfare (Quintile)	0.221*** (1.86)	0.127*** (15.51)
Employment status		
Employed	Base category	
Unemployed	-0.292 (2.32)	-0.364 (2.37)
Not in labour force	-0.277 (2.06)	-0.150** (2.12)
Poverty status of household		
Very poor	Base category	
Poor	0.335** (4.22)	-0.348*** (2.65)
Non Poor	0.862*** (3.97)	-0.122*** (2.52)
Household ownership of housing unit		
Own	Base category	
Renting	-0.236 (1.70)	-0.121*** (1.98)
Rent-free	-0.169 (1.54)	-0.510*** (1.72)
Perching	0.195 (1.09)	-0.148** (1.01)
Squatting	NA	-0.244 (1.73)
Ecological zone		
Coastal	Base category	
Forest	NA	0.521** (1.95)
Savannah	NA	-0.268** (2.14)
Accra (GAMA)	NA	0.382*** (2.82)
Constant	-4.660*** (802.7)	-7.99***(4.32)
R-squared	0.6798	0.6608
Prob > Chi^2 (F)	0.0000	0.0000
Number of observations	2,172	14,009

Note: *NA means not applicable; *, **, *** are significant at 10%, 5% and 1%; standard errors are within brackets;* **Source:** Author's estimation using GLSS 7 data

Still on Table 7, households that own the dwelling they stay-in are better in welfare in terms of real expenditure than other households who are either renting or staying in rent-free houses. A household that stays in a rented accommodation has real expenditure lower by about 23.6% compared to a household that owns their dwelling unit. In the same vein, a household in a rent-free dwelling has real expenditure lower by 16.9% than a household that owns its housing unit. Though

these figures are not significant in coastal areas, they are significant at the national level (perhaps because most coastal homes stay in rental or rent-free houses – 56.3% as against national level of 47.45%). This finding is so because most households that own apartment are relatively rich than those that does not own their dwellings. Thus, as majority (55.8%) stay in compound houses, landlords of such houses usually rent out and hence they earn some income to boost their expenditures. The finding is previously summarised by Gordon and Pulis (2010) who indicated that in the coastal communities in the Western region of Ghana, most households own a dwelling unit.

Table 7 further shows that the ecological zone disparity indicates that households in forest zone and GAMA have 52% and 38% higher real expenditures respectively, than coastal homes while homes in the savannah zone have about 27% less real expenditure than coastal homes. Our model is well fitted as the probability Chi^2 is significant at the 1% level for both coastal and national level samples. Also, the R^2 is 0.6798 and 0.6608 for coastal and national samples, respectively. This means that variations in household real expenditures in coastal areas are explained by the variables in this study up to about 68% in coastal areas and about 66% at national level.

Discussion of econometric results

The quest to harnessing the blue economy for economic growth and sustainable development has recently been on the forefront of developmental efforts. The blue economy principles have become necessary given the dwindling land resources (FICCI-KAS, 2019) and pressures mounting on the ocean resources

for sustenance. This study looked at one of the ways blue economy policy documents or studies should focus attention on. That is looking at the blue economy in the socioeconomic spheres of marine communities. Thus, this is earlier stated by Ababouch (2015) that fisheries and aquaculture are important to the quest to move towards a blue economy/blue growth because they are interconnected to and rely on aquatic ecosystem and the tendency for people employed in the sector not to serve as only users of the resource but also check on the sustainable use of the resource.

Household characteristics such as membership size indicate a smaller size compared to national average. More coastal folks are literate (50.6%) compared to national average of 47.4% and more coastal dwellers have ever attended school than the national average who have ever attended school. Improved access to education helps to build human capital base and contributes to higher skilled labour force (World Bank, 2017). Education could serve as a panacea to living sustainable life which boosts achievement of a blue economy society. Also, access to pipe-borne water in coastal areas is encouraging (55.38% against national average of 38.97%) and higher proportion (95.76% against 89.4% national average) of coastal dwellers leaves in decent apartments and again, majority of coastal homes are connected to the national grid. This indicates that welfare is enhanced in coastal communities compared to other ecological zones in Ghana. Thus, this is a good sign for blue economy to strive in coastal communities.

It is found that a good number of coastal dwellers either dispose waste indiscriminately or resort to public dumping sites, which could lead to such wastes

being carried into the ocean and thus creating pollution and subsequently affecting marine ecosystem. Again, it is realised that a good percentage of coastal households have no toilet facilities and resort to open defecation (bush or beach) when easing themselves. This could compound the problem of polluting the ocean and undermines the objectives of a blue economy effort. This finding was earlier found by Jambeck et al. (2015) and Schmidt et al. (2017a) that there are indications that large metric tons (4.4 and 12.7 million) of debris from land-based sources make their way into the oceans each year.

On poverty disparities, it is revealed that poverty is minimal in the coastal zone compared to the forest zone, savannah zone and national average, as lower percentages of the very poor and poor households are registered in coastal communities over the years 2005 to 2017. Perhaps there is a lot of livelihood diversification at coastal areas (Gordon & Pulis, 2010) that have uplifted poverty compared to other zones. This is a good indicator for the blue economy concept. As the blue economy entails limitation on fishing activities, fishers and fishing communities should built their economic capacities to still be relevant and be economic resilient, to curb any consequences that might arise from marine resource limitation due to blue economy implementation. Also, coastal areas have more employed persons than the national average (81% against 79%) and majority of these employed in coastal areas are self-employed (either in agriculture or non-agriculture). This means that there are opportunities for livelihood diversification in coastal areas. Thus, availability of livelihood diversification can help to absorb a greater proportion of small-scale fishers and other unskilled informal sector

workers whose lives depend directly or indirectly on fishing. Hence, in the context of the blue economy, fishers could find other means of livelihood sustenance should regulations alter their dependence on fishing for livelihood.

Thus, this study is conceptualised to argue that the socioeconomic characteristics of marine communities could negatively or positively affect efforts to achieving blue economy. Where there is non-socioeconomic robust fishing community (as explained in figure 15) there is tendency for issues like overfishing, pollution of the ocean, and other mishaps that threatened the health of marine resources. Overfishing ultimately reduces fish stock which results in lower fish catch and compromises food security. Overfishing is driven by factors including those associated with lack of alternative livelihoods in coastal communities and illegal, unregulated and unreported (IUU) fishing. Studies suggest that ending overfishing could help reap over 90 million metric tons of annual harvest, which is more than both current and future productions (Costello et al. 2016; Ye et al. 2013).

Qualitative Results Analysis

In a content analysis of the FGD and KII showed a mixed result. On the sanitation characteristics of the communities, one respondent (chief fisherman) indicated the community members "*pour both liquid and solid waste into the sea and also defecate around the beaches*" (Chief fisherman from Azizanya in Ada East District, Greater Accra region). Another KII said that;

"*You see, because of the lack of good drainage system, there is water logged at my place and other places in the community*" (Chief Fisherman from Ahwiam in Ada West District, Greater Accra region).

We personally saw some residents defecating along the beaches, dispose solid and liquid waste into the sea, and bath their animals (sheep) in the sea as shown in the picture in Figure 18. At a community in the Volta region, we saw an elementary school along the beach with a signpost as seen in Figure 18 with inscription "please do not defecate here" and just a few meters after the signpost, we saw one gentleman defecating. At Ahwiam in the Ada East District, we witness others bathing their animals in the water and a few meters from the sea shores was a rubbish dump site.

On jobs availability in the coastal communities and why fishing alone seems to be the only job for majority. There were mixed reactions as some respondents indicated that they have alternative jobs and can survive whenever there is cut in their fishing activities. One respondent said;

"*Though we fish most often, there are some alternative jobs we at times engaged in; these are labourers in construction works, the young ones engage in Okada-commercial motor riding and some goes to market to sell on market days"* (FGD participant from Dzelukope, in Volta Region).

Another person added that;

"*You know we have to feed our families all year around, so we engage in other forms of income generating activities during lean or close season*" (FGD participant from Tettevikope Volta Region).

"*I must say that, though some do some other jobs aside fishing, majority engage in non-skill jobs. So, if there is going to be say close season for several months, most fishermen would feel it. So, if you people can tell the government to*

provide us with skills either self-employable or not, I think it would help" (FGD participant from Dzelukope, Volta Region).

"*This alternative job issue you are talking about pertains to the young ones. How can an old person like me get to do any other job? So, if there is going to be any changes in the fishing business, they should consider the older persons. We are important because we have high experience in the industry and need to teach the young ones*" (FGD participant from Kedzikope, Volta Region).

"*You can see there are no much alternative jobs in the villages as there are in the urban areas. So most of us from the villages do not have anything to do when there is close season or ban on fishing*" (FGD participant from Hedzranawo, Volta Region).

Figure 18: Pictures from the fishing communities showing waste disposal behaviours; Source: Author's fieldwork, 2021

Chapter Summary

The chapter discussed the results of the first empirical chapter which is on the socioeconomic characteristics of coastal communities in the context of the blue economy. One main hypothesis was tested: (a) the socioeconomic characteristics of fisheries-dependent communities have significant effects on the coastal resources. Using multiple regression estimation technique (OLS) and qualitative analysis (FGD, KII) the study revealed that socioeconomic conditions such as employment, household poverty status, access to electricity, education, good water, and housing nature including its ownership, are encouraging as most coastal communities in Ghana have good access. These are all welfare enhancing indicators and that is good ground for blue economy. However, a good number of coastal communities still have poor toilet facilities and resort to open defecation and also dispose waste indiscriminately. These unhealthy practices which pollute could threaten the health of marine resources. In a nutshell, the study argues that socioeconomic characteristics of fisheries-dependent communities' matters in blue economy discourse.

CHAPTER SIX

SOCIAL RESILIENCE AND DEMOGRAPHIC CHARACTERISTICS OF COASTAL COMMUNITIES IN GHANA: IMPLICATIONS FOR THE BLUE ECONOMY

Introduction

The blue economy emphasizes marine conservation. In most cases, examining the design and effect marine conservation policies (like MPAs) are done from a biological point of view. However, studies (Christie 2004; Wahle et al., 2003; Mascia, 2003) have concluded that social factors are as important as the biological or physical factors in determining marine conservation success or failure (Christie et al. 2003).

This chapter therefore presents results relating to an examination of the state social resilience and demographic characteristics of coastal communities and their implications to the blue economy. Thus, the chapter identifies the state of social resilience in marine communities and how demographic characteristics affects social resilience. The results presented here in this chapter addresses the issues of; enhancing social resilience requires what necessary factors should be looked at in marine communities? How can the principle of social resilience be built into marine communities to achieve blue economy?

Descriptive statistics and distribution of data

The descriptive statistics and distribution of variables are shown in Table 8. In Table 8, the majority of the fishermen are from Central region (34.42%) followed

by Western region (32.97%) and then Greater Accra (16.91%) and Volta (15.88%). Majority (79%) of them had leave within their communities for the last 20 years. On marital status and family divestiture, Table 8 further revealed that majority (73.52%) of the fishermen are married while 16.29% stays single and 5.5% are divorcees. This means that the majority that are married could be social resilient, as they may pool resources together with their spouses. This could help them to attain certain livelihood status than those unmarried counterparts. Again, the average number of children a fisherman has is about five children. However, with an average number of children of five, could mean a strain on the fisherman's livelihood as more individual are to be catered for by the fisherman.

The mean age of fishers in the study is 41 years. A number of them (49%) have had a feel of some formal education, though majority (about 51%) have never attended any form of formal education. Though majority (which is slim) has no formal education at all, the remaining percentage have felt formal education and can influence the rest who have no formal education in terms of their co-fishing activities. Thus, the effects of a lack of education might not be apparent in the fishing business along the coast of Ghana. The respondents are Christians in majority (70.47%) and 21.38% are traditional faith believers. with only 3.05% indicating they are neither Christian nor traditionalist nor Islamic faith. This religious faith has some effect on the nature of fishing and perception of the fishing and fishing activities as well as environmental knowledge and practices. Majority being Christian could mean that certain believes about the sea-god might not be

prevalent. Similar conclusions have been made by Adjei and Sika-Bright (2019) that traditional believes about the sea being God affects fishing and fish efforts.

Fishermen have an average of 23 years of fishing experience in the industry. Fishing is found to be the primary job of most (about 88%) of the respondents and only 12% said fishing is not their primary job. Again, as can be seen in Table 8, 75.36% indicated they have no secondary job while 24.64% indicated that they have secondary jobs aside fishing. Also, fishermen average income from fishing as a percentage of total income is 85.75%. Meaning majority of the fishermen income if from fishing or income from fishing is the highest among fishermen stream of incomes. Thus, fishing seems to be their main source of livelihood. This finding is in line with Dovlo et al (2016).

