Impacts of oil pollution on the Atlantic coast of Cameroon

Gwendoline Akeng
Impacts of Oil Pollution on the Atlantic Coast of Cameroon:

BY

AKENG GWENDOLINE CAMEROON

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• Declaration

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

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

(Signature):

(Date): 21/9/2021

Supervised by: Clive Schofield

Supervisor’s affiliation
Dedication

To my loving and considerate fiancé of mine Abraham Elfred Sandy for his constant words of encouragement and support even when I almost gave up because of the stress from home and coupled with book work here, he stood firmly by me reminding me the reason I left home to Sweden he has always been there and for this, I say a million thanks.

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• Abstract

Title of Dissertation: Impacts of Oil Pollution on the Atlantic Coast of Cameroon: Threats and Response Options

Degree: Master of Science

The dissertation is a study of the impacts of oil pollution on the Atlantic Coast of Cameroon, threats and response options. A short description of the Atlantic Coast of Cameroon is presented and the impacts of the oil pollution discussed both from the environment and the sea. Cameroon’s coast stretches from the Akwafe River, which is the Nigeria border. Ocean lies from Akwafe river which is a Nigeria border at latitude 4 40°N right to Equatorial Guinea border which is the Campo River at the south latitude 2 20°N. In Cameroon, Douala is the headquarters of the Wouri division of the littoral region and it is also the biggest town in Cameroon and 80% of Industries in Cameroon are found in this area. This coastal area consists of a surface area of about 210km² and situated on coordinates 04 03’N 009 41’E at an altitude of 13m.

The Atlantic Coast ecosystem has a high biodiversity with a lot of benefits from them, for instance mangroves which help to protect the coastline of Douala from erosion. Additionally, they act as shelter to some marine species and also as their place of breeding and nursery. These mangroves are threatened by the oil pollution from the oil and gas industry and this indicates that there is great need to protect the environment and this ecosystem for the upcoming generation. The impacts of oil pollution from industries around the coast of Cameroon has severe effects on the marine ecosystem as it destroys the mangroves that prevent erosion in this area and serves as shelter for many marine species, it has made many marine species to migrate to other areas and it has also affected the health of the local community in this area as they drink and use this polluted water for their needs. This is despite Law no 96/12 of 5th August 1996 which states how the enforcement by which industrial waste is disposed in the Douala environment and the aquatic ecosystem under the supervision of the Ministry of Mines, Water and Energy Resources. These laws have not been respected as industries
disposed of their industrial waste on the environment and ecosystem of the Douala marine space without being treated. Moreover, during the survey of this study, it was discovered that there were some gaps which needed to be filled and that is why, some proposed measures are suggested in this study to see how these environmental and governance issues could be solved. The introduction of some modern equipment such as wet scrubbers or carbon could help reduce pollution in this area, mutual understanding of job functions from all ministries, allocation of funds to universities to support students from environmental Science to help them carry out research could also help to reduce or mitigate this governance challenge.

**KEYWORDS:** Competence, Pollution, Pollutants, Ecosystem, Mitigation, Coastal and Impacts
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- list of abbreviation

EMS......................................................................................................................Environmental Management System
EIA........................................................................................................................Environmental Impact Assessment
ESIA......................................................................................................................Environmental Social Impact Assessment
FL..........................................................................................................................Framework Law
1.1. Introduction

Industrial sector has made a considerable number of important contributions to the economics of Cameroon. 80% of Industries in Cameroon make are found around the Coast and some of these industries include; oil and gas industry, food processing, textiles and accessories, chemical and mining, building and transport material, paper and pulp, wood processing and agro-industrial companies just to mention a few (Angwe and Ganache, 1997). For instance, according to 1999/2000 statistics, 60,000 people were employed and paid a salary of about US$190 million that year in salaries (Luken et al; 2002). In Cameroon, the Atlantic coast is facing a huge problem as a result of pollution from different sources. Sources of pollution along the coast of Cameroon may include those activities carried out by industries along the coast, oil extraction and refinery activities, and oil pollution which is the main problem Cameroon is facing currently and searching for means in which this issue can be solved (Dieudonné, 2000). This oil pollution has caused a lot of impact on the marine environment, ecosystem and also the health of the local community has been seriously affected (Epule et al; 2011).

*Figure 1.* The industries found at the Atlantic coast of Cameroon
The location of Douala in Cameroon

This section provides some contextual background regarding the coastline of Cameroon, which is approximately 402 kilometres (Km) in length on the Gulf of Guinea in the Atlantic Ocean. Cameroon’s coast stretches from the Akwafe River, which is the Nigeria border. Ocean lies from Akwafe river which is a Nigeria border at latitude 4 40’N right to Equatorial Guinea border which is the Campo River at the south latitude 2 20’N (Bekker, 2003). (Fig 1). There are rivers at this coastal area that meet into the ocean and there are boundaries separating towns. There provinces cover this zone which are the Southwest province in the north, the Littoral in the centre and the South province in the south (Fig. 2) with some administrative divisions: Fako, Ndian, Wouri, Sanaga Maritime and Ocean division. Continental shelf and has rivers that flow into the ocean. In Cameroon, Douala is the headquarters of the wouri division.
of the littoral region and it is also the biggest town in Cameroon (Fils et al; 2018). It consists of a surface area of about 210km² and situated on coordinates 04 03’N 009 41˚E at an altitude of 13m (Asaah et al; 2006).

The largest seaport and airport are found in this city (Douala) and it is the country’s economic capital due to its facilities and it controls the country’s major exports and has a population of about five million persons (Delancey et al; 2019). This city is at the bank of the Wouri River and has a climate which is from the equatorial regime and its humid and warm all year long as it is characterised by a long rainy season which is from March to November and a short dry season from December to February (Antonio-Nkondjio et al; 2015). The amount of rainfall in this city is very high, that is, about 4000 millimeters yearly and with a stable temperature of 27.0°C yearly and also with an elevating humidity throughout the year reaching toward `100%` are found in this area (West, 2011). The monsoon watering this region has a high wind gust with the exception of its phases of onset which is from April- May each year to around September to October, a period which is often followed by violent storms (Ngo-Massou et al; 2012).

Figure 1: **location of the Cameroon coast**
The Coast of Cameroon also features estuaries, lagoons, fringed with mangroves and beaches. In these estuaries, there are a wide range of habitats and there is need for them to be well managed as they act as reservoirs of biodiversity including many invertebrates, birds, fish, reptiles, amphibians and some mammals (Monkiedje, et al; 20049).

This sector has provided Cameroonian citizens especially those at the coastal area the opportunity to work and make a living based on coastal and marine resources and related activities such as fisheries (FAO, 2005). A key activity in the region is the exploitation of aquatic products which are among important commodities traded for foods in the country, and almost 30 % of these enter regional trade, not only as a source
of foreign currency but also to meet food security needs in the nation of Cameroon (FAO 2007). Marine capture fisheries may contribute to food security either directly as a source of essential nutrients; or indirectly as a source of income to buy food. An average total fish production of 70,000 tons which falls short of the annual consumption average of 200,000 tons implies that the sector experiences socioeconomic and ecological challenges, particularly with increased perturbations in local climate (MINEPIA 2003). In Cameroon as in most developing countries, fish provides about 19% of the protein intake and it also contributes about 15% of employment (FAO 2004).

The Atlantic Coast ecosystem has a high biodiversity with a lot of benefits from them, for instance mangroves which help the coastline of Douala from erosion, they act as shelter to some marine species and also as their place of breeding and nursery (Ajonina, 2008). These mangroves are threatened by the oil pollution from the oil and gas industry and this indicates that there is great need to protect the environment and this ecosystem for the upcoming generation (Alemagi, 2007).

