

Challenges in Implementing Environmental Sustainability Practices in Ghana's Downstream Petroleum Sector: A Mixed-Method Study

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Dedication

To Tess, Peter, Afua and Kwadwo!

Acknowledgements

"If the highest aim of a captain were to preserve his ship, he would keep it in port forever."

St. Thomas Aquinas

The completion of this thesis is like trotting on an unchartered path. In this journey, I unexpectedly learned from many academic and research challenges. I overcame these challenges through my supervisors' continuous forbearance and guidance. In this light, I would like to express my gratitude to Dr. Ulrikke Wethal (qualitative part) and Prof. Fred Johnsen (quantitative part) for their advice, support and proofreading. Though my supervisors were originally to supervise each aspect of this thesis, they supervised the entire work in unison to improve the text's cohesiveness. I doff my hat!

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Abstract

The environmental impact associated with the petroleum industry is pervasive and expansive. Anthropological climate change and pollution are some of the impacts associated with the petroleum industry. Petroleum regulators and businesses have implemented environmental sustainability practices to minimise these cataclysmic impacts. This thesis investigates the challenges facing implementing environmental sustainability practices in Ghana's downstream petroleum sector. Pragmatism philosophy and convergent parallel research design were chosen. A total sample size of 171 was estimated for the quantitative part of the study. Also, a total sample size of 10 was selected for the qualitative study. The study participants were selected by probability and non-probability sampling techniques: stratified random, simple random, and purposive samplings. The quantitative data was collected via a questionnaire, and the qualitative data through an interview guide. IBM SPSS program version 26 was used to analyse the quantitative data. The quantitative data was analysed using descriptive and inferential statistics, including Pearson correlation and simple linear regression analysis. The qualitative interview data was based on thematic analyses. An interdisciplinary framework guided the research process by drawing insights from ecological modernisation and corporate social responsibility theories for data analyses. The significant findings from both data sets are high cost of implementation; lack of technical personnel or expertise; lack of proper understanding of environmental sustainability; lack of leadership commitment and employee engagement; inadequate infrastructure; lack of proper coordination; and lack of uniformity and standards in some key areas. The study's findings revealed that qualitative data corroborated the quantitative data analysis. The linear regression analysis results revealed a positive effect of the challenges confronting environmental sustainability practices on implementing environmental sustainability practices in the downstream petroleum sector in Ghana ($\beta = .162, SE = .039, t = 4.16, p < .05$). It is worth stating that the findings of this study that there is a need to continue strengthening the government's environmental sustainability policies and ensuring that those policies are strictly followed by the downstream petroleum sector businesses while integrating the involvement of all stakeholders.

Keywords: Petroleum, downstream, sustainability, pragmatism, climate change, interdisciplinarity

Abbreviations

NPA: National Petroleum Authority

EPA: Environmental Protection Agency

TOR: Tema Oil Refinery

OMCs: Oil Marketing Companies

CSR: Corporate Social Responsibility

TBL: Triple Bottom Line

EMT: Ecological Modernization Theory

SUM: Center for Development and the Environment

CEO: Chief Executive Officer (s)

BOST: Bulk Oil Storage and Transport

ESP: Environmental Sustainability Practice (s)

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Chapter 1: Introduction

“Instead of eating exclusively from the sun, humanity now began to sip petroleum.”

Michael Pollan

1.1 Introduction

This chapter highlights the general overview of the study. It makes a case for why environmental sustainability practices (ESPs) are critical in petroleum exploration and processing. The chapter also provides the research objective and questions guiding the study.

The oil and gas industry provides huge revenues to countries endowed with crude oil. For instance, different forecasting projects the petroleum industry to expand in the next few years. For instance, the Organization of the Petroleum Exporting Countries (OPEC) forecast an increase in petroleum production and sales in 2021 of 32.11 million barrels per day and 34.15 million barrels per day in 2022 (Energy Information Administration (EIA), n.d.). Petroleum, sometimes called crude oil, is a non-renewable natural resource formed due to the decomposition of dead plants and animals (fossils) beneath the earth. This naturally occurring liquid is extracted through refining and other chemical processes to produce other products. These products include petrol, kerosene, bitumen, LPG (Liquified Petroleum Gas), and Paraffin wax. These other products could be oil or gas, hence the oil and gas industry. Petroleum operations provide three substantial economic benefits. The first is the revenue and income to the government via the sale of commodities and corporation taxes. Secondly, provision of direct and indirect employment opportunities to the population, and thirdly, serving as a source of energy to the economy for national consumption (Abudu & Sai, 2020).

Climate change, pollution and habitat destructions are a few existential problems usually attributed to petroleum activities. A debate has long prevailed as to whether petroleum exploitation and processing is sustainable or not. Some petroleum businesses contend that they are sustainable in that they have employed business practices to make their operations efficient (Ihlen, 2009). The apparent paradox here remains that insofar as there is petroleum exploration and processing, there would be emissions of harmful gases (methane, carbon dioxide etc.) in the

process of exploration and processing that are harmful to the environment. On the other hand, Ebenhack and Martinez (2008) have argued that petroleum resources can be used judiciously to benefit the present and the future through a sustainability framework. In recognition of the petroleum industry's pivotal role in development, the World Bank and the Norwegian government have developed a program dubbed "The Petroleum Governance Initiative (PGI)" to provide capacity buildings to oil and gas developing countries to manage their oil resources sustainably. Through the PGI program, oil-producing countries can compare the best environmental and management practices in reducing the negative impacts of petroleum activities (Mayorga, 2010). The heated and sometimes rancorous accusations and counter-accusations between pro-environmental groups and petroleum businesses are repleted in the media, conferences, and academia. However, the scope of this study is not to delve into and analyse the grounds of these opposing groups but to focus on environmental sustainability practices and their implementation challenges. Environmental sustainability practices are a set of actions and policies initiated and implemented by businesses and other stakeholders in the petroleum industry to reduce the negative environmental impacts of business or petroleum operations (Arora et al., 2018). Examples of these practices include waste and water management, promoting a healthy ecosystem, green mobility, mitigation of climate change, etc.

Ghana discovered petroleum in large quantities in 2007 (Ghana National Petroleum Corporation, n.d.). In 2010, the country authorised the commercial production of crude oil and natural gas. The oil and gas value chain includes the supply sources of exploration and production. The other processes include adding value to the crude oil through conversion and refining. Additionally, it includes a regulatory framework mechanism and marketing of the finished petroleum products to consumers (Abudu & Sai, 2020). In recent times, the all-essential natural resource exploration has contributed significantly to the total exportation of Ghana, which gives revenue for economic development. According to Ghana Statistical Service (2016), the contribution of the oil and gas sector to Ghana's Gross Domestic Product (GDP) has been phenomenal. The GDP of Ghana had recorded at 14% in 2011 after two years of exportation and processing of crude oil and natural gas, thus from a single-digit growth rate of 4.8% in 2009.

Ghana's petroleum industry is categorised into two main streams: upstream and downstream sectors. The upstream sector involves the exploration and production of oil. The downstream sector covers the transportation of oil and gas, refining and processing of crude oil and gas products, and the distribution and marketing of the products (NPA, 2020). Expectedly, the petroleum finds in the upstream sector have increased the operational activities of the downstream sector of Ghana. For instance, the former Managing Director of TOR (Tema Oil Refinery), Isaac Osei, indicates that the refinery processed 1 million barrels of local crude produced from the Tweneboah, Enyera, and Ntomme (TEN) fields in the Western Region of Ghana in 2016 (Energy News Africa., n.d., as cited in Anamua, n.d.). Aside from local production and processing of crude oil, the monumental national consumption of petroleum products has also increased downstream operational activities. The national consumption of petroleum products has soared from 1,546,612 Metric Tons in 1999 to 4,060,764 Metric Tons in 2019 (NPA ,2020).

Despite the benefits Ghana is expected to gain from petroleum industries, a significant critique levelled against the extractive industries, including the petroleum industry in Ghana, is the pervasive environmental destruction their activities have had on the environment (Holmås & Oteng-adjei, 2012). Some of the environmental problems include but not limited to be air pollution, deforestation, water contamination and ozone layer depletion. The finding of oil and gas in commercial quantities has further heightened these concerns. For instance, the oil and gas find has led to the destruction of biological and ecological resources within the areas such as Ahanta West, Shama, Nzema East/West, Jomoro, Elembelle and Sekondi-Takoradi (Amoasah, 2010; Sakyi et al., 2012).

Ghana is likely to suffer from further environmental impacts if proper attention is not paid to the management and sustainability of the environment as a result of petroleum exploration, processing and consumption. The *Cambridge Dictionary* defines an environment as "the air, water, and land in or on which people, animals, and plants live" (Environment, n.d.). It is worth indicating that both the interpretation sections of Acts establishing the National Petroleum Authority (NPA) and Environmental Protection Agency (EPA) do not define an environment. However, both Act 691 of NPA and Act 490 of EPA stipulate their functions concerning what constitutes an environment. For example, section two, subsection (h) of the EPA Act 490, states

that the agency is mandated to regulate standards and practices to protect air, water and land (EPA, n.d.). Therefore, in this thesis, an environment is used in reference to the adverse impacts of the petroleum industry, especially the downstream industry, on land, air, and water in Ghana.

When it comes to the environmental impact of the downstream petroleum sector relative to the upstream sector in Ghana, not much attention has been paid to it. However, the downstream petroleum sector in Ghana has its own environmental, health, and safety impacts (NPA,2020). For instance, it is estimated that the construction of the Tema Liquefied Natural Gas (LNG) Terminal at Tema harbour in Ghana negatively impacted air quality, noise pollution, loss of vegetation and negative impacts on flora and fauna (African Development Bank Group, 2019).

Although the actors (businesses) in the downstream petroleum sector have implemented environmentally sustainable practices in their operations to minimise these environmental impacts, they have been criticised for not meeting the expectations (Achaw & Boateng, 2012; Yalley et al., 2012). The gap between expectation and practice is vital for a research investigation on the challenges facing the implementation of environmental sustainability practices in Ghana's downstream petroleum sector. A deeper understanding of the challenges facing the implementation of the environmental sustainability practices in the downstream petroleum sector in Ghana will help policymakers and stakeholders make informed decisions and ensure proper environmental policy implementations.

Several studies have been conducted on the oil and gas industry in Ghana. However, these studies have extensively focused on the upstream petroleum industry (Abudu & Sai, 2020; Gbadago et al., n.d.; Kankam & Ackah, 2014; Stephens, 2021). Strikingly, few of these studies focused on the downstream petroleum sector (Achaw & Boateng, 2012; Amponsah & Opei, 2017). For example, Amponsah and Opei (2017) have examined the downstream petroleum industry and the key players. They discovered poor infrastructure, lack of capital, weak local currency, the inefficiency of Tema Oil Refinery (TOR) in production, poor maintenance culture, and government disruption in paying under-recoveries (losses due to governmental subsidies) as challenges facing the sector. Also, Achaw and Boateng (2012) have examined safety practices in Ghana's oil and gas industries. The study identified critical operations that cause a hazard to lives and the environment. None of these studies has examined the environmental sustainability practices of the downstream petroleum sector and the challenges faced by the actors in Ghana.

To fill these gaps in the literature, this study used a mixed-method study to gain a deeper understanding of the challenges facing the implementation of environmental sustainability practices in the downstream petroleum sector of Ghana. Also, interdisciplinarity guided and informed this research project. The environmental impacts confronting the downstream petroleum industry are incalculable. They range from social and physical sciences and other petroleum perspectives. Consequently, Corporate Social Responsibility as used in the business disciplines (Bowen, 1953) and Ecological Modernisation theory as used predominantly in environmental studies (Hajer, 1996; Mol & Sonnenfeld, 2014) were used to get in-depth insight from the findings.

1.2 Problem Statement

Petroleum commercial discovery in Ghana in 2007 reignited the debate about the extent to which the extractive industry has contributed to Ghana's development. While the news was greeted with tremendous enthusiasm by a section of the populace, others were sceptical. The scepticism is attributable primarily to the perceived failure of the previously exploited natural resources like gold, manganese, bauxite and diamond as a vehicle for development (Adams et al., 2019; Banchirigah, 2008; Hilson, 2004). Undoubtedly, petroleum exploration and processing may compound the environmental challenges hitherto experienced by the Ghanaian society from the extractive industries if the obstacles are not systematically identified and addressed.

Until now, Ghana's mining industry, particularly gold mining in the forest regions of Ghana, has seen a protracted period of conflict and disturbances with the neighbouring communities. Most of these conflicts are ascribed to the fact that the environment is ruined while the benefits from these mines do not contribute significantly to the local economy. This situation has resulted in "galamsey" (illegal mining) activities with their own concomitant environmental impacts. Given such problems, it becomes critical for the downstream oil and gas industry to implement environmental sustainability practices to avoid or minimise any future negative environment-induced mass protestations. Unfortunately, there have been concerns raised against the current implementation of the environmental sustainability practices of the downstream petroleum sector. While most of them are found not to be meeting the standard regulations and ensuring good practices, others are yet to fully implement these environmental sustainability practices (Achaw & Boateng, 2012; Yalley et al., 2012).

1.3 Purpose of the Study

This study aims to investigate the challenges facing the implementation of environmental sustainability practices in Ghana's downstream petroleum sector. Implementing environmentally sustainable practices in the petroleum sector would ultimately make the sector more resilient. Identifying the barriers to sustainability would inform industry actors to find long-lasting solutions needed to make the downstream sector efficient and robust. This study provides relevant downstream sustainability information for government, policymakers and stakeholders to decide how to implement environmental policies and practices.

1.4 Research Objective and Questions

The overarching objective of this study is to identify challenges the downstream petroleum businesses face in implementing environmental sustainability practices. To achieve this, a mixed-method approach is selected. This methodological approach ensures that the defects that may be inherent in one method would be minimized by the other method. In this way, the extent to which the qualitative and quantitative results enhance knowledge on environmental sustainability implementation challenges in Ghana's downstream sector is also analysed to expand knowledge. Therefore, the following quantitative, qualitative and mixed methods research questions are formulated for the study:

1.4.1 Quantitative Research Questions

The following research questions guided the quantitative part of the study:

RQ1: What are the current environmental sustainability practices of the downstream petroleum sector in Ghana?

RQ2: What are the goals of the environmental sustainability practices of the downstream petroleum sector in Ghana?

RQ3: To what extent have the goals of the environmental sustainability practices of the downstream petroleum sector in Ghana been achieved?

RQ4: What are the challenges confronting the environmental sustainability practices in the petroleum sector in Ghana?

RQ5: What is the impact of the challenges confronting the environmental sustainability practices on the environmental sustainability in the downstream petroleum sector of Ghana?

1.4.2 Qualitative Research Questions

The following research questions guided the qualitative part of the study:

RQ1: What do downstream businesses and regulators consider as the main challenges in implementing environmental sustainability practices?

RQ2. How do Ghanaian businesses in the downstream petroleum sector deal with environmental sustainability challenges in their operations?

1.4.3 Mixed-Method Research Questions

In the process of integrating or converging the quantitative and qualitative results of the study for discussion, the following mixed-method research questions underpinned the study:

RQ1: Do the themes from the qualitative results support the quantitative results in terms of the challenges in the implementation of the environmental sustainability practices in the downstream petroleum sector?

RQ2: To what extent do the qualitative results enhance the understanding of the quantitative results and vice versa?

1.5 Justification of the Study

The issue of downstream sustainability has grown in importance in recent years but is under-researched. An examination of sustainable practices in the petroleum industry globally indicates that some of the problems in the sector include stakeholder pressures, costs of adopting sustainability practices, lack of consensus at the management levels, lack of sustainability standards and lack of appropriate regulations (Dashore & Sohani, 2013; Gopalakrishnan et al., 2012; Muduli et al., 2013). This study seeks to identify the challenges in implementing environmentally sustainable practices specifically for Ghana. This would enable regulators and

businesses to review and improve their sustainable practices to reduce negative environmental impacts associated with downstream operations.

1.6 Organization of the study

This research project is divided into six chapters. Chapter 1 is the introduction section, where the main focus of the study is outlined. Chapter 2 follows with an overview of Ghana's context pertinent to the research objectives. Chapter 3 is the review of the relevant literature and theoretical frameworks underpinning the study. Chapter 4 is the methodology and methods section. The study's philosophy and design, sampling, population, validity and reliability, data collection procedures, positionality and ethical considerations are discussed here. Chapter 5 presents the research findings or results from the quantitative, qualitative and mixed-method research questions. Chapter 6 discusses the study's findings together with literature and theories. The chapter ends with a brief reflection on research philosophy and methods, conclusions, implications, and suggestions for future research.

1.7 Chapter Summary

Despite the concerns about environmental issues in Ghana's oil and gas sector, little is known about the challenges facing the environmental sustainability practices in Ghana's downstream petroleum sector. This study investigates the challenges facing the implementation of environmental sustainability practices in Ghana's downstream petroleum sector. A mixed-method research approach is used to gain a deeper understanding of the problem under consideration. Corporate social responsibility and ecological modernization theories are used as the theoretical foundation for the study. The background context of Ghana's downstream petroleum sector is presented in Chapter 2.

Chapter 2: Background Context

“Nobody gets beyond a petroleum economy. Not while there’s petroleum there.”

Dan Simmons

2.1 Introduction

This chapter contextualizes the purpose of the study on Ghana's Petroleum industry, specifically the downstream petroleum industry and its environmental impacts. This chapter further discusses the history of the petroleum industry in Ghana and ends with a summary of Ghana's key downstream actors.

2.2 Brief History of Petroleum Industry in Ghana

An attempt to explore Ghana's petroleum richness began in the precolonial era. The early explorers from 1896 started petroleum exploration and development in Tano Basin near the western region of Ghana. The drilling of wells for oil and gas was predominantly onshore by numerous oil companies. During this era, wells were explored "without geological understanding and the benefit of seismic data" (Petroleum Commission Ghana, n.d, para.4). Despite these initial challenges, early explorers were not overwhelmed. African and Eastern Trade Corporation (AETC), Societe Francaise de Petrole (SFP), and Gulf Oil Company were early exploration companies. These companies' motivation to discover commercial oil and gas reserves was ostensibly due to the traces of seepages and calcic waters as indicators of hydrocarbons (chemical components of petroleum and natural gas) availability in Ghana's sedimentary basins (Petroleum Commission Ghana, n.d.). Ghana's post-independence exploration saw a shift of focus from onshore to offshore wells. This momentum was occasioned by establishing Ghana National Petroleum Commission (GNPC) in 1983 by Act 64. The main objective of GNPC formation was to ensure an "adequate and reliable supply of petroleum products" (Ghana National Petroleum Corporation, n.d.). GNPC's core role was also augmented by the additional passage of Petroleum Law of Act 84. Act 84 provided the legal framework for oil exploitation between the states and non-state actors in the upstream industry of Ghana.

From the 2000s, exploration and development activities were intensified in the Ghana deep waters. International Oil Companies (IOCs) were on the front burner though they used some seismic data from the GNPC. The prospect of discovering more hydrocarbons has led to drilling more wells and development by key IOCs such as Aker Energy, Tullow Oil and Kosmos Energy. Spectacularly, the collaborative and partnership agreement between Tullow oil, Kosmos energy, EO Group and Anadarko companies led to the discovery of petroleum in commercial quantities in Cape Three Points of Ghana. According to Ghana Petroleum Commission, the discovery was “the most significant discovery crowning years of a concerted effort by all” (Petroleum Commission Ghana, n.d, para. 12). The eventual commercial discovery of oil in 2007 received national attention as it was considered one of the means of raising revenue for Ghana's development.

The downstream sector, which is the focus of this thesis, started with Tema Oil Refinery in 1963. The refinery was originally owned by Ente Nazionale Indrocarburi (ENI Group) of Italy, but Ghana acquired it in 1977 and changed the name to Tema Oil Refinery (TOR). The primary object of TOR was to refine crude oil for different petroleum finished products (Gasoline-petrol, Gas oil -diesel, Liquefied Petroleum Gas, Premix etc.) for national consumption. Crude oil to the refinery was mainly imported until 2010. Till 2010, T.O.R. was Ghana's only refiner of petroleum products. However, with the introduction of petroleum deregulation and liberalisation policy in the sector, TOR is currently competing with Bulk Oil Distributors (BDCs) in the downstream sector supply of finished petroleum products to Oil Marketing Companies (OMC) (Tema Oil Refinery, n.d.). Petroleum deregulation is an economic policy recommended by the Bretton Woods institutions to reduce states' control of the petroleum sector by encouraging private participation. This form of open-door policy has significantly increased the number of both local and international private suppliers. Likewise, the Oil Marketing Companies (OMCs) have local and international petroleum businesses. Ghana Oil Company (GOIL), Shell (GH), and Total (GH) are some of the operators in the sector. GOIL has the most significant market share of about 17% of OMCs supplies of petroleum products.