As low as 23% of the fishermen belongs to a fishing self-help association with majority (77%) not belonging to any of such association or group. This indicates that most of the fishermen would not benefit from a group support and risk sharing that such groups usually have. This can make the fishermen vulnerable to any shocks. It is revealed that majority (80.65%) of the fishermen at a point in time during a year, migrates from their usual home fishing grounds to other fishing grounds either within or outside Ghana. Majority (about 69%) do not own a fishing canoe and has to work under a canoe owner ether in a profit sharing or sole work for the canoe owner for payment.

Table 8: Descriptive statistic and distribution of data

Variable	Measurement	Response	%	Obs.
Region	The region that the respondent is from	Greater Accra	16.91	83
		Central	34.42	169
		Western	32.79	161
		Volta	15.88	78
Community membership	Whether the respondent is from the community or a migrant	Yes	79.02	403
		No	20.98	107
Marital status	The marital status of the respondent	Single	16.29	80
		Married	73.52	361
		Divorce	5.50	27
		Widowed	2.85	14
		Separated	2.44	12
Children	The number of children the respondent has	(figure in mean value)	4.57*	491
Age	The age of a fisherman in completed years	(figure in mean value)	41*	491
Education	Level of education of the respondent	None	50.51	248
		BECE	36.25	178
		MSLC	3.05	15
		SHS	7.74	38
		Voc/Tech/Teacher	1.83	9
		Tertiary	0.61	3
Religion	The religious faith the respondent belongs to or practices	Traditional	21.38	105
		Christianity	70.47	346
		Islam	5.10	25
		Others	3.05	15
Experience	Number of years the respondent have being a fisher	(figure in mean value)	23.58*	491
Fishing as primary job	Whether fishing is the primary job for the respondent	Yes	87.58	430
		No	12.42	61
Secondary job	Whether respondent has secondary job	Yes	24.64	121
		No	75.36	370
Income from fishing	The percentage share of fishing income from total income	(figure in mean value)	85.75*	491
Fishermen Association	Whether the respondent belong to any fishermen association or group	Yes	23.22	114
		No	76.78	377
Migrate to fish	Fisherman migrates to other fishing grounds	Yes	80.65	396
		No	19.35	95
Ownership of canoe	Whether the respondent owns a fishing canoe	Yes	31.36	154
		No	68.64	337

Note: * figures in mean values; **Source:** Author's computation, 2022

The state of social resilience of fishermen

A PCA was used to identify the variables to measure fishermen response to prospective policy changes and this PCA helped to reduce the complex nature of the factors. In PCA analysis each component is labelled as accurately as possible to enable the interpretation of the results accurately. The basis of statements was used to label each component comprising it (as shown in Table 9).

Table 10 captures the descriptive statistics as well as reliability analysis for the 17 statements that measures social resilience. In the table, only 12 statements, out of the 17 statements, has been seen to have effect on the scale. Thus, these 12 statements (as seen in Table 10) mirror the social resilience measure in this study. These 12 statements were analysed using PCA, which showed that four factors best described them (see Table 11). These four factors together explain 64.8% of the variations in the analysis.

The first PCA captured statements that seeks to understand how fishermen perceive risk and their absorptive and adaptive ability. This represents 24.3% of the variance. Thus, statement such as "*I have many career options available if I decide to no longer be a fisherman*" was analysed. These statements measure the fishermen being able to lay hands on work somewhere should the need be and coping with small changes. The second component, represents 19.7% of the variance and looks at fishermen planning, learning and reorganization ability in the fishing industry. The third component is made up of 11.1% of the variance and are statements that relates to fishermen coping threshold attainment. The fourth component is 9.7% of the variance and dwell on fishermen ability and interest to adapt to change.

Table 9: Descriptive statistics and reliability analysis

Survey items (questionnaires)	Mean	Standard deviation	Item-total correlation	α if item is deleted
I have many career options available if I decide to no longer be a fisher	1.98	1.06	0.46	0.653
I am confident that I could get work elsewhere if I needed to	1.89	0.97	0.45	0.656
I am too young to retire and too old to find work elsewhere	2.68	0.90	0.47	0.656
I would be nervous trying something else	2.09	1.08	0.43	0.656
I can cope with small changes in the industry	1.66	0.91	0.41	0.662
I have planned for my financial security	2.86	0.94	0.68	0.666
Every time there is a change, I plan a way to make it work for me	2.18	1.00	0.32	0.670
I am more likely to adapt to change compared to other fishers	3.01	0.85	-0.05	0.676
I think I am competitive enough to survive much longer	1.66	0.88	0.23	0.680
I am confident things will turn out well for me regardless of changes in fishing	3.06	0.98	0.20	0.684
If there are any more changes I will not survive much longer	2.86	1.15	0.13	0.684
I am interested in learning new skills outside of the industry	2.32	1.10	0.17	0.685
I would find it very difficult working for someone else	1.89	1.02	0.56	0.685
Change is normal part of our everyday life	2.85	0.84	0.28	0.686
I would like to start up a business one day doing something other than fishing	1.97	0.95	0.30	0.693
I believe that the future will look after itself	1.64	0.85	0.02	0.700
I am always thinking of new and better ways to improve my fishing business	2.97	0.94	0.27	0.706

Note: α is Chronbach's α; statements were measured on 5-point scale: 1=strongly disagree, 2=disagree, 3=don't know, 4=agree, 5=strongly agree.
Source: Author's estimations, 2022

This study discussed the nature of the results as to what might be behind the four key social resilience components that is found here. The thesis discussed social resilience components in the theoretical review section, as in chapter three. These components are: the risk perception in approaching change; the ability in planning, learning and reorganization; how fishermen perceive their ability to cope with change; and their interest level in adapting to change.

Table 10: Principal Components Analysis (matrix of the fishermen response to policy change)

Survey items (questionnaires)	PCA 1 (24.3%)	PCA 2 (19.7%)	PCA 3 (11.1%)	PCA 4 (9.7%)
I have many career options available if I decide to no longer be a fisher	0.808			
I am confident that I could get work elsewhere if I needed to	0.787			
I am too young to retire and too old to find work elsewhere	0.625			
I would be nervous trying something else	0.603			
I can cope with small changes in the industry	0.462			
I have planned for my financial security		0.858		
Every time there is a change, I plan a way to make it work for me		0.746		
I am more likely to adapt to change compared to other fishers		0.628		
I do not think I am competitive enough to survive much longer			0.682	
I am confident things will turn out well for me			0.637	
If there are any changes, I will not survive much longer			0.547	
I am interested in learning new skills outside of the industry				0.936

Source: Author's construct, 2022

Even though it is complex to measure of social resilience because it is multidimensional in nature, the results from the PCA analysis indicate that the

source of social resilience of fishermen along the coast of Ghana, can be described by four broad attributes; (i) the perception of risk emanating from change, (ii) ability to plan, learn and reorganize, (iii) perception of the ability to cope with change and (iv) the level of interest in the prospective change.

General resilience theories (Holling, 1973; Carpenter & Gunderson, 2001) conceptualized socio-ecological resilience into three broad system. The first is the ability of a system to absorb disturbance without losing its structure or function. Second is the extent that a system is self-organizing. Third, the extent to which a system builds its learning and adaptation capacity. Three of the results of this thesis (factors that describe fishermen social resilience to prospective policy change) can be mapped against this general resilience theory.

The measure of fishermen perception of their coping ability to change, as seen in this thesis, is similar to the general resilience theoretical definition "*the amount of disturb a system can absorb*". This measure (perception of coping ability) has been used by other studies and found to be highly profound. One of such studies is Smith et al. (2003) that concluded that fishers have witnessed their stress levels increased as well as increases in depression, anxiety and anger resulting from the Florida Bet Ban policy change. Understanding how people perceive their stress experiences and their nearness to coping thresholds, would help to determine at what level/threshold of disturbance that a system can absorb before losing its function.

Again, the second measure (i.e., the level of interest of fishermen to policy change) correspond with the general resilience theory definition that "*the degree to*

which the system is capable of self-organisation". The thesis refers to the fishermen interest level in adapting to a policy change requirement to be associated with the level of finance, social and emotional flexibility of the fishermen. Thus, such statements (or questions) like "*I would be nervous trying something else*" and "*I have planned my financial security*" etc. are being used to measure that. Some researchers (Carpenter & Gunderson, 2001; Shindler & Cheek, 1999) stressed the importance of flexibility in resilience maintenance. Understanding how capable an individual is coupled with his interest to change when circumstances demand, can be a vital ingredient to analyzing potential self-organisation.

The third general resilience theory emphasize planning, learning and reorganization ability and the thesis summarized from the PCA analysis that this component holds in the study area. Thus, the third general resilience theory definition of resilience (learning and reorganization abilities – Folke et al. 2002) is confirmed in this thesis. Such statements like "*I am interested in learning new skills outside of the industry*", "*anytime there is a change I plan a way to make it work for me*" etc. were analysed.

The fourth factor that this thesis ascertained to be important in understanding fishermen coping and adaptive ability to change regarding their perception of risk. The PCA results suggest that fishermen risk assessment informs their responds to the potential policy change. This study found perception of risk to be vital partly because it examines social resilience to prospective policy change (not an actual policy in place). This fourth factor is not readily related to general resilience theory, but some scholars (Gallopin, 2006; Vogel, 2006; Berkes & Jolly,

2001; Gramling & Freudenberg, 1992) have empirically made conclusions in that direction. For instance, Gramling & Freudenberg (1992) indicated that miners' perception of change significantly affected their coping and response to change.

With this state of social resilience of fishers, this thesis further explores the link between fishers' demographic characteristics and social resilience. This is estimated and reported in Table 11. Table 11 represents the econometric estimation of the demographic characteristics on social resilience of fishermen. The table 11 indicates that as a fisherman ages, he becomes less socially resilient to changes in the fishing industry. This finding is not significant and is contrary to expectations.

The resilience of fishermen is associated with the level of education of the fisherman. Being educated increases one's resilience compared to an uneducated person. A fisherman who has received a secondary school level education has 7% more chance of being socially resilient than a co-fisherman who received no formal education. A tertiary level educated fisherman has 19% increases in the likelihood of being socially resilient than a non-educated fisher. Thus, as one gets educated it helps builds his resilience. This is so because an educated person might easily understand policy change and prepare towards it than a non-educated person.

Also, fishermen who are married are seen as being resilient than those fishermen who stays single. However, fishermen who have ever married but are currently either divorced, widowed or separated are less likely to be socially resilient than a single status fisher. Thus, being married helps builds fishermen resilience. This is so because a married fisher could pool resources with the spouse to enable him stay resilient to changes that affect his fishing activities (earnings

from fishing). An increase in the number of children fisherman has reduces the likelihood of the fisher being resilient by about 2% (however it is not significant).

Still on Table 11, the experience of fishers is found to affect their social resilience. A one-year increases in the years of fishing boost the resilience of fishers by about 6.6%. Also, having an alternative job increases the odds of being socially resilient by more than 10%. Perhaps fishermen with alternative sources of livelihood could fall on such alternative during times of close season or ban on fishing. They are able to generate earning aside fishing and thereby enhancing their resilience to changes in fishing industry.

Being an employee fisher reduces the likelihood of being socially resilient. Perhaps, employee fisher is not able to take decisions on his own (decisions to cope with change) when there are changes in the industry. If a fisherman belongs to a fishermen association or self-help group it more than doubles the odds of being socially resilient than not being part of any fishermen association. This could be so because a group is able to diversify risk thereby building individual resilience. Also, a group could help its members by providing finance and have a unified voice to fight for their welfare and wellbeing. As the income share of fishing increases for fishers, this increases their resilience. A one percent increases in income from fishing, increases resilience by about 2%. Also, those migrant fishers are 2.4% more likely to be resilient than non-migratory fishermen.