As earlier said, the Cameroon maritime and coastal zone is blessed with a large biodiversity and most of the factories are located within this area. These factories lack measures to control and prevent pollution from their industries as they have no ways of treating their industrial waste before they dispose of it in the ecosystem (Folack, 1996). Cameroon's marine system is very rich and diverse with a wealth of species and habitats found both on and off-shore (Alemagi et al., 2006). The sheltered coast of Cameroon (3,060km²) and Gabon 2500km². Mangroves help to protect coastal zones and also provide timber forest products to the population (Badola & Hussein, 2005; Barbier et al., 2008; Walterset al, 2008). The mangrove serves as a shelter to some marine species where they can reproduce. Mangroves are also used in Cameroon by the local communities as fuel wood for cooking and also, they use it to form charcoal which they sell to earn a living. These local community also use mangroves as material to build their houses, boats, furniture like chairs and tables just to list a few. The leaves of these mangroves are used by the locals as a source of cure to some illnesses, the
bark used to produce tea bags and also for smoking. Mangrove lagoon is used in Cameroon for canoe racing for the traditional purpose of a tribe called Sawa and the canoe race takes place once each year (Fusi et al; 2016). This area of Cameroon is so attractive as there are many different marine species and the sea port is also found here. The cultural value of the local community made them so attached to this ecosystem. The fact that this local community has the belief that their forefathers live in the ocean, makes it difficult for members who are not from that community to visit the ocean or that area. These prohibited areas are usually the deep seas and sacrifices are made once a year to appease the gods. However, water is a mobile resource and as such, sacred portions of the sea are constantly loaded with pollutants that have been washed away through the drainage system from the inlands. The inhabitants also use the area for recreation. Festivals are organised to mark the seasons, death of chiefs, birth of twins (Mokake,2021).

1.3 The problem within the coastal zone

Industrial pollution is a significant problem in developing countries especially Cameroon which has almost 500 industries and 80% of which are found around the Atlantic coast in Douala and these industries are located in this area in large part because, the stakeholders have seen that river and the ocean provide an easy opportunity to dispose of the waste that results make from these industries (Luken et al; 2002). Cameroon's Atlantic coastal zone extends from the Rio del Rey estuary to that of mangroves in Kribi, and it has a land area of 9670km2 (Alemagi, 2006). In this area of Cameroon, as well as 80% of industries in the country, there is also a population of 5million people. That is the reason why pollution is very high at the coastal area since these industries use the ocean as their dumping area for their waste (Ngoran, S. 2015).

A particular problem, and the focus for the present research, is to discharge untreated liquid waste, especially derived from the oil and gas sector, at the Atlantic coast (Guevart et al; 2006). This problem. calls for great concern and attention as the marine and the coastal environment is severely impacted by this type of pollution (Okafor-Yarwood, 2018). As a result of the huge amount of pollution that this sector produces
are estimated at 84,290 m³ per year (MINEPDED, UNDP 2006) and the damages it creates to this ecosystem. It is therefore very important that measures be taken to solve this problem (Price et al; 2000). The oil and gas sector along the Atlantic coast of Cameroon has made great contributions to the Cameroon economy representing 33% of government revenues in 2017, however, these economic benefits have clearly come with severe effects on the marine habitats (Simeon, 2014). Looking at the issue of pollution in the coastal area from the oil and gas industry, industrial oil pollution is a major problem. This occurs because the oil industry often uses water for a variety of purposes including cooling. A range of potentially toxic chemicals such as hydrocarbons, petroleum, nitrogen, phosphorus just to name a few are also used as inputs and can contaminate the water resulting in the release of effluent or liquid pollution, which contains harmful substances, shows that this sector uses products like water and chemicals as inputs and the fact that this sector uses effluent, it causes liquid pollution due to the activities they carry on which contain harmful substances that affects marine species like hydrocarbons which are carcinogenic (Monkiedje et al; 2004). Additionally, when there is an incident of oil spill, it produces tar balls. When these tar balls are formed on the sea surface, it becomes very difficult to separate them from the water surface (Gabche, 2002). According to (Barbosa, 2003) when these tar balls were analysed, the presence of 16 polyaromatic hydrocarbons were found of which benzo(a)pyrene and naphthalene are highly dangerous to humans and animals. For instance, the incident of oil spill that happened on 7 September 2004 in Limbe, a coastal area where we have the largest oil refinery. The spill occurred as a result of trying to pump out oil from a tanker to storage tanks and the beach around this area was covered with oil spill and the sand at the beach changed its colour from black sand to brown because of the oil spill. Slick was found floating on tidal water with wave action. The effects of liquid pollution will be discussed and also problems that marine species, humans and the coastal environment face as far as liquid pollution caused by the oil and gas sector is concerned (Rautiu, 2006).
It has been suggested that the owners of these industries and the people living around this coastal region generally do not know the effects of this pollution and industries keep increasing in this area (Alemagi, D. 2006).

In order for this oil pollution problem to be solve, owners of these industries have to be aware of the harm they are causing to the marine species with the waste effluent and also to the population living around the coastal area. For example, some of the communities use water from streams to cook, drink and do many other activities and also the population feeds on some of the marine species like fish which has been contaminated already and this causes health problems to them and some even die (Rakotondrabe, et al; 2017).

**1.4. Importance of the study**

Oil pollution is a topic that is very important not only in Cameroon but also around the globe as many countries face this same challenges though in the context of Cameroon, it looks like it does not really have that much importance like other issues for example, the conservation and protection of the forest as such, this dissertation is to create awareness to Cameroonians (Horta, 2012).

This problem of industrial pollution is, as noted above, a serious one and needs to be called to the attention of the industry owners who see this waste dumping into rivers and the ocean as a normal thing to do not knowing how much harm they are causing to this ocean and its habitat as well as threatening human health. This issue of pollution is not only found in Cameroon but also in the whole world as such, awareness has to be created so that industry managers will educate their employers on how to manage the waste to improve marine species and also the health conditions of the population around this area (Cooper, P. 199).

Coastal and marine pollution is a problem and to deal with it there is so much to be done to achieve it. Furthermore, as beneficiaries of nature, people should all be
responsible for looking after the environment, collectively and individually. Thirdly, through regulation and technology, the Littoral zone should be managed equally so as to conserve and protect biodiversity. This research will highlight the effects of industrial oil pollution on the marine environment.

1.5. Aims/Objectives
The aim of this study is to assess the impacts of industrial oil pollution at the Atlantic Coast of Cameroon. This study will present some objectives which will be used to produce some research interview questions. The objectives of this study will be;

- To identify the main causes of oil pollution on the coast of Cameroon
- To assess and gain insights into stakeholder perspectives on the causes and impacts of oil pollution on the coast of Cameroon.
- To identify local, national and international efforts for the governance of oil pollution applicable to Cameroon.
- To explore options for improved governance of oil pollution.

Research Questions
- What is the current situation regarding oil pollution on the coast of Cameroon?
- What are the main causes of oil pollution on the coast of Cameroon?
- What are the key impacts of oil pollution in Cameroon's coastal area?
- What is being done (locally, nationally, internationally) to address oil pollution on the coast of Cameroon?
- What international conventions/treaties are applicable to oil pollution in marine and coastal areas and what is the government doing to ensure effective implementation of them?
- What are potential ways to better address the challenge of oil pollution in Cameroon’s coastal area in the future?
This dissertation focuses specifically on oil pollution and a primary and secondary data collection will be used to carry out this research. A qualitative methodology will be applied using a semi-structured interview to conduct the interview to managers of industries along the Atlantic coast of Cameroon, workers, individuals residing at this area and leaders of the fishermen association. These participants are the main people who will answer the research questions and they will be in the best position to give relevant information on how they are affected by this governance challenge. The responses that will be gotten from the participants will then be analyzed to see if there are some gaps that need private sector, industries, or government intervention.

After the Introduction chapter outlining the nature and importance of the study, research aims, objectives and questions as well as issues related to research methodology, Chapter 2 describes and contextualises the littoral zone of Cameroon. It outlines relevant industrial activities and other characteristics, especially those related to the coastal and marine environment and biodiversity, found within the area. Chapter 3 is devoted to the concern of governance considerations on industrial oil pollution, chapter 4 deals with stakeholder perspective in industrial oil pollution in Cameroon and therefore deals with the existing complex body of legislation for setting out frameworks of regulation and control. Chapter 5 will be discussing the potential responses option. The study will then be concluded by explaining how biodiversity loss and ineffectual management of natural resources are of growing concern due to the introduction of high quantities of untreated industrial liquid waste. Some recommendations will be applied to the parties involved like the stakeholders, government, and the population of the area and the environmental regulations be implemented and enforced to mitigate industrial pollution at the Coast of Cameroon.