2.3 Environmental Impacts of Downstream Petroleum Sector in Ghana

Environmental impacts from the petroleum sector are not exclusive to the upstream sector (Connelly et al., 2015). Downstream operations relative to the upstream sector equally occasion environmental problems. In particular, through refinery, storage, transportation and marketing of petroleum products, the downstream sector has direct or indirect negative impacts on the environment. For example, crude oil, made up of different hydrocarbons at the refinery, is separated. Here, separations are done through fractional distillation (a process of separating crude oil) and other chemical processes which lead to emissions of gases. The gases contain toxic pollutants such as carbon monoxide and sulfur dioxide. Sulfur dioxide, for example, contributes to climate change and river-bodies acidification. Solarin et al. (2017) argue that sulfur dioxide from fossil fuel combustion contributes significantly to oceanic acidification in Ghana. This means that marine organisms in close proximity to Tema Oil Refinery are adversely affected. Chemu Lagoon, which is close to TOR, is heavily polluted by residual by-products from Tema Oil Refinery (Nkrumah et al., 2013). News of fire outbreaks at gas and petrol filling stations have been reported variously in the media (BBC, n.d.). Apart from the loss of lives and properties, the fire affects the immediate physical environment. Martin et al. (2016) argue that fires destroy the natural environment through plumes by contaminating air, water and the land with toxic substances.

The storage of petroleum products also negatively impacts Ghana's environment. Crude oil is stored at the refinery before processing. The refined petroleum products are also stored at BDCs and OMC facilities before getting to consumers. Apart from the floating storage unit and floating regasification unit (storage tankers on ships) terminals at Tema Harbour, almost all the downstream processing businesses store petroleum products underground. Petroleum spills and leakages from the storage tankers may contaminate the underground waters. For example, Bulk Oil Storage and Transport (BOST), a national company of Ghana, has several petroleum storage facilities across Ghana. BOST alone has a total storage capacity of 427,500 cubic meters. Invariably, BOST and other oil marketing companies (OMCs) and bulk oil distribution companies (BDCs) storage tankers' spills also contaminate underground water. However, Nkrumah et al.(2013) state that underground water contamination in Ghana due to the storage of

petroleum products is not significant. However, with the introduction of petroleum deregulation in the downstream sector, the number of businesses in petroleum storage is expected to increase. This causality can lead to a higher risk of underground water contamination due to petroleum products.

Closely related to the storage environmental risk is the risk associated with petroleum product transportation in Ghana. Petroleum products are commonly transported via trucks, pipelines, railways and barges. Pipeline transportation of hazardous materials is widely considered the safest among other means of petroleum transportation (Bolonkin, 2008). TOR, BOST and West African Gas Pipeline Company limited (WAPCo) are a few companies that transport crude oil or petroleum products through pipelines in Ghana. Bubbico et al.(2018) state that it is safer when inflammable materials such as LPG are transported through pipelines.

Nevertheless, some analysts would disagree with the above view. Ghoreishi et al. (2017) state that supporters in favour of pipelines seem to ignore the small animals endangered in the process of digging up the lands for pipelines. There is growing evidence that supports the view that digging up trenches for pipelines contaminates soil (Ali & Choi, 2021; Ghoreishi et al., 2017; Shukla et al., 2020). More so, pipeline leakages may also affect micro-organisms such as fungi and protozoa, which improve soil fertility in the ecosystem.

Some environmental risks are associated with road transportation of petroleum products. One such risk is the tipping of trucks on the road, where spills from these trucks introduce hazardous foreign petrochemical materials into the soil. This renders the land or soil infertile for crop cultivation. Significantly, the OMCs' downstream sector (specifically retail outlets) mirrors environmental concerns often raised against upstream sector operational activities. Thus, gas venting (getting rid of unwanted gases-methane and carbon dioxide) contributes significantly to climate change (Connelly et al., 2015).

Baffour et al. (2014) outline vapour recovery systems (venting) and air pollution, spillage and leakages as some of the environmental impacts some filling or gas stations have on Ghana's environment. The authors claim that air pollution resulting from venting activities would negatively impact the environment, especially in cities with plenty of gas or filling stations. Ghana has few petroleum refinery businesses that engage in gas flaring. However, over 5000

venting operations from most retail outlets may hinder Ghana's quest to reduce climate change mitigation.

Furthermore, the haphazard siting of filling stations in Ghana's cities and peri-urban areas affects Ghana's spatial planning and the environment (Today Newspaper, n.d.). Some of the issues affected communities raise include health and safety concerns the gas stations pose to their lives. Mass protestations that have met some gas stations near residents in communities are also attributable to environmental concerns. Residues of metals have been found in the soil nearby petroleum filling stations (Adeniyi & Afolabi, 2002). This is particularly troubling in Ghana in the era where the Government of Ghana and agricultural Civil Society Organizations (CSOs) encourage the citizenry to embark on backyard farming in the cities and the peri-urban areas of Ghana. In this sense, people would not be encouraged to venture into backyard farming to boost food security in Ghana when the soil in their vicinities have been contaminated with heavy metals such as copper, lead and mercury.

In recognition of some of the environmental issues above, Ghana has passed some legislation and created institutional frameworks to tackle the environmental issues in the downstream sector. National Petroleum Authority (NPA.) Acts of Parliament: Act 2005 and Act 691 are specifically created to regulate the downstream sector. Also, the Environmental Protection Agency (EPA) Act 490 of 1994 mandates the EPA to conduct an environmental impact assessment of all downstream business operations to safeguard the environment

2.4 Key Downstream Actors in Ghana

1. **Ministry of Energy:** It is the highest policy-making body for all energy-related issues in Ghana. It sets the general aims and objectives for the sector.
2. **National Petroleum Authority (NPA):** The principal governmental agency coordinates and regulates the downstream. The NPA stipulates regulations relating to licensing, operations, measurements of petroleum products etc.
3. **Tema Oil Refinery (TOR):** It is the first and the largest crude oil refinery company in Ghana. TOR processes both imported and locally produced crude oil for consumption and export.

4. **Bulk Oil Storage and Transportation Company Limited (BOST):** BOST's principal work is transporting and storing petroleum products. Tanks, pipelines and trucks of BOST are dotted in all the zones of Ghana for distribution purposes.
5. **Bulk Distribution Companies (BDCs):** This is an association of petroleum suppliers to bulk consumers of petroleum products. Petroleum retail outlets get their supplies from the BDCs.
6. **Oil Marketing Companies (OMCs):** This is also an association of petroleum products suppliers to smaller consumers throughout many retail outlets such as gas or filling stations and the general public.

2.5 Chapter Summary

This chapter aimed to trace the origin of petroleum exploration and processing in Ghana. It also discussed the context in which this master thesis lies. As it has been indicated at the beginning, petroleum exploration and processing began by foreign companies until the establishment of GNPC. The continuous search for commercial availability of petroleum was due to seepages of hydrocarbons in the sedimentary basins of Ghana. Finally, Ghana discovered commercial quantities of petroleum in 2007. The downstream sector activities in Ghana began by establishing TOR in 1963. The volume of activities in the downstream sector has increased exponentially due to the supply of crude oil from the upstream sector in Ghana and the deregulation of petroleum policy. The downstream activities such as storage, refinery, and transportation have direct and indirect negative impacts on the environment. Some of these negative impacts include oceanic acidification, emissions of harmful gases and loss of vegetation. The downstream sector also has environmental impacts similar to the upstream petroleum sector. Institutions such as NPA and EPA have been created to regulate and streamline the downstream sector. The next chapter presents relevant literature review and theoretical frameworks chosen to guide this study.

Chapter 3: Literature Review and Theoretical Frameworks

“Even in literature and art, no man who bothers about originality will ever be original: whereas if you simply try to tell the truth (without caring twopence how often it has been told before), you will, nine times out of ten, become original without ever having noticed it.”

C.S Lewis

3.1 Introduction

This chapter aims to evaluate relevant literature and the choice of theoretical frameworks. The first part emphasises four themes in literature: Nexus and Complexities between Sustainability and Sustainable Development in Petroleum industry; Environmental Sustainability Practices in Petroleum Sector; Environmental Sustainability Drivers and Goals and Environmental Sustainability Barriers. These themes conflate and contribute to understanding the research topic. The second part discusses the origins and characteristics of corporate social responsibility and ecological modernisation theories pertinent to the study. This is to create an analytical framework for the study.

3.2 Nexus and Complexities between Sustainability and Sustainable Development in Petroleum Industry

In recent years, the concepts of sustainability and sustainable development have been recurring themes in development and environmental policies. These concepts are used interchangeably in most literature. Many definitions abound to identify sustainability and sustainable development. However, the most widely used definition is the one proffered by the Brundtland Report in 1987 “Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development (1987), para.27). This definition was an apparent realization that technological and economic growth have negative impacts on the environment, and the earth's

capacity cannot be maintained. In the development process, measures must be put in place to reduce environmental impacts so that the next generations do not suffer any environmental externality.

Some scholars have found Brundtland's definition problematic because of the inherent contradictions between sustainability and development (Costanza & Patten, 1995; Jabareen, 2008; Pearce & Atkinson, 1998). Costanza and Patten (1995) argue that defining sustainability is an exercise in futility because what constitutes sustainability predicts what will last and not what is achieved. They posit three main questions that potentially render the sustainability definition a prediction: First, what system persists? Is it an economic, cultural or ecological characteristic that is preferred to persist? Two, how long does a system persist? Nothing exists endlessly, and three, when do we assess the persistence of a system? We can only observe what has persisted after the fact. Hence, many of the attempted definitions of sustainability of a system are expectations that are uncertain and subject to disputes. Redclift (2005) also point out the trade-offs between "development" and "sustainability" practices making the two concepts oxymoronic. Nevertheless, not all scholars would agree with these claims. According to Du Pisani (2006,p.94), sustainable development is "the heir to the concepts of progress, sustainability, growth and development" and a compromise between the two extremes: growth and conservation. In a nutshell, sustainable development is variously seen in literature as a vehicle for achieving sustainability.

Global summits and conferences on sustainability and sustainable developments have three key themes that encapsulate the critical components of sustainability, i.e., 3Es of Economic, Environmental and Equity or 3Ps of profits, planet and people of sustainability. These components are called the Triple Bottom Line (Elkington, 1997). These 3Ps mean that any sustainable policy or practice must include these three elements as its base. The elements of sustainability are not separated from each other. Balancing and integrating these elements would ultimately achieve the goal of sustainability and sustainable development. The three elements of sustainability are: First, the social element of sustainability is centred on people and their wellbeing. Second, economic sustainability applies to commercial realms, and the third is environmental sustainability.

Perhaps, environmental sustainability is the most popular in literature among the three pillars of sustainability. Potential impacts from the petroleum sector affect sustainability's social, economic, and environmental components. Its impacts on the environment are more pronounced and telling. This is also mainly related to the focus of this study. Environmental problems such as climate change, pollution, land degradation and many others facing societies are traceable to the environment. In the 20th century, Du Pisani (2006,p.89) points out that "environmental concern became more acute and radical because of the fear that economic growth might endanger the survival of the human race and the planet". This revelation and panic have fuelled environmentalism in both public and private spheres.

Morelli (2011,p.6) defines environmental sustainability as "a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs". The petroleum sector is classified as an extractive industry that exploits natural resources like crude oil for economic and social development. The environmental impacts of oil and gas industries are mitigated through sustainability practices. These practices are the institutional structures guiding petroleum businesses towards sustainability (Beckmann et al., 2014). In this context, practices by the downstream sector in Ghana geared towards reducing the adverse impacts on the environment are deemed environmental sustainability practices.

3.3 Environmental Sustainability Practices in the Petroleum Sector

A large and growing body of literature has investigated actions and practices in the petroleum industry that seek to protect the environment (Amponsah & Opei, 2017; Dryzek, 1997; Ihlen, 2009; Mayorga, 2010; Pies, 2012; Stead & Stead, 2000). Petroleum businesses that usually publicise their sustainable practices have also been criticised on the grounds of adopting greenwashing strategies to improve business reputations (Macalister, 2009; Sheehan, 2018). Despite the growing greenwashing claims pointed at petroleum businesses, many continue to devise strategies to reduce their negative environmental impacts. In the field of sustainability, environmental sustainability practices embody a multitude of strategies, actions and policies that are implemented to reduce emissions, pollution, water contamination etc. There is no agreed definition of what constitutes good or best practices. However, any action, policy, or strategy classified as a practice must reduce adverse environmental impacts on business operations (Arora

et al., 2018). Sustainable environmental practices restore and improve the environment (Dyllick & Hockerts, 2017).

Mayorga (2010,p.7) defines the good environmental practice as "the application of the most appropriate combination of management measures for minimizing the impacts of oil and gas development". Some petroleum analysts add adjectives such as "good" or "best" to describe the concept of environmental practice, as found in Mayorga (2010) and other related literature. This makes the definition of environmental practice nebulous. This is because petroleum businesses are distinct from each other. "Good "environmental practices for one business may not be "good" for another business. Notwithstanding the differences that may arise from what constitutes "good "or "best" practice, all the practices seek to reduce negative environmental impacts. Notable examples of petroleum business practices identified in the literature include recycling used oil, flaring reductions (burning of associated gases from crude oil), water pollution mitigation, cleaner fuels, methane reductions etc.

Studies such as the one conducted by Ihlen (2009) have shown that some Norwegian petroleum businesses consider cutting down emissions, long-term petroleum management, and cleaner oil production as sustainable practices that make the sector efficient. The respondents in Ihlen's study primarily based their responses on comparison to other petroleum businesses elsewhere. However, it has contributed to an understanding of environmentally sustainable practices in the petroleum industry. These results reflect those of James (1994), who also found that businesses measure their environmental performance with other businesses to determine sustainability outcomes.

By illustrating environmental sustainability practices, British Petroleum (2020) has shown that its practices include reducing emissions, waste and water management, air quality and biodiversity protection. In all these examples identified here, environmental sustainability practice is recognised as reducing the negative impacts on the environment due to petroleum operations. However, one question that needs to be asked is whether the practices identified are peculiar to the upstream or downstream sector or both in Ghana. The distinction is necessary because some petroleum businesses operate exclusively in one sector while others operate in both sectors as integrated (SHELL and TOR are examples). This clarification was made during fieldwork in this study to guide participants from integrated petroleum businesses to answer the research questions

concerning downstream practices and challenges and not lump up their responses from two sectors.

3.4 Sustainability Drivers and Goals

Sustainability drivers are the factors that induce the efficacious realization of sustainability goals (Daneshpour & Takala, 2016). Different organizations have different drivers that underscore their sustainability initiatives and goals. In the petroleum industry, the preeminent goal of the sustainability drive is "to restore public confidence" in the face of environmental problems associated with petroleum activities (Mojarad et al., 2018,p.636). Mojarad et al. (2018) have indicated that profitability, climate change, population growth, and increasing competition among businesses are some of the factors that instigate petroleum businesses towards sustainability.

Stead and Stead (1995) have categorised sustainability drivers into economic, environmental, and legal. In the economic realm, sustainable operations reduce the cost of operations and increase profitability. Environmental issues such as climatic change and global warming have influenced governments globally to pass legislation to reduce organisations' environmental impacts. The imposition of penalties and fines on organisations has heightened the importance of conforming with legislation. This means that many organizations that adopt sustainability do so because of the laws of their countries (Giunipero et al., 2012; Gopalakrishnan et al., 2012). In some cases, legislation alone may not ensure the comprehensive accomplishment of sustainability implementation (Adams, 1990). This is why a continuous monitoring of sustainability initiatives is necessary to ensure that businesses obey sustainability laws.

Management commitment is indispensable in successfully implementing sustainability practices. (Giunipero et al., 2012). When managers are active in environmental sustainability policy formulations, they will have the wherewithal to implement sustainability practices. The end result for successful sustainability implementations is considered a win-win for all stakeholders in the business environment (Elkington, 1994). Sustainability implementations influenced by business managers will be more effective and successful than when sustainability initiatives are separated from them. The call of action for managers toward sustainability is broadly divided into process and market-driven strategies that managers formulate (Giunipero et al., 2012; Gopalakrishnan et al., 2012; Zhu & Geng, 2013). The process-driven is a business strategy businesses adopt towards making it efficient in all their operations, including environmental sustainability practices. In

contrast, market-driven is a reactionary strategy aimed at meeting the needs of customers, say, adapting climate change mitigation practices.

In many countries, managers, workers, pressure groups and customers play a significant role in influencing organizations to implement sustainability practices (Gopalakrishnan et al., 2012; Pearce & Atkinson, 1998). Shareholders also play a role in increasing corporate responsiveness with regard to sustainability.

3.5 Sustainability Barriers

There are factors inducing businesses to adopt sustainability practices, and at the same time, there are other factors that impede businesses' efforts to implement sustainability practices. Financial constraint is a critical inhibitor preventing businesses from pursuing sustainability practices (Abubakar, 2014; Ekins & Zenghelis, 2021; Gracia & Siregar, 2021; Presley et al., 2007). Sustainability implementation has often been viewed to be priceless to undertake in many businesses. While Presley et al. (2007) attribute high costs to activities in sustainability implementations, Gracia and Siregar (2021) argue that higher costs incurred by firms eventually decrease the overall operational costs. The basis of the latter's argument is that businesses can reduce costs due to efficiency arising from sustainability in the long run.

Sorana (2020) calls our attention to how leadership roles in the petroleum industry can improve sustainability practices and business performances. Decision-makers such as shareholders, board of directors and CEOs influence business operations and practices. Business sustainability strategies can be initiated and facilitated entirely by the CEO. If decision-makers are cognisant of environmental sustainability issues and sustainability knowledge, sustainability activities can permeate the entire organogram. However, if the decision-makers are less interested in sustainability issues, sustainability implementations would be less effective. Nwachukwu and Vu (2020) drew on an extensive survey range to assess leadership roles and sustainability practices in emerging markets. They suggested that business leaders can implement sustainability initiatives if they are committed. This is particularly relevant to Ghana's petroleum sector, where many international oil companies seek to enter. In this respect, the role of effective business leadership in championing environmentally sustainable practices in the sector cannot be overemphasized. In a recent study, however, Walls et al. (2020) have questioned the cognitive processes and motivational underpinnings of business leaders toward sustainability. They contend

that business organizations require sustainability scholarship and not the individual values of business leaders.

In the absence of organizational scholarship and research to perpetuate environmental sustainability practices, sustainability would be short-lived. In a study investigating sustainability practices among businesses in Nigeria, Nkamnebe and Idoko (2013) emphasized the importance of having uniform standards and appropriate regulations for sustainability. In their seminal article, Knol-Kauffman et al. (2021) caution against regulatory ineptitude in the petroleum industry. Any mismatch between the petroleum business practices and the law leads to environmental pollution. Put differently; downstream petroleum businesses must follow sustainability legislation set out by regulators in different countries.

To date, several studies have investigated the impacts of business strategies on sustainability (Ruka & Rashidirad, 2019; Sueyoshi & Wang, 2014). The study by Ruka & Rashidirad (2019) offers probably the most comprehensive empirical analysis of the big petroleum companies such as British Petroleum (BP), Exxon Mobil, Gazprom, Sinopec and Saudi Aramco business strategies and the environment. In analysing the five petroleum businesses' strategies based on their environmental strategies report, the researchers found out that the petroleum businesses have been compelled to initiate business practices to conserve the environment. A broadly similar point has also recently been made by Tarei et al. (2021), who note that businesses without environmental strategies rarely achieve business sustainability. That said, studies that have examined petroleum industries and environmental sustainability practices rely on businesses' annual reports as secondary information. Thus, the apparent difficulty in their research is the acceptance of the reliability of self-report information.