Table 11: Econometric estimation results of demographic characteristics on social resilience

Explanatory variables		Social Resilient (dependent variable)	
		Logit	**Probit**
Age of the respondent		-0.054	-0.052
		(0.047)	(0.043)
Educational level of respondent			
No formal education		Base category	
Primary (BECE)		0.0667	0.061
		(0.046)	(0.041)
MSLC		0.062	
		(0.057)	
Senior High School		0.0704*	0.086*
		(0.050)	(0.044)
Vocational/Technical/Teacher		0.081*	
		(0.050)	
Tertiary		0.1941*	0.017
		(0.054)	(0.048)
Marital Status of respondent			
Single		Base category	
Married/cohabiting or living together		0.0317*	-0.0311
		(0.024)	(0.022)
Others (widow, divorced, separated)		-0.0128	-0.01
		(0.036)	(0.035)
Number of children respondent has		-0.0186	-0.029
		(0.024)	(0.022)
Years of being fisherman (experience)		0.0657*	0.064*
		(0.043)	(0.039)
Have alternative job (yes)		0.102***	0.092***
		(0.039)	(0.03)
Employed by someone (yes)		-0.0033	-0.0032
		(0.003)	(0.003)
Belongs to fishermen association (yes)		2.88*	3.006
		(1.7)	(0.001)
Percentage of income from fishing		0.0198*	0.0190*
		(0.012)	(0.011)
Migrate to fish (yes)		0.024*	0.0054
		(0.21)	(0.02)
		0.0021	0.0053
		(0.028)	(0.026)
Predicted probabilities	**Min**	0.006	0.002
	Max	0.67	0.64
Log likelihood		-457.02402	-456.28781
Prob>Chi^2		0.0000	0.0000
Pseudo R^2		0.0622	0.0632
Observations		491	491

Note: The standard errors are within brackets; ***, **, * =significant at 1 per cent; 5 percent 10 per cent levels. **Source:** Author's own estimation, 2022

The model estimated is robust, showing from the probability chi-square (Prob>Chi^2) value of 0.0000, indicating that the explanatory variables together significantly determined the dependent variable. Again, a probit model was used to reaffirm the logit model. The logit model has predicted probabilities in the range of 0.006 minimum and 0.67 maximum while that of the probit model is 0.002 minimum and 0.64 maximum. Endogeneity test to ensure that there is no correlation between an explanatory variable and regression error term(s) was done (Abdallah et al. 2015). Again, omitted-variable bias was estimated to be sure that there is no correlation between the error term and the independent variables (Stock & Watson, 2003). Probability value of 0.3068 was gotten and is higher than the usual threshold of 0.05 (95% significance) indicating that we do not need more variables. The study further did a multicollinearity test to ensure no regressor should be a linear function of another (e.g. a fisherman may look resilient just because he has a family support). A variance inflation factor (VIF) of 2.3 indicates that there is no multicollinearity in the model which indicates that endogeneity is not a serious problem.

Qualitative Results Analysis

In a narrative analysis of the FGD and KII showed a mixed result. On whether the respondent fishers see themselves as being socially resilient, some indicated they are resilient while others maintained that they are not. One participant who thinks he is resilient, though such resilience seems to be Godly, has this to say;

"I know some would say if there are changes in fishing practice that limits our fishing business, they would not survive. But God being so wonderful anytime

*there is close season we survive because everyone is forced to do other things to get money" (*FGD participant from Dzelukope, Volta Region).

In another word, an old aged fisherman counter this by saying;

"Those of us who are old and never learn any skill at our youthful age and has no strength currently, how do we survive? When the last tidal wave hit some communities, I remember I was thinking that if this wave were to hit my community badly like it did in Blekusu, by now I would have been gone by this incident" (FGD participant from in Kedzikope, Volta Region).

"The issue is that we the young ones have at least some other forms of work like Okada riding, carpentry, mason, which we rely on in times of no fishing or lean season. I think that is what makes us look like we can survive if there are changes that limit fishing" (FGD participant from Tetevikope, Volta Region).

To add to this, another fisher said;

"Also, those who don't migrate to fish seem to be facing problems when there is lean season or ban on fishing or close season. Whenever there are changes like ban on fishing or close season, some of us migrate even to Benin to fish" (FGD participant from Dzelukope, Volta Region).

"To me we are resilient. Those that are not much educated are those found wanting when there is change in the industry. Whenever, there is going to be any change from government, most of the fishermen do not understand well the issue and how to deal with it. So, you would see them resisting" (FGD participant from Hedzranawo, Volta Region).

Lack of education is seen as an issue that affects fishing and fishermen resilience. In a Key Informant Interview (KII) of the chief fisherman for Dzelukope, Volta Region has this to say;

"Most of the fishermen are lacking education concerning fishing as a business. Fishing is environmentally inclined and so to survive in fishing one needs much education. Maybe the government should provide us a continuous education, perhaps 3 to 4 times a year" (KII of chief fisherman, Dzelukope, Volta Region)

When the participants were asked whether they if there are small changes in the industry they can cope. Most said that they can with just few maintaining that they can't. One participant said;

"We can cope with government regulations with small changes as we use to cope with others like close season. However, any change to come we should be pre-informed for us to prepare as unforeseen changes affects almost all of us badly" (FGD participant from Kedzikope, Volta Region).

This statement connotes that the fishermen would be resilient to prospective policy change when they are duly informed and educated about it. However, they might not be able to withstand unforeseen events like disasters, climate change or tidal waves.

When the participants were asked whether they know what Marine Protected Area (MPA) is, many indicated that they do not know what it is. Some other few participants however said they have heard of it or knows what MPA is

about. After carefully explaining what MPA entails regarding its nature and benefits, the respondents were asked to indicate whether they would welcome government initiative to establish one within their area. One participant had this to say;

"*If government want to establish one then the government should first of all educate us on it, provide us temporary alternative jobs to help us earn income. Either than this we may resist any attempt by government to establish one*" (FGD participant from Tetevikope, Volta Region).

Another participant rather indicates that he does not understand why MPA should even be established. He narrated that;

"*The fish multiples every time and we fish them. So, if government put in an MPA, it restricts us from fishing and the fishes would over multiply. So, if government even brings that MPA, we will still sneak to those grounds and fish*" (FGD participant from Dzelukope, Volta Region).

When this participant was asked why at times, they get low fish catches, he added;

"*We have too many canoes on the water more than the rate at which the fish reproduces. Also, this light fishing we have been complaining about kills the fishes and others use the poli net that catches even the smallest fish".*

However, from a KII of the chief fisherman of Dzelukope, revealed that there are three earmarked fishing grounds as appropriate for MPA establishment in the Volta Region. These are Woe Cape St. Paul, Kedzi and Fort Prezensten, "*these*

places have been noted for MPA establishment, but government is reluctant to execute that" (KII of the chief fisherman, Dzelukope, Volta Region).

The analysis of the qualitative results indicates that most of the fishermen perceive themselves to be resilient as confirmed by the quantitative analysis. The qualitative and quantitative approach (mixed method) adopted in this chapter helps to accentuate the findings together. To measure social resilience is complex and using only quantitative method might not capture certain qualitative aspect of the issue. The perception of individuals concerning a change in policy is integral part of resilience as established in the literature. Thus, to get a comprehensive understanding of social resilience of fishermen, who depend on resource that is connected to the environment, a mixed method would be appropriate.

This chapter established that most of the fishermen are socially resilient. Thus, being socially resilient could have a positive implication to the blue economy discourse. The next section discusses these implications.

Implications for the Blue Economy

Resilience studies are in two parts; community resilience and individual resilience. Studies on community resilience agreed that a sum of individual resilient people is not an indication that the community is resilient (Norris et al. 2008). Put in another way, community members can be resilient together but not in a similar way (Brown & Kulig, 1996/97) which means that the community resilience does not guarantee the same individual resilience.

This study analysed the resilience of individual fishermen along the coast of Ghana. It was established that, in general, the fishermen have been found to be socially resilient and this imply that the blue economy could be successful when initiated well in the context of socioeconomic characteristics taken into consideration. Resilient fishermen could mean that they can respond well to policy changes in the fishing industry without being much affected. Thus, a change in marine policy that may affect fishing grounds and hence limit fishing activities (e.g., close season, ban on fishing, MPA establishment, etc.). This limitation would affect fishermen's welfare and livelihood since they depend much on the fishing. A resilient fisherman would be able to bounce back from such shock coming from changes in marine policy. A non-resilient fisher on the other hand would be affected much and may not be able to recover from the shock.

A resilient fisherman would be ready for an MPA establishment since they have alternative to rely on in times of such MPA establishments. Marine Protected Areas (MPAs) entails closing certain fishing grounds as a reserve to enable fishes grow and multiple. Such MPAs helps to conserve the marine resources. However, MPA establishment limits the fishing grounds available and fishermen may now have limited harvest leading to lower incomes and subsequently their welfare issues. A resilient fisherman would be able to absorb such limit to their income and welfare from the MPA establishment than their counterparts that are non-resilient.

Chapter Summary

Results and discussion on social resilience and its interrelationship with the blue economy is captured in this chapter. The chapter also identifies ways to

understand and assesses social resilience in marine communities given their demographic characteristics. Using a PCA and binary logistic regression this chapter explored the state of social resilience of fishermen and the demographic characteristics that affect social resilience, this exploration was done using a primary data collected from field work. The study revealed that a PCA analysis showing that the source of social resilience of fishermen along the coast of Ghana, can be explained by four broad characteristics; (i) the risk perception emanating from change, (ii) planning, learning and reorganization ability, (iii) how people perceive their ability to cope with change and (iv) the interest level of individuals in a prospective change.

Again, a mixed analysis showed that demographic characteristics affects the state of social resilience of fishermen in the study. It was found that increases in income share of fishing increases fishermen resilience and a migrant fisher are more likely to be resilient than non-migratory fishermen. Also, experience fishers socially resilient and having an alternative job increases the odds of being socially resilient. Thus, demographic characteristics affects social resilience, at least for the study area.

In a nutshell, this study proved that building fishermen social resilience is a factor needed for achieving blue economy. The next empirical chapter investigates the link between blue economy and sustainable development goals.

CHAPTER SEVEN

BLUE ECONOMY AND SUSTAINABLE DEVELOPMENT GOALS: EXPLORING THE SOCIAL DIMENSIONS OF SUSTAINABLE DEVELOPMENT GOALS IN THE BLUE ECONOMY DISCOURSE

Introduction

The blue economy is an emerging concept which advocates for sustainable exploitation and use of ocean resources. Voyer et al. (2018) asserted that there are two competition forces in the blue economy discourse; (i) opportunities for growth and development (ii) threats and vulnerable ecosystem that needs protection. Thus, there is need to grip the ocean's opportunities for growth and development while identifying and addressing its threats and vulnerabilities. Thus, in relation to the oceans, the World Bank and UN emphasizes "*balancing the triple bottom lines of sustainable development*" as key component of the blue economy (World Bank & UN, 2017, p.4).

Efforts have been dedicated to studying the links between social, economic and environmental aspects of sustainability across the SDGs (Le Blanc, 2017) and if any trade-offs exist (Gibson, 2006; Lee et al., 2020; Ntona & Morgera, 2018). Some scholars (Lee et al., 2020; Ntona & Morgera, 2018) conceptualizes the intricate interconnections between SDG 14 (life below sea) and other Goals based on the diverse benefits provided to humankind by marine ecosystems.

This chapter discussed results from a systematic literature on published literature that looked at the connection between the blue economy and the SDGs. In order to achieve the objective, a literature review was done on journal articles

that are peer reviewed and have looked at the link between blue economy and SDGs. The chapter further looked at the social dimensions of sustainable development that is often missing in blue economy policy planning. The section that follows, presents the data descriptive and distribution of the literature sourced for the review. This introduction section is followed by discussions of the results.

Descriptive statistics and distribution of the data

The United Nations SDGs were developed to promote and achieve sustainable development globally. The SDGs have 17 goals and 169 targets with 232 indicators (UN, 2018). Studies addressing blue economy linked to SDGs are very recent. Table 12 captures the journal publications on the issue of blue economy link to SDGs. In the table, 25 journals (all Scopus indexed, peer reviewed) with publishers such as Elsevier, Taylor and Francis, SAGE, Springer, MDPI, Palgrave McMillan and Frontiers in Marine Science. The Table 12 shows that those publications (on blue economy SDGs link), most notably, started in appearing in the literature from 2013. From 2013 onwards, interest in such study grew and is currently being studied by many scholars following the UN declaring that 2021 to 2030 is period of sustainable development through ocean science.

In the Table 12, it can be seen that *Marine Policy* Journal has published more papers on the issue of blue economy SDG link. *Ocean and Coastal Management* and *Frontiers in Marine Science* are the next journals to have such publications. The other journals have published at least one article on the issue of blue economy link to SDGs.