1.6. Methodology
This study will focus specifically on oil pollution, notably from the industrial sector of oil and gas along the Atlantic coast of Cameroon. To prepare for this study, research efforts will focus on acquiring information from primary and secondary data sources.
Qualitative methodology will be used and so, primary data will be attained through individual, semi-structured interviews which will be conducted to get the data that will be needed and will be done through stakeholders. These stakeholders include managers, and workers of some of the industries around the Atlantic coast in Douala, leader of the local fishing community around the coast and small-scale fish traders who are based at the Atlantic coast. Additionally, secondary data will be used to carry out this work using internet sources and also making use of journals and other documents that can provide information related to this issue. Chapter 3 will provide detailed information on where the research will be conducted, the approach used in getting data, how this data will be collected, how reliable the data will be, the tools which will be used in analysing this data and the limitations of the data collection process.

Chapter 2

Literature Review

2.1 Introduction

Many industries along the Atlantic coast of Cameroon have contributed to pollution impacting coastal and marine areas\(^1\). However, pollution related to the oil and gas industry calls for particular concern as oil pollution is a great danger to marine species and environment (Alemagi, 2009). Many Cameroonians have been provided with jobs through this industry hence reducing employment in Cameroon since the mid-1970s and it has made a great contribution to national government revenue and foreign exchange earnings (Alemagi, 2007).

Of concern is that oil discharges to Cameroon’s coastal ecosystems have increased in recent years (Dieudonne, 2007). Accordingly, this chapter provides an overview and assessment of the available literature concerning the oil industry generally and the oil industry in Cameroon specifically. This chapter will review and identify some types

\(^1\) oil and gas industry, mining industry, textile industry, texaco, totalfinaelf, plasticam, SCDP etc
of untreated liquid waste derived from the oil industry in the environment. Finally, it will discuss some of the literature on problems encountered in relation to the threat of this liquid waste related to the oil industry in the form of pollution at the coastal area. These problems may arise as a result of single factors or through a combination of different types of industrial discharges. The literature dealing with the environmental impacts linked to this industry is then addressed with an emphasis on impacts on coastal and marine ecosystems. Additionally, the literature related to the international and domestic governance framework concerning both the oil industry and the environment is explored. It can be observed in relation to oil and gas industrial pollution in the coastal zone of Cameroon, that the oil industry involves the use of a number of different products such as chemicals and water as inputs. Further, the different industries that use water generate oil pollution from their activities. This oil pollution may come either through manufacturing processes, washing and cleaning operations and it may contain pollutants such as benzene, xylene, toluene, and ethylbenzene which are harmful to the coastal and marine environment (Okafor-Yarwood, 2018). These problems may arise as a result of single factors or through a combination of different types of industrial discharges. As industrial activities deal with manufacturing of mixed substances and chemicals.

2.1.1 An overview of the oil industry

Countries that produce oil in the world are about 90. The 12 recent countries involved in the Organization of Petroleum Exporting Countries (OPEC) are 76% of the world's proven oil reserves and 43.5% of world oil production in 2005 (Chang et al; 2012). Being a neighbour to Nigeria, Cameroon’s oil production is very limited, about 63,000 barrels per day in 2006, which was only 0.1% of world production (Pegg, 2006). The way the oil industry is grouped is by exploration, which is the first phase, then drilling and lastly, extraction (Zolfaghari et al; 2016). The upstream phase involves remote sensing and satellite mapping techniques with seismic testing to identify potential oil reserves (Hansen et al; 2019). Companies then drill exploratory wells to channel the oil to the surface. Transportation of crude oil occurs with tankers, barges, trucks and pipelines (Martinez et al; 2011). As a result of growth in the oil industry it can be
observed that oil now accounts for more than half of the annual tonnage of all sea cargoes, and by 1997 there were more miles of oil pipelines than railways (Burger, 1997). Oil refining involves “cracking” where serious heat and pressure is mounted to crude oil so that other refined oil products can be obtained (Shah et al; 2011). Alemagi, et al; 2006 establish that oil companies were among the major industries that had adopted environmental management systems as fundamental tools for promoting corporate social responsibility and environmental management along the coast of Cameroon. As a market-based instrument, ISO 14001 seeks to internalise external environmental costs by making sure that both producers and consumers have to use their natural resources in such a way that it will not have an impact on the marine environment and ecosystems (Hillary, 1997). By taking into consideration the ISO 14001, oil companies are aiming for their more environmentally proactive products and processes to be rewarded in the marketplace. The benefit of the oil industry has been both in the social and economic context. Oil contributes significantly to foreign exchange earnings in many nations (Hoyle et al, 2012). Doyle 1994 noted that, roughly US $2 billion a day exchanged hands in worldwide petroleum transactions. Furthermore, oil taxes are a major source of income in close to 100 nations (Ross, 2013). British petroleum 2000 made estimated that the world’s oil industry accounted for 4% of the world's GDP in 2000. Because the price of oil had doubled greatly since then, this contribution may now be as much as 7% or 8%. The world’s oil industry has also contributed greatly as far as employment is concerned. According to the International Labour Organisation (ILO), 2 million workers were employed in 2002. This represented about 0.1% of the total global employment (ILO, 2002). The ILO further estimates that each job in oil production or refining generates between one and four indirect jobs in industries that either supply needed inputs or benefit from value added activities and the oil industry is a major contributor globally and it is in decline given global moves away from fossil fuels and efforts to decarbonise economies (Layke et al; 2050).
2.1.2 The oil industry in Cameroon

The government of Cameroon is in charge of Crude oil. Law No. 99/013 of 22 December 1999, was proclaimed by the state ensuring that only she was responsible in making agreements with oil companies in the country (Ayamena et al; 2016). Oil exploration, production and marketing in Cameroon takes place through a range of complex joint venture partnership agreements and production sharing contracts between the government and the oil firms (Tamba, 2017). Taxes and royalties from these companies are paid and reported directly to the government. Through the state-owned National Hydrocarbon Corporation or Société Nationale des Hydrocarbures (SNH), the government regulates the activities of oil companies (Marius & Alex 2019). SNH is also responsible for selling the government's share of oil output (both to the international market and to the national oil refinery) and for transferring the resulting oil revenue to the treasury (Gauthier & Zeufack 2011). The major companies operating in Cameroon are Total, Pecten, Shell and Parenco (Tchanche, 2014). In 2006, Cameroon was the sixth largest oil producer in Sub-Saharan Africa producing about 63,000 barrels of oil per day (Cosse, 2006). Oil production in the country commenced in 1976 and reached its peak in 1985 at 181,000 barrels per day. Production gradually dropped to 110,000 barrels per day by 1996, a brief stabilisation and continued to dropped to 58,000 barrels per day by 2005 before a marginal increase to 63,000 barrels per day in 2006 (see Fig. 1).

Fig. 1. Cameroon's oil production, 1985–2010. Source: Cosse 2006.
predicted that oil production in Cameroon will continue to drop over the medium to long term, but at an uncertain and likely slower pace. As a result of an intensification of deeper drilling in exploited fields, proven reserves increased by 13% between 2002 and 2005 (Cosse, 2006). In addition, several new exploration contracts had been signed. Despite the fact that the oil field is not in the country, rising oil prices were expected to continue stimulating oil exploration (Gauthier & Zeufack 2011). In January 2005, Cameroon had proven oil reserves of 400 million barrels with a majority of these located offshore in the Rio del Rey basin (Energy information administration, 2005). The share of oil exported that same year stood as a percentage of about 30% (Fig. 2). There has been a gradual drop in the share of oil. Revenue that this oil companies provide has contributed greatly to the government by providing her with income used in developing that country through the construction of (Pegg, 2009). Oil output has averaged 4.2% of GDP since 1990, with a low of 2.2% in 1994 and a high of 6.9% in 2001 (Fig. 3). Oil revenue has also accounted for an average of about a quarter of overall government revenue since 1990 with a high of about 34% in 1991 (Fig. 4). Direct employment in the Cameroon oil industry is low. The United Nations Industrial Development Organization (UNIDO,2005) estimated that 647 Cameroonians are employed in the petroleum refineries (mostly nationals and specifically local indigenes). This group had the highest wage per employee ($14,217 per annum) among all industries in Cameroon.