Data from several studies have also identified a lack of skilled human resources in most businesses to track environmental problems in their operations (Bhinekawati & Bradly, 2020; Dube & Gawande, 2014). Sustainability practices require skilled human resources who are knowledgeable on sustainability issues. That said, Bolis et al.(2012) argue that the role of employees towards sustainability is least studied in the literature. The success or the failure of sustainability implementation in organizations depends on how skilled or knowledgeable its employees are in sustainability. While an employee's role is indispensable to sustainability, the

existing literature has not given many details about the specific roles that individual employees or units can play towards sustainability, especially in the petroleum industry.

It is thought that communications and coordination across the supply chain are crucial for sustainability success. Current studies show that communication is an exceptionally supportive factor for sustainable management practices (Shen et al., 2012; Walker & Jones, 2012). Shared information in the petroleum industry among its many actors presents cohesive knowledge of tackling the myriad challenges confronting the sector. Processing and organizing multiple information from different actors improve sustainability performance (Terrado et al., 2007). Dashore and Sohani (2013) state that effective communication guarantees coordination among downstream players for sustainability implementation. This means that the many regulators and different petroleum players must have coordinated strategies to make the sector effective.

Physical or technical infrastructures for petroleum exploration and exploitation and their impacts on the environment are prominent in sustainability literature. Petroleum infrastructures include physical facilities, machinery, installations and equipment used in petroleum exploitations. Examples include a refinery, ships (oil transportation), pipelines, valves etc. According to Bernath-Plaisted et al. (2017), some oil infrastructures have caused habitat changes, water contamination and noise pollution. There is an agreement among sustainability researchers that not having appropriate infrastructures for sustainability initiatives and practices renders sustainability a façade (Dashore & Sohani, 2013; Gopalakrishnan et al., 2012; Wu & Wu, 2012). Hasheminasab et al. (2020) have studied and revealed that petroleum infrastructures have an impact on all the pillars of sustainability. They further reveal that technical infrastructure ensures environmental resiliency at the refinery (downstream). However, a key drawback in their study was that challenges in acquiring these infrastructures such as cost component were not acknowledged.

3.6 Theoretical Frameworks

This section of the thesis presents theoretical frameworks underpinning the study, particularly as they apply to environmental sustainability discourse in the petroleum industry.

3.6.1 Ecological Modernization Theory (EMT)

Ecological modernization theory began in the 1980s as a theoretical framework for shaping environmental issues for continuous economic growth and development. The advent of EMT recognises that earlier environmental policies and practices have failed (Andersen & Massa, 2000). Hajer (1996) defines ecological modernization as a discourse that recognizes environmental problems with the perspective that the existing economic, social and political institutions can remedy the environmental problems. Based upon remedying environmental problems as suggested by Hajer, Dryzek (1997) offers a corollary definition of EMT as restructuring a capitalist economy to be more environmentally friendly.

EMT is increasingly used to explore and analyse actors in society towards effective and efficient implementation of environmental policies and practices (David et al., 2009; Hajer, 2012; Howes et al., 2010). Gibbs (2006) has chronicled the historical development of EMT into three phases. Thus, the first phase of EMT was centred on technology (scientific approach) as the main instrument for solving environmental issues. The second phase is the twin function of the state, and the market and the third phase deals with consumption and its impacts on the environment.

Early theorists of EMT are of European background, notably Joseph Huber, Gert Spaargaren, David Sonnenfeld, Arthur Mol and Maarten Hajer hence the accusations that EMT is Eurocentric and rarely applicable in different contexts. However, this Eurocentric claim is not tenable in the light of the applications of the EMT framework in different geographical contexts globally (Han et al., 2021; Howes et al., 2010; Lam et al., 2005; Mol & Sonnenfeld, 2014). To buttress the universal application of EMT, the passage of various petroleum institutional frameworks in Ghana, such as NPA and EPA, are geared towards overcoming the potential ecological crisis associated with petroleum businesses.

In substance, EMT is self-reformatory of the hitherto environmental consequences of the capitalist economy. Capitalism contrasts with socialism, where the state is the main economic actor. EMT operates in a capitalist economy (Gouldson & Murphy, 1997; Mol, 2002). Christoff

(1996) emphasizes the partnership framework among public and private actors, including market-based incentives in a capitalist economy. Some of these incentives include taxes, subsidies and emissions trading schemes to protect the environment. Critics of EMT, such as Foster (2002), have questioned how EMT can change capitalists' demands in a market economy to favour best environmental practices. This is because the ultimate aim of capitalists is to capture and exploit environmental resources. One fundamental difficulty with this line of reasoning espoused by EMT critics, such as Foster (2002), disregard regulatory mechanisms that states can institute to influence the market in the interest of the environment. For example, many governments have passed legislation to conserve biodiversity, ensuring clean water and air. Therefore, regulatory mechanisms serve as a countervailing force over excesses in the capitalist exploitation of environmental resources.

The axiom, a problem well-stated, is half-solved and appears to be relevant in this study with EMT. In other words, when challenges militating against environmental sustainability implementation are identified, effective solutions to the challenges are provided. The object of EMT is to solve environmental problems using technology, market mechanisms and state regulations (Hajer, 2012; Mol & Sonnenfeld, 2014; Murphy, 2000). Most studies about EMTs have primarily focused on policy recommendations in environmental management (Bailey et al., 2011; Jänicke, 2008; Spaargaren & Mol, 1992). For policy outcomes associated with EMT to be practicable and not regarded as business-as-usual and greenwashing, the implicit assumption of EMT is to identify specific problems that need to be addressed.

Without identifying specific environmental problems EMT seeks to address, the whole concept becomes rhetoric (Revell, 2005). Dryzek (1997, p.146) calls this rhetoric a "discourse of reassurance". This means EMT should not be about normative policy prescriptions for all environmental issues. That is to say, specific environmental issues must be identified and understood before appropriate solutions can be proffered. The potential and the far-reaching policies EMT can offer in a capitalist fossil-based economy cannot be overestimated (Bailey et al., 2011; Namuyondo, 2014; Rufus, 2014). However, Scanlan (2017) has vigorously criticized EMT in the petroleum industry as an attempt to alter and obscure the negative consequences of petroleum operations. This thesis will demonstrate that EMT is not only a policy framing concept

but also an understanding of the sources of environmental problems, particularly when applied to Ghana's downstream industry.

Different actors in society formulate different environmental policies and practices which may conflict with each other. Despite these differences, EMT can still proffer explanations and analyses (Christoff, 1996). For example, the downstream businesses may design environmentally sustainable technology like green refinery technologies (technology with more minor environmental impacts) rather than hydrodesulfurization (a chemical process of removing sulphur from petroleum products). This can attract consumers who care about protecting the environment (Choi & Ng, 2011). Such patronage from consumers ultimately augments business marketing profile and profitability. Other businesses may be influenced to incorporate some of these new technologies and innovations in their operations. However, some environmentalists would undoubtedly take issue with the EMT argument that different actors involved in environmental management are the panacea to environmental challenges. It does not provide the magical wand due to the private interests of businesses and sclerotic state governments (Adams, 1990.; Hajer, 1996). While it is true that differential interests among actors may defeat the object of EMT, it does not necessarily follow that all the actors in an economy would tread a similar environmentally destructive path. Multiple actors from the public, private and civil societies coordinate in many ways to standardize environmental practices that promote sustainability (Lambin & Thorlakson, 2018).

EMT is widely recognised as a framework for resolving sustainability conundrums (Baah & Kharlamova, 2016; Lam et al., 2005; Pies, 2012). Yet, there is no end in sight to the constituents or variables defining EMT. The most comprehensive account of what constitutes EMT is in the work of Mol & Sonnenfeld (2014) titled *"Ecological modernisation around the world: Perspectives and critical debates"*. The authors outline five principles central to EMT discourse and practices. First, science and technology. This is the preventive remedy to environmental problems. It also includes infrastructures or clean energy technologies different from hitherto pollutant-causing technologies. The second is economic agents. It refers to business leaders, regulators, consumers and producers in environmental reforms. The third is the role of the nation-state. Less bureaucratic processes in the management of environmental problems. Fourth, evolving ideologies. That is to say; there is no fixed practice or strategy that can fully address all

environmental problems. Through continuing-scientific research, new practices emerge which may render previous practices antiquated. Usually, either short-term or medium-term and long-term strategies are designed by stakeholders to address sustainability problems. The fifth and final principle is modifications in social movements. That is the transformation of social practices that promote sustainability such as engaging downstream employees in pro-environmental activities.

3.6.2 Corporate Social Responsibility (CSR) Theory

A large volume of published studies highlights the significant role of CSR in today's society and business environment (Bhinekawati & Bradly, 2020; Elkington, 1997; Kirat, 2015; Agudelo et al., 2019; Ruka & Rashidirad, 2019; Sherman, 2012). Simply put, CSR is a management tool employed by businesses to address social, economic and environmental issues associated with their operations. However, CSR is not a recent phenomenon in business practices and ethos. According to Chaffee (2017), CSR originated in ancient Roman Laws and is reflected in prisons, asylum and homes for the poor. In the middle ages, the role of organisations was centred on social functions and welfare (Chaffee, 2017; Harrison, 1966). In the 1900s, booming economic activities metamorphosed CSR roles into improving the general well-being of workers (Harrison, 1966). CSR's evolution from the earliest times appears to be rooted in social constructs to improve livelihood. A recent systematic literature review by Agudelo et al. (2019) about CSR histography found out that as the social needs of society change, so does the theory of CSR.

The period of the 1950s and 1960s is generally considered in the literature as the beginning of the modern construct of CSR in business nomenclature. One of the most influential modern accounts of CSR comes from Bowen (1953), who believed that corporations' activities have an impact on society. This means the decisions of business executives must reflect the kind of impacts associated with their business operations. Bowen is credited with the coinage of the term CSR. In a landmark book, "*Social responsibilities of the businessman*", Bowen (1953) defines CSR as the responsibilities of businessmen required to achieve the aims and values of society. Building on the work of Bowen (1953), Carrol (1979) states that corporate social responsibility theory involves the economic, legal, ethical, and discretionary objectives that society has for corporations at any time. He argues that these social responsibilities carried out by corporations

are for the sake of both the society and the corporation itself. So, organizations or businesses are obligated to consider society's interests when taking their decisions.

Schneider (2020) argues that continuous capitalist expansion propels businesses to legitimise their activities, leading to an inevitable societal problem. Environmental impacts associated with business operations are widely considered a critical societal challenge (Dyllick & Hockerts, 2017; Massey, 2004). Petroleum businesses that have adopted a CSR framework for practices to deal with social, economic and environmental issues are puzzled due to non-clarity about environmental practices as an ethical responsibility (Kirat, 2015; Mannan et al., 2009; Miasa & Apitsa, 2021; Stephens, 2017). Due to this fluidity and high capital involvement in associated petroleum businesses, some investors may not take environmental impacts that affect society seriously.

CSR theories by Bowen (1953) and Carrol (1979) did not include the element of environmental sustainability. The Triple Bottom Line (TBL) by John Elkington in his book "*Cannibals with Forks*" addresses this limit (Visser & Elkington, 2013). According to Elkington (1997), TBL is anchored around sustaining "People, Planet, Profit" in all business endeavours. According to Elkington (1997,p.5), TBL is a principle for all businesses to achieve "sustainable development values". Environmental values such as recycling, carbon capture and storage and pollution prevention are standard practices among petroleum businesses promoting sustainable development. Much of the available literature and practices on sustainability discourse address triangular issues of the 3Ps suggested by Elkington. Most indexes measuring Petroleum businesses' CSR use the TBL framework (Ahmad et al., 2017; Duttagupta et al., 2021; Ercan et al., 2013; Ibe et al., 2015). However, several writers have forcefully challenged the TBL framework in recent years. For instance, Srivastava et al. (2021) argue that the TBL framework is nothing new to what is already known in CSR literature before Elkington. Therefore, dichotomizing between CSR and TBL is unnecessary.

The other main criticisms of TBL in sustainability draw upon Sridhar and Jones (2013) research. The authors identify ambiguities in the measurement criteria used by different corporations as troubling. Thus, the objectivity and reliability of values are not uniform. The second critique of Sridhar and Jones is approaching TBL as a systemic. Dividing TBL into parts fails to approach sustainability as a holistic phenomenon. Finally, they posit a lack of integration in the TBL

approach. Each element complements the other is the philosophy behind TBL but, in actuality, are separated. In agreeing with the latter's criticism, Gibson (2010) states that expertise in social, economic, and environmental fields of study is needed to collect and analyse TBL data. However, it is apparent that such arguments tend to overlook the fact that the interdisciplinarity approach does not need three separate and independent fields of knowledge before analysing TBL.

Broadly, CSR is categorized into two main perspectives-business (internal or competitive) and institutional (external), depending on the extent of application (Chen et al., 2020; Agudelo et al., 2019; Mijatovic & Stokic, 2010; O'Connor & Gronewold, 2013). The former relates to internal business practices seeking to have a competitive edge over its competitors, whereas the latter relates to isomorphic issues such as economic, social or environmental factors that businesses in a similar industry seek to adhere to or respond to external pressures. Simply put, CSR's internal and external categorizations are the recognition that societal objectives are manifold (Aguilera et al., 2007; Chen et al., 2020; Mahmud et al., 2020). This study adopted the institutional perspectives of CSR, which is rooted in DiMaggio and Powell (1983) conceptualization of organizations or businesses. Among the institutional perspectives of CSR, perhaps the most well-known work is that of DiMaggio and Powell (1983). Isomorphism, according to DiMaggio and Powell (1983, p.149) is a "a constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions". In other words, isomorphism explains why business organisations follow the same strategies or adopt the same practices. They identified three characteristics of organisational isomorphisms.

First is coercive isomorphism. These are external pressures exerted directly on organisations and must be followed. Governmental regulations and consumers are some of the examples of external or isomorphic issues that influence organisations towards efficiency. The second is mimetic isomorphism. This is where organisations aspire to attain the status of an established organisation or an organisation copies a successful competitor's strategy. Finally, normative isomorphism refers to organisational pressures that emanate from the workforce or professionals where guidelines are followed according to specific organisational goals.

This study adopts these three elements of isomorphism to guide the scope of the study.

Regulators formulate standards for the businesses to comply within the downstream petroleum

sector. The major drawback of the isomorphism approach in CSR is its inability to explain how different organizations respond to external pressures (Preuss et al., 2009; See, 2009).

Nevertheless, combining quantitative and qualitative approaches in this study will address how different downstream businesses have responded to environmental sustainability challenges and practices.

According to DiMaggio and Powell (1983), organizations or businesses become responsible is dependent on how these pressures interconnect in business operations effectively. More substantial work in examining institutional pressures on petroleum businesses and environmental discourse is found in the work of de Abreu et al. (2016). Their study revealed that petroleum businesses are influenced by normative pressures about environmental issues contrasting the popular view that environmental issues are either coercive or mimetic. Nonetheless, Greening and Gray (1994) insist on separating external and internal perspectives of CSR when dealing with the environmental impacts of businesses. Their call for separation stems from the fact that internal business practices conflict with external objectives as stipulated by society. This view is supported by El-Bassiouny and Letmathe (2018), who write that organizations would be hesitant to implement practices that conflict with the goals of the organization. A highly regulatory and sometimes regimented industry like the petroleum industry requires an institutional CSR perspective to have a broader scope especially when dealing with multiple environmental impacts associated with many downstream business operations.

3.7 Chapter Summary

The first part of this chapter aimed to outline how the concepts of sustainability and sustainable development are related to the petroleum industry. The importance of sustainability to the petroleum industry has grown considerably since the Bruntland report in 1987. Despite the inherent challenges when defining sustainability and sustainable development, most scholars agree that the latter is the vehicle for achieving the former. Sustainable practices by the petroleum industry mitigate the harmful impacts associated with their operations. Three key elements serve as a bedrock in sustainability discourse. These are the 3Ps of profit, planet and people. Elkington (1997) calls these elements Triple Bottom Line. Balancing all these elements equally and ultimately will achieve the goal of sustainability. Different reasons motivate organisations to undertake sustainable practices.

Economic, legal and good reputations are factors accounting for the adoption of sustainability practices. Alternatively, other factors impede the adoption and implantation of sustainability practices. These include a lack of finance, infrastructure, human skills and requisite regulation framework. The second part looked at the etymology and characteristics of the theories of EMT and CSR that are pertinent to this study. The core of the EMT framework is to shape capitalists' exploitation of economic activities and improve environmental quality. Scientific ideas, state powers, economic agents and discursive practices are the guiding principles to achieving environmental quality. Regarding CSR, its main thrust is that businesses have an indelible footprint of their activities in society. In this sense, the goals and values of society automatically become part of organisations' goals. Internal and external or institutional perspectives guide CSR analysis. This study adopted the institutional perspective to guide the study in the writings of Di Maggio and Powell (1983). The authors outlined that coercive, mimetic and normative isomorphisms guide organisations or businesses to be efficient. The next chapter describes the methodological design used in this study.

Chapter 4: Methodological Design

“Education is all a matter of building bridges.”

Ralph Ellison

4.1 Introduction

Chapter four contains the research philosophy, method, design, tools, and analysis used for this study. The methods were selected to understand the challenges facing implementing environmental sustainability practices in Ghana's downstream petroleum sector. In this chapter, I explain the research philosophy, research design, the population of the study, the sample size and sample size determination and the sampling procedure used for the study. I also explain the data collection instruments, the data collection procedures, and the plan for data analysis. Finally, in this chapter, I explain the reliability and validity of the data collected and the strategies for enhancing the study's trustworthiness, positionality and ethical considerations.

4.2 Research Philosophy

The philosophical underpinning of this study is pragmatism. Pragmatism philosophy in research recognises that there are many ways of appreciating and interpreting the social world.

Pragmatism discards the philosophical dichotomy of objectivity and subjectivity, representing positivism and interpretivism (Creswell et al., 2008; Onwuegbuzie & Johnson, 2006; Terrell, 2012). Positivism uses scientific methods and argues that reality (truth) is independent of researchers, whereas interpretivism is about the social construction of reality. Neither positivist nor interpretivist position is complete due to multiple realities (Thornhill et al., 2009). Thus, perspectives or answers from different participants may differ from each other in an inquiry.

Two assumptions bordering on objectivity and subjectivity were made to understand the research problem. The objectivist assumption in this thesis is that the downstream businesses have environmental sustainability practices, which can be analysed externally. Moreover, the subjectivist assumption is that the downstream businesses are socially constructed (business

practices are implemented by human actors) and that the sustainable environmental implementation challenges can be best understood from the actors involved.

Quantitative and qualitative methods or paradigms of research are associated with positivist and interpretivist philosophies, respectively. Because pragmatism is neither positivism nor interpretivism, it uses quantitative and qualitative paradigms in an inquiry (Creswell & Clark, 2017; Morgan, 2014). The scope of pragmatism crosses quantitative and qualitative methods and focuses on choosing the method or methods that work best in addressing a research problem (Tashakkori & Teddlie, 1998). Based on the research questions and problem under investigation, neither quantitative nor qualitative methods can address it holistically. Therefore, a mixed-method paradigm was chosen.

4.3 Research Design

This study adopted the convergent parallel mixed-method design among many research methods. Ivankova et al. (2006) have identified over forty mixed-method designs. The most popular one is the convergent parallel design. A convergent-parallel research design requires that the researcher concurrently undertakes the quantitative and qualitative approaches in the same research study, weighs the methods equally, analyses the two parts separately, and analyse both results together as one phase study (Creswell & Plano Clark, 2011). Convergent Parallel design is also called concurrent triangulation design (Creswell et al., 2008). This is because the results from quantitative and qualitative parts are compared and contrasted complementarily. It is now well established from various studies that using a mixed-method approach overcomes weaknesses in using one method with the strength of another (Creswell et al., 2008; Johnson & Onwuegbuzie, 2007; McKim, 2017).

That said, mixed-methods approaches such as convergent-parallel have been assailed primarily on the grounds of ontological (social world), epistemological (knowledge) and practicality challenges. The ontological criticism is that it is incompatible to mix objectivity (quantitative) and subjectivity (qualitative) approaches. Smith and Heshusius (1986,p.4) justify this critique as a "hasty and unjustified "leap to compatibility". Their reason is that the two paradigms have different empirical procedures and purposes. For example, while the goal of quantitative inquiry is to confirm a theory or the otherwise with an explanation, qualitative is to describe or discover a theory. Epistemologically, researchers are not separated from the social world they seek to

analyse (Data & Silverman, 2011). This means that objective observation of any phenomenon is intrinsically problematic. On the practical side, Molina-Azorín and López-Gamero (2016) have identified two main challenges with the mixed-method approach. First, it is time-consuming and requires effort and money. Second, the researcher needs to acquire and apply quantitative and qualitative inquiry skills, which could be cumbersome.