Table 12: Journals that have published on blue economy SDG linkage

S/N	Journal Name	Number of Publications	Publisher
1	Marine Policy	12	Elsevier
2	Frontiers in Marine Science	4	Perspective
3	Renewable Energy	1	Elsevier
4	Biological Conservation	1	Elsevier
5	Hydrobiologia	1	Springer
6	Sustainability (MDPI)	2	MDPI (Switzerland)
7	Trends in Ecological Evolution	1	Elsevier
8	Deep-Sea Resource PT. II	1	Elsevier
9	Ocean and Coastal Management	4	Elsevier
10	Environmental Science and Policy	1	Elsevier
11	Aquatic Conservation	1	Elsevier
12	Dialogues in Human Geography	1	SAGE Publication
13	Water Policy	1	Elsevier
14	Environmental History	1	Oxford University Press
15	International Journal of Tourism Research	1	Wiley Online
16	Journal of Plant Literature	1	Springer
17	Current Opinion in Environmental Science	1	Elsevier
18	World Maritime Univ. Journal of Marine Affairs	1	Core (Springer)
19	Procedia Social & Behavioural Sciences	1	Elsevier
20	Journal of Indian Ocean Region	1	Taylor & Francis
21	Resources Policy	1	Elsevier
22	Nature Sustainability	1	Springer Nature
23	Coastal Management	1	Taylor & Francis
24	Environmental Development and Sustainability	1	Springer Nature
25	Review of Fisheries Biology Fisheries	1	Springer Nature

Source: Author compilation from literature

Link between the blue economy and sustainable development goals

This section presents the results and conceptualization of the link between the blue economy and SDGs. The SDGs were adopted in September 2015 which covers social, economic and environmental aspects of development attainable by 2030. Blue economy concept emerged out of the 2012 UN Convention on Sustainable Development. In 2010, Gunter Pauli wrote a book "*The Blue Economy:*

10 Years, 100 Innovations and 100 million Jobs" (Pauli, 2010). This has given rise to academic debate on the blue economy and subsequently (after the SDGs were initiated) studying the link between blue economy and SDGs. Thus, this section attempts to identify the link between blue economy and the UN's SDGs. Understanding how blue economy is linked to SDGs offers a way to develop local purview that is scaled at global view for achieving the SDGs. Figures 19 and 20 give the possible association of the blue economy and SDGs as highlighted in the literature.

In Figure 19, over the years 2010 to 2020, the number of studies on blue economy-SDG link have increased and in 2010 there seems to be one publication (Pauli, 2010) that looked at blue economy and sustainable development. Though at that time the SDGs were not in place, the article made mentioned of how the blue economy, when pursuit could help achieve sustainable development such as offer of jobs to end poverty (SDG 1) and sustainable fishing to ensure food security to end hunger (SDG 2). After the year 2010 over to 2015, before the UN SDG in September 2015, there has been some other articles that attempt to link the blue economy concept to sustainable development. Some of these publications are; Taylor (2012) that summarized that the pursuit of the blue economy could lead to sustainable use of the marine ecosystem (SDG 14) and Kathijotes (2013) which indicated that the blue economy could spur the attainment of jobs (SDG 8), ensure climate awareness to reduce the impact of climate change (SDG 13).

The UN SDGs were adopted in September 2015 and after its adoption, studies that tried to link the blue economy and the SDGs have increased. In Figure

19, it is revealed that in 2016 the number of such publications rose and keep increasing an attained highest in 2018. However, 2019 and 2020 publications though higher than previous years (2010 to 2015) are less than the 2018 publications. This could be attributed to the Corona Virus Disease (COVID 19) pandemic that have affected humanity across the globe and therefore could have affected academic article outputs over that period. In Figure 20, it is evident that the blue economy has a link with the SDGs and academic and policy interest on this have risen and continue to rise. In the coming years, this interest is expected to heighten as the UN has formally stated that the years 2021 to 2030 are periods for achieving sustainable development through ocean science.

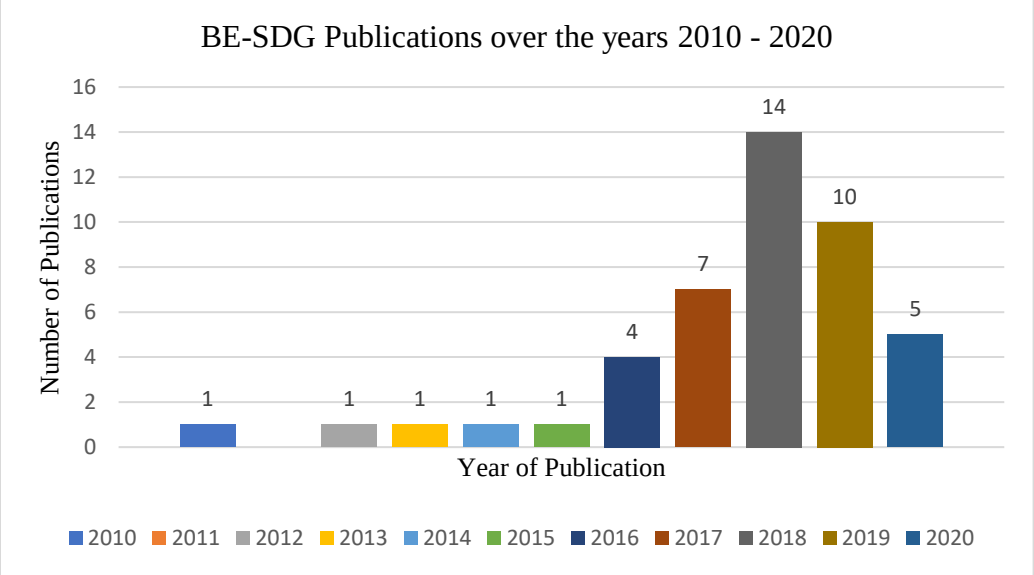


Figure 19: Year and number of publications on Blue economy link to SDG
Source: Author's compilation, 2021.

The blue economy entails environmentally benign marine ecosystem without pollution or destruction of marine life. Environmental sustainability cut across many of the SDGs especially those that targets global environmental issues such as SDG 6 (clean water & sanitation), SDG 13 (climate change), SDG 14 (life

below water) and SDG 15 (life on land). The SDG addresses marine debris and pollution through Goal 14 (target 14.1) with a particular focus on sources from land-based activities.

In Figure 20 the blue economy is said to be extremely linked to SDGs 14 to 17. As the blue economy directly talks about sustainability of ocean and water resources, SDG 14 (life below water) is the greatest goal linked to efforts geared towards attaining the blue economy. All the published articles made mentioned of a link between blue economy and SDG 14. This is so because the SDG 14 directly talks about sustainable use of marine resources by conserving marine ecosystem. All the targets of SDG 14 illustrate the principle of blue economy, though the SDG 14 did not mention blue economy. For instance, the blue economy mainly calls for sustainable exploitation and use of marine resources, which is in line with all the targets of SDG 14. However, the SDG 14 does not totally equate to the blue economy principles since it is said to emphasize environmental protection or marine resource conservation and sustainable use without looking at ocean's contribution towards poverty alleviation (SDG 1), hunger (SDG 2) and human health (SDG 3) (Wood & DeClerck, 2015; FAO, 2016d).

The second topmost SDG to be associated with the blue economy is SDG 17 (partnership for the goals). The principles of the blue economy dwell on efforts by all, government, local communities, NGOs, institutions (both local and international) and civil society organisations to ensure its success. Thus, SDG 17 directly affects this coordinated effort needed by the blue economy concept. Mascia *et al.*, (2003) indicated that the blue economy is the work of all including;

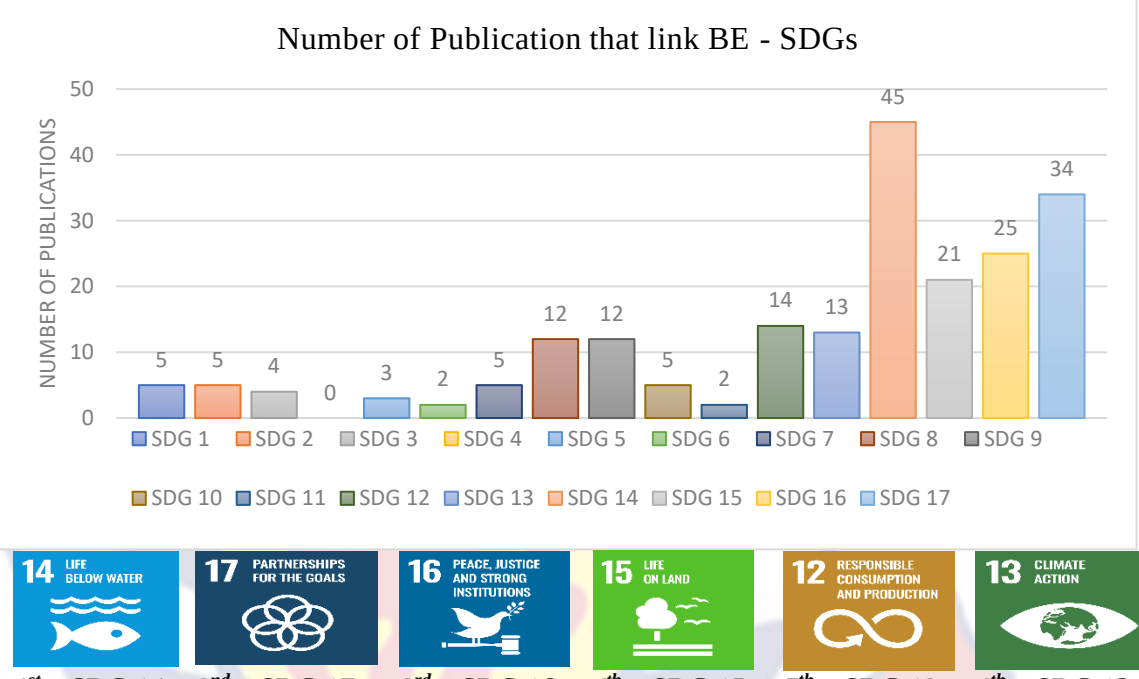
government, international organisations, civil society organisations (including NGOs), corporate institutions, fishermen and coastal communities. Thus, to achieve blue economy there is the need for coordinated efforts between and among stakeholders both locally and internationally as concluded by Lundberg (2013) in the author's study of the eutrophication issue of the Baltic Sea.

Again, SDG 15 (life on land) is linked to the blue economy, as shown in Figure 20. As the SDG 15 stresses life on land, what happens on land (human activities) directly affects the ocean resources. For instance, there are estimates that waste from land-based activities entering the ocean is significant (Jambeck et al. 2018). In addition, abandoned, lost or otherwise discarded fishing gear contributes an estimated 640,000 tons of marine debris globally (Macfadyen et al. 2009). Recent studies have suggested that the ocean receives an estimated 8 million metric tons of plastic waste per year (Jambeck et al. 2015). In addition, SDG 15 focused on safeguarding against land degradation and biodiversity loss which identification and management of terrestrial waste sinks from an important part. Thus, efforts to achieve blue economy should be tailored towards sustainable lives on land.

In an invigorating effort in achieving the blue economy, climate change related issues are of concern. Life below water (SDG 14) is affected by life on land if there are poor sanitation (like poorly managed waste sites) which creates tons of waste that are carried to the ocean (Jambeck et al. 2018), thereby affecting marine resources.

In the case of SDG 1 (no poverty) and the blue economy, it is showed that when the ocean is healthy and resilient and human uses it in sustainably manner it

could contribute to alleviation of income poverty and multidimensional poverty and ensures human well-being in coastal communities (Schmidt et al. 2017b). Surprisingly, SDG 6 (clean water & sanitation) is not much associated with blue economy while SDGs 12 (responsible consumption) and 15 (life on land) are highly linked to blue economy.



1st – SDG 14 *2nd* – SDG 17 *3rd* – SDG 16 *4th* – SDG 15 *5th* – SDG 12 *6th* – SDG 13

Figure 20: Number of publications on blue economy and each SDG links
Note: *Top six SDGs (14, 17, 16, 15, 12, 13).* **Source:** Author's compilation, 2021

The top six most frequently cited SDGs said to be linked to the blue economy are; in descending order, SDG 14, 17, 16, 15, 12 and 13. The caveat in this study is that though majority of the SDGs are said to be closely associated with the concept of the blue economy, it is not clear that the rest of the SDGs are irrelevant to blue economy. Future studies could explain how blue economy is related to this SDGs (SDGs 2 and 3 in particular).