Fig. 2. Cameroon's annual (1990–2005) oil exports as a percentage of total exports. Source: Cosse 2006.
In summary, although it is relatively small in global or even regional terms, the oil industry has not made great changes in the economy of Cameroon over the past three decades. This seems to continue at a reduced rate. Against this background, the remainder of this paper considers the environmental impact of the oil industry along the Atlantic coast. Notwithstanding its prolonged existence, there is limited information on the industry's impacts on this aquatic ecosystem and there has been little discussion or documentation on practical initiatives to facilitate and improve cleaner production indicating that this study will bring out some challenges on data collection and suggest ways to fill some of this gap.
2.1.3 Environmental impacts

The Cameroon government became a member of the United Nations Organisation at independence in 1960 and she made some laws on how the environment has to be managed and protected. This was done through some international conventions which were multilateral and bilateral especially as other countries had interest to come to Cameroon and invest (Asangwe, 2002). The crude oil exploration and exploitation industry has been the focus of a developing legal framework at a national level. The Ministry of Mines, Water and Energy Resources in Cameroon is the one responsible for any liquid discharge on the marine environment be it from the petroleum industries Reference Bureau (2003). There is a law in the Cameroon legal code that states how industries should properly treat their waste before disposing of it in the marine and Coastal area of Douala as a result of preventing environmental impacts on the people and also as this town is the economic centre of the country. Law no 96/12 of 5th August 1996 states how the enforcement by which industrial waste is disposed in the Douala environment and the aquatic ecosystem under the supervision of the Ministry of Mines, Water and Energy Resources (UNDP, 2000). These laws have not been respected as industries disposed of their industrial waste on the environment and ecosystem of the Douala marine space without being treated. As a result of the untreated waste dumped on the environment and marine space has formed soil oil aggregates, which has covered a great area of the land water interface and the population in this area is growing very rapidly. These aggregates prevent solar radiation from getting to the bottom of the lagoon, preventing the growth of plankton and other micro life hence making it a problem as the people of this locality depend on fish (Thomas, 2002). This oil pollution takes the form of petroleum lumps and tar balls on surface water and displays light grey, brown or black sticky lumps with varying sizes. The surface serves as a substrate for developing bacteria, unicellular algae and other harmful microorganisms. As a result of these, the local community in this area have issues acquiring good quality water as the water from the lagoon is being polluted with oil substances from the industrial waste not being treated and disposed of in the lagoon. This water becomes harmful to this community as many get ill.
For example, Oben et al; 2006 sampled stranded tar balls emanating from the oil industry on the beach of Douala on the Cameroon coast. They found that tar-ball load, which is one of the ways in which oil pollution, is high at the Cameroon coast compared to those in other West and Central African countries. Tar balls were analysed, the presence of 16 polyaromatic hydrocarbons were found of which benzo(a)pyrene and naphthalene are highly dangerous to humans and animals. For instance, the incident of oil spill that happened on 7 September 2004 in Limbe, a coastal area where we have the largest oil refinery. The spill occurred as a result of trying to pump out oil from a tanker to storage tanks and the beach around this area was covered with oil spill and the sand at the beach changed its colour from black sand to brown because of the oil spill. Slick was found floating on tidal water with wave action. The effects of liquid pollution will be discussed and also problems that marine species, humans and the coastal environment face as far as liquid pollution caused by the oil and gas sector is concerned (Rautiu, 2006).

The lack of oxygen in the marine environment is dangerous to marine species. The presence of crude oil also hindered the growth of seeds of Zea mays (maize) and Capsicum frutescens (chilli pepper). It also acts as a potent contact herbicide on these two plants and on Abelmoschus esculentus (okro) (Amakiri & Onofeghara, 1983). Mangrove and salt marshes foe instance are habitat of the ecosystem at the Cameroon Coast so with the occurrence of oil spill, it will destroy this habit and it might take them time to recover (IMO et al; 1993).

The huge quantity of waste from that is obtained from oil drilling and extraction contain hazardous and toxic effluents called produced water. Extracted from the ground with oil, produced water is often discharged into surface waters. Doyle 1994 argues that this produced water is saltier than sea water and it consist of ‘industrial strength’ that is, toxic substances like; benzene, xylene, toluene, and ethylbenzene. The produced water and the waste produced from oil extraction company along the coastline of Cameroon are treated for hydrocarbon content and disposed of into the sea. Though treated, produced water and drilling waste still has
some toxic substances that consist of some heavy metals and other material that may occur naturally that calls for serious attention as they are of great danger to the environment, safety and health (Epstein & Selber, 2002). The Chad-Cameroon Pipeline is one of the major oils and gas related projects in Cameroon Sub-Saharan African (Guyer, 2002).

Source: White 2006. Utzinger et al; 2005 further noted that while the environmental assessment (EA) covered the expected 20- to 30-year life span of the project, mapping was not done and also, they area was not monitored to be able to identify those impacts of the project on the habitat and the environment. Those people who settled around the Coast and accepted the project, they showed concern about the impact of the project on the marine species especially as their main activity is fishing. These people also
complained that very little information was given to them about any emergency prevention and response procedures (International Advisory Group, 2004). In a report, the African Forum and Network on Debt and Development 2007 argued that the construction and operation of the Chad–Cameroon petroleum pipeline project has caused impact to coral reefs to many communities forgetting that these coral reefs act as a natural habitat for several hundred fish species. This project has caused many species to migrate causing a decline in the fishing activity in this area of the Coast. From this, one can say that this project with its negative impacts was as a result of not involving the local community in the planning process.

Chapter 3

Governance Considerations

3.1 International governance related to oil pollution

Oil pollution has been a problem of great concern for many years. Such oil pollution can come from offshore or onshore through the extraction of oil or through the transfer of oil, including from pipelines on land and from tankers at sea. Since the 1960s, there have been some measures to how the impact of oil pollution could be reduced or eliminated on the marine environment and as such, there is a clear indication that there was an awareness in regards to oil pollution (Carpenter, 2019). Oil pollution can therefore come from different sources and go into the marine ecosystem causing a series of impacts both to marine organisms and the marine environment. The different sources of this oil pollution could come from accidents occurring through ships and tankers, industrial waste and oil extraction (Clark, 2001). OILPOL which is an international convention for oil pollution at sea was the first convention to set out some measures on how ships have to operate when it comes to oil from the ships and this convention was held in the year 1952 and was amended in 1962 with more laws to govern some specific areas at (Molenaar, 1998). The impact of oil pollution that started
since the 1960s, led to the introduction of some laws that will help to eradicate pollution either from industries or ships. The Torrey Canyon incident that occurs in the Seven Sisters Reef in the year 1967 and the spill of 19,000 tons of crude oil led to the introduction of new laws and regulations so that this type of incident will not take place hence the rules introduce was as a result of preventing the same incident from happening (Healy, 1969). Rules where lied down whereby compensation were given to countries affected by the spill and because of this incident, the International Convention on Civil Liability for Oil Pollution Damage in 1969 (Healy, 1969) and the International Convention for the Prevention of Pollution from Ships (MARPOL Convention) in 1973, emerged. These two conventions were later modified by the protocol of 1978 (IMO, 2015). World primary energy consumption in 2017 stood at nearly 80 percent of oil equivalents (BP Statistical Review of World Energy); oil and gas represented 63 percent of world energy supply, with coal providing 27 per cent, nuclear energy 7 per cent and hydro-electric 3 per cent (Ahmad & Zhang 2020). The challenge is to meet world energy demands, whilst minimizing adverse impact on the environment by conforming to current good practice. The exploitation of oil and gas reserves has not always been without some ecological side effects (Gossen, 2006). Oil spills, damaged land, accidents and fires, and incidents of air and water pollution have all been recorded at various times and places. In recent times the social impact of operations, especially in remote communities, has also attracted attention. The oil and gas industry has worked for a long time to meet the challenge of providing environmental protection. Much has already been achieved but the industry recognizes that even more can be accomplished. This is especially so when viewed against global-level moves away from the use of fossil fuels such as oil and gas with a view to constraining emissions of greenhouse gases such as CO₂ in order to restrain global warming (Mohn, 2020).