Notwithstanding the above criticisms and challenges, mixed-method researchers have responded to some of these criticisms by highlighting the more significant advantages of pragmatism. To these researchers, the pragmatic paradigm offers the most unifying and intermediary position in research methods and philosophies (Johnson & Onwuegbuzie, 2007; Morgan, 2014; Tashakkori & Teddlie, 1998). There is no need for researchers to argue for or against positivism or interpretivism. Pragmatism merges these two philosophies. Furthermore, Dawadi et al. (2021) argue that mixed methods provide expansive knowledge with depth and breadth. For instance, through qualitative interviews, researchers acquire an in-depth answer about a phenomenon being studied, while quantitative sampling of a population in a study provides breadth through representative data collection. Combining quantitative and qualitative approaches in a study broadens knowledge in both depth and breadth.

The use of mixed-method in undertaking interdisciplinary development and environment-related research is encouraged (Clark & Dickson, 2003; Kinnebrew et al., 2021; McNeill et al., 2001; Nunfam, 2021; Ratinen, 2013). Regarding using mixed methods in petroleum impact studies, Arthur (2020) opines that quantitative data provides statistical insight to assess petroleum impacts. In contrast, qualitative data provides an interpretation of the quantitative data. I chose the convergent-parallel mixed method to understand broader and in-depth challenges facing environmental sustainability implementation in the downstream sector. The research design in this study is given in Figure 1.

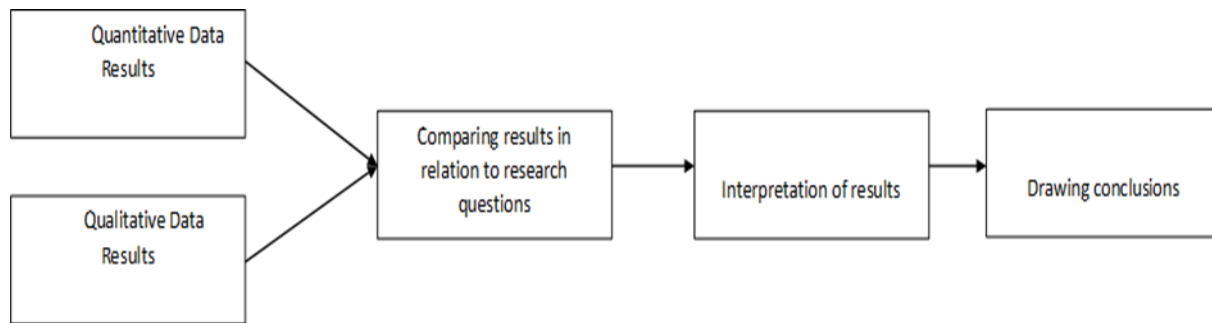


Fig. 4.1. Researcher's conceptualisation of convergent Parallel mixed-method design

4.4 The Setting

The setting chosen for the study is the Greater Accra Region of Ghana. Accra is the capital city of the Republic of Ghana. It is the most urbanised and cosmopolitan city in Ghana. The choice of Accra is for practical purposes for both qualitative and quantitative data collection. Except for a few downstream businesses having their headquarters dotted in other regions of Ghana, the majority are located in Accra. Again, all downstream regulators are also in Accra. This provided easy accessibility for all respondents to be contacted for data collection.

4.5 Population of the Study

A study population is a total group about which some information is required (Banerjee & Chaudhury, 2010). The population of this study comprised all businesses and the key regulators in the downstream petroleum sector in Ghana. 1034 businesses represented the quantitative population (See Table 4.1) and 1036 businesses and regulators represented the qualitative population.

4.6 Sampling and Sample Size Determination

Nachmias and Nachmias (2008) describe the sampling procedure as a process for choosing a portion of a population to make extrapolations about that population. In other words, the sampling procedure is used to select the required sample size to represent the study population. A sample is carefully chosen according to some prearranged conditions (Antwi & Hamza, 2015; O'leary, 2017; Teddlie & Yu, 2007). There are two main sampling procedures – probability sampling procedures and non-probability sampling procedures. The former includes sampling

procedures such as purposive sampling, quota sampling and snowball sampling. In the non-probability sampling procedures, members of the population do not have an equal chance of being chosen.

Table 4.1. Population, sample size and sampling procedure

Downstream Players	Population	Proportion	Sample Size
Refinery Companies	3	0.003	1
Bulk Distribution Companies (BDCs)	35	0.034	6
Transport Operators	750	0.725	124
Oil Marketing Companies (OMCs)	116	0.112	19
LPG Marketing Companies (LPGMCs)	42	0.041	7
Export Companies	27	0.026	4
Bunkering Companies	61	0.059	10
Total	1034		171

Source: NPA (2020)

In the probability sampling procedure, each member of the population has a known (non-zero) chance of being selected. Simple random, stratified, cluster and systematic samplings are common types of probability in research methods in the literature. The essential merit of probability sampling is that the selected sample size represents the population. Both probability and non-probability sampling procedures were used to select the study participants in this study. Probability sampling procedures were used for the quantitative part of the study, while non-probability sampling was used for the qualitative part of the study.

Quantitative Sampling Procedure and characteristics: The probability sampling procedures of stratified and simple random sampling techniques were used to select the estimated sample size of 171 downstream petroleum sector companies in Ghana. First of all, a stratified sampling technique was used to group the downstream petroleum sector stakeholders into seven strata. Then the sample in each stratum was selected proportionally. Secondly, a simple random sampling technique was used to select the businesses in each proportionally selected sample. The sampling frame of the downstream petroleum sector businesses was obtained from the National Petroleum Authority (NPA) database.

Table 4.2 Background characteristics of the sampled downstream petroleum sector

Demographics	Frequency	Percent
Average Turnover (2019)		
Less than \$1million	2	1.20%
\$1 million-\$5 million	36	21.10%
\$6 million-\$10 million	71	41.50%
\$ 11 million -\$15 million	36	21.10%
More than \$15million	26	15.20%
Number of Employees		
Less than 100	138	80.70%
100-199	27	15.80%
400-499	1	0.60%
500 and above	5	2.90%
Years of Operation		
Under 2 years	5	2.90%
2-5 years	53	31.00%
6-10 years	74	43.30%
Over 10 years	39	22.80%
Legal Status		
Sole proprietorship	16	9.40%
Public limited Company (PLC)	49	28.70%
Private limited company (Ltd)	58	33.90%
Partnership	33	19.30%
Private Unlimited company	15	8.80%

The businesses were then given codes, and the codes associated with these companies were entered into statistical software (Microsoft Excel) for the simple random sample selection. The non-probability sampling technique of purposive sampling was used to select the study participants from each of the strata. Thus, participants were selected based on being an employee

at the company for at least one year, having a managerial role in the company and volunteering to participate in the study. The distribution of the background characteristics of the sampled downstream petroleum sector that participated in the quantitative study is below (See Table 4.2).

Quantitative Sample Size Determination: A sample is a part of the study's fully defined target population or population. In order to make accurate inferences or extrapolations, the sample must be representative of the population. A representative sample is one in which each member of the population has an equal and exclusive chance of being chosen. Sample size calculations are usually done in selecting a sample for a study (Banerjee & Chaudhury,2010). This is to ensure that the sample selected is representative of the target population. The quantitative sample size for the study was determined using the Yamane (1967) sample size calculation formula:

$$n = \frac{N}{1 + N(e^2)}$$

Where N is the population size and e is the level of precision. Based on the Yamane formula, the sample size was computed as:

$$n = \frac{1034}{1 + 1034(0.07^2)} = 171, \text{ based on a 95\% confidence interval, } p = 0.5, N = 1034, \text{ with } \pm 7\%$$

precision. Hence a total of 171 downstream petroleum sector businesses or players were sampled for the study.

Qualitative Sample Size: Sampling size is also determined in a qualitative inquiry but is not the same as quantitative inquiry. The common concept to determine sampling in qualitative inquiry is saturation (Malterud et al., 2016). Saturation does not give additional information or insights when adding more participants to the study. Sandelowski (1995) suggests that a qualitative sample size of 10 may be adequate for qualitative inquiry. Based on this recommendation, a sample size of 10 downstream industry players was purposively selected from 1036 downstream actors in the qualitative part.

4.7 Inclusion-Exclusion Criteria

Inclusion criteria are features that the potential participants must have if they are to take part in a study. In contrast, exclusion criteria are those features that prohibit potential participants from taking part in a study. This study involved businesses in the downstream petroleum sector in

Ghana and their regulators. They include participants from downstream petroleum companies in Ghana that have adopted environmental sustainability in their business operations and the state institutions that have been mandated to regulate the activities of the sector to ensure that they conform to standards and are within the regulatory framework. Calibration companies were excluded since they do not implement environmental sustainability practices (ESPs). Businesses in the upstream sector were also excluded.

4.8 Data Collection Instrument and Pilot Testing

A data collection instrument refers to the device used to collect data, including a paper questionnaire or computer-assisted interviewing system (Adosi, 2020). Both quantitative and qualitative data collection tools were used to collect data for the study.

Quantitative Data Collection Instrument: Concerning the quantitative data, a data collection instrument entitled "Environmental Sustainability Questionnaire" was used to collect the data (See Appendix A). The questionnaire was piloted with 15 downstream industry players. This led to further revision of the questionnaire before the final deployment of the questionnaires to the 171 samples.

Qualitative Data Collection Instrument: A semi-structured, open-ended interview guide with probes was developed for the study (See Appendix B). I conducted the interviews using an audio recorder. This instrument allowed me to ask questions pertinent to the study. Likewise, it also offered the respondents the opportunity to explain related issues I might have missed. Open-ended questions conferred over the telephone are not the same as when conversing face-to-face (Dillman et al., 1976; Thornhill et al., 2009). This is because a face-to-face interview provides a conducive atmosphere between the researcher and respondents with minimum distraction. Hence, I persevered and travelled to Ghana amid the pandemic to conduct the interviews in person.

4.9 Pilot Test

A pilot study should be performed, epitomising all the procedures of the main study and validating the feasibility of the study. Through pilot testing, researchers assess the inclusion and exclusion criteria of the participants, test the data collection instruments used for measurements in the study, and train researchers and research assistants (Bryman, 2009; Leon et al., 2011).

Authors such as Creswell (2003) and Bryman and Bell (2011) contend that a pilot study serves

as a model to ensure the quality of the questions and respondents' perspectives. Therefore, they recommend that before the questionnaire is used in the survey for data collection, it be pilot tested. Pilot testing also helps to improve the reliability and validity of the questionnaire (Thornhill et. al , 2009). Based on these recommendations, a pilot study was conducted to test the qualitative and quantitative data collection instruments.

Quantitative Pilot Test: A quantitative pilot study was conducted across 15 downstream petroleum businesses that had not been included in the main study but met the criteria for inclusion in the study. The rationale for the quantitative pilot study was to allow for an evaluation in terms of acceptance and understanding of the questionnaire by the respondents. It was also to test the feasibility of the data collection procedure. In all, 14 out of the 15 questionnaires submitted to the participants were returned. This led to the improvement of the questionnaire and was also very instrumental in improving the reliability and validity of the questionnaire (Bryman, 2016).

Qualitative Pilot Test: Based on the assumption that qualitative research involves the practice of a non-standard instrument for a smaller and non-random sample, pre-assessment of data gathering for validating the trustworthiness of a qualitative study is used (Baskarada, 2014; Meyrick, 2006). After the interview guide was designed, it was pilot-tested. I selected 3 participants from the downstream petroleum businesses. I sent them the letters of introduction collected from the institution through my supervisor (See Appendix C). The study's information letter contained the title page, problem statement, purpose statement, research questions, and proposed interview questions. I received responses from all the participants from the downstream petroleum businesses that were eventually reflected in the final interview guide.

4.10 Reliability and Validity

4.10.1 Reliability

Quantitative Data Reliability and Validity: Reliability of a research instrument measures the degree to which the research instrument is free from bias and therefore ensures consistent measurements (Kothari, 2004). Reliability gives stability to the findings from quantitative data (Altheide & Johnson, 1994). In other words, reliability indicates whether research reproduces consistent findings if they are repeated. The quantitative data piloted on a sample of 15

downstream petroleum businesses allowed for reliability and validity of the questionnaire to be computed and changes made before the actual study was conducted. The reliability of the data collection instrument was measured using Cronbach's alpha. Usually, Cronbach's alpha coefficient is used to determine the scale's internal consistency. A Cronbach's alpha of 0.7 to 0.8 is usually considered to be reliable (Bryman & Bell, 2011; Veal, 1997). The results of the reliability of the questionnaire are shown in Table 4.3. As shown in Table 4.3, all the scales had values above 0.7 which means the questionnaire was considered reliable.

Table 4.3 Cronbach alpha of reliability analysis of measurement scales of the questionnaire

Scale	N of Items	Cronbach's Alpha
Environmental sustainability practices	8	.737
Environmental sustainability goals	16	.876
Achievement of environmental sustainability goals	16	.879
Challenges to environmental sustainability	10	.744

4.10.2 Validity

The validity of a research instrument refers to the degree to which the study instruments measure what it is supposed to measure (Mugenda & Mugenda, 2008). Thus, researchers use validity to ensure that the issues they are studying are truly measured. In other words, the questionnaire should reflect the research problem under investigation. Taherdoost (2018) and Drost (2004) have broadly identified four typologies for achieving validity in quantitative social science studies. These are criterion, face, content and construct validities. I used face validity and content validity in this study. Taherdoost (2018) defines face validity as a measure from a perspective of non-experts and content validity are measures or questionnaires based on literature review and experts in the concepts or issues in the study.

The content validity of this study was ensured by the questionnaire I sent to some downstream petroleum actors for their comments and suggestions. To ensure face validity, the questionnaire was given to some of my colleague students through SUM (Center for Development and the Environment) thesis peer review sessions for their input and critique. The general critique from my peers was that the issues in the questionnaire refer broadly to the three pillars of sustainability and not specifically environmental sustainability issues. This helped me narrow the questionnaire issues to petroleum environmental sustainability based on my research objectives. Both two

interventions assisted me in improving the validity of the questionnaire before administering them to the participants.

4.11 Issues of Trustworthiness in Qualitative Data

Issues of trustworthiness in a qualitative inquiry contrast with reliability and validity in a quantitative inquiry (Anney, 2014). According to Lincoln and Guba (1985), elements of credibility, transferability, dependability and confirmability are the elements of trustworthiness in naturalistic and social science inquiries. This section contains the procedures used to maximise credibility, transferability, dependability, and confirmability procedures as Lincoln and Guba (1985) suggested.

Beck (1993) explains credibility as the measurement of how lucid and correct a phenomenon is in qualitative inquiry. To put it another way, credibility refers to the confidence in the truth of the qualitative data (interview data) and the interpretations of them. Credibility ensures that the results derived from the data are accurate and based on actual data. The following strategies were adopted to enhance credibility. First, I spent considerable time, about a year, structuring the interview guide from late 2019 when I drafted this study's proposal. While developing the guide and also taking several sustainability courses at SUM, I particularly noted issues of environmental sustainability in the petroleum industry in the literature that were finally included in the guide. Second, the interview guide was subjected to pilot testing; inputs from the test helped improve the draft interview guide before finally deploying it to the study's participants. After each interview section, I presented the key points or issues I wrote in my field notes for further clarification from my respondents to clarify any doubts. Of particular importance here was that I distinguished environmental sustainability practices in the downstream as the object of the study and not what pertains in the upstream. This is because some businesses had both downstream and upstream operations licenses. Finally, I replayed the relevant portion of the audio recorder together with the transcripts to ensure that exemplar quotes were not used out of context. Again, the respondents' answers in response to the interview questions were read several times to appreciate all the issues discussed.

Transferability refers to the extent how which the findings of a study can be transferred to other settings. Transferability in qualitative research is akin to external validity or generalizability in a quantitative study. Lincoln and Guba (1985) advised that qualitative researchers should indicate

the specific context of an inquiry. This study's setting and context is the downstream petroleum industry in Ghana. To enhance transferability, participants were selected to include a diverse population of business operations and regulators typifying a downstream petroleum sector in Ghana and globally. The sample size included different business operations in the downstream petroleum sectors: refinery; storage; bunkering; transportation; distribution, marketing and key regulators.

Dependability is the qualitative counterpart to reliability in quantitative studies. Lincoln and Guba (1985) state that dependability is about data stability over time and conditions. In other words, dependability stipulates that findings and analysis from the study are supported by data given by respondents in the study. Cutcliffe and McKenna (2004) suggest using audit trails to enhance dependability. Therefore, I used an audit trail procedure to enhance the study's dependability, that is, the transcript from the interview data. The exemplar quotes were based on a comparison of the transcripts and audio recorder to ascertain what the respondents precisely stated. After the transcription, I compared my written reflections with the data and ensured my opinions and biases had not infiltrated the data.

Confirmability in qualitative inquiry is akin to objectivity in quantitative inquiry. Confirmability in qualitative research is how other researchers could confirm the study's findings (Lincoln & Guba, 1985). The data were checked and rechecked before they were documented during the entire data collection and analysis process. All the interview recordings were also played slowly and repetitively to capture the respondents' answers clearly without ambiguity. Again, all exemplar quotes inserted in my work were compared with the field notes and audio recordings to free the data from distortions.

It is worth noting that issues of reliability and validity in qualitative designs are more contested than in quantitative design (Cutcliffe & McKenna, 2004). Biases, preferences and values of human subjects or respondents and researchers generally account for this contestation. However, in mixed-method designs, Onwuegbuzie and Johnson (2006) argue that contestations about validity and reliability are minimal. Their argument is premised on the fact that mixed methods research encompasses merging complementary merits and nonoverlapping demerits of quantitative and qualitative research.

4.12 Data Collection Procedure

The data collection procedure is the process one follows to collect and measure the data on the study's variables. This enables one to answer stated research questions, test hypotheses, ethically evaluate outcomes, and ensure anonymity (Singh & Burgess, 2007). According to Trochim (2006), the participants of a study need to be made aware of the purpose of the study so that the participant can make an informed decision as to whether they will participate in the study. In this study, I collected introductory letters from the University of Oslo to the participating businesses and regulators for permission to collect data from their entities (See Appendix C). I added an information letter explaining the purpose of the study, methods and what their involvement in the study may require (See Appendix D). The purpose of the study was explained to the participants, and informed consent was sought (both orally and written) and obtained from each of the participants (see appendix E).

Quantitative Data Collection Procedure: For the quantitative data collection, I recruited two research assistants to assist in the administration and collection of the survey questionnaire between August and September 2020. The two assistants were second-year marketing students at universities in Ghana. I prepared them for the task through Zoom meetings and telephone about the "Dos" and "Don'ts" involved. A confidentiality agreement was signed (see appendix F). Ordinarily, the quantitative and qualitative data are simultaneously collected in a convergent mixed-method study. This was, however, practically impossible; due to the COVID-19 pandemic, both Ghana and Norway's borders were closed. It took nine weeks for the questionnaire to be administered.

Qualitative Data Collection Procedure: I travelled to Ghana between December 2020 and January 2021, when the borders were opened for qualitative data collection. Before my departure, I contacted the potential respondents by telephone and email with the letters of introduction and information concerning this thesis project. This created cordiality and a good atmosphere for the interviews. For instance, instead of one respondent to be interviewed in some institutions and units, I had the opportunity to have a pre-interview conversation with some officials who also had knowledge about the topic. Though these pre-interviews were off-records, they allowed me to become familiar with some of the issues under consideration before meeting the officially designated officials for the interview. All the 10 participants selected for the interview were

cooperative and responsive to the interview, albeit rescheduling of interview meetings due to localised COVID-19 restrictions. Another Covid-19 induced challenge was about audibility. I had to increase my tone of voice and sometimes "shout" continuously for the respondents to hear me clearly due to wearing a mask and physical distancing and vice versa. The venues for the interviews were mutually agreed upon between the respondents and me. All the interviews took place at the premises of the respondents' businesses outfit. The interviews were completed within an hour.