Social dimension of SDGs in the context of the blue economy

Table 13 shows the literature review on social dimension of sustainable development in blue economy policy discourse. Majority (49 out of 53) of the publications (92%) emphasizes ecological aspect of sustainable development in the blue economy discourse. However, only about 17% of the reviewed literature makes reference to social aspect of sustainable development as a key component of blue economy efforts. The statistics given here are overlapping as there are publications that makes reference to both social and ecological aspect of sustainable development as evident in blue economy fashion.

Table 13: Publications that includes social dimension in blue economy discourse

Number of Journal publications	Social dimension	Ecological dimension
42	No	Yes
7	Yes	Yes
2	Yes	No
2	No	No

Source: Author's compilation, 2021

There is not much empirical literature on the blue economy principles across the globe. A thematic review showed that some number of the literature on the blue economy are reports (FICCI-KAS, 2019; AfDB, 2018; World Bank & UN, 2017) and concept definition (Sakhuja, 2015) and narratives on blue economy (Bari, 2016) that advocate for adoption of blue economy principles (FAO, 2014b). For instance, the FICCI-KAS report (2019) suggests among other things that to fully device the blue economy concept in India, the need for full-fledge ministry of blue economy is necessary and the African Development Bank (2016) Blue Economy

Flagship which issued a guideline for small-scale fisheries (SSF) is deemed to open up the benefits of the Blue Economy through resorting to changes in fishing practices, boost markets access and increased local consumption. Also, the Caribbean Development Bank (2018), as part of its Strategic Plan, puts together a document on *"Financing the Blue Economy: A Caribbean Development Opportunity"* which surveys the potential of the blue economy to drive sustained and inclusive economic growth. All these reports have recognised that the blue economy principles are worth undertaking and thus there is the need to really understand what the blue economy is and its limitations as well as effects on marine resource use. However, these reports concentrate less on how social dimension (broadly known as social resilience) should be incorporated into blue economy policy planning.

Literature review on the concept definition or narratives of the blue economy (Bari, 2016; Howard, 2018) showed that out of the 53 journal articles, 92% (49 articles) have defined the concept blue economy in their study. However, though the concept blue economy is regarded as a buzzword (Choi, 2017), these definitions hammered on ecological considerations and less on social dimension of the blue economy. For instance, UNCTAD (2014, p 2) surmised that at the core of the Blue Economy lies the idea of "*optimization of natural marine resources within ecological limits*". Also, Campbell et al. (2013) indicated that the concept blue economy seeks to stem biodiversity loss whilst stimulating economic development, thereby integrating both environmental and economic interests. However, Smith-

Godfrey (2016) indicated that the concept blue economy has a line separating socio-economic development from environmental degradation.

Another strand of the literature looked at ocean importance to communities and fishers (in terms of welfare, social lives, employment, food provision, etc.) without actually exploring the menace of the blue economy. Islam and Shamsuddoha (2018) noted that marine resources are sources of livelihood and income for millions of people along Bangladesh coastal areas and beyond. Branch et al. (2002) indicated that socioeconomic issues such as low education, high dependency ratio, high unemployment, lower mean incomes, and pronounced poverty rates are still evident in majority of the communities studied. The authors surmised that the development of Exclusive use zones was necessary to harness the potentials of the ocean for these fishers. Earlier, in a similar vein, Hilborn (1992) noted that attention be paid to the behaviour of fishermen in response to regulations and allocation of property rights in order to design policies that enhance the ocean usage. This could help increase the benefits fishers will enjoy out of their work. The social lives of fishers are interconnected with marine resources and to sustainably manage marine economy (blue economy) literature should look at the social aspect of the blue economy. Thus, these studies done on fishers overlooked the issue of how the socioeconomic context of fishing communities could be aligned to the concept of the blue economy.

Again, other studies discussed the impact of activities and influence that impact greatly on marine resources which could lead to marine resource 'extinction'. These activities are ranked (among top five) by Beaumont (1997) as highest been

fishing/hunting and deep-sea mineral exploration or exploitation. Illegal and unregulated fishing, pirates, improper fishing practices (fishing small and immature fishes, throwing chemicals that kills younger fishes etc.) are among other human activities that is found to have destroyed many marine resources. Also, marine shipping has also been found to pose threat to marine resources. Threats to ocean health such as noise (Kaplan & Solomon, 2016), bio invasions (Seebens et al. 2016), destruction of sea wildlife (Rockwood et al. 2017), pollution (Vollaard, 2017) and greenhouse gas emissions (Johanson et al. 2017) are among others that are found to affect the biodiversity of marine resources. There have also been indications that large metric tons (4.4 and 12.7 million) of plastic debris from land-based sources make their way into the oceans each year (Jambeck et al. 2015; Schmidt et al. 2017a).

From the literature outlined, it's imperative that academics and policy makers study and know the blue economy in all its evolving and discourses. Policy makers will need a guide as to which kind of policy and at what time and in which way should they conceive policies on the blue economy. The areas policy makers should focus for sustainable blue economy development is thus, important. Holding on to the principles of the blue economy entails countries' relooking their laws and regulations on marine resource use, marine practices, and policy change and resource conservation efforts. All these will restrict the utilisations of marine resource usage and have critical impact on the livelihood of people and could have implications on the social and economic spheres (Wingard, 2000). If the local people whom the policy affects directly are not resilient to institutional change,

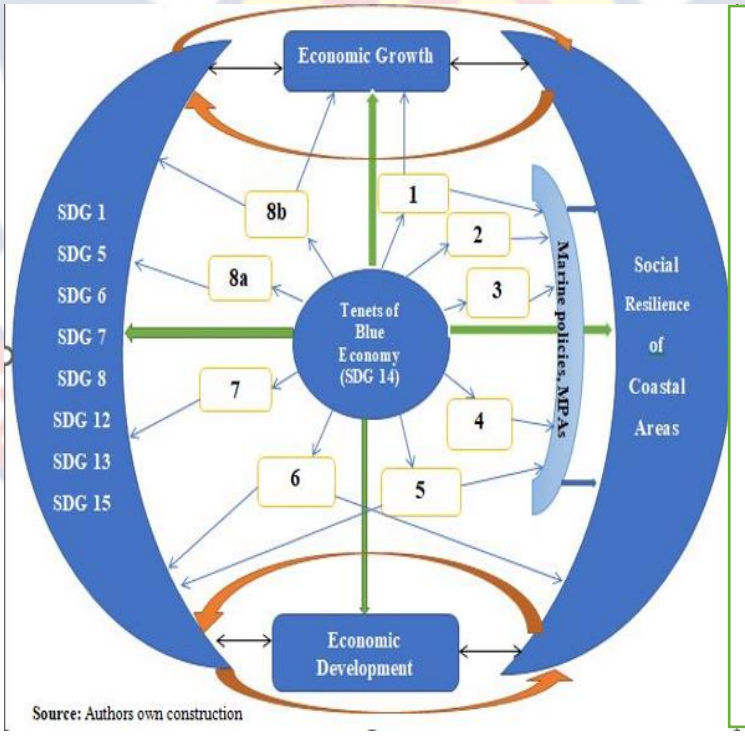
there may arose conflicts (Marshall & Marshall, 2007) and the policy may crumble. Thus, there is the need to look at marine resource usage change policies cum its effects on local livelihood and as to whether the local people are resilient to this change.

Conceptualizing the tripod blue economy-Social resilience-SDGs

Based on literature reviewed and the results and discussion of this chapter (chapter seven), the study conceptualise the study by linking the blue economy, sustainable development goals and social resilience. This conceptual framework is captured in Figure 21. The framework asserts that the tenets of the blue economy could be likened to a cramp in a wheel that holds every part of society's development and resilience. In Figure 23, the study purports the tenets of the blue economy to be in line with the objectives of SDG 14, though the SDG 14 did not mention the concept of blue economy. The blue economy tenets when pursued will help achieve economic growth and economic development as well as attaining majority of the SDGs and building social resilience of coastal communities. To implement the tenets of the blue economy (tenet 1 to 6) will require reorienting and re-enacting policies and programmes that help to achieve tenets 1 to 6. These policies may include putting together and defining marine protected areas (MPAs) amidst restriction on fishing and changes in fishing practices. If marine policies are designed in a way that incorporates social and economic consequences, the blue economy could be achieved without much consequence on coastal communities.

In the conceptual framework, tenets 1 to 3 when implemented will help to reduce climate-related events and its associated effect on marine resources and

hence, building climate resilient marine communities. By making efforts to prevent marine pollution, protect marine ecosystem and minimise acidification of the ocean, marine policies could be establishment of MPAs and Marine Spatial Planning. Marine policies should put attention on the pertinent cycles for sustainable blue economy advancement amid climate change pressures (i.e., energy efficiency from marine resources, marine and coastal biodiversity, climate resilient building in coastal communities and ecosystem restoration). Achieving climate resilient marine societies could help increase the benefits we can obtain from marine resources. Employment creation (SDG 8), food security (SDG 2) and build climate resilient marine communities (SDG 13 and 14) could be achieved upon discharging the tenets (1 to 3) of this conceptual framework.



Key
1= Prevent and reduce marine pollution
2= Protect marine and coastal ecosystem
3= Minimise acidification of the ocean
4= End overfishing and illegal and destructive fishing practice
5= Conserve at least 10% of coastal and marine areas
6= End harmful fishing subsidies
7= Increase economic benefits of small island states
8= Develop research and development on coastal

Figure 21: Blue economy, Social resilience and SDGs
Source: Author's own construction

Dwelling on the tenets (tenet 4, 5, 6 and 8b) of this conceptual framework will enhance the achievement of some SDGs (SDG 1, 10, and 8). Tenets 4 (end over fishing), 5 (conserve 10% of coastal and marine areas) and 6 (end harmful fishing) could help achieve SDG 8 (promote sustained, inclusive and sustainable development). By ending over fishing and harmful fishing governments could establish MPAs which should be done with participation of marine communities to ensure that the marine policy goes a long way to reduce tensions or conflicts (Kamstra, 1994) that might arise.

Marine communities have fishers, maritime workers, and farmers who are often small-scaled in nature that uses less technology and lacks finance and markets access (UNECA, 2016). Thus, implementing tenet 8b (help small-scale fishing) of this conceptual framework could potentially help to attain SDG 1 (end poverty) and SDG 10 (reduce inequalities within countries). Helping small-scale fishing is by providing finance (or support) and education (marine education and other economic activities' skills) to these small-scale fishers could lead to boost their economic fortunes and increase social resilience. Also, in most economies, women are majority small-scale business owners (Osabuohien & Karakara, 2018) and marine communities are no exception. Women are largely engaged in post-harvest activities in fishing jobs as indicated that about 80% of seafood is marketed by women in West Africa (FAO, 2012). Helping small-scale fishers will help to achieve some of the targets in SDG goal 5 which is on achieving gender equality and empower of women and girls. Marine policies could ensure that small-scale fishers are provided with efficient and environmentally sound fishing boats, fishing

lading could be improved, farm contract (where small-scales are assigned to companies to help provide finance). Small-scale fishers should also be given marine education in the areas of human activities that affects marine resource negatively. This could help reduce inequalities (SDG 10) and ensure that marine communities are socially resilient (small-scale fishers able to adapt to policy change).

Again, tenet 8a (develop R&D on coastal management) and tenet 7 (small-island developing states) could ensure that some SDGs (SDG 1, 9, 11, and 12) are achieved. Advancing research and development on coastal management would increase our knowledge and understanding in ensuring that coastal regions could help build "*resilient infrastructure, promote inclusive and sustainable industrialisation*" (SDG 9) in coastal communities. This would also ensure that these marine communities become cities and human settlements that are "*inclusive, safe, resilient and sustainable*" (SDG 11). Also, increasing the economic benefits of small-island developing states (where marine activities are the major economic engagements) would lead to end poverty (SDG 1) as incomes could rise and "end hunger, achieve food security and improved nutrition and promote sustainable agriculture" (SDG 2) in these states. Thus, the tenets of the blue economy (as captured here conceptually) when implemented could lead to greater economic growth and development and help achieve most of the targets of the SDGs goals.