The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in June 1992—‘The Earth Summit’—focused world attention on the close links that exist between the environment and socio-economic development (Quarrie,1992). The Summit reviewed global environmental issues and resulted in two
conventions (the Framework Convention on Climate Change and the Convention on Biological Diversity), as well as the Rio Declaration and Agenda 21—plan of action (Lindner, 2019).

3.2 Domestic governance of the oil and gas industry in Cameroon

Alemagi et al; 2006 argue that parliamentary legislation provides the basis for adequate protection of the environment in Cameroon. The Head of State is responsible for ratifying the constitutionality of the formulated legal regulations or legislation. Legislation geared towards mitigating industrial pollution from the oil industry is implemented by seven different ministries and authorities at the regional level (provincial, divisional, sub-divisional and districts level). Oil pollution on the coast of Douala is a major concern as hydrocarbons which are organic compounds containing carbon and hydrogen which are found in crude oil and natural gas and these are found in the oil and gas sector in Douala, causing great danger to the marine species and the ecosystem (Kouega, 2007). Domestically, the Ministry of Environment and Nature Protection has the main authority to implement legislation pertaining to the control of industrial pollution from the oil industry (Gottesfeld et al; 2013). Important responsibilities relating to the regulation of the adverse impacts of oil pollution are also vested in the hands of, the most important being those of Industries, Mines and Technological Development, Water and Energy, Transport and Higher Education (Alemagi et al; 2006). The majority of Cameroon's environmental legislation is based on the traditional normative or “command-and-control” approach which is typified by controls of discharge to the atmosphere, water or land and environmental quality standards (Alemagi et al; 2006). As Hillary 1997 puts it, “command and control” succinctly describes the operation of such environmental legislation, because while the legislation sets the environmental standards for a certain process or operation—the “command” part—inspection is necessary by enforcement authorities to ensure compliance to the standards—the “control” part. Environmental legislation is necessary and has certain important properties in protecting and safeguarding the
environment. For instance, normative environmental legislation has the important benefit of establishing guaranteed and harmonised levels of environmental protection throughout a country or a given region (Alemagi, 2007). In regularising operations through normative environmental legislation, the government of Cameroon has taken a fundamental step towards improving the sustainability of its oil industry. The following laws or normative environmental legislation governed the protection of the environment in Cameroon from the adverse impacts of the oil industry (Fogw et al;2013):

(i) Decree No. 76/372 of September 1976. This law was put in place to control those pollutants from the oil industries from polluting the ecosystem as they were considered dangerous to it.

(ii) Law No. 96/12 of August 1996. This regulation was put in place so that the way the environment in Cameroon is managed should be controlled through the use of Environmental Impact Assessment.

(iii) Law No. 99/013 of 22 July 1999. This law institutes a petroleum code. This law was put in place to monitor the activities of petroleum companies so that there are no impacts affecting the environment and the population in that area which was done, through the use of EIA.

(iv) Decree No. 2005/0577/PM of 23 February 2005. This law was established to adjust any step that was needed for EIA to be carried out properly.

(v) Order No. 0069/MINEP of 8 March 2005 was established to moderate the way EIA projects were being carried out.

The above laws were put in place so that it will help to maintain the relationship of living organisms to one another and to their physical surroundings for a sustainable development in Cameroon within the oil industry. A case in point is Decree No. 2005/0577/PM of 23 February 2005 on the process and procedural framework governing EIA in the country. This was the first attempt that was made by the
Cameroon government to make sure that EIA steps are properly followed. In Cameroon EIA (ESIA) is regulated by the Framework Law (FL), of 1996 and its implementing regulations: Decree no 2013/0171 of 14 February 2013 on the Modalities for the Realization of Environmental and Social Impact Assessment (ESIA), order No of 08 February 2016 states that, any project which may endanger the environment shall carry out an impact assessment in order to determine the direct or indirect impact of the project so that the population can be protected and the ecosystem sustained for future use (Saeed et ai; 2012).

3.1.2 Governance of marine and coastal environment in Cameroon

The oil and gas refineries are a major polluter and these activities consume a great amount of energy and water, hence it produces huge amounts of wastewater and sends out hazardous gases into the air generating also some solid waste that cannot be treated or disposed of easily (Manrino, 2001). This industry, known to be a threat to the environment, also plays a positive impact in the coastal area as it creates jobs to many and also brings revenue to the national government through huge volume of taxes (Raukas, A; 2009). The oil and gas industry has resulted into a substantial environmental impact in terms of liquid and air pollution and this industry remains indifferent towards environmental problems which result in grave environmental effects and is now causing a threat to the ecosystem (Barbosa, 2003). Taking the environmental variable into consideration in productive processes has been a crucial issue and an important challenge for the oil and gas industry. This is because these industries are subject to greater environmental and sustainability demands than was the case in the past. In particular, the commitment to promote sustainable development goes beyond ethical and moral obligations, and has become a demand from society. This commitment is a limiting factor to the survival of companies as numerous consumers might be influenced by the effect associated with those plants that cause damage to the environment (Mariano, 2007). Industrial effluent especially solvent waste was estimated at 84,290m$^3$ annually (MINEPDED, UNDP 2006). The use of streams as a dumping area for septic tanks is a current practice which leads to
groundwater pollution in the city of Douala in Cameroon leading to waterborne diseases where by in September, 2010, more than 385 Cameroonian lost their lives because of a cholera outbreak (Gabche, 2002). In Cameroon, the way the environment is protected is governed by a series of inadequate and ill adapted texts which are laws that control and protects the environment from industrial activities and one of these laws was; law on toxic waste (No. 89/027 of 2 September 1976) (Fogw et al; 2013). The drafting of this law was in order to protect and to make sure that the health of humans and the environment was secured. However, critical analysis of the law indicates that environmental protection was not well handled and also, there was a clear lack of balance in the objectives that were set, especially those concerned with the environmental protection and prevention of industrial pollution (Fombad et al; 1997). This law did not provide attendant measures that would help in the possible effective control of industrial pollution at the Cameroon coast using efficient technical facilities (Luken et al; 2002). In order to remove the problem of pollution and to meet with the provisions of the agenda 21 of the 1992 summit in Rio de Janeiro, the Cameroon government took a bold step to improve the legal regulatory framework pertaining to environmental management in Cameroon though despite the effort, this problem keeps increasing instead of decreasing because the implementation of the regulations is not effective (UN 1993, ISWA 2002).

It is noticed that those involved in policy-making that addresses the issue of polluting behaviour to make sure that there is environmental protection and quality in the coast of Cameroon have used the measure of voluntary tools. This is used between regulators and those polluting the environment as a way of making it a compulsory tool for the laws to be respected by those involved in the issue of pollution. (Gottesfeld et al; 2013).