4.13 Data Analysis Plan

Quantitative Data Analysis: In the quantitative stage, participants' answers from the data collection tools were processed using IBM SPSS program version 26. Both descriptive and inferential analyses were performed on the data. For descriptive statistics, mean, standard deviation, minimum and maximum values, frequencies and percentages were conducted. For the inferential analyses, Pearson correlation and linear regression analysis were conducted. While research questions 1, 2, 3 and 4 were analysed using descriptive statistics, Pearson correlation and linear regression were employed to answer research question 5.

Qualitative Data Analysis: Thematic analysis was used in analysing the qualitative interview data. Riger and Sigurvinsdottir (2016) define the thematic analysis process as searching for repeated ideas in qualitative data. Interviews were transcribed by using a VLC media player. The downstream petroleum business sector participants were assigned names BUSS 1 to BUSS 8 and regulators REG1 and REG2 for anonymity. Inductive and deductive approaches are usually used to generate themes for qualitative data analysis. The former is generated from the raw data, and the latter, deductive themes, are based on theories selected for the study (Bryman, 2016). Neuman (2003) describes qualitative data analysis as an inductive process involving going from specific transcripts and interview notes to general themes.

Nonetheless, some social scientists have criticized the inductive approach as an illusion. Armat et al. (2018) argue that the issue of inductive coding of data is fallacious since a researcher is influenced by issues within the purview of study in literature. Consequently, Ryan and Bernard (2003) suggest that the answers to research questions constitute the qualitative research themes. Based on this suggestion, after repeated reading, comparing, and interpreting the interview, exemplar quotes addressing the research questions were selected and grouped to form themes.

Mixed Methods Data Analysis: The mixed-method analysis comprised combining both qualitative and quantitative data for meaningful interpretation (Tashakkori & Teddlie, 1998). I looked for findings to address the mixed-method research questions in section 1.4.3 of this thesis. Quantitative and qualitative data were then analysed independently to answer the quantitative and qualitative research questions. After independent analyses were completed, the findings were jointly integrated with the discussion section.

4.14 Ethical Considerations

Ethical considerations are a continual companion for any scientific inquiry. Prior ethical approval is required in all inquiries involving human participants. This means that in social sciences as well as natural sciences, humanities or in an interdisciplinarity inquiry, researchers face various choices and decisions in their work. Ethical research delves into what is feasible, just, and fair in a given situation (Markham & Buchanan, 2015). Based on the anonymity guidelines stipulated by Norwegian Social Sciences Data Services (NSD), all participants in the study were anonymized. Adhering to the anonymity principle means that prior project approval from NSD was sought and approved.

As a result, the study participants were informed about the study's purpose, and I made sure that the questionnaire was answered anonymously. More so, the qualitative interviews were done to avoid using personal names and any other records that could identify the respondents. The interview records- tape recordings, field notes and anything that could lead to the study participants will be destroyed after the main work is submitted and approved. The study participants were informed that they could skip any question or item on the questionnaire or the interview that they did not wish to answer for any reason.

Participants were reminded again that participation was entirely voluntary in the consent form that each participant signed at the beginning of the study and the information letter. The participants were fortified to ask any questions or put forward any doubts they may have, with either part or all of the processes, while ensuring their anonymity or confidentiality. I did not involve myself in the participants' responses without giving an opinion other than when I must elucidate an issue or a question to the participants.

4.15 Positionality Statements

Personal values or characteristics such as age, gender, ethnicity, social class, religious belief or non-belief can influence how researchers perceive things (Seale, 2012). Prior experiences and backgrounds of researchers can influence the research process and outcomes. Some scholars believe that positionality is a tradition among qualitative researchers (Bourke, 2014; Mason-Bish, 2019). However, Sikes (2014) calls for writing positionality statements in any research irrespective of the epistemological approach. The aim of positionality is to illuminate the research process leading to a reliable and trustworthy analysis. The nature of a mixed-method design requires that both qualitative and quantitative data collection instruments are designed and administered. It stands to reason that the socio-cultural background of the researcher is highlighted in relation to the participants.

As a teacher in Ghana with a background in development studies, I have been aware that some Ghanaians complained about how petroleum exploitation and processes have affected their livelihood. Additionally, I am aware of some practices that petroleum businesses are implementing in sustainability discourses but lack an understanding of the associated challenges businesses are confronted with. This particular thesis is to gain a comprehensive understanding of the challenges downstream. As such, participants in the study were chosen from actors in the downstream petroleum industry.

As a student-researcher from Norwegian University and conducting research in a Ghanaian setting, establishing trust with participants was a sine qua non before data collection. This was especially important when two research assistants were recruited to administer the questionnaires in the quantitative part. Since these assistants' role was limited to questionnaire administration and collection, their roles did not influence the actual design and analysis of the data. Trust was further cemented when in some instances, I called the respondents through the assistants to explain and clarify the scope of the study via telephone. In the qualitative interview, I presented the introduction letter and ID cards for identification purposes. The respondents were receptive and confident that, being a Ghanaian myself, I would be able to understand the context of petroleum issues in Ghana more than a non-Ghanaian researcher would.

Moreover, the background between the researcher and respondents may affect how data is collected and analysed (Anyan, 2013). In drawing up the quantitative data instrument, I drafted

the questionnaire before sending it to friends to improve validity. Though the comments and subsequent adjustments of the questionnaire were in the spirit of research rigour, I cannot say for sure whether the views expressed by my friends were influenced by their individual biases or not about the topic. With the qualitative data, I used semi-structured interviews as an instrument. As part of the interview introduction remarks, I indicated that I am a Ghanaian who had an "outside knowledge" about the downstream petroleum sector of Ghana. I did probe the questions to ascertain the answers about the topic. Incontrovertibly, as a teacher, I may have overused my probing skills in unearthing answers as required by my profession. The plausible danger is that the respondents may also have given alternative perspectives or thoughts about the questions that may also be outside the scope of this thesis. For example, when I asked whether petroleum businesses were implementing environmental sustainability practices or not, I got direct and indirect responses.

While most of the answers were direct and unequivocal, few other respondents weaved their answers in poetic and proverbial sentences. For instance, a respondent preceded this proverb before answering the central question: All fingers are not the same; to wit this proverb to the above question, this respondent meant that there are varying degrees of ESP implementations in Ghana and cannot give a definite answer. The impression I got from some of these indirect answers was that because the questions bordered on regulatory or petroleum laws of Ghana, respondents were extra careful in providing answers due to legal implications. Because I was familiar with the local language (poems, proverbs), I subtly understood their indirect answers and further probed their answers according to the study's objective.

4.16 Chapter summary

This study adopted pragmatism as a research philosophy and followed a convergent parallel research design. Pragmatism embraces both objectivity and subjectivity elements of inquiry. The goal was to synchronise these two differing epistemic approaches so that their findings would lead to valid results and expand knowledge. Consequently, quantitative and qualitative research questions were developed to guide the study. A questionnaire and semi-structured interview guide were used to collect data. The study participants for the qualitative part were 10. This was chosen to get in-depth answers concerning the study. One hundred and seventy-one sampled businesses represented the quantitative study and provided the breadth of the study. Analyses of

both data sets increased confidence in the study's outcome. This is because what the qualitative part could not do was compensated for by the quantitative part and vice-versa. While the quantitative part used descriptive and inferential statistics, the qualitative part used themes as bases for analyses. Ethical considerations regarding this study were epitomised in the approval of Norwegian Social Sciences Data Services (NSD) guiding principles of social research. The positionality statement ended the chapter by indicating my background characteristics with respect to data collection and analyses. The chapter that follows present the major results or findings from the quantitative, qualitative and mixed method research questions.

Chapter 5: Results/Findings

“If I had twenty days to solve a problem, I would spend nineteen days to define it.”

Albert Einstein

5.1 Introduction

This study investigates the challenges facing the implementation of environmental sustainability practices in Ghana's downstream petroleum sector. To achieve the objective of this study, a convergent parallel mixed-method research approach was adopted for the study. This chapter presents the findings of the study. The findings of the study are presented under three main sections – findings of quantitative data analysis, findings of qualitative data analysis and findings of mixed-method data analysis.

5.2 Findings of Quantitative Data Analysis

This section presents the findings of the quantitative data analysis. The quantitative data analysis was guided by the quantitative research questions guiding the study.

RQ1: What are the current environmental sustainability practices of the downstream petroleum sector in Ghana?

The objective of research question one is to identify the current environmental sustainability practices of the downstream petroleum sector in Ghana. This research question is into two parts. The first is to determine the extent of implementation of the environmental sustainability practices of the downstream petroleum sector. The other is to determine the current environmental sustainability practices of the downstream petroleum sector in Ghana.

RQ1a: What is the extent of implementation of environmental sustainability practices of the downstream petroleum sector? Descriptive statistics of frequency and percentage were computed to determine the extent of implementation of the environmental sustainability practices of the downstream petroleum sector. Table 5.1 presents the results of the analysis. As shown in the table, out of the total of 171 downstream petroleum sector businesses that participated in the study, 90 (52.6%) indicated recent and ongoing implementation of environmental sustainability

practices. This means that more than half of the sampled downstream petroleum sector businesses had recently adopted environmental sustainability practices, and it was ongoing.

Table 5.1 Distribution of extent of implementation of environmental sustainability practices of downstream petroleum sector in Ghana

Environmental sustainability implementation	Frequency	Per cent
Recent and ongoing implementation	90	52.6
Made significant progress in implementation	81	47.4
No plan for environmental sustainability practices now and in future	-	-
Will adopt in future	-	-
Total	171	100

An inspection of the data in Table 5.1 indicates that although downstream businesses have made some significant progress in implementing environmental sustainability practices, their progress is not up to the standards (Achaw and Boateng, 2012; Yalley et al., 2012). So, for these businesses, there is more room for improvement. Meanwhile, it is interesting to note that none of the downstream sectors chose "no plan for environmental sustainability practices now and in future" and "will adopt in future". This is a surprising observation, which suggests that the government and the various stakeholders of the downstream petroleum sector are doing their work by ensuring that the downstream petroleum sector complies with environmental sustainability policies and directives. This result could also imply that the downstream petroleum businesses, the government, stakeholders, and the citizens are gradually becoming increasingly aware of the negative impacts of petroleum businesses' operations on the environment.

RQ1b: What are the current environmental sustainability practices of the downstream petroleum sector in Ghana? Descriptive statistics of mean, standard deviation, minimum, and maximum values were computed to determine the current environmental sustainability practices of Ghana's sampled downstream petroleum sector. Table 5.2 shows the results of the descriptive statistics of the current environmental sustainability practices of the sampled downstream petroleum sector in Ghana. As shown in the table, most of the sampled downstream petroleum sector businesses in Ghana agreed to engage in various environmentally sustainable practices.

Table 5.2 Descriptive statistics showing the current environmental sustainability practices of the sampled downstream petroleum sector in Ghana

Environmental Sustainability Practices	Mean	Std. Dev.	Min.	Max.
Environmentally friendly processes	3.9	0.86	1.0	5.0
Considering for ways to reduce waste	4.3	0.75	1.0	5.0
Engaged in free emission processes	4.3	0.71	2.0	5.0
Used renewable resources in operations	4.2	0.72	1.0	5.0
Reused scrap materials	4.1	0.70	2.0	5.0
Reprocessed defective end products	4.2	0.68	1.0	5.0
Use outsourcing ecological guidelines	4.1	0.79	2.0	5.0
Engaged employee in environmental programmes	4.2	1.00	1.0	5.0

Note: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

RQ2: What are the goals of the environmental sustainability practices of the downstream petroleum sector in Ghana?

This research question aims to find out the goals of the environmental sustainability practices of the downstream petroleum sector in Ghana. Descriptive statistics of mean, standard deviation, minimum, and maximum values were calculated to answer this research question. Table 5.3 shows the results of the goals of the environmental sustainability practices of the sampled downstream petroleum sector companies in Ghana. The findings of this research question show that the downstream petroleum sector in Ghana engages in environmental sustainability practices based on three main reasons broadly – economic, environmental, and legal. The economic reasons or goals found in this research question are the desire to achieve a competitive advantage, enhance revenue, reduce cost, increase the market, and improve organizational performance. As revealed from the findings of this research question, the environmental goals include environmental advocacy pressures, the desire to conserve energy, the desire to conserve resources, the desire to reduce pollution, and the desire to reduce waste. This research question's findings suggest that the legal goals or reasons are to reduce consumer risk and conform to legal/regulatory pressures. These legal goals show that the regulators direct Ghana's downstream petroleum sector businesses to adopt environmental sustainability practices.

Table 5.3 Descriptive statistics showing the goals of the environmental sustainability practices of the sampled downstream petroleum sector companies in Ghana

Goals of Environmental Sustainability Practices	Mean	Std. Dev.	Min.	Max.
To reduce cost.	3.9	0.90	1	5
To enhance revenues/profits.	4.3	0.75	1	5
To achieve competitive advantages.	4.3	0.75	2	5
To conserve energy.	4.4	0.67	2	5
To conserve resources/resources pressures.	4.2	0.78	1	5
To reduce pollution.	4.3	0.74	2	5
To reduce waste.	4.2	0.76	1	5
To reduce consumer risk.	4.3	0.65	2	5
To conform to legal/regulatory pressures.	4.2	0.73	2	5
To meet investors' demands.	4.2	0.68	2	5
To improve organizational performance.	4.2	0.72	2	5
To meet the demands of marketing pressures.	4.2	0.76	1	5
To meet the demands of environmental advocacy pressures.	4.2	0.76	1	5
To enter into new markets.	4.2	0.83	2	5
To increase market share.	4.1	0.92	1	5
To increase sales turnover.	4.2	1.05	1	5

Note: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

RQ3: To what extent have the goals of the environmental sustainability practices of the downstream petroleum sector in Ghana been achieved?

The objective of this research question was to determine how far the downstream petroleum sector companies have gone in terms of the achievement of environmental sustainability practices. To find out the answer to this research question, I computed the descriptive statistics of mean, standard deviation, minimum, and maximum. Table 5.4 shows the results of the extent to which the sampled downstream petroleum sector has achieved the goals of the environmental sustainability practices in Ghana. As indicated in the table, the downstream petroleum sector has achieved significant success as far as environmentally sustainable practices are concerned.

Table 5.4 Descriptive statistics showing the extent to which the goals of the environmental sustainability practices in Ghana have been achieved by the sampled downstream petroleum sector.

Achievement of Environmental Sustainability Practices	Mean	Std. Dev.	Min.	Max.
Reduced cost.	3.9	0.96	0	5
Enhanced revenues/profits.	4.2	0.86	0	5
Achieved competitive advantages.	4.1	0.83	1	5
Conserved energy.	4.3	0.66	2	5
Conserved resources/resources pressures.	4.1	0.80	0	5
Reduced pollution.	4.2	0.76	1	5
Reduced waste.	4.1	0.83	0	5
Reduced consumer risk.	4.2	1.11	0	5
Conformed to legal/regulatory pressures.	4.0	1.11	0	5
Meet investors' demands.	4.2	0.87	0	5
Improve organizational performance.	4.2	0.81	1	5
Meet the demands of marketing pressures.	4.3	0.76	1	5
Meet the demands of environmental advocacy pressures.	4.3	0.72	1	5
Ability to enter into new markets.	4.2	0.63	2	5
Increased market share.	4.1	0.84	0	5
Increased sales turnover.	4.1	1.08	0	5

Note: 0 – Not at all, 1 – To a small extent, 2 – To some extent, 3 – To a moderate extent, 4 – To a great extent, 5 – To a very great extent.

RQ4: What are the challenges confronting the environmental sustainability practices in the petroleum sector in Ghana?

The objective of research question four was to determine the main challenges confronting the environmental sustainability practices in the downstream petroleum sector in Ghana. To answer this research question, I computed the descriptive statistics of mean, standard deviation, minimum, and maximum. Table 5.5 shows the findings of the main challenges confronting the environmental sustainability practices in the downstream petroleum sector in Ghana as reported by the sampled downstream petroleum sector companies. With regards to difficulty in changing current business practices, it is found that among the majority of the SMEs in Ghana, most of the decisions of the businesses are by one man or a few persons, who mostly are family members or are related. Thus, in a situation where these people do not favour implementing environmental sustainability practices, it becomes a real challenge to implement environmental sustainability practices due to cost.

Table 5.5 Descriptive statistics showing the challenges confronting the environmental sustainability practices in the petroleum sector in Ghana.

Challenges to Environmental Sustainability Practices	Mean	Std. Dev.	Min.	Max.
Problems of stakeholder pressures	3.8	0.89	1	5
Costs of adopting sustainability and economic conditions	4.1	0.98	1	5
Lack of consensus at the CEO level	4.0	0.93	1	5
Lack of sustainability standards and appropriate regulations	4.2	0.93	1	5
Misalignment of short and long-term strategic goals	4.1	0.97	1	5
Lack of human resources	4.0	0.96	1	5
Difficult to change current company practices	4.2	0.98	1	5
Lack of communication and coordination	3.9	0.96	1	5
Lack of appropriate information	3.9	1.10	1	5
Lack of necessary infrastructures	4.0	1.25	1	5

Note: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

The lack of sustainability standards and appropriate regulations in these areas presents a challenge to Ghana's downstream petroleum sector companies implementing environmental sustainability practices. The environmental sustainability regulatory framework in Ghana does not cover all pertinent areas, such as the kind of equipment to purchase, the frequency of adoption of sustainability strategies, the timelines for adoption of each environmental sustainability strategy, and the type, duration, as well as the frequency of environmental training for employees. These decisions are left to the downstream sector petroleum businesses to make. As found in these results, misalignment of short and long-term strategic goals shows that most downstream petroleum sector businesses in Ghana do not have clear-cut long and short-term strategic goals regarding environmental sustainability practices.

Although most of them have goals for environmental sustainability practices, these goals, as shown in these results, are misaligned with the objectives, mission, and vision of the businesses. This makes it challenging to ensure the continual implementation of environmental sustainability practices. This indicates that downstream petroleum sector businesses are implementing sustainability practices because they are being compelled and not because they willingly want to strategically align the practices to their businesses' vision. This shows that if they encounter challenges in the implementation, they are likely to stop. This underscores the need for the regulators to strengthen their efforts to ensure that the downstream petroleum sector businesses implement environmental sustainability practices.

RQ5: What is the impact of the challenges confronting the environmental sustainability implementation on the environmental sustainability practices in the downstream petroleum sector of Ghana?

The objective of research question five is to determine whether there is an effect of the challenges confronting the environmental sustainability implementation on the environmental sustainability practices in the downstream petroleum sector of Ghana. I performed Pearson correlation analysis and simple linear regression analysis to answer this research question. The independent variable, in this case, is the challenges of the environmental sustainability implementation, while the dependent variable is the environmental sustainability practices (ESPs). Tables 5.6-5.9 show the Pearson correlation results and the simple linear regression analysis of the impact of the challenges confronting the environmental sustainability implementation on the environmental sustainability practices in the downstream petroleum sector of Ghana.

Table 5.6 Pearson Correlations showing the relationship between the challenges confronting the environmental sustainability implementation and environmental sustainability practices in the downstream petroleum sector in Ghana

Variables	Environmental Sustainability Challenges	Environmental sustainability practices
Environmental Sustainability Challenges	1	.305**
Environmental sustainability practices	.305**	1

** . Correlation is significant at the 0.01 level (2-tailed).
 Weak correlation – 0.1 to 0.3; Moderate correlation – 0.3 to 0.5;
 Strong correlation – 0.5 to 1.0

Table 5.6 shows the results of the Pearson correlation between the challenges confronting the environmental sustainability implementation and the environmental sustainability practices in the downstream petroleum sector in Ghana. As demonstrated in the table, there is a positive correlation ($r = .305, p < .05$) between the challenges confronting the environmental sustainability implementation and the environmental sustainability practices in the downstream petroleum sector in Ghana. However, as shown in the table, the Pearson correlation is moderate. This result shows that although the correlation is not strong, as the challenges confronting the environmental sustainability implementation increase, the environmental sustainability practices

of the downstream petroleum sector also increase. This shows that although the downstream petroleum sector businesses in Ghana are confronted with many challenges in their environmental sustainability implementation, these challenges do not prevent them from implementing the environmental sustainability practices.