Chapter Summary

The chapter captured results and discussion in two parts. First results and discussion were on the link between blue economy and the UN SDGs. The second results and discussion were on the social dimension of sustainable development

being less considered in the blue economy policy dialogue. The results suggest that, the top six most frequently cited SDGs said to be linked to the blue economy are; in descending order, SDG 14, 17, 16, 15, 12 and 13. The results also indicates that most blue economy publications paid less attention to the social aspect of sustainable development in the blue economy thinking spheres. Thus, the conceptualization of the tripod; blue economy-social resilience-sustainable development goals is explained in the chapter. The chapter that follows highlights the thesis summary of findings (for chapters 5, 6 and 7). Conclusions emanating from the findings are also stated as well as policy recommendations provided and suggestions for future research engagements.

CHAPTER EIGHT

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The channels of human usage and extraction of the ocean resources, over history, have been changing causing an unsustainable use of the ocean. How to sustainably exploit and use marine resources has lately come to be known as the Blue Economy. The notion of the blue economy encourages maximizing ocean resource usage without environmental destruction. The core aspect of the Blue Economy lies the idea on how to maximise natural marine resources giving ecological constraints, and the integration of socioeconomic development in the realms of environmental sustainability. There are indications that marine policy changes had impacted on marine communities (Marschke & Berkes, 2006), and thus adapting to the impact of marine policy changes and climate change is vital. Again, the Blue Economy can be an impetus to achieving most of the SDGs. Thus, this study relates the blue economy to social resilience and sustainable development goals in an econometric analysis. The chapter captures the summary of findings, conclusions drawn and recommendations made from the study including suggestions for future research directions.

Summary

This study investigated the issue of blue economy, social resilience of fishermen and sustainable development goals in Ghana. The study offers an understanding on how socioeconomic characteristics of fisheries-dependent communities affects the blue economy efforts and how social resilience of

fishermen could be an impetus to achieving the blue economy and sustainable development. Three major areas were considered; (a) socioeconomic characteristics of fisheries-dependent communities in the context of the blue economy, (b) the state of social resilience of fishermen in coastal communities in Ghana and demographic characteristics link to social resilience, and (c) how the blue economy and sustainable development goals are linked. A mixed method approach was adopted.

One hypothesis was tested in the first empirical analysis: (a) the socioeconomic characteristics of fisheries-dependent communities have significant effects on the sustainability of the ocean. A nationally representative household survey data on socioeconomic characteristics disaggregated into coastal and full Ghanaian sample was used. With a sample of 2,172 coastal households and a national sample of 14,009 households, and primary data on fishermen, ordinary least squares and qualitative results analysis (in content analysis) were used to estimate socioeconomic characteristics effect on blue economy and the level of environmental knowledge of fishermen.

The study found that welfare in coastal communities is encouraging as revealed by household expenditure dynamics. Specifically, the study established that household expenditure on non-food (education and health) keeps increasing and this is an indicator that welfare is being enhanced among coastal homes and this is a good ground for blue economy principles to strive. It is revealed that coastal rural households' expenditure on food (as a % of total expenditure) keeps reducing over the years 2005 to 2017 while their expenditure on housing and other non-food

items (education and health) keeps increasing. Meaning coastal homes have adequate food consumption and now increase their expenditure on other non-food essentials. Again, other socioeconomic conditions such as employment, household poverty status, access to electricity, education, good water, and housing nature including its ownership, are encouraging as most coastal communities have good access. These are all welfare enhancing indicators and such is good ground to roll out blue economy measures. However, a good number of coastal communities still have no toilet facilities and resort to open defecation and again some households dispose waste indiscriminately in public dumping site. These unhealthy practices which pollute could threaten the health of marine resources.

Again, findings from the first empirical analysis showed that most marine communities in Ghana have some level of poor amenities (such as toilet facilities and waste disposal) that are potential threats to the Blue Economy. On another note, coastal households enjoy high welfare living, which is good ground for the blue economy principles as livelihood diversification could reduce pressure on fishing as the only job. However, rural coastal communities' have appalling socioeconomic characteristics than their urban counterparts. This could have great implications for achieving the blue economy in Ghana.

The second empirical analysis focused on establishing the state of social resilience of fishermen along the coast of Ghana. Two hypotheses were tested: (a) the state of social resilience of fishermen in coastal communities (b) assess the link between social resilience and demographic characteristics of coastal communities in Ghana. Using a primary data, the study provided an objective analysis into how

social resilience of fishermen could help achieve blue economy. With a sample of 510 fishermen, the PCA and binary logistic models were used to study social resilience and blue economy linkage.

The findings revealed that the source of social resilience of fishermen along the coast of Ghana, is broadly defined by four characteristics; (i) risk perception emanating from change, (ii) planning, learning, and reorganization abilities, (iii) how individual perceive their ability to coping with change and (iv) the interest level of individual in the prospective change. Again, exploring the link between fishers' demographic characteristics and social resilience showed that as a fisherman ages, he becomes less socially resilient to changes in the fishing industry. Educated fishermen are resilient compared to an uneducated person, just as a married fisherman is resilient to an unmarried counterpart. In a content analysis of the FGD and KII however showed a mixed result. Some fishermen perceive themselves to be resilient while others maintained they are not.

Given that the concept of the blue economy is closely connected with sustainable development, the third empirical chapter sought to systematically survey the literature on the relationship between blue economy and the SDGs. In order the achieve the objective, a literature review was done on journal articles that are peer reviewed and have looked at the linkages of the blue economy to the SDGs. A total of 43 articles from 25 journals (all Scopus indexed, peer reviewed) with publishers such as Elsevier, Taylor & Francis, SAGE, Springer, MDPI, and Frontiers in Marine Science were reviewed. The review found that the blue economy is said to be highly linked to SDGs 14 to 17. All the published articles

made mentioned of a link between blue economy and SDG 14. The top six most frequently cited SDGs said to be linked to the blue economy are; in descending order, SDG 14, 17, 16, 15, 12 and 13.

Conclusions

Findings from this study sharpens our knowledge on the concept of the blue economy and ocean resource sustainability. In addition to this the social resilience of fishermen is one of the critical factors to achieving ocean sustainability and hence blue economy. The results of the first empirical analysis chapter on how socioeconomic characteristics of fisheries-dependent communities could serve as a good factor to ocean sustainability (a blue economy discourse) as carried out. The first empirical chapter relied on tow data sources; i.e. household survey data (i.e., Ghana Living Standard Survey round 7) and field data collected. The chapter adopted an econometric analysis (ordinary least squares and tables, graphs and qualitative narratives) of welfare variables such as real expenditure, socioeconomic variables – age, gender, income, marital status, etc. for the analysis. The findings suggested that the socioeconomic characteristics of fisheries-dependent communities in Ghana are in a good shape to sustaining the ocean.

Specifically, the first empirical chapter found that welfare in coastal communities is encouraging as revealed by household expenditure dynamics. The study established that household expenditure on non-food (education and health) keeps increasing and this is an indicator that welfare is being enhanced among coastal homes and this is a good ground for blue economy principles to strive. It is revealed that coastal rural households' expenditure on food (as a % of total

expenditure) keeps reducing over the years 2005 to 2017 while their expenditure on housing and other non-food items (education and health) keeps increasing. Meaning coastal homes have adequate food consumption and now increase their expenditure on other non-food essentials. Again, other socioeconomic conditions such as employment, household poverty status, access to electricity, education, good water, and housing nature including its ownership, are encouraging as most coastal communities have good access. These are all welfare enhancing indicators and such is good ground to roll out blue economy measures. However, a good number of coastal communities still have no toilet facilities and resort to open defecation and again some households dispose waste indiscriminately in public dumping site. These unhealthy practices which pollute could threaten the health of marine resources.

On the hypothesis relating to social resilience and blue economy the study surmises that social resilience of fishermen is conducive to achieving blue economy. Primary data was collected on fishermen and chief fishermen along the coast of Ghana for this study. Mixed method (quantitative and qualitative) was used for the analysis. In particular, the PCA method was used for the analysis of the social resilience state of fishermen and logit regression model was used for assessing the association between social resilience and demographic characteristics of fishermen. Again, qualitative data was analysed in a narrative format. Thus, the findings of the chapter dwelled on mixed method.

The second empirical chapter revealed that a PCA analysis showing that the source of social resilience of fishermen along the coast of Ghana, can be explained

by four broad characteristics; (i) the risk perception emanating from change, (ii) planning, learning, and reorganization ability, (iii) how people perceive their ability to cope with change and (iv) the interest level of individuals in a prospective change. Also, the chapter found that educated fishermen are resilient compared to uneducated person, just as a married fisherman is resilient to an unmarried counterpart. A narrative analysis of the FGD however showed a mixed result. Some fishermen perceive themselves to be resilient while others maintained they are not. This showed that demographic characteristics affects the state of social resilience of fishermen in the study. It was found that increases in income share of fishing increases fishermen resilience and a migrant fisher are more likely to be resilient than non-migratory fishermen. Also, experience fishers socially resilient and having an alternative job increases the odds of being socially resilient. Thus, demographic characteristics affects social resilience, at least for the study area.

The third empirical chapter was carried out by doing a systematic literature review on the link between blue economy and SDGs on one hand and the social aspect of sustainable development in the blue economy policy discourse. Literature was carried through search conditions and those literature were screen and analysed. In all 45 articles were used to assess the link between blue economy and SDGs and 53 articles used for assessing the social aspect of sustainable development in the blue economy discourse. The chapter found that the top six most frequently cited SDGs said to be linked to the blue economy are; in descending order, SDG 14, 17, 16, 15, 12 and 13.

The objectives of the study were achieved using both quantitative and qualitative data and adopting mixed method approach. The blue economy that is concern of sustainability of the ocean ecosystem need understanding on the socioeconomic effect on such sustainability, how fishermen could be resilient to changes in ocean governance and how the blue economy could help achieve some sustainable development goals. Therefore, this study looked at these issues and relates to the blue economy discourse in Ghana.

In a nutshell, the analysis from the empirical chapters tilts towards the connection between blue economy, social resilience and sustainable development goals. There is no doubt that socio-economic characteristics of coastal communities and social resilience of fishermen is highly connected with the blue economy, probably due to fishing activities seen as the most connected human activity with the ocean. Thus, to achieve blue economy (sustainable management of ocean resources) concentration should be much on fishermen and coastal communities.

Recommendations

Owing to the results and discussions of the evidences from the empirical chapters, and the conclusions drawn the study makes some recommendations that can be looked at by the MoFAD, Ministry of Food and Agriculture, Environmental Protection Agency, NGOs working in coastal communities, and the fishermen in the study area. These recommendations could be of help to other international bodies (such as the UN and AU) that have blue economy as one of their flagship programs. The following recommendations are drawn;

The Ministry of Fisheries and Aquaculture Development (MF&AD) should put up policies that are geared towards creating an enabling environment to ensure good or robust socioeconomic coastal communities. There should be an open and concerted effort by all (the Government, NGOs, and Ministries) (with political will) to develop other alternative sources of livelihood in coastal communities that create significant local employment to help leave a less-crowded sector (with a more educated younger generation shifting into other sectors and places). This will help curb overfishing to achieve sustainable fishing.

The Ministry (MF&AD) should partner with organisations (such NGOs, financial institutions, etc.) to roll out support target policies and capacity to secure fishing including those of social rights and welfare, and social programmes in the study area. There should also be target on coastal communities' eco-tourism and recreational fishing in this regard.

There should be deliberate attempts to develop coastal communities' sanitation including those of access to good toilet facilities and good waste disposal methods. Government through its agencies (the Ministry of Sanitation, Environmental Protection Agency, Ministry of Fisheries and Aquaculture Development, *inter alia*) could come together in helping provide these amenities. Good drainage systems, coastal beaches cleaning and environmental sanitation practices should be encouraged in coastal communities.

Again, to protect and conserve marine resources to achieve the benefits of a blue economy, there should be efforts between the ministries and agencies mentioned earlier. This may call for protection measures such as MPAs to allow

key areas to be protected. Such policies could be part policies of governments and the corporate social responsibility of firms in private sector, which focuses on sustainability, environmental and social protection in coastal communities. Fisheries practitioners should consider an eco-system-based approach to fisheries management as the only viable way to move forward on the needed governance measures for sustainable use and conservation of marine and coastal ecosystem.

Suggestions for future research

Carrying out this study and presenting preliminary results in departmental seminars other researchers made suggestions to help improve the study. Some of those suggestions were taken on board and others were not taken onboard due to time constraint and resource availability. Those suggestions that could not be tackled are highlighted here as suggestions for future research. These suggestions for future research forms part of the researcher's catalogue of research issues to be taken on.