This approach was used in Cameroon to enable the mitigation of industrial pollution at the Atlantic coast and so, Environmental Management Systems (EMSs) was used as a way of solving the issue of pollution (Clausen et al; 2002). This EMS is an organizational procedure, processes and responsibilities which is used in the
implementation of environmental policies (Begley, 1996). Environmental managers of industries at the coast are responsible for the environmental management as their duty is to maintain EMS in the industries along the Cameroon coast. These managers are aware of the problems to give priority to the rate of progress and also, at the corporate level, they are also in position to give response on the implementation and the outcome of EMSs but those ministries involved in the oil pollution in Cameroon face a lot of problems as many are not focus on their own job function but all focus on same job indicating that specific duties are not assigned to them hence, they end up conflicting with each other. (Duncan, 1997). It has also been observed that the way of obtaining an effective and efficient management of industrial pollution is to use a combination of tools, potentially including the use of economic instruments together with the traditional command and control approach. It is good to understand that the general effectiveness and efficiency of the formulated initiatives did not address the issue of pollution in a proper way. The regulations and the enforcement guiding pollution at the coast of Cameroon have been criticized because there were no efficient ways that they used in treating the problem of industrial pollution around the coast (Weidenbaum, 1979) hence there was a need for another approach where taxes, fees, and funds are initiated not using just the environmental management systems in the corporate arena.

The Cameroon government, because the voluntary tool had a series of limitations, decided to rely mainly on the command-and-control approach that states the effluent or emission standard to cope with industrial pollution at the coast of Cameroon (Alemagi et al; 2006). The way of controlling this pollution at the coast has been a problem because of poor monitoring and enforcement of environmental laws by the pollution control boards (Alemagi, 2007). This is due to the slow reaction of imposing action on those responsible for polluting the coastal environment. Shortcomings in efforts aimed at eradicating pollution at the coast of Cameroon also stems from these actors involved in controlling and monitoring the environment against pollution, being slow in taking up their responsibilities by implementing penalties to actors involved in causing the issue of industrial oil pollution, something partly attributable to their
having no defined strategies in terms of controlling the quality of the coastal aquatic environment against liquid effluent, financial restriction of the control boards, low penalties for non-conformities with the status and standard of bribery and corruption and the existence of many small-scale units that generally lack technical and, financial and managerial capabilities to treat their emission and liquid waste (Mariano, 2001).

There is little or no coordination between the policies and laws which exist in Cameroon for pollution control affecting the enforcement of regulation. So, legal instruments are needed like some standards to be put in place for emission discharges and effluent and also the ambient standard where there is a certain limit of gas or effluent concentration is allowed in the receiving environment. Industrial plants do not follow standards or restrictions on the emission and effluent so this led in Cameroon to situations where many citizens lost their lives because they had to drink from streams and rivers which were contaminated leading to mens rea (the state of mind of someone to deliberately commit an offence) where serious section was to be inflicted to the plants but because those responsible for implementing the penalties did not know the exact plan that released much dangerous substance than the other (Fuo and Semie 2011). The government approach towards inhabitation of industrial oil pollution has been predominantly through legislation-based command and control measures while natural resource management has been mainly carried out through programmes supported by allocations from central and state budgets (Rietbergen et al; 2014). Command and control approaches to governance means the direct regulation that states what is acceptable and what is prohibited and this approach is different from other regulatory methods that is, the use of economic incentives in which the use of taxes and subsidies as incentives for compliance is included which is not same when its being implemented in Cameroon (Forton, 2012).

This approach for controlling industrial pollution incorporates a range of methods which include; effective behaviours through laws, incentives, threat, contracts and agreements. Unfortunately, in this regard, there is awareness of a problem which needs a solution to be established but this is lacking in Cameroon in the aspect of regulation,
monitory, and implementation (Ashukem, 2020). The use of this approach involves the government or similar bodies to command the reduction of pollution, that is to say starting from the emission level of effluent pollution and also to realise effective control through implementation of laws and regulations. The way it will be obtained, if done through the installation of technology which will help to control liquid pollution then this issue of pollution will be mitigated at the Cameroon Coast. This approach indicates that regulation has the prospective to promote rapid resolution of some environmental policy objectives, and may also provide clarity to those that are subject to the regulation, and maybe clearer understanding of what is required and how to meet the requirements (Herrington et al; 2007). Moreover, such regulatory strategies designed to solve environmental problems can result in unexpected consequences if the application is conducted uncritically. That is why using a combination of tools that is the command-and-control tool with economic instruments (instruments that effect change and influence behaviour through their impact on market signals) may help solve the problem of industrial oil pollution along the coast of Cameroon (inack-Mbai 1999).

3.1.3 Conclusion

To conclude, Cameroon’s way of dealing with the problems caused by liquid pollution, including oil pollution, has mostly relied on the command-and-control approach based on a set of laws designed to perform a preventive rather than a proactive role. The presence of well-drafted legislations that specify standards for various pollution and penalties for noncompliance has helped to reduce pollution to some extent. However, successful implementation of these laws and regulations has not been achieved to the required extent, starting from informal units, limited authorities of the regulators, political interference, and low remuneration for the officials involved that provides an incentive for corruption. Consequently, use of a combination of tools like economic instrument and the Command and control is proposed as this will help mitigate industrial liquid pollution if the actors involved in controlling this problem like the
Ministry of Environmental Protection have to be given the full authority to impose penalties to ensure safety enforcement of actions not allowing many actors to take part in the implementation and monitory because it will cause conflicts and hence slow down the mitigation of industrial pollution (Alemagi et al; 2006). Additionally, a judicious mix of legal process and sanctions duly complemented by the enforcement are needed to improve the governance of both polluting industries and to help protect the environment. Inadequate coordination between stakeholders is another issue that has to be solved because stakeholders have no collaborative forum between them so there is no way that pollution along the coast can be solved unless this issue of collaborative forum among these stakeholders is put in place. The fact that there is also corruption taking place between the stakeholders is another issue that needs to be adjusted (Jorgenson, 2001).
Chapter 4

Stakeholder Perspectives

4.0. Identification of stakeholders

Stakeholders and stakeholder groups are diverse and could be seen as individuals, an investor, government, communities, suppliers, customers and also like an organization, such as non-governmental organisations (NGOs), that can be impacted or can impact a business or any other issues involved in the country or societies. They can either be internal or external stakeholders (Voinov & Bousquet 2010). Key stakeholders who are directly involved with the issue of oil pollution in Cameroon are as follows:

Table1: showing stakeholders and their functions in oil pollution in Cameroon.

<table>
<thead>
<tr>
<th>Ministry</th>
<th>Duties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Mines, Technological Development and industries</td>
<td>This Ministry is responsible for creating ways of developing industries and controlling pollution from these industries so that they will not create problems to the ecosystem. It also provides regulations that industries have to follow so that the environment can be prevented from pollution and the marine ecosystem as well.</td>
</tr>
<tr>
<td>Ministry of Environment and Nature Protection</td>
<td>This ministry is in charge of supervising environmental impact assessment. It works with other ministries to make sure that natural resources are well managed and it controls the way industries manage their industrial waste.</td>
</tr>
<tr>
<td>Stakeholder Group</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ministry of Public Health</td>
<td>This ministry provides ways in which industrial waste can be treated and it also creates workshops where the general public is being educated on pollution being it solid or liquid pollution. This ministry also holds seminars whereby awareness is created to industrial personnel on the impacts of oil pollution on the marine environment, ecosystem and on the health of the local population.</td>
</tr>
<tr>
<td>Local Communities</td>
<td>These stakeholders have in-depth knowledge of the area at the Atlantic coast since they have been living there for many years, their source of living is mainly fishing and farming but because of the oil pollution in this area, the marine species turn to migrate to other areas while some die because they cannot live in a polluted zone and this makes life difficult for the local people. The oil also affects their soil and makes it difficult for their crops to grow because the nutrients in the soil are destroyed by the pollutant substances found in the oil. Local community groups and NGOs are also of relevance here.</td>
</tr>
<tr>
<td>Industry players</td>
<td>The industries at the Atlantic Coast still face the problem of waste treatment as they still dispose of their industrial waste in the ocean causing so many impacts on the environment and the ecosystem. These stakeholders need to be educated on the impacts their industrial waste is causing to the marine environment and the ecosystem.</td>
</tr>
</tbody>
</table>
4.1 Research approach

4.1.1 Semi-structured interviews

The research approach adopted in this study was predominantly qualitative in character, using semi-structured interviews. This required that data be collected from the stakeholders who are involved in or are impacted by those industries around the Atlantic coast of Cameroon because they are directly involved with the problem of oil pollution in the area.