Table 5.7 Regression coefficients of the simple linear regression analysis showing the impact of the challenges confronting the environmental sustainability implementation on environmental sustainability practices in the downstream petroleum sector in Ghana

	Unstandardized Coefficients		Standardized Coefficients		95.0% Confidence Interval for B		
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
(Constant)	3.511	0.16		21.952	0.00	3.195	3.826
Environmental Sustainability Challenges	0.162	0.039	0.305	4.16	0.00	0.085	0.239

Note: Dependent Variable: Environmental sustainability practices

Table 5.7 shows the results of the regression coefficients of the simple linear regression analysis of the impact of the challenges confronting the environmental sustainability implementation on environmental sustainability practices in the downstream petroleum sector in Ghana. The prediction simple linear regression equation model is written as:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

where Y = environmental sustainability practices, X_1 = challenges of the environmental sustainability implementation, ε = error term, β_0 = intercept or the constant, and β_1 = slope or the gradient. Based on the results from Table 11, the predicted simple linear regression equation model written as:

$$Y = 3.511 + 0.162X_1$$

The predicted simple linear regression equation model shows that a unit increase in the challenges of the environmental sustainability implementation results in .162 increases in the environmental sustainability practices. These increases are found to be statistically significant at the level of 5% ($\beta = .162, SE = .039, t = 4.16, p < .05$). This result is consistent with the results from the Pearson correlation analysis. These results indicate that there is a positive linear relationship between the challenges confronting the environmental sustainability implementation

and the environmental sustainability practices in the downstream petroleum sector in Ghana. As indicated earlier, these results could be attributed to the fact that the downstream petroleum sector is required by law to enforce environmental sustainability, and so the challenges they encounter in no way should prevent them from adhering to the law or the requirements.

Table 5.8 Model summary of simple linear regression analysis showing the impact of the challenges confronting the environmental sustainability implementation on environmental sustainability practices in the downstream petroleum sector in Ghana

R	R Square	Adjusted R Square	Std. Error of the Estimate
.305 ^a	0.093	0.088	0.4431

a. Predictors: (Constant), Environmental Sustainability Challenges

Table 5.8 shows the model summary of the simple linear regression analysis of the impact of the challenges confronting the environmental sustainability implementation on environmental sustainability practices in the downstream petroleum sector in Ghana. As shown in the table, the results reveal that only 9.3% of the variation in the environmental sustainability practices implementation is accounted for by the challenges confronting the environmental sustainability implementation. This means that other factors account for significant variations in the environmental sustainability practices apart from the challenges. This could further explain why the challenges they encounter in the sustainability implementation do not negatively impact their sustainability practices.

Table 5.9 ANOVA summary of the simple linear regression analysis showing the impact of the challenges confronting the environmental sustainability practices on environmental sustainability practices in the downstream petroleum sector in Ghana

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.397	1	3.397	17.302	.000 ^b
Residual	33.18	169	0.196		
Total	36.577	170			

a. Dependent Variable: Environmental sustainability practices

b. Predictor: Environmental Sustainability Challenges

Table 5.9 shows the ANOVA summary of the simple linear regression analysis of the impact of the challenges confronting the environmental sustainability implementation on environmental sustainability practices in the downstream petroleum sector in Ghana. The results of the ANOVA $F(1,169) = 17.302, p < .05$ shows that overall, the regression model significantly predicts the

dependent variable. This means the simple linear regression model can be used to predict the environmental sustainability practices in the downstream petroleum sector in Ghana, using the challenges confronting the environmental sustainability implementation as the predictor or the independent variable.

5.3 Findings of Qualitative Data

Qualitative inquiry is an interpretive process which means a researcher interprets data through "words, images, experiences and observations that are not quantified" (O'Leary, 2017, p.142). This section presents the results of the qualitative data. These findings are grouped under the research questions as themes. Exemplar quotes relevant to the research questions have been captured as themes. The findings here are briefly interpreted. The following research questions guided the qualitative data analysis:

RQ1: What do downstream businesses and regulators consider as the main challenges in terms of implementing environmental sustainability practices?

RQ2. How do Ghanaian businesses in the downstream petroleum sector deal with environmental sustainability challenges in their operations?

RQ1: What do downstream businesses and regulators consider as the main challenges in terms of implementing environmental sustainability practices?

The objective of the first qualitative research question was to find out what the downstream businesses and regulators consider as the main challenges confronting the implementation of the environmental sustainability practices in the downstream petroleum sector in Ghana. The following themes highlighting the main challenges in implementing environmental sustainability practices were derived from the excerpts or quotes from the downstream petroleum sector businesses and regulators.

High Cost

When asked about what they consider to be the most significant challenges when implementing environmental sustainability practices in the downstream petroleum sector, most of the downstream petroleum sector businesses interviewed indicated high cost as a challenge. They

stressed the high cost of procuring the needed equipment and materials to implement the environmental sustainability practices. The following are some of the exemplar quotes from the interviews that align with the high cost of implementing environmental sustainability practices.

“Our main concern has to do with the costs associated with instituting sustainability practices. There are often significant upfront costs or investments required that do not have immediate financial returns. And this is a huge blow to our financial standing at the moment. But I know in the long run we shall reap the benefits. Imagine, contracting a foreign firm yearly to come and inspect of facilities, it comes at a huge cost to us” (BUSS 2).

“I think the problem has always been the cost-driven aspect of the environmental sustainability practices. It involves huge capital or funds to implement these practices” (BUSS 5).

Concerns regarding the cost of environmental sustainability implementation were widespread among respondents. Only a few respondents did not indicate cost as a key challenge. Cost as a challenge was reported more by fully-owned Ghanaian businesses than businesses with foreign interests (Amponsah and Opei, 2017).

Getting Qualified Personnel

Qualified personnel are very instrumental to the smooth implementation of environmental sustainability practices. From the participants' quotes, it can be deduced that there is a challenge when it comes to getting or finding trained personnel for the implementation of environmental sustainability practices in the downstream petroleum sector in Ghana. When asked what respondents consider the most considerable challenges when implementing environmental sustainability practices in the downstream petroleum sector, almost all the downstream sector businesses interviewed for the study indicated difficulty in getting qualified personnel in environmental sustainability. They mentioned that getting certified environmental personnel to ensure proper implementation and environmental standards is very difficult. A quote by a downstream petroleum sector company that captures this particular challenge states:

"We lack technical personnel to carry out our environmental sustainability practices. We have to hire personnel from outside the company to ensure the smooth implementation of our environmental sustainability policies and guidelines". (BUSS 1).

Businesses' strategies (understandings) about sustainability

The lack of proper understanding of environmental sustainability is another challenge for implementing environmental sustainability practices in the downstream petroleum sector in Ghana. The quotes from the participants interviewed reveal that majority of the employees in the downstream petroleum sector do not adequately understand the concept of environmental sustainability. A downstream petroleum business participant whose quotes capture this particular challenge reported that:

"...there is difficulty in getting the whole concept of environmental sustainability properly internalize [and] affecting all our corporate strategies" (BUSS 1).

This quotation from the participants suggests that this problem of lack of proper understanding of environmental sustainability is not found only with a particular group of employees in businesses but also with businesses' strategic goals to be attained. One of the quotes that bring this challenge into perspective is:

"Lack of understanding of environmental sustainability is a big issue. And this problem is with all the employees from the leadership to all the employees. The problem becomes even more dangerous when it starts from the head [office]. If not, we cannot have a corporate strategy that will guide us on sustainability pathways". (BUSS 4).

The reason for this is not apparent from the data, but it may have something to do with understanding the concept of sustainability. It can also be inferred from this theme that most downstream businesses do not have a definitive understanding of sustainability. This finding supports the view of Costanza and Patten (1995) that what constitutes sustainability is uncertain and is disputed among actors.

Leadership and Employees' sustainability roles

Lack of leadership commitment and employee engagement was also found to be one of the main challenges the downstream petroleum sector businesses expressed as hampering the implementation of environmental sustainability practices in the downstream petroleum sector in Ghana. A participant whose quote captures this particular challenge indicates that:

"... it is one thing having an environmental sustainability practice and another thing managing the practice to ensure that it is successful [continuously] to stand the test of time. And this requires leadership, commitment, stakeholders and employee engagement and disciplined mechanisms at all times. For now, to get all these ingredients is a challenge". (BUSS 4).

Inadequate Physical Infrastructure

Environmental sustainability practices require a high infrastructure level, especially in the oil and gas industry. Therefore, businesses need to have adequate infrastructure to ensure the smooth implementation of environmental sustainability practices (Dashore and Sohani, 2013).

Unfortunately, the quotes from the study participants reveal that one of the main challenges confronting the implementation of the environmental sustainability practices in the downstream petroleum sector in Ghana is inadequate physical infrastructure. Below are some of the quotes from the participants that highlight this challenge:

"Compared with foreign businesses, our infrastructure capacity is relatively low. It is our expectation that we will be able to procure environmentally friendly infrastructures such as residue fluid catalytic cracking technology as TOR [Tema Oil Refinery] have done. This and many modern infrastructures will help to reduce negative petroleum impacts". (BUSS 9).

"Energy infrastructures such as pipeline, plants are needed to make the downstream environmentally friendly. Though most of these businesses have them, I can tell you that they need more especially modern infrastructures, and because of cost involved in retrofitting these infrastructures, these businesses hardly do. So, I am [of] the view that if the government intervenes in this regard, it will really help". (BUSS 10).

The challenge of inadequate infrastructure experienced by the downstream petroleum sector businesses is seen to have a negative effect on the smooth implementation of the environmental sustainability practices in the downstream petroleum sector. The following quote by one of the study participants shows an example of how inadequate infrastructure impedes environmental sustainability practices in the downstream petroleum sector in Ghana.

"...our operations require that our inflammable products are stored in containers underground. Though we have quality impermeable materials for containments, leakages of some effluents (liquids) sometimes occur at some of our sites". (BUSS 2).

Improper Coordination by Regulators

The driving force of every sustainability implementation is the regulatory framework (Mann et al., 2010; Stead & Stead, 2000). In other words, regulations set out the institutional scope outlining what is expected from each downstream actor with regard to sustainability.

Environmental sustainability regulatory frameworks ensure that institutions, businesses, and organizations operate within the confines of the law to ensure environmental safety (Knol-Kauffman et al., 2021). To ensure proper implementation of these frameworks, there should be, first of all, proper coordination between the regulators. In a situation where there is a lack of proper coordination, implementing these frameworks will be a challenge. This seems to be the case for regulators of the downstream petroleum sector in Ghana. As expressed by most of the key regulators of the downstream petroleum sector who participated in the interview, there is a lack of proper coordination between the key regulators. The following quotes from some of the key regulators illustrate this theme.

"Our ACT specifies that the EPA grants environmental impact license to businesses before we (NPA) grant operating license. This means we need collaboration from them before we take actions which is difficult sometimes. But we don't go for inspection with them. When the environmental conditions are not met, we take action and notify the EPA later. However, the EPA grants the license but does not monitor it. We do it". (REG 1)

"...I think environmental permit functions and licensing ought to be in the hands of NPA directly, instead of EPA. This will give the authority outright oversight responsibility to monitor environmental practices". (REG 1).

"I will say communication gap between us and the NPA. The EPA grants the permits to downstream businesses and the NPA is the main regulator that check the practices. In the process of enforcing the practices by the NPA, they don't include the EPA. The NPA singularly enforces all operational practices in the downstream sector". (REG 2).

The ongoing dispute between the EPA and Tema Development Corporation (TDC) about granting a permit to the proposed construction of a refinery business (Sentuo) noticeably illustrates how different regulatory bodies can impede the work of one another. EPA has rejected Sentuo's application because the proposed site is a wetland that joins the Chemu Lagoon. However, TDC, a local regulatory body of infrastructures, insists otherwise and that the construction can continue (Kudah,2021). As indicated in the literature previously, refinery activities by TOR have already polluted the Chemu Lagoon by contaminating its ecological functions.

Lack of Uniformity and Standards in Some Key Areas

Environmental sustainability implementation requires standards in key areas of sustainability activities. This will help to ensure that the planning processes needed to ensure smooth implementation of environmental sustainability practices are streamlined. The results from the downstream petroleum sector businesses reveal that there is a lack of uniformity and standards in some of the key areas of environmental sustainability practices. According to the study's participants, though the sector is highly regulated, the absence of unified codes and lack of standards in some of the key areas of sustainability hinders the ability of the downstream petroleum sector businesses to implement environmental sustainability practices. A participant contended that:

"Our challenge has been the lack of sustainability standards and appropriate regulations to deal with most of the sustainability challenges. For instance, we do not have standards that deal with procurement purchases that ensures that all procurement meet certain environmental sustainability standards. In this sector, we buy a lot of things needed in our operations. This makes it difficult for us whenever we are doing some purchases to help in our sustainability practices. What to buy and not to buy is a big issue. Though GSA [Ghana Standard Authority] certifies our calibrators we buy for appropriate measurement, not all our instruments are standardized". (BUSS 6).

RQ2. How do Ghanaian businesses in the downstream petroleum sector deal with environmental sustainability challenges in their operations?

The objective of this qualitative research question was to find out how, despite the environmental sustainability challenges, the downstream petroleum sector businesses deal with the environmental sustainability challenges in their operations. The theme, as well as exemplary quotes from the interview, are presented as follows.

Training of Personnel

Training of personnel is significant for every organization that wants to excel in any area or function of the organization. Hence training personnel is one of the methods the downstream petroleum sector businesses in Ghana are using to deal with the environmental sustainability challenges in their operations. They occasionally organize training for technical and non-technical employees to have qualified technical personnel who can effectively and efficiently handle the implementation of environmental sustainability practices. With regards to the technical training, the businesses provide to their personnel, one of the participants of the downstream petroleum sector businesses, whose quote is found to be representative of the other participants, pointed out that:

"We lacked technical personnel to carry out our environmental sustainability practices. But like I earlier said, we have been able to train our employees to handle these issues. We from time to time engage environmental consultants and the EPA to train our staff on how to handle environmental sustainability issues in our company". (BUSS 1).

In terms of some of the specific training the downstream sector businesses provide to their staff, one of the participants of the downstream petroleum sector businesses said:

"We do train our drivers on safety and other things so that the environment is safe. We train every driver of our company on how to perform periodic checking of road worthiness of trucks with our company's checklists. We also train our drivers on how to use the EPA environmental sustainability practices checklists". (BUSS 7).

To provide non-technical training to the employees, the downstream petroleum sector businesses interviewed reported that they provide training in leadership, environmental awareness, and

employee engagement in environmental sustainability to their employees. One of the quotes from the participants of the study highlighting this form of training states:

"We also provide continuous training in leadership, environmental awareness, and employee engagement to help mitigate these challenges". (BUSS 4).

Establishment of Sustainability Units and hiring of Technical Personnel

To successfully deal with the challenges confronting the implementation of the environmental sustainability practices, some of the downstream petroleum sector businesses, apart from providing training to their employees, have gone a step further to establish environmental sustainability units in their businesses. One of these downstream petroleum sector businesses reported:

"... Now we have a sustainability unit at the head [office] (BUSS 1).

Apart from the training and establishment of environmental sustainability units, some of the downstream petroleum sector businesses, in order to get things done the right way, have had to hire technical people from outside their businesses. To these businesses, the hired technical personnel ensure that they achieve the required results their businesses want from their environmental sustainability practices. One of the participants' quotes that highlights this particular method stated:

"We had to hire personnel from outside the company to ensure the smooth implementation of our environmental sustainability policies and guidelines." (BUSS 1).

Government Intervention

Many respondents seek government fiscal policy interventions in areas such as tax exemptions to purchase the required tools such as arrestors [a device that prevents flames or fires] and interceptors [a device that collects pollutants in pipelines] for their operations. The following quotes from the participants highlight the theme above:

"We sometimes seek government interventions to reduce the high costs in buying these gadgets". (BUSS 10).

"We request governmental interventions such as tax exemptions to acquire sulfur recovery units [process of reducing sulphur elements and pollutants] through the [Claus Process], arrestors and interceptors for our operations". (BUSS 3).

The study participants seek government support in terms of tax exemptions and subsidies from the quotes above. However, from the participants' quotes, it seems that these tax provisions are not given to all the downstream petroleum sector businesses. Due to this, some of the participants of the downstream petroleum sector businesses reported:

"Government interventions basically about granting us tax exemptions on trucks import will be welcomed". (BUSS 7).

"I think the government and state institutions need to come in. The government should provide tax exemptions, especially to those of us that are doing our best to embark on environmental sustainability programs". (BUSS 5).

Commitment and Prioritization of Environmental Sustainability Practices

Commitment is key to the implementation of environmental sustainability practices. To this end, the qualitative study participants reported that to deal with the environmental sustainability challenges successfully, they have to demonstrate commitment and prioritize environmental sustainability practices. The following are some of the quotes that demonstrate this theme.

"And we also need to make sustainability as part of our corporate social responsibility. This way we will feel obligated to carry out environmental sustainability practices irrespective of the challenges we may encounter". (BUSS 2).

"I think that all we need to do is to show the commitment, which we have already done in adopting these practices". (BUSS 1).

5.4 Mixed-Methods Results

This section presents the integrated results of the mixed-methods questions as indicated in section 1.4.3. The qualitative and quantitative results were integrated to answer the primary and secondary research questions. I merged the two types of data by developing a table depicting mutually supportive results from both strands to answer the mixed-method research question one.

Research question two was analysed based on the comparable contents emanating from both strands (Jick, 1979).

The objective of mixed-method research question one was to determine how the results from the quantitative data analysis support the themes of the qualitative data analysis when it comes to the challenges facing the implementation of the environmental sustainability practices in the downstream petroleum sector in Ghana. Table 5.10 shows how the quantitative results support the themes of the qualitative results in terms of the challenges in the implementation of the environmental sustainability practices in the downstream petroleum sector. As indicated in the table, overall, the quantitative results of the challenges facing the downstream petroleum sector implementation in Ghana support the prominent themes derived from the qualitative results.

As shown in Table 5.10, the quantitative results supported the qualitative theme of the high implementation cost of environmental sustainability practices. The participants of the quantitative study strongly agreed (Mean \pm SD = 4.1 \pm 0.98) that the costs of adopting sustainability and economic conditions pose a challenge to the implementation of environmental sustainability practices in the downstream petroleum sector in Ghana. The qualitative theme of *getting qualified personnel* generated from the qualitative interviews was also strongly supported by the quantitative results. The majority of the participants in the quantitative study agreed that there are inadequate human resources when it comes to the implementation of environmental sustainability practices (Mean \pm SD = 4.0 \pm 0.96).

Table 5.10 Quantitative results and qualitative themes

Quantitative Results	Costs of adopting sustainability and economic conditions	Lack of human resources	Misalignment of short term and long-term strategic goals	Lack of consensus at the CEO level	Lack of necessary infrastructures	Lack of communication and coordination	Lack of appropriate information
Qualitative Themes	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
High cost	4.1(0.98)						
Getting qualified personnel.		4.0(0.96)					
Business strategies about sustainability			4.1(0.97)				
Leadership, commitment and employee engagement				4.0(0.93)			
Inadequate infrastructure					4.0(1.25)		
Improper coordination by regulators						3.9(0.96)	
Lack of uniformity and standards in some key areas							3.9(1.1)

The quantitative results indicate that majority of the participants of the quantitative study strongly agreed (Mean \pm SD = 4.1 \pm 0.97) that the misalignment of short and long-term strategic goals poses a serious challenge to the implementation of the environmental sustainability practices in the downstream petroleum sector. Based on the results of the qualitative data analysis, this is strongly attributed to the lack of proper understanding of environmental sustainability. As a result of their lack of proper understanding of environmental sustainability, most downstream sector businesses cannot appropriately align their short- and long-term goals strategically to achieve better environmental sustainability results or performance. Again, the qualitative theme of understanding environmental sustainability was also upheld by the results of the quantitative data analysis.

Moreover, the qualitative theme of *leadership, commitment and employee engagement* was also supported by the results of the quantitative analysis. The results from the quantitative analysis, as shown in Table 5.10, indicates (Mean \pm SD = 4.0 \pm 0.93) lack of consensus at the CEO level as one of the main challenges facing the implementation of environmental sustainability practices in the downstream petroleum sector, which according to the qualitative results, is as a result of lack of commitment being shown by the CEOs to properly implement environmental sustainability practices.