First empirical analysis

- Future studies should look at this problem by widening the variables studied and may also look at a community-by-community case. This will allow for an appreciation of diversity in culture along the coast of Ghana and how that affects blue economy efforts.
- There is virtually no marine protected area in Ghana as World Bank (2012) reports that MPAs in Ghana (% of total surface area) is 0.01% in 2010. Thus, this is a threat to preserving biodiversity in Ghana. Thus, future

studies could explore the readiness of coastal communities in Ghana to adjust to a policy emanation from an MPA objective. This will help to understand the likelihood of blue economy policy succeeding as the blue economy principles includes MPAs practices to conserve marine resources.

Second empirical analysis

- Examine coastal communities' resilience in relation to climate change. Climate change has a devastating effect on coastal resources as evidence is being felt in this 21st century. A study on climate change effect on coastal communities and fishermen could be a turning point in offering suggestions.

Third empirical analysis

- Explore the literature on how studies have regarded the blue economy and its varying relation to socio-ecological considerations.

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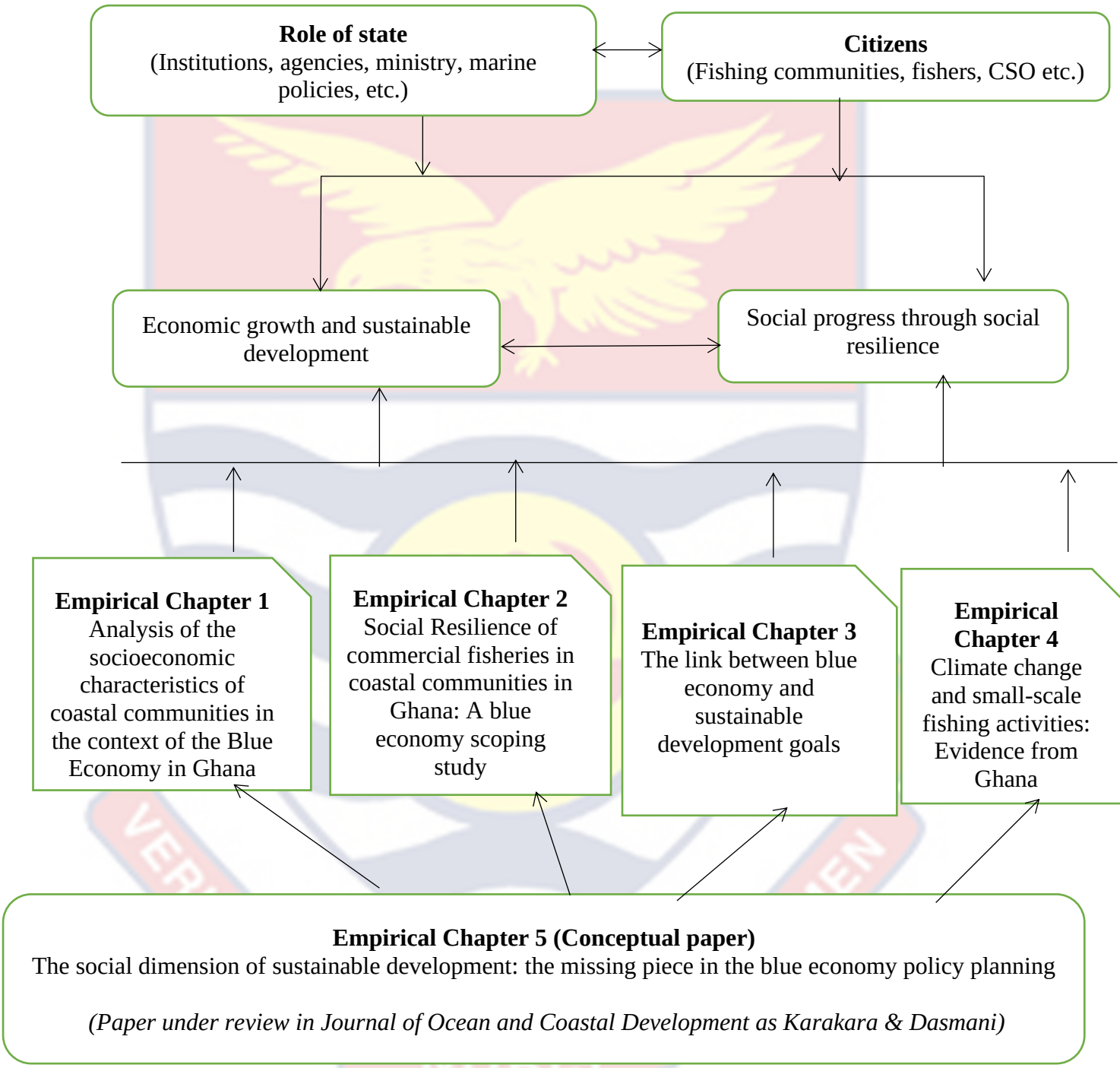
Appendix "A"

Broad structure of the thesis



Appendix B

Regional and District distributions of coastal fishing communities and fish species

Region	Districts	Main Fish species landed
Volta (78)	Ketu South Municipal (Total respondents – 41)	Anchovy (*Engraulis encrasicolus*); Burrito (*Brachydeuterus auritus*); Bumper (*Chloroscombrus chyrsurus*); Flat sardinella, (*Sardinella maderensis*); Round sardinella (*Sardinella aurita*); Horse Mackerel (*Caranx hippos*).
	Keta Municipal (Total respondents – 37)	Anchovy (*Engraulis encrasicolus*); Burrito (*Brachydeuterus auritus*); Bumper (*Chloroscombrus chyrsurus*); Flat sardinella, (*Sardinella maderensis*); Round sardinella (*Sardinella aurita*); Horse Mackerel (*Caranx hippos*)
Greater Accra (83)	Ada East District (Total respondents – 22)	Anchovy (*Engraulis encrasicolus*); Round Sardinella (*Sardinella aurita*); Frigate Mackerel (*Caranx hippos*); Chub Mackerel (*Scomber colias*)
	Ada West District (Total respondents – 24)	Anchovy (*Engraulis encrasicolus*); Round Sardinella (*Sardinella aurita*); Chub Mackerel (*Scomber colias*)
	Ningo Prampram District (Total respondents – 37)	Anchovy (*Engraulis encrasicolus*); Sardinellas (*Sardinella spp*); Mackerels (*Caranx spp*)
Central (169)	Mfantseman Municipal (Total respondents – 74)	Anchovy (*Engraulis encrasicolus*); Atlantic little tuna (*Euthynnus alleratus*) and, Scad Mackerel (*Caranx rhoncus*); Threadfin (*Galeoides decadactylus*); Chub Mackerel (*Scomber colias);* Burrito (*Brachydeuterus auritus)*
	Cape Coast Metropolitan (Total respondents – 23)	Threadfin (Galeoides decadactylus); Chub Mackerel (Scomber colias); Burrito (Brachydeuterus auritus)
	Abura-Asebu-Kwamankese District (Total respondents – 12)	Anchovy (Engraulis encrasicolus); Atlantic little tuna (Euthynnus alleratus); Scad Mackerel (Caranx rhoncus); Threadfin (*Galeoides decadactylus*); Chub Mackerel (Scomber japonicus); Burrito (*Brachydeuterus auritus*).
	Komenda-Edina-Eguafo-Abrem Municipal (Total respondents – 60)	Atlantic little tuna (*Euthynnus alleteratus*); Frigate mackerel (*Auxis thazard*); Burrito (*Brachydeuterus auritus*)
Western (161)	Shama District (Total respondents – 75)	Sardinellas; Frigate Mackerel (*Auxis thazard*); Long-finned Herring (*Ilisha africana*).
	Sekondi Takoradi Metropolitan (Total respondents – 37)	Sardines (Sardinella aurita and Sardinella maderensis); Frigate Mackerel, (Auxis thazard); Long-finned Herring (Ilisha africana).
	Ahanta West District (Total respondents – 49)	Sardines (Sardinella aurita and Sardinella maderensis)

Appendix C

Author(s)/Year	Title	Journal (Publisher)	Volume/Page
Taylor III, J.E. (2012)	Knowing the black box: Methodological challenges in marine environmental history.	Environmental History	18 (1), 60 – 75
Visbeck, M. et al., (2014)	Securing blue wealth: the need for spatial sustainable development goals for the ocean and coasts.	Marine Policy (Elsevier)	48, 184 – 191
Carr, L.M. & Liu, D.Y. (2016)	Measuring stakeholder perspectives on environmental and community stability in a tourism-dependent economy.	International Journal of Tourism Research	18 (6), 620 – 632
Ehlers, P. (2016)	Blue growth and ocean governance – how to balance the use and the protection of the seas.	WMU Journal of Maritime Affairs (World Maritime University)	15 (2), 187 – 203
Hays, G.C., et al., (2016)	Key questions in marine megafauna movement ecology.	Trends in Ecological Evolution (	31 (6), 463 – 475
Yang, L., et al., (2016)	Studies on charges for sea area utilization management and its effects on the sustainable development of marine economy in Guangdong province, China.	Sustainability (MDPI)	8 (2), 116
Granit, J., et al., (2017)	A conceptual framework for governing and managing key flows in a source-to-sea continuum.	Water Policy (	19 (4), 673 – 691
Lent, R. & Squires, D. (2017)	Reducing marine mammal bycatch in global fisheries: An economics approach	Deep-Sea Research Part II	140, 268 – 277
Niner, H.J., et al., (2017)	A global snapshot of marine biodiversity offsetting policy.	Marine Policy (Elsevier)	81, 368 – 374
Sun, C., et al., (2017)	Estimating the efficiency of complex marine systems in China's coastal regions using a network data envelope analysis model	Ocean and Coastal Management (	139, 77 – 91
Thiele, T. & Gerber, L.R. (2017)	Innovative financing for the high seas.	Aquaculture Conservation (	27, 89 – 99
Winder, G. & Le Heron, R. (2017)	Assembling a blue economy moment: Geographic engagement with globalizing biological-	Dialogues in Human Geography (	7 (1), 3 – 36

	economic relations in multi-use marine environments.		
Amengual, J. & Alvarez-Berastegui, D. (2018)	A critical evaluation of the Aichi Biodiversity target 11 and the Mediterranean MPA network, two years ahead of its deadline	Biological Conservation (	225, 187 – 196
Bennett, N.J., et al., (2018)	Coastal and indigenous community access to marine resources and the ocean: A policy imperative for Canada	Marine Policy (Elsevier)	87, 186 – 193
Fraschetti, S., et al., (2018)	Light and shade in marine conservation across European and Contiguous seas	Frontier in Marine Science (	5, 420
Hassler, B., et al. (2018)	Collective action and agency in Baltic sea marine spatial planning: transnational policy coordination in the promotion of regional coherence	Marine Policy (Elsevier)	92, 138 – 147
Hemer, M.A., et al., (2018)	Perspectives on a way forward for ocean renewable energy in Australia.	Renewable Energy (	127, 733 – 745
Islam, M.M. & Shamsuddoha, M. (2018)	Coastal and marine conservation strategy for Bangladesh in the context of achieving blue growth and sustainable development goals	Environmental Science Policy (	87, 45 – 54
Jambeck, J., et al. (2018)	Challenges and emerging solutions to the land-based plastics waste issue in Africa	Marine Policy (Elsevier)	96, 256 – 263
Ntona, M. & Morgera, E. (2018)	Connecting SDG 14 with other sustainable development goals through marine spatial planning	Marine Policy (Elsevier)	93, 214 – 222
Retzlaff, R. & LeBleu, C. (2018)	Marine Spatial Planning: exploring the role of planning, practice and research	Journal of Plant Literature	33 (4), 466 – 491
Salpin, C., et al., (2018)	Marine scientific research in pacific small island developing states	Marine Policy (Elsevier)	95, 363 – 371
Sara, G., et al., (2018)	Integrating multiple stressors in aquaculture to build the blue growth in a changing sea	Hydrobiologia (	809 (1), 5 – 17
Stead, S.M. (2018)	Rethinking marine resource governance for the United Nations Sustainable Development Goals	Current Opinion in Environmental Sustainability	34, 54 – 61