Semi-structured interviews are a set of predetermined questions that researchers set and it gives them the opportunity to ask more serious questions depending on the responses they get from the person they are conducting the interview with (Kallio et al; 2016). This research approach also provides those involved a chance to follow up with questions leading from the response received. This allows for more information to be collected that will clarify and make them better understand the issue of the oil pollution at the coastal area of Cameroon. This type of interview is usually carried out face-to-face but under current circumstances imposed by the global covid-19 pandemic and resultant travel restrictions, alternative approaches via the internet, including use of programs such as Zoom or Skype was conducted. Additionally, such interviews were required to follow research ethical standards with the respondent needing to give their consent.

The reason why qualitative methodology was engaged using semi-structured interviews is because it makes the researcher more focused and specific on the key stakeholders involved in this governance issue, they are carrying out their research on (Hignett & Mc Dermott 2015). This method also gives the researcher ways to request for important information, some guide on how to go about it and also get direction from those persons that have a better understanding of the issue of industrial oil pollution. The skill and knowledge the researcher gets from interviewing the stakeholders, makes their work and data collected more trustworthy, reliable, and they are arguably given valid information by these stakeholders. With this, they will make a logical conclusion and some recommendation to either the government and private
sectors, or on both, on issues involving economy, environment, and social so that some decisions can be taken and implemented.

Semi-structured interviews also give the researcher the opportunity to explore further and ask more questions to the respondent. By so doing, it enhances the conversation and more information is provided and this enables the researcher to be comfortable with the respondent, hence the researcher moves from asking general questions to specific ones, as it will clarify some issues, and the researcher could request the respondent for additional information (Blee & Taylor 2002). Notwithstanding, the enormous contribution of the qualitative methodology using semi-structured interviews when conducting research, the use of semi-structured interviews clearly takes substantial time, meaning that the researcher will need to be highly efficient so as to be able to achieve their objectives and also it requires the researcher to work very hard which makes it labour intensive. When this method is used in natural and social sciences research with the use of the semi-structured interview, it provides the research with good outcomes as a result of important information and qualitative data gotten from the respondent which will be required in making motivating decisions in economic, social and environmental for society purposes.

4.1.1 Challenges reaching stakeholders
In the course of carrying out research and conducting some interviews to some stakeholders, there were quite a number of challenges faced and as a result made it difficult to get some information from some of them. Firstly, as noted above, the usual way to conduct semi-structured interviews is face-to-face and this option was rendered impossible due to the global covid-19 pandemic. This severely complicated access to key stakeholders, for instance those belonging to different ministries than that of the researcher, coming from community stakeholders or involved in oil-related industries.

A further problem, exacerbated by the pandemic was the fact that some of the stakeholders identified had very busy schedules. On multiple occasions the researcher experienced the frustration of having scheduled an appointment for an interview, it
ended up being cancelled, with the researcher being informed that the potential interviewee was very busy and did not have the time to talk. Another challenge in reaching stakeholders was that some of them were not willing to disclose information perceived to be valuable or confidential, especially those in ministries and those who hold high positions in some industries in the coastal area of Cameroon. Indeed, most of them were very reluctant to disclose some information even after assuring them that whatever information they give me will be kept confidential but they could not provide me with relevant information the researcher needed. While these constraints clearly impacted on the information that the researcher was able to gather, nevertheless, some valuable perspectives were gathered which are outlined in the following section.

4.1.2 Summary of responses, results and discussion
According to an interviewee in one of the industries around the Atlantic Coast of Cameroon, the present condition of the oil pollution on the Coast of Cameroon has not changed greatly as industries still dispose of their industrial oil waste into the waters and with this, it impacts so many marine species and also affects the lives of the local communities. The local communities depend so much on the ecosystem and as a result of the oil pollution, it causes the loss of the rich biodiversity that this ecosystem has, including the loss of marine species leading to reductions in the rate of fish catch which is one of the main activities of the locals in this community. This stakeholder observed that oil pollution also affects the soil making it difficult for these people to cultivate as their soil nutrient is destroyed by the substances found in the pollutants. It was further explained that, some of these industries are not given incentives when it comes to paying penalties for disposing effluent on the ocean causing pollution and harm to the environment and the ecosystem in general. Despite the law that says incentives be given to any industry that dispose of waste without treating it but some of these industries do not pay these incentives as some of them have relationship with the ministry in charge of environmental protection and some of them also pay some amount of money each year to this ministry and as a result, they can dispose of their
industrial waste on the marine ecosystem freely not paying attention on the causes of their acts to this ecosystem. It was however explained that these industries do this because the cost of treating their waste is very high and they cannot afford it so the ocean is the only place they can dispose of their waste.

Other industrial players explained that, the major causes of oil spills along the coast of Cameroon are attributed to the following factors; failure of equipment at refineries and other petroleum related industries, corrosion of pipes that transport the petroleum and petroleum products which causes their rupture, deliberate discharge of untreated petroleum wastes from industries into the sea was also pinpoint as a potential cause. According to an interviewee it is as a result of lack of funds to get proper treatment facilities for such wastes that they end up in the sea.

A representative in the ministry of Environmental Protection explained that the main manifestations of oil pollution are a change in the physio-chemical properties and an increase in the toxicity of the waters due to the presence of hydrocarbons, heavy metals like mercury. Changes in physical properties of the water like colour affects the autotrophic organisms in the water due to reduced sunlight penetration. A reduction in the population of phytoplankton leads to a drop in the fish population which in turn affects the fishing yields of the local community. The chemical composition of the polluted water equally damages the soils of the farmlands located at the coasts. Equally, many respondents reported an increase in the number of illnesses (like skin diseases, cholera, poisoning, eye damage) in the local population whenever oil spills occurred, which could be explained by intoxication by the water since most of them depend on this for their various needs; laundry, bathing, drinking, cooking.

The Ministry of Environmental Protection has full authority to provide laws and regulations governing industrial pollution in Cameroon in general and oil pollution as a whole. This ministry is being assisted by other ministries like Mines water and Energy, Transport and Higher Education and Commercial Development. The law that was enacted in 1989 on toxic waste was in order to protect the environment and marine ecosystem and also to protect human health but as mention during this study by an
interviewee, there has not been great change because the ministry of Environmental Protection has not been focusing on the objectives that are allocated to protect the environment and prevent industrial pollution as a result, this governance challenge has been persisting and the impacts both on the ecosystem and the environment is very drastic as the rich biodiversity is gradually disappearing, marine species migrating and human’s health are in great danger.

The international convention applicable to oil pollution both on the marine and coastal areas is the MARPOL 73/78 Convention of October 1983. Cameroon is a member state to it by accession and it entered into force on 18th of December 2009. Very little has been done by the country to really give full strength to the convention thereby might be one of the drawbacks to the fight against oil pollution as highlighted by some interviewees. ‘The country has not made any amendments to its existing national regulations after its accession to this treaty’ said one interviewee.

Technological readiness (using a number of techniques to carry out clean up). However, according to Merv (2000), the average costs of clean up varies from 20 USD to 200 USD and Cameroon being a poor developing country might not be able to undertake such a clean-up campaign especially if thousands of tons of oil are involved. As a result of this, the best option is prevention as was raised by most of the interviewees.

Chapter 5

Potential Response Options

5.1 Legislative gaps
The way of controlling oil pollution at the coast has been a problem because of poor monitoring and enforcement of environmental laws by the pollution control boards which is due to the slow reaction of imposing action on those responsible for polluting
the coastal environment and also eradicating pollution at the coast of Cameroon is also because these actors involved in controlling and monitoring the environment against pollution, are slow in taking up their responsibilities by implementing penalties to actors involved in causing the issue of industrial oil pollution, they have no defined strategies in controlling the quality of the coastal aquatic environment against liquid effluent, financial restriction of the control boards least penalties for non-conformities with the status and standard of bribery and corruption and many small scale units that generally lack technical and, financial and managerial capabilities to treat their emission and liquid waste (Mariano, 2001). The pollution control laws in Cameroon have neither kept speed with the changing of constitutional directives nor have operationalized the scope for action. There is no coordination between the policies and laws which exist in Cameroon for pollution control affecting the enforcement of regulation.