The quantitative results also supported the qualitative theme of inadequate physical infrastructure. Most of the quantitative study participants also agreed (Mean \pm SD = 4.0 \pm 1.25) that the lack of necessary infrastructure is a challenge to the implementation of the environmental sustainability practices in the downstream petroleum sector in Ghana. In addition, the qualitative theme of *improper coordination by regulators* was also supported by the quantitative results. The participants of the quantitative study moderately agreed (Mean \pm SD = 3.9 \pm 0.96) that lack of communication and coordination is one of the challenges being faced by the downstream petroleum sector when it comes to the implementation of the downstream petroleum sector in Ghana. The theme of *lack of uniformity and standards in some key areas* is also moderately agreed by the participants of the quantitative study (Mean \pm SD = 3.9 \pm 1.1). To the quantitative participants, lacking appropriate information to standardize inhibit implementation.

RQ2: To what extent do the qualitative results enhance the understanding of the quantitative results and vice versa?

Current Environmental Sustainability Practices

The quantitative results highlighting the current environmental sustainability practices of the downstream petroleum were supported by the results of the qualitative data analysis. The participants of the quantitative study strongly agreed that they engaged in ways to reduce waste (Mean \pm SD=4.3 \pm 0.75), engaged in free emission processes (Mean \pm SD = 4.3 \pm 0.71), used renewable resources in operations (Mean \pm SD = 4.2 \pm 0.72), reused scrap materials (Mean \pm SD = 4.1 \pm 0.70), reprocessed defective end products (Mean \pm SD = 4.2 \pm 0.68), used outsourcing ecological guidelines (Mean \pm SD = 4.1 \pm 0.79), engaged employee in environmental programs (Mean \pm SD = 4.2 \pm 1.00). These quantitative results were supported by the results of the qualitative data analysis. Some of the exemplary key quotes from the qualitative data analysis that supports these quantitative results of downstream environmental practices include:

"We also follow the environmental guidelines to ensure that we comply to protect our environment. Interceptors in our operation as you can see make it possible to eliminate harmful substances that may destroy water bodies. Without these interceptors, pollutants from petrol, will be washed to the land when it rains and destroy it" (BUSS 1).

"Investment in environmental safety to protect against environmental pollution; our operations require that our inflammable products are stored in containers underground. Though we have quality impermeable materials for containments, leakages of some effluents (liquids) sometimes occur at some of our sites" (BUSS 2).

Other key exemplary quotes include:

"We engage in recycling of oil products. We do this by buying old oil for some industrial purposes. Used Motor oil only makes dirty so we buy them and retreat them for other uses like hydraulic and lubricating products. Used oils from cars in Ghana are disposed of any how in Ghana and destroying our fertile lands" (BUSS 3).

"We also comply with all applicable legal and regulatory requirements... Valving of fluids in our premises through our pipeline systems make sure we don't destroy our subsurface and the environment" (BUSS 4).

"Well, the products we transport are very inflammable so we transport with care to reduce accidents. We have tracking devices installed in all our tracks to enhance mobility. Products are discharged in line with NPA discharge manual where you cannot discharge any products without arresters to prevent the release of gases into atmosphere" (BUSS 7)

Overall, all the sampled downstream businesses who indicated ongoing implementation of environmental practices and making significant progress underscore the different environmental sustainability practices being undertaken, notwithstanding the challenges downstream businesses face.

Goals of Environmental Sustainability Practices

The results of the quantitative data analysis on the goals of the environmental sustainability practices of the downstream petroleum sector in Ghana revealed that the downstream petroleum sector engages in environmental sustainability practices to achieve economic, environmental, and legal goals. Overall, the themes obtained from the qualitative results uphold the quantitative results. With respect to the achievement of environmental goals, the participants of the quantitative study strongly agreed that they engaged in environmental sustainability practices to conserve energy (Mean \pm SD = 4.4 \pm 0.67), conserve resources (Mean \pm SD = 4.2 \pm 0.78), to reduce pollution (Mean \pm SD = 4.3 \pm 0.74), and to reduce waste (Mean \pm SD = 4.2 \pm 0.76). These quantitative results were supported by the qualitative results in these exemplar quotes:

"...our goal is to ensure that we protect our air, water, land, and everything that is concerned with the environment... The motivation is numerous. For now, I will say the legal and regulatory concerns, the ability to protect the environment, the opportunity to improve our reputation and sales, and our own concerns and value for the environment. If our work destroys the environment today, we the workers will also be affected. Nowadays, the talk of climate change issues in the media means a lot to our operations and we must do more" (BUSS 1).

"Climate change mitigations and air pollution are few goals that come to mind...we do these for several reasons and one is, our company gets huge capital from international capital market and banks so we don't want our reputation and credibility to be bruised before the investors. Our directors take much interest in sustainability in all our branches globally including Ghana. Bear in mind also that the NPA/EPA is very strict too" (BUSS 7).

"As I indicated before, the goal of all these is to make the environment safe and clean. To reduce pollution of the environment associated with petroleum products. You know Ghana is blessed with fertile lands so we don't want petroleum leakages and spills to destroy them" (BUSS 9).

In terms of achievement of economic goals, the participants of the study strongly agreed that they engaged in sustainability practices to achieve competitive advantage (Mean \pm SD = 4.3 \pm 0.75), to enhance revenue (Mean \pm SD = 4.3 \pm 0.75) and to improve organizational performance (Mean \pm SD = 4.2 \pm 0.72). This quotation from these respondents from the qualitative strand underscores the economic goals in the quantitative strand:

"Our goal is to reduce pollution and its impact on the environment...Our goal is also to improve our company's image and reputation with consumers. Of course, we are also in for-profit" (BUSS 3).

"Our main motivation is our commitment to provide a safe environment for human life and property. Recognizing the critical link between a healthy environment and our business, we are committed to protecting and enhancing the environment. Such stewardship, to us, is indispensable to our continued business success" (BUSS 4).

More so, the study participants moderately agreed that they engaged in sustainability practices to reduce cost (Mean \pm SD =3.9 \pm 0.90). When it comes to the achievement of legal goals, the participants of the study strongly agreed that they engaged in sustainability practices to conform to legal/regulatory pressures (Mean \pm SD = 4.2 \pm 0.73) to meet investors' demands (Mean \pm SD = 4.2 \pm 0.68), and to meet the demands of marketing pressures (Mean \pm SD = 4.2 \pm 0.76). These results were supported by the following qualitative results. This respondent succinctly pointed out why businesses implement environmental sustainability practices:

"Massive sanctions. The regulations guiding their operations enjoins them [businesses] to adhere to sustainable environmental practices in which we enforce to the later" (BUSS 10).

This respondent posits an analogous explanation about legal goals achievement drive:

"We have been able to conform to many, although not all, of the international and local regulations and standards" (BUSS 5).

Extent of Achievement of Environmental Sustainability Goals

In terms of the achievement of the environmental goals, the participants of the quantitative study strongly agreed that they have to a great extent, been able to conserve energy (Mean \pm SD = 4.3 \pm 0.66), able to conserve resources (Mean \pm SD = 4.1 \pm 0.80), able to reduce pollution (Mean \pm SD= 4.2 \pm 0.76), able to reduce waste (Mean \pm SD = 4.1 \pm 0.83), able to conform to legal or regulatory pressures (Mean \pm SD = 4.0 \pm 1.11), and able to meet the demands of environmental advocacy pressures (Mean \pm SD = 4.3 \pm 0.72). These quantitative results were supported by the qualitative results as well. The qualitative results that uphold these quantitative results include quotes such as:

"We have been able to reduce our energy use by 20%. We have also been able to reduce, reuse and recycle about 15% of our materials and products" (BUSS 5).

"We have been able to comply with about 80% of the regulations. In terms of pollution, we have done tremendously well by incorporating green procurement in our supply chain and procurement practices" (BUSS 6).

The participants of the quantitative study also strongly agreed that they, to a great extent, have been able to meet investor's demands (Mean \pm SD = 4.2 \pm 0.87), improve organizational performance (Mean \pm SD = 4.2 \pm 0.81), and meet the demands of marketing pressures (Mean \pm SD = 4.3 \pm 0.76). The results of the qualitative analysis also sustained these results. The participants of the qualitative study reported, when asked about the goals the business entity is achieving:

"The first is to meet the demands of stakeholders. When I say stakeholders, I mean the regulators, policymakers, investors, the international and local standard organizations, and the rest. We also embark on these practices to remain competitive and to also of course cut down cost and make profits" (BUSS 2).

Impacts of the challenges of environmental sustainability implementation

The results from the simple linear regression analysis revealed a positive impact of the challenges confronting the environmental sustainability implementation and the environmental sustainability practices of the downstream petroleum sector in Ghana. This means that, although moderate, as the environmental challenges confronting the environmental sustainability implementation increase, the downstream petroleum sector businesses' adoption of the environmental sustainability practices also increases. This result is attributed to the mandatory regulatory requirement of the downstream petroleum sector in Ghana. The downstream petroleum sector is required by law to ensure environmental sustainability practices in its operations. Hence, despite their challenges, these challenges do not affect their sustainability implementation because of the regulatory requirements.

Again, the qualitative data analysis results reveal challenges in sustainability implementation. Furthermore, these challenges confronting the implementation of environmental sustainability practices impact Ghana's downstream petroleum sector businesses. In terms of economic impacts on the businesses, the exemplary quotes in the qualitative strand amplify the impacts as follows:

"The conversation has always been cost implications. Cost has always been the major economic impact of the environmental sustainability challenges. A part from cost we have time and efforts. It requires time and energy or efforts on the part of our company to deal with the environmental sustainability challenges. We also have to deal with the difficulty of the staff in understanding environmental sustainability practices" (BUSS 6).

"These challenges have increased our operational cost. Enhancements and investment into efficient technologies such as waste avoidance, energy and resource efficiency have really come with additional cost to the company" (BUSS 3).

For the impacts on the customers of the companies, an exemplary quote is captured below:

"And as you know, operational cost must eventually end up in price, and the consumer or customer will have to pay. And so, the consumer will have to pay more if the cost of implementation is high. Venting and flaring of gas and other emissions contribute to air pollution" (BUSS 2).

This finding reflects those of Presley et al. (2007), who also found out that the high cost of environmental sustainability implementation leads to a higher price of goods and services.

5.5 Chapter Summary

The purpose of this research was to identify the challenges that downstream petroleum businesses in Ghana experience while implementing environmental sustainability practices. The research also intended to ascertain current environmental sustainability practices, environmental sustainability practice goals, and the extent to which environmental sustainability practice goals have been met in Ghana's downstream petroleum industry. Furthermore, the research sought to ascertain the influence of environmental sustainability challenges on the environmental sustainability practices of Ghana's downstream petroleum industry. According to the findings of the qualitative and quantitative data analysis, there are seven significant problems facing environmental sustainability implementation practices. High implementation costs, a lack of expertise, a lack of effective business sustainability strategies, a lack of leadership commitment and employee engagement, an inadequate physical infrastructure, a lack of proper coordination, and a lack of uniformity and standards in some key areas are the significant challenges.

In terms of the current environmental sustainability practices, analysis has revealed that most downstream petroleum industries in Ghana reduce waste, employ free emission processes, reuse scrap materials, reprocess faulty end products, and use renewable resources in operations. The qualitative data analysis shows that downstream petroleum businesses in Ghana concentrate more on process-driven than market-driven environmental initiatives. The qualitative data analysis showed that most downstream petroleum industries in Ghana pursue environmental sustainability owing to regulatory and economic requirements.

The qualitative and quantitative data analyses have shown that the downstream petroleum businesses in Ghana have made significant progress when it comes to their environmental sustainability goals. According to quantitative data analysis, downstream petroleum companies have achieved tremendous success in achieving the economic, environmental, and legal goals of their environmental sustainability practices. However, qualitative data analysis revealed that the downstream petroleum industries have not made much progress toward economic goals. Furthermore, the quantitative data analysis indicated that environmental sustainability challenges positively impact the implementation of environmental sustainability practices in Ghana's downstream petroleum sector. The next chapter that follows explore the major findings together with literature and theoretical frameworks.

Chapter 6: Discussion, Conclusion and Recommendations

“Two heads are better than one, not because either is infallible, but because they are unlikely to go wrong in the same direction.”

C.S Lewis

6.1 Introduction

This convergent-parallel mixed-method aimed to investigate the challenges facing implementing environmental sustainability practices in Ghana's downstream petroleum sector. This chapter is to discuss the findings of the study. The findings will be discussed in a unified narrative that integrates the study's problem, objectives, literature, theoretical frameworks, implications and recommendations for future research. The study comprised qualitative, quantitative and mixed-method research questions. However, to achieve the objective of convergent-parallel mixed-method research design, only the mixed-method findings would be the bases for discussion and conclusion. The point here is to avoid repetitions. The discussion of the mixed-method research findings is based on section 1.4.3, as presented earlier in this thesis. The discussion structure is as follows: first, a mixed-methods triangulated findings with literature; second, a discussion of the findings with theoretical frameworks; third, a brief reflection on research philosophy, mixed-methods design and interdisciplinarity and finally, recommendations and conclusions are presented.

6.2 Discussion of Findings

The main challenges confronting the implementation of environmental sustainability practices

The first mixed-method research question is to determine whether the themes from the qualitative results support the quantitative results in terms of the challenges in implementing the environmental sustainability practices in the downstream petroleum sector in Ghana. The triangulated results from both the quantitative and qualitative study revealed seven main

challenges as themes confronting environmental sustainability implementation practices. These challenges are discussed as follows:

The first challenge found by both the qualitative and the quantitative study to be confronting the environmental sustainability practices in the downstream petroleum sector in Ghana is the *high cost of implementation*. Many businesses have often viewed environmental sustainability implementation as expensive (Abubakar, 2014; Ekins & Zenghelis, 2021; Gracia & Siregar, 2021; Presley et al., 2007). Hence, the cost of adopting environmental sustainability is one of the key reasons that hinder businesses from adopting sustainability practices. The literature found that the huge cost of implementing environmental sustainability practices and economic conditions makes it difficult for many businesses to implement many environmental sustainability practices. The results from both the qualitative and the quantitative study revealed that the high cost of investment in environmental sustainability practices hinders environmental sustainability practices in the downstream petroleum sector in Ghana.

Meanwhile, the numerous taxes placed on downstream petroleum sector businesses make it challenging for them to accrue enough revenue to implement environmental sustainability. Currently, there are five major taxes levied on downstream petroleum businesses in Ghana, namely, petroleum income tax, internal revenue tax, income tax, value-added tax, and national health insurance levy. Downstream petroleum businesses, including their upstream counterparts, are currently required to pay a minimum tax on chargeable income at a rate of 35% (Price Water Coopers, 2017). These and other major taxes levied on downstream petroleum businesses pose financial challenges to businesses, hindering their pursuance of environmental sustainability practices that are capital intensive.

The theme of *lack of technical personnel or expertise* was identified. A challenge facing many businesses in implementing environmental sustainability initiatives is the lack of expertise to track environmental problems that occur during the activity phase and deal with external demands for new environmental technologies. Environmental sustainability practices require managers and workers who have expertise or knowledge in the field (Bhinekawati & Bradly, 2020; Dube & Gawande, 2014). Many organizations lack the qualified staff needed to oversee the administration, control, and implementation of environmental sustainability initiatives. It is found in this study that the downstream petroleum sector businesses in Ghana are no exception

when it comes to this challenge. The majority of the study participants indicated that lack of technical personnel or expertise is one of the main challenges confronting the implementation of the environmental sustainability practices of the downstream petroleum sector in Ghana. In Ghana, because environmental sustainability practices in the oil and gas industry are relatively recent, getting the required expertise to undertake environmental sustainability initiatives is very difficult. As a result, roles have been undertaken by employees or personnel who have little or no knowledge of environmental sustainability. A probable explanation for this might be that most training and tertiary institutions in Ghana do not offer courses in environmental sustainability. This has made it difficult for the downstream petroleum businesses to find the needed technical expertise to efficiently and effectively implement environmental sustainability initiatives.

The third challenge confronting the environmental sustainability practices in the downstream petroleum sector in Ghana is the *lack of effective business sustainability strategies*. A lack of proper understanding of environmental sustainability initiatives poses a real challenge to effective and efficient environmental sustainability practices (Abubakar, 2014; Giunipero et al., 2012). Effective and efficient implementation of environmental sustainability practices requires all employees and managers to understand environmental sustainability practice strategies. This has been the case among downstream petroleum businesses in Ghana. The study results revealed that the majority of the downstream petroleum businesses lack the proper understanding of environmental sustainability initiatives. Many businesses do not have short-term to long-term strategies to implement environmental sustainability initiatives and cannot introduce appropriate actions to achieve success. As such, most of these businesses' implementation of environmental sustainability practices has been inconsistent. This result may be explained by the lack of technical expertise in the sector to implement environmental sustainability initiatives successfully.

Lack of leadership commitment and employee engagement is the fourth main challenge found to inhibit the implementation of the environmental sustainability practices in the downstream petroleum sector. Leadership commitment and employee engagement are at the heart of every successful implementation of environmental sustainability practices. When leaders are committed to achieving environmental sustainability goals, they engage employees in a way they can to achieve those goals and go to all lengths to find the money to fund the projects. However,

the problem arises when leaders who are supposed to show a high level of commitment show no seriousness in achieving environmental sustainability goals (Walls et al., 2020). The study results on the challenges confronting the implementation of environmental sustainability practices in the downstream petroleum sector in Ghana confirm this particular kind of challenge. The study participants reported that a lack of leadership commitment and employee engagement is one of the main challenges hampering the implementation of environmental sustainability practices in Ghana's downstream petroleum sector. If the CEOs consider environmental sustainability issues irrelevant, the efforts of managers and the employees will be in vain. The successful implementation of environmental sustainability initiatives is mainly because these individuals are in favour and are committed to the course.

The fifth theme that inhibits environmental sustainability practices in the downstream petroleum sector in Ghana is *inadequate physical infrastructure*. Infrastructure and modern technology are critical to effective, efficient, and profitable environmental sustainability practices. With the appropriate infrastructure and technology, environmental sustainability can be implemented with ease to achieve immediate short-term and long-term benefits. Likewise, a lack of proper infrastructure will turn even the most brilliant sustainability initiative into a worst one (Dashore & Sohani, 2013; Gopalakrishnan et al., 2012; Wu & Wu, 2012). Similarly, inadequate infrastructure hampers the effective implementation of environmental sustainability initiatives to achieve the required results.

The majority of the study participants revealed that downstream petroleum sector businesses could not effectively implement their environmental sustainability practices. They blame this challenge on the lack of finance to purchase state-of-the-art technologies for proper implementation of sustainability to achieve the required results. Their concerns are that infrastructure for the smooth implementation of sustainability practices is costly, and they cannot bear the cost year after year. They, therefore, have no option but to only focus on the obsolescent ones that are not highly capital intensive, which are not yielding the required economic benefits to their businesses. According to Nikolaou and Evangelinos(2010), more than 20 per cent of the total revenue by some organizations is devoted to securing equipment, adopting sustainability strategies and environmental training for workers. This shows how considerable funds are essential to support infrastructure, innovation, informational and human resources sustainability

requirements (Wu & Wu, 2012). To ensure effective and efficient implementation of environmental sustainability practices will require financial support from the government. This will ease some of the businesses' financial burdens and help them channel their efforts and commitment to many environmental sustainability initiatives.

Lack of proper coordination is the sixth inhibitor of the environmental sustainability practices in the downstream petroleum sector in Ghana. The study revealed that a lack of proper coordination on the part of regulators poses a challenge to the smooth implementation of the environmental sustainability practices in the downstream petroleum sector. In Ghana, the law mandates the Environmental Protection Agency (EPA), one of the key regulators of the downstream petroleum sector, to formulate environmental policies and make recommendations for the protection of the environment. It also grants EPA the mandate to issue environmental impact licenses to businesses, including downstream petroleum sector businesses (EPA, n.d). National Petroleum Authority, another key regulator of the downstream petroleum sector, on the other hand, give operating licenses to the downstream petroleum sector businesses. This means that for effective monitoring and evaluation, to ensure that the downstream petroleum sector businesses are working within the environmental limits, there should be proper coordination between these two licensing award institutions. However, the study results revealed a lack of proper coordination between these two regulators, making supervision, monitoring and evaluation for effective and efficient environmental sustainability implementation a challenge.

This result suggests that the government regulators are not doing enough to ensure the environmental sustainability practices of the downstream petroleum sector businesses in Ghana. Their attention is more focused on granting licenses and formulating environmental policies rather than ensuring that those policies and licenses are rightly implemented. This result is in line with findings in the literature. Hashmi and Al-Habib (2013) found that government regulators were not doing enough to control carbon emissions among the downstream petroleum sector businesses in Saudi Arabia. Dashore and Sohani (2013) also identified a lack of proper coordination among regulators as a critical inhibitor of environmental sustainability implementation among downstream petroleum sector companies.

Efficient communication and coordination among regulators are essential for effective environmental sustainability implementation (Endrikat et al., 2014). The lack of proper

coordination among these key regulators was found not to pose a real challenge to the key regulators only but also to the downstream petroleum sector businesses as well. The downstream businesses reported that they would have to satisfy all the requirements of EPA and, at the same time, meet all the requirements of the NPA. They reported that the procedures involved in these requirements make effective and efficient environmental sustainability implementation very difficult for them to achieve. Again, the lack of proper coordination between these key regulators creates loopholes. It gives leeway for some petroleum businesses to evade the implementation of specific environmental requirements (Ite et al., 2013).

The seventh theme found in this study to inhibit the environmental sustainability practices in the downstream petroleum sector in Ghana is the *lack of uniformity and standards in some key areas*. The environmental sustainability regulatory framework in Ghana does not cover all pertinent areas, such as the kind of equipment to purchase, the frequency of adoption of sustainability strategies, the timelines for adoption of each environmental sustainability strategy, and the type, duration, as well as the frequency of environmental training for employees. These decisions are left to the downstream sector petroleum companies to make. The lack of sustainability standards and appropriate regulations in these areas presents a real challenge to implementing environmental sustainability practices by Ghana's downstream petroleum sector companies, as revealed in the study. Nkamnebe and Idoko (2013) identified the absence of specific enabling laws that complement environmental sustainability practice adoption among businesses in Nigeria.

The extent to which the qualitative results enhance the understanding of the quantitative results and vice versa

The second mixed-method research question is to determine the extent to which the qualitative results enhance the understanding of the quantitative results and vice versa. The discussions of the triangulated results with this mixed-method research question are presented below. The discussions are based on four primary areas. It includes how the qualitative results enhance the understanding of the quantitative results and vice versa in terms of (a) the current environmental sustainability practices of the downstream petroleum sector, (b) the goals of the environmental sustainability practices of the downstream petroleum sector, (c) the extent of achievement of environmental sustainability goals of the downstream petroleum sector, and (d) the impact of the

challenges of the environmental sustainability implementation of the downstream petroleum sector.

Current environmental sustainability practices

The results from the quantitative data analysis revealed that most of the downstream petroleum sector businesses in Ghana engage in the reduction of waste, engagement in free emission processes, reuse of scrap materials, reprocessing of defective end products, and use of renewable resources in operations. However, the qualitative data analysis results revealed that the downstream petroleum sector businesses in Ghana are more focused on process-driven than on market-driven environmental strategies. The qualitative study participants reported using interceptors in their operation, engaging in recycling used-oil products, reusing and recycling materials, eliminating or reducing harmful discharges into the environment, cutting down on energy use, and following NPA carbon emission manuals. The few market-driven strategies indicated in the qualitative study are initiated to upgrade the businesses' production process to advance their environmental efficiencies and competitive advantages. This result agrees with previous literature that there is a more effective implementation of process-driven environmental sustainability strategies in both small and large organizations than market-driven ones (Abubakar, 2014; Giunipero et al., 2012; Gopalakrishnan et al., 2012; Wu & Wu, 2012; Zhu & Geng, 2013).

Goals of the environmental sustainability practices

Environmental sustainability practices goals vary from organization to organization. Notwithstanding, previous literature points out that critical drivers of environmental sustainability practices in any organization can be categorized into three main areas – economic, social, and environmental (Abubakar, 2014; Carter & Easton, 2011; Gopalakrishnan et al., 2012; Mann et al., 2010; Walker & Jones, 2012). Consistent with the literature, the quantitative study results confirm that the main drivers of the environmental sustainability practices in the downstream petroleum sector in Ghana are economic, social, and environmental. The results of the qualitative data analysis indicated that most downstream petroleum sectors in Ghana engage in environmental sustainability practices due to legal and economic obligations but not

environmental reasons per se. This result may be explained by the fact that some businesses are not aware of the negative impacts their operations have on the environment directly.

For economic reasons, the qualitative data analysis revealed that the downstream petroleum sector businesses engage in environmental sustainability practices to remain competitive, make a profit, cut costs, improve sales, achieve business performance, and improve business reputation and company image. In terms of the legal drivers of environmental sustainability practices, the qualitative data analysis revealed that downstream petroleum sector businesses engage in environmental sustainability practices to meet standards –both local and international- and meet stakeholders' demands. This finding aligns with the literature (Dashore & Sohani, 2013; Gopalakrishnan et al., 2012; Holt & Ghobadian, 2009). For example, Holt and Ghobadian (2009) have expressed that a legal drive is the most significant pressure that influences businesses to improve environmental sustainability performance.

The extent of achievement of environmental sustainability goals by the downstream petroleum sector businesses in Ghana

The results of both the qualitative and quantitative data analysis indicate that the downstream petroleum sector businesses have made significant progress in the achievement of the goals of their environmental sustainability practices. It was observed from the results of the quantitative data analysis that the downstream petroleum businesses had made significant progress when it comes to the achievement of the economic, environmental, as well as legal goals of their environmental sustainability practices. However, the qualitative data analysis results revealed the downstream petroleum sector businesses had not made much progress when it came to achieving economic goals. Few of the qualitative study participants reported massive progress when it came to achieving the economic goals of environmental sustainability practices. This could be partly attributed to the many challenges confronting the downstream petroleum businesses, which have slowed down the achievement of economic benefits of the sustainability practices (Dashore & Sohani, 2013; Gopalakrishnan et al., 2012).

Impact of the challenges of environmental sustainability implementation

The quantitative data analysis indicated a positive impact of environmental sustainability challenges on environmental sustainability implementation. One would have thought that the challenges of environmental sustainability practices would have a negative impact on the sustainability practices of the downstream petroleum businesses. However, the simple linear regression analysis results instead revealed that as the challenges of the environmental sustainability practices increase, implementation of environmental sustainability practices also increase. One of the reasons for this result is the regulatory framework that mandates downstream petroleum sector businesses to ensure environmental protection in their operations. The pressure from the key downstream regulators presents the downstream petroleum businesses with limited options to ensure that their business operations protect the environment despite operational challenges.

Another reason for this result is the economic benefits environmental sustainability presents. Implementation of environmental sustainability practices presents enormous benefits to businesses. The use or reuse of a limited number of resources can positively impact the environment, reducing the cost of operation. Ambec and Lanoie (2008) reported that less pollution leads to lesser liability costs, which might reduce potential fines and lawsuit costs. Governments offer tax credits to businesses that involve in environmentally sustainable practices like recycling. Environmentally friendly products are more likely to attract more customers than unfriendly ones. However, this development is more ostensible in advanced economies.

Despite these positive indications of the challenges of environmental sustainability implementation, the results from the qualitative data analysis further explain some negative impacts of the challenges on the downstream petroleum sector businesses. For instance, most of the downstream petroleum businesses that participated in the qualitative study reported experiencing high financial burdens resulting in continuous budget deficits. This result is in line with the literature. According to Horváthová (2012), despite the long-term economic benefits of environmental sustainability, there is usually a negative impact in the short term for businesses who are actively pursuing environmental sustainability practices.

The qualitative participants reported a large amount of companies' time and energy are directed to ensuring environmental sustainability practices. This result is also in line with the literature. According to BBC (2021), becoming environmentally friendly is time-consuming, particularly in large businesses. Again, other qualitative study participants reported that the challenges of the environmental sustainability practices had had a negative impact on certain business decisions, such as a reduction in salaries. This result is found to disagree in some sense with findings in the literature that environmental sustainability is all a "win-win" situation (Elkington, 1994). It is true that new jobs and businesses will emerge when implementing environmentally sustainable practices; however, some employees, especially in the downstream petroleum sector, may lose their jobs through downsizing as a result of the high environmental sustainability investments cost (Presley et al.,2017).

6.3 Theoretical Framework

The triangulated results from this study as discussed with ecological modernization and the corporate social responsibility theories.

6.3.1 Ecological Modernization Theory (EMT)

The overarching goal of EMT is to reform capitalists' exploitation of the environment and improve environmental policies and practices (Dryzek, 1997; Spaargaren & Mol, 1992). In effect, ecological modernization theory supports the notion that environmentalism and economic benefits are connected. Ecological modernization theory also describes why businesses want to improve their environmental practices, implying that environmental sustainability practices would help businesses improve their environmental, social and economic outcomes. The mixed-methods findings are congruent with the primary principles or themes of EMT as developed by Mol & Sonnenfeld (2014). Themes such as (a) physical infrastructure, (b) business leadership, (c) state regulators, and (d) business strategies were identified as the significant challenges facing the implementation of environmental sustainability practices. These findings parallel the EMT framework, as shown in Table 6.1.

Table 6.1 Exploration of Ecological Modernization Theory (EMT)

This empirical study	EMT
Physical infrastructure	Science and Technology
Business leadership	Economic agents and market dynamics
Regulators and standards	Role of nation-states
Business strategies	Changing discursive practices

Note: Major themes of EMT adapted from Mol & Sonnenfeld(2014)

Through the analysis of the challenges militating against environmental sustainability practices in Ghana's downstream above, empirical evidence here is explored in relation to EMT. This largely dispels the claim that EMT is about policy-centredness in environmental management (Bailey et al., 2011; Jänicke, 2008; Spaargaren & Mol, 1992). EMT has received considerable critical attention in petroleum environmentalism, as mentioned in the theoretical frameworks. This is because the EMT framework incorporates present capitalist economic policy tools for environmental protection. More recently, however, literature has emerged that offers contradictory expositions about EMT. A good summary of the contradictory exposition about EMT has been provided in the work of Scanlan (2017), who sees EMT as a greenwashing framework. Scanlan (2017) decision to outrightly reject EMT in petroleum environmental management as greenwashing merits some discussion based on these findings. Firstly, he based his environmental impact analysis and measurement on one of the many petroleum environmental practices, hydraulic fracturing (pumping water and other chemicals into wells to increase natural gas flow).

The scope of his study was relatively narrow and focused solely on CSR statements published online. Secondly, no attempt was made to quantify the impact of hydraulic fracturing on environmental sustainability. However, the sample size in this mixed-method study represents the downstream population in Ghana. This study also employs regression analysis to determine the impact of the environmental challenge on environmental sustainability practices. Some environmental challenges in this empirical study are identified and analysed with EMT larger than Scanlan's work. Consequently, greenwashing critique against EMT in the petroleum industry is jettisoned (Baah & Kharlamova, 2016; Lam et al., 2005). This is because the EMT framework employed in this study has explored how downstream businesses respond to environmental sustainability practices and their associated challenges identified.

In this study, challenges emanating from private businesses and public entities were found to militate against smooth, sustainable implementation, as indicated by the following EMT theorists (Adams, 1990; Christoff, 1996; Hajer, 2012). The study results also revealed a positive relationship between the environmental sustainability practices of the downstream petroleum sector and the environmental sustainability challenges faced by the businesses. This result explained that employing government environmental sustainability policies (regulations) has helped downstream petroleum sector businesses achieve environmental successes in sustainability despite the challenges (Lambin & Thorlakson, 2018).

Comparing findings from this study to other studies using the EMT framework, some similarities and differences exist. For example, Bailey et al. (2011) identify poor state regulations and infrastructure as challenges in solving an intractable environmental problem of climate change. These agree with the data obtained from this study on the overlapping roles of the EPA and NPA. By contrast, the challenge of the high cost of procuring physical infrastructures identified in this study is incongruous with Bailey et al. (2011). Their study found that businesses can acquire low-cost technologies through command-and-control mechanisms set by regulators. In this study, participants in the qualitative strand requested direct government subsidies to acquire modern physical infrastructures in petroleum. Christoff (1996) supports this view of direct government support and writes that market incentives such as subsidies enhance partnership in environmental policies and practices.

Likewise, Hanf (2003) found that the regulatory framework is pivotal in achieving sustainability due to collaboration between business and state regulators, confirming this study's findings. Nonetheless, Hanf (2003) conceived EMT as a reordering of regulatory space. Thus, environmental quality should be the yardstick of economic agents' decisions. However, in this study, producers (petroleum businesses) implement environmental practices despite their challenges due to regulations or laws. This study contributes to research on the EMT framework by demonstrating that the inherent challenges associated with practices aimed at protecting the environment are identified in depth and breadth. This will prove helpful in expanding our understanding of how petroleum businesses implement sustainability practices and policies.

6.3.2 Corporate Social Responsibility Theory (CSR)

According to Carroll (1979), corporate social responsibility theory incorporates the economic, legal, ethical, and discretionary standards that society has for organizations at any given time. Today, CSR encapsulates economic, environmental, and social policies into businesses' corporate social responsibilities (Carter & Easton, 2011; Dyllick & Hockerts, 2017). According to the isomorphic institutional framework of CSR, as explained in chapter 3, three external pressures influence organisations or businesses to adopt similar practices. Implementing similar practices mean that the challenges inherent in these processes are similar. To analyse the challenges downstream businesses face, this study employed the institutional perspective of CSR when implementing environmental sustainability practices. This choice is not inconsequential. Many CSR analysts and scholars have previously used this theory in their quest to analyse how petroleum businesses implement environmental sustainability practices (de Abreu et al., 2016; Mijatovic & Stokic, 2010; O'Connor & Gronewold, 2013; Sherman, 2012; Stephens, 2017).

Findings from this study are in tandem with DiMaggio and Powell (1983) three characteristics of institutional isomorphism in CSR, as have been explained earlier. Firstly, both quantitative and qualitative findings identify the high cost of implementation as a challenge. In the qualitative data, in particular, almost all the sampled respondents decried the substantial financial burdens the implementation of environmental sustainability challenges place on their shoulders. Many of these respondents requested governmental interventions to reduce the high costs of procuring modern technologies and infrastructure for effective implementation. Ordinarily, this would have reflected mimetic isomorphism (DiMaggio & Powell, 1983; Shabana et al., 2017). Businesses procure modern technologies when enough funds are available. However, because the majority of the downstream businesses are local without stronger financial strength, they requested external governmental interventions to operationalize environmental sustainability practices. In this way, the finding mirrors coercive isomorphism because acquiring these technologies depends on governmental assistance. This finding contradicts the supporters of mimetic isomorphism that business leaders bear the costs of their operations (Carmona & Macías, 2001; Guidi et al., 2018; Jang et al., 2014; Shabana et al., 2017).

Secondly, the lack of physical infrastructures was identified as a challenge in both parts of the datasets. Thus, businesses recognised the need to utilise environmentally friendly infrastructures of their own volition. Many of the respondents aspired to procure the same modern infrastructures used in other businesses in the qualitative data. This agrees with mimetic isomorphism literature that businesses copy the practices of successful ones (DiMaggio & Powell, 1983; Rudyanto, 2019; Tipurić & Krajnović, 2020).

Thirdly, the challenge of getting qualified personnel or lack of human resources was identified in both datasets. Corporations or businesses would not have effective implementation and evaluation without the workforce or skilled personnel being conversant and knowledgeable in environmental sustainability practices. However, this study revealed that downstream businesses, despite this challenge, hire consultants or train their non-skilled labour force in environmental sustainability. This also reflects normative isomorphism about the role of professionals in organisations in achieving sustainability norms and values (DiMaggio & Powell, 1983).

Consequently, the findings of this study contribute to knowledge by indicating that all the three elements of the isomorphism framework can be used to analyse environmental issues in the petroleum industry contrary to the only coercive and normative issues relevant in the petroleum industry (de Abreu et al., 2016). By responding to environmental problems in the downstream sector, businesses apply coercive, mimetic and normative isomorphisms in their operations, as indicated in the study's findings.

The results presented here under CSR practices confirm the “sustainable development values” in TBL of sustainability as espoused by Elkington (1997, p.5). Furthermore, the results from both the qualitative and quantitative data analyses revealed that most downstream petroleum sector businesses in Ghana have been able to integrate environmental sustainability practices into their business operations. These activities by the downstream petroleum sector businesses indicate that environmental sustainability practices have permeated the downstream sector through corporate social responsibility.

ESPs that the downstream sector has adopted by way of CSR in this study include engaging in the recycling and reusing of petroleum products, eliminating or reducing harmful discharges into

the environment, cutting down on energy use etc. According to previous research studies, businesses show their level of sustainability implementation through redesigning products, aligning core business principles to create environmentally friendly products, recycling, efficient waste disposal and compliance with government legislation (Gopalakrishnan et al., 2012; James, 1994; Mayorga, 2010).

Despite the corroboration of this study by DiMaggio and Powell (1983), a slight difference exists with the CSR framework used in other petroleum industries. An example of this is the study by Miasa and Apitsa (2021) in Madagascar, in which downstream businesses have individual internal responsibilities influencing their CSR practices to protect the environment. In this study, environmental practices are induced by national regulations steered by EPA and NPA.

Brief reflections on research philosophy, mixed-methods and interdisciplinarity as adopted in the study

This study used the convergent-parallel mixed method to identify and understand the downstream businesses' challenges when implementing environmental sustainability practices. The mixed-methods approach blends the qualitative and quantitative paradigms in social and cultural research (Onwuegbuzie & Johnson, 2006). Epistemology of pragmatism considers reality as a continuum and rejects objectivity and subjectivity dichotomies. Regarding ontology, pragmatists support positivists' position of external reality (single truth) and share the view of interpretivists and describe the nature of reality as constructed by human actors. That said, pragmatists' research orientation is directed to what approach best answers well-thought-out research questions and not necessarily choosing either qualitative or quantitative approach (O'Leary, 2017). The underlying postulation here is that researchers choose the approach that proffers the best chance of answering research questions. This is the point for choosing a mixed-methods approach in this study.

Philosophical assumptions provide the foundation for understanding a research problem in order to draw a valid conclusion (Creswell and Plano, 2011). Therefore, two assumptions influenced this researcher to adopt a mixed methods design based on the chosen topic and research questions. One, environmental sustainability practices are deemed an objective reality that manifests through implementing various environmental practices by downstream businesses to

reduce the negative petroleum environmental impacts. Two, it was viewed that how different downstream businesses responded or adopted the practices differed in implementation with associated challenges. With these two assumptions, neither positivist nor interpretivist approach could adequately answer the research questions, hence, adopting the pragmatism paradigm. In choosing this particular mixed method, a thorough review of the characteristics, merits and demerits of both qualitative and quantitative approaches was done to integrate both would lead to complementarity in the merits and not the demerits.

Most of the qualitative themes were corroborated by the quantitative findings in the final analysis. However, this is not always the case in using the convergent-parallel mixed method, as findings from each part could also conflict or disagree (Creswell et al., 2008). The corresponding analysis and interpretations would have been different had this study produced conflicting results. The ultimate goal of the mixed methods approach is not about corroborative results but to develop knowledge and valid results (Creswell et al., 2008; Molina-Azorín & López-Gamero, 2016; Onwuegbuzie & Johnson, 2006; Teddlie & Yu, 2007). In consonance with this, I would not have been perturbed by conflicting results but deemed it an exercise to develop knowledge and produce valid results.

McNeill et al. (2001) have observed that studying environmental issues involves drawing on many disciplines to appreciate the problem under consideration holistically. The authors meant that a mono-disciplinary perspective in understanding and addressing environmental problems is deficient. An interdisciplinary approach is about framing a common terminology, methodology, and framework agreed upon by different disciplines in addressing a research problem (McNeill et al., 2001). Also, Peek and Guikema (2021) define interdisciplinarity as a process that blends data, methods, insights or theories from two or more disciplines to address complex questions. Despite its popularity in academic research, interdisciplinarity is criticised for its application. Put differently, interdisciplinary researchers do not often indicate what actually makes their inquiry interdisciplinarity. Due to non-clarity in elaborating an interdisciplinarity approach, long-standing academic programs have been shut down, claiming its usage is ubiquitous (Szostak, 2015). By the same token, Repko and Szostak (2020) have labelled interdisciplinarity as a heuristic, iterative and reflexive process. To make interdisciplinarity usages unambiguous, Szostak (2015) distinguishes between an intentional and extensional definition of