Thompson, K.F., et al., (2018)	Seabed mining and approaches to governance of the deep seabed	Frontier in Marine Science	5, 480
Vitro, L.R. (2018)	A preliminary assessment of the indicators for sustainable development goal 14 "conserve and sustainably use the oceans, seas and marine resources for sustainable development"	Marine Policy (Elsevier)	98, 47 – 57
Waiti, D. & Lorrenij, R. (2018)	Sustainable management of deep sea mineral activities: a case study of development of national regulatory frameworks for the Republic of the Marshall Islands	Marine Policy (Elsevier)	95, 388 – 393
Okafor-Yarwood, I. et al., (2020)	The blue economy-cultural livelihood-ecosystem conservation triangle: The Africa experience.	Frontiers in Marine Science (	7: 586

Appendix D

Appendix D1

Correlation matrix of variables of estimation

Variables	HHEXP_R	Gender	Employ	Poverty Status	HH size	Residence	Own House	Age	Welfare
HHEXP_R	1								
Gender	-0.079	1							
Employ	-0.107	0.095	1						
Poverty Status	0.344	0.088	-0.113	1					
HH size	0.230	-0.188	-0.053	-0.364	1				
Residence	-0.288	-0.077	0.009	-0.378	0.194	1			
Own house	0.018	0.106	-0.076	0.279	-0.296	-0.271	1		
Age	-0.005	0.134	0.281	-0.109	0.136	0.082	-0.231	1	
Welfare	0.603	0.056	-0.061	0.392	-0.335	-0.335	0.189	-0.111	1

Appendix D2

Multicolinearity test using Variance Inflation Factor (VIF)

Variables	VIF	1/VIF
Employment		
Employed	1.04	0.964
Not employed	1.15	0.871
Gender	1.09	0.918
Poverty Status		
Poor	2.08	0.480
Non-poor	2.86	0.349
HH size	1.35	0.739
Residence	1.44	0.693
Own house		
Renting	1.53	0.654
Own	1.36	0.736
Perching	1.01	0.989
Squatting	1.01	0.993
Age	1.25	0.803
Welfare	1.39	0.721
Ecological zone		
Forest	2.16	0.463
Savannah	2.48	0.404
Coastal	1.59	0.628
Mean VIF	**1.55**	

Variables used for the regression of the first objective

Appendix D3

Variable	Measurement	Type of variable	Expected sign
Household real expenditure per capita	The real expenditure per capita of the household (measured in GH¢)	Continuous	+
Gender	The gender of the household head (base: female)	Categorical	-/+
Employment	The employment status of the household head (base: employed)	Categorical	-/+
Poverty status	Poverty status of the household (base: non-poor)	Categorical	-/+
Household size	The number of household members	Continuous	-/+
Residence	The residence where household stay. Whether Rural/Urban (base: rural)	Categorical	-/+
Age	The age of the Household head	Continuous	-/+
Welfare quintile	The welfare quintile that the household founds themselve	Categorical	-/+
House ownership	Whether household owns the house or dwelling unit they stay (base: owns)	Categorical	+
Ecological zone	The ecological zone the household stays (base: coastal zone)	Categorical	+

Appendix E1

Questionnaires for fishermen

Part One: Biodata and basic fishing activities of respondents

1. Name: …… Cellphone:……
2. Community:…… District……. Region:……
3. Do you come from this community? Yes [ ] No (migrant) [ ]
4. Sex…… Age…… Religion ……..
5. Marital status Single [ ] Married [ ] Divorce [ ] Widowed [ ] Separated [ ] if married, how many wives…….
6. How many children do you have?.....
7. Are all your children in school? Yes [ ] No [ ]
8. Level of education: None [ ] BECE[ ] MSLC[ ] SHS[ ] Voc/Tech/Teacher[ ] Tertiary[ ] Other (specify) ……
9. How many years have you been a fisherman?.....
10. Is fishing your primary job? Yes [ ] No [ ]
11. Do you have secondary job? Yes [ ] No [ ] if yes, which job ……..
12. What percentage of your income is derived from fishing?.....
13. Do you migrate to fish? Yes[ ] No[ ] if yes, where and which month ….
14. Do you fish for someone (i.e. employed) Yes [ ] No [ ]
15. Do you belong to fishermen association? Yes [ ] No [ ]
16. How do you finance your fishing trip? Bank Loan [ ] Self [ ] Family &Friends [ ] Fish mummies [ ] Other(specify) ……..
17. Do you have bank account or belong to credit union? Yes [ ] No [ ]
18. If yes, how much savings do you have in the account? ……..
19. Did you see a decline in fish stock over the last three years? Yes [ ] No [ ]
20. If yes, what might have accounted for this?.....
21. Do you own a fishing canoe? Yes [ ] No [ ]
22. Are you aware of the SAIKO activity? Yes [ ] No [ ]
23. If yes, do you see the SAIKO activity affecting your fishing activity? Yes [ ] No [ ]

24. How does it affect your fishing? .....

25. Do you know what Marine Protected Area is? Yes [ ] No [ ]

26. Will you welcome government initiative to establish MPA? Yes[ ] No [ ]

Part Two: Measuring Social Resilience of Fishermen

27. Please use the key: 1 = Strongly disagree; 2 = Disagree; 3 = Don't know; 4 = Agree; 5 = Strongly agree

Measuring social resilience of fishermen	1	2	3	4	5
I have many career options available if I decide to no longer be a fisher					
I am confident that I could get work elsewhere if I needed to					
I am too young to retire and too old to find work elsewhere*					
I would be nervous trying something else*					
I can cope with small changes in the industry					
I have planned for my financial security					
Every time there is a change I plan a way to make it work for me					
I am more likely to adapt to change compared to other fishers					
I think I am competitive enough to survive much longer					
I am confident things will turn out well for me regardless of changes in fishing					
If there are any more changes I will not survive much longer*					
I am interested in learning new skills outside of the industry					
I would find it very difficult working for someone else					
Change is normal part of our everyday life					
I would like to start up a business one day doing something other than fishing					
I believe that the future will look after itself					
I am always thinking of new and better ways to improve my fishing business					

Adopted from Marshall and Marshall (2007).

Part Three: fishermen knowledge and experience of climate change

28. When did you first notice that there has been significant changes in climate/weather patterns? (Indicate the decade, e.g. 1980s)……..

29. How many drought/flood incidences have you witnessed in your lifetime?

a. Drought incidence 1 to 3 times[ ] 4 – 6 times[ ] more than 6 times[ ] Never[ ]

b. Flood incidence, 1 to 3 times[ ] 4 – 6 times[ ] more than 6 times[ ] Never[ ]

30. What type of extreme weather events have been common in this area in the last five years? (multiple ticks allowed)

a. Increased drought incidences [ ]
b. Increased flood incidences [ ]
c. Extreme temperatures [ ]
d. Late rains [ ]
e. Early rains [ ]
f. Persistent winds [ ]

31. What common damages/ losses do people in this area usually experience due to extreme weather events? (multiple ticks allowed)

a. Crop damage [ ]
b. Livestock loss [ ]
c. Loss of biodiversity [ ]
d. Scarcity of water [ ]
e. Low yields [ ]
f. Low fish catches [ ]
g. Fishing vessels damage [ ]
h. Fishing gear damage [ ]
i. Others specify ……

32. Which years did you get poor fish catches in the past 5 years? ……

33. Has any of the fish species disappeared? Yes [ ] No [ ]

If yes, what has caused this disappearance? ……

What are the reasons for these ecological changes? ……

34. In your own view, what are the causes of fish catches variability or change? ……

35. What are strategies and their challenges and constraints you put in place to adapt to the following climate changes related to fishing?

Climate changes	**Challenges**	**Strategies**
Drought		
Floods		
Strong winds		
Heavy rainfall		
Heat/temperature rise		
Tidal waves		

Appendix E2

Key Informant Interviews

Questionnaire for chief fishermen

1. Name: ……... Phone: ……
2. Community:…… District…… Region:……
3. Does fishing go on all the year around? Yes [ ] No [ ]
4. Does the fishing village observe non-fishing days? (Fishing holiday) Yes [ ] No [ ] If Yes state the day(s)……
5. What ethnic or indigenous groups are present in the area? .....
6. Do you have migrants in the community? Yes [ ] No [ ]
7. What conditions do migrant fishermen have to satisfy at this center?

If Ghanaian ……

If Non-Ghanaian ……

8. Does the canoes here migrate to other centers within Ghana? Yes[ ] No[ ] If Yes, where and when do they go ……
9. Do canoes at other centers migrate into this center? Yes [ ] No [ ]

If Yes, where and when do they come ……

10. Does the canoes here migrate outside Ghana? Yes [ ] No [ ]

If Yes, where and when do they go ……

11. How do migration rates impact on the characteristics of the community? .....
12. Has the community had any traditional marine resource management systems (customary marine tenure and periodic closures) and how does it impact on fishing and coastal management. Yes [ ] No [ ] impact……
13. Does the community have strong religious beliefs or social conventions that can help enforce environmental protection? a. Sometimes [ ] b. Never [ ] c. always [ ]
14. Does the community presently have customary marine tenure rights or concessions? Yes [ ] No [ ]

15. Are there traditional mechanisms to control or regulate resource use/extraction? Example

a. Periodic closures Yes [ ] No [ ]

b. Seasonal fishing Yes [ ] No [ ]

c. Prohibition of gathering certain species Yes [ ] No [ ]

d. Open access Yes [ ] No [ ]

16. Describe patterns of human use and resource management in the community from past to present time

……

17. Is there strong leadership capacity in the community that is responsive to prevailing ecological conditions and supportive of fishers? Yes [ ] No [ ]

18. Are there multiple leadership roles or just a single well defined leader in the community? Yes [ ] No [ ]

19. How is the leadership structure in the community as you would define leadership? a. Single leader [ ] b. Multiple leaders [ ]

a. Responsive (to ecological conditions) [ ] b. Unresponsive (to ecological conditions) [ ]

a. Supportive (of MPA networks) [ ] b. Unsupportive (of MPA networks) [ ]

20. How much trust do local stakeholders or fishers have in their leaders in relation to marine resource management? a.None [ ] b.Moderate [ ] c.High [ ]

21. How close or connected are relationships among community members?

a. Strong bonds and tightly connected [ ]

b. Moderate and open to other actors or networks [ ]

c. Weak and with distrust [ ]

22. Do the community have any historical information available on cultural resources associated with Marine Protected Areas and the

protection of these cultural resources? Yes [ ] No [ ] if yes, what are they ……

23. Do community members aware of the benefits of an MPA or MPA network?

a. None = Not aware of the benefits of MPAs or MPA networks [ ]

b. Moderate = Can identify 1 benefit of MPAs or MPA networks [ ]

c. High = Can identify >1 benefit of MPAs or MPA networks [ ]

24. Are there any stakeholders (like NGOs, government institutions) in the community in advocating for marine resource management? Yes[ ] No [ ]

25. To what extent are the stakeholders get involved in marine resource management?

Low and unconcern [ ] Moderate [ ] High and encouraging [ ]

26. Are mechanisms in place that monitor and ensure accountability of local and national authorities (stakeholders) for resource management actions? Yes [ ] No [ ] if yes, mention any ……

27. Has the community ever experience any conflict regarding fishing grounds or marine resource exploitation or management? Yes [ ] No[ ]

28. What are the predominant sources of conflict and issues related to fishing grounds?

a. Religion-based conflict [ ]

b. Socioeconomic [ ]

c. Political [ ]

d. Clan or family conflict [ ]

e. Class conflict [ ]

28. What mechanisms or institutions in the community help resolve conflicts emerging from resource conflicts in the community?

a. No Mechanisms [ ]

b. Formal legislation [ ]

c. Community rules/regulations [ ]

d. Traditional laws Institutions [ ]

e. Government agency [ ]

f. Multi-sectoral body [ ]

g. NGOs or community organizations [ ]

h. Tribal leader or chief [ ]

i. Council of elders [ ]

29. Do the community have some ways of local training on management of marine resources?

a. Coastal resource management Yes [ ] No [ ]

b. Environmental education Yes [ ] No [ ]

c. Enforcement and surveillance Yes [ ] No [ ]

Appendix E3

Focus Group Discussion

Questionnaire for fishermen participants

1. Do you consider yourself to be socially resilient? Such that when there is any changes in the fishing industry you can survive without being much affected by those changes.
2. If there is small changes in the industry, can you cope and survive (changes such as government regulation on fishing)?
3. Do you know what a Marine Protected Area (MPA) is and what its benefits could be?
4. Would you welcome government initiative to establish an MPA?
5. What makes you get low fish catch at times?
6. Do you have alternative jobs available in your community such that you can rely on it when fishing activities are affected?