Considering the issue of oil pollution at the Atlantic Coast of Cameroon, it is noticed that addressing this problem has had very little progress. The main cause of this oil pollution being from industries, it is discovered that even with the law passed by the government on environmental Protection and management, the rate in which pollutant substances are seen in this marine ecosystem is of high rate regarding Law No. 96/2 of 5th August 996 which the Cameroon government still respect. The following reasons are some of the gaps discovered during this study why oil pollution is still a great issue at the Atlantic Coast of Cameroon.

Ineffective enforcement is one of the main reasons why oil pollution is a great issue at the Coast of Cameroon. The Cameroon government does not really follow the laws they create and hence fail to implement them accordingly. When laws are created, they meant to be implemented and those who fail to abide to these are giving some punishments for instance, industries that do not follow the regulations of these laws are giving incentives as punishment but many do not comply yet the government do not take action and because of this, they continue polluting the environment and the marine ecosystem with their industrial oil waste.
Insufficient Funds is another reason why oil pollution is still a serious problem in Cameroon. It is discovered that among all the universities in Cameroon, only two offer environmental science and they are; University of Bamenda and that of Buea. These universities which are basically considered to do much when it comes to environmental issues like oil pollution on the Atlantic Coast of Cameroon by using some strategic research monitoring luck fund to carry out their research as they do not get help from the government. Their assistance comes from their faculties and from individual students which is not enough for them to carry out the research. The government does not assist them as there are others like industries and non-governmental organisations who also seek for fund help from the government hence the competition is high and this makes it difficult for the universities to carry out their research and assist in mitigating oil pollution at the Coast of Cameroon.

Poor monitoring as a factor that could be considered to be another gap while oil pollution is an issue at the Atlantic Coast of Cameroon is due to the fact that Cameroon has a ministry of scientific research and they are meant to have equipment to monitor oil pollution on industries which is not the case. During the study, it was discovered that some of the scientists are reluctant to perform their duties by carrying out their daily activities that are assigned to them by monitoring industrial pollutants at the Atlantic Coast. Without an effective monitoring of the Coast, this issue of oil pollution will continue to generate more problems to this ecosystem and most of the biodiversity will be lost and nothing will be left for the generation to Come.

Lack of equipment could be seen as another factor for the delay of oil pollution to be mitigated at the Atlantic Coast of Cameroon. This is one of the major problems industries at the Atlantic Coast of Cameroon are facing. These industries still use outdated equipment and until they change these equipment, industrial pollution as a whole will continue to be an issue in this area. The fact that they cannot afford to buy modern equipment is a problem the government has to look into because some of this equipment is needed to treat their waste before they dispose of it to the ecosystem to avoid polluting the environment.
5.1.2 Recommendations
The present research study led to the following recommendations that might help mitigate this governance issue in relation to oil pollution impacts on the Atlantic coast of Cameroon.

The installation of new technology will help to control oil pollution in industries along the Atlantic Coast of Cameroon which will help mitigate oil pollution at the Cameroon Coast. By using the Command-and-control approach indicates that the regulation has the prospective to promote rapid resolution of some environmental policy objectives and may also provide clarity to those that are subject to the regulation and maybe clearer understanding of what is required and how to meet the requirements hence by introducing new technology and equipment will help solve this issue at the Cameroon Coast.

Command and control should be provided as well as incentives to all the parties.

Concerning Cameroon’s governance of oil pollution, this has mostly relied on the command-and-control approach, based on a set of laws designed to perform a preventive rather than a proactive role. The presence of well drafted legislations that specify standards for various pollution and penalties for noncompliance has helped to reduce pollution to some extent, but not to the required extent starting from informal units where the authority of regulators is limited, political interference and low enumeration for officials that provides an incentive for corruption. Consequently, a combination of tools is necessary to help mitigate industrial liquid pollution. For example, key actors involved in controlling this problem such as the Ministry of Environmental Protection have to be given the full authority to impose penalties to ensure stronger enforcement of actions. Additionally, not allowing too many actors to
take part in the implementation and monitoring would appear to be beneficial because it would reduce conflicts and hence slow down the mitigation of industrial pollution.

Similarly, inadequate coordination between stakeholders is another issue that has to be solved because stakeholders have no collaborative forum between them so there is no way that pollution along the coast can be solved unless this issue of collaborative forum among these stakeholders is put in place.

To solve the issue of oil pollution at the Atlantic Coast of Cameroon there is clearly also a need for modern equipment to reduce or counter such oil pollution. With the use of modern equipment such as wet scrubbers or carbon absorption among others which will help in reducing pollution in industries along the Coastal area of Cameroon. By using these instruments during operations at production level in the oil and gas refinery in Cameroon can control by using equipment such as cyclone, bags filters, electrostatic precipitators and scrubbers. However, if the oil and gas industry is reporting to the actors in charge of pollution control on the monthly bases as required then it is the view of this researcher that this will help in mitigating this issue because the amount of effluent discharge will be control and quantity known if it goes above what is required then fines, strict liability or absolute liability will be apply to them hence it will make these industries at the coast more conscious of the discharge they make hence reducing pollution.

Another contribution to the solution of oil pollution problems in Cameroon would be for the Cameroon government to consider providing adequate funds to universities that offer environmental science so that, the university students can have the access to carry out their research without any difficulties and as such, they will be able to do strategic monitoring to help the country as well to work in mitigating oil pollution as they will bring their own knowledge.

5.1.3 Conclusion

To conclude, Cameroon`s control on liquid oil pollution has mostly relied on command and control based on a set of laws designed to perform a preventive rather than a proactive role. The presence of well drafted legislations that specify standards for
various pollution and penalties for noncompliance has helped to reduce pollution to some extent but not to the required extent starting from informal units where regulators have limited authority, political interference, low enumeration that provides an incentive for corruption. As a result, it is a core conclusion of this study that a combination of tools is needed to help mitigate industrial liquid oil pollution. In particular, key actors involved in controlling this problem like the Ministry of Environmental Protection have to be given the full authority to impose penalties to ensure stronger enforcement of actions not allowing many actors to take part in the implementation and monitory because it will cause conflicts and hence slow down the mitigation of industrial pollution (Alemaghi et al; 2006) and also, a judicious mixed of legal process and sanctions duly complemented by the enforcement needs to be improve. Inadequate coordination between stakeholders is another issue that has to be solved because stakeholders have no collaborative forum between them so there is no way that pollution along the coast can be solved unless this issue of collaborative forum among these stakeholders is put in place (Jorgenson, 2001). This combination of approaches may provide the best way to solve the problems of oil pollution in Cameroon. Cameroon’s way of dealing with the problems caused by liquid pollution, including oil pollution, has mostly relied on the command-and-control approach based on a set of laws designed to perform a preventive rather than a proactive role. The presence of well-drafted legislations that specify standards for various pollution and penalties for noncompliance has helped to reduce pollution to some extent. However, successful implementation of these laws and regulations has not been achieved to the required extent, starting from informal units, limited authorities of the regulators, political interference, and low remuneration for the officials involved that provides an incentive for corruption. Consequently, use of a combination of tools like economic instrument and the Command and control is proposed as this will help mitigate industrial liquid pollution if the actors involved in controlling this problem like the Ministry of Environmental Protection have to be given the full authority to impose penalties to ensure safety enforcement of actions not allowing many actors to take part in the implementation and monitory because it will cause conflicts and hence slow
down the mitigation of industrial pollution (Alemagi et al; 2006). Additionally, a judicious mix of legal process and sanctions duly complemented by the enforcement are needed to improve the governance of both polluting industries and to help protect the environment. Inadequate coordination between stakeholders is another issue that has to be solved because stakeholders have no collaborative forum between them so there is no way that pollution along the coast can be solved unless this issue of collaborative forum among these stakeholders is put in place. The fact that there is also corruption taking place between the stakeholders is another issue that needs to be adjusted (Jorgenson, 2001).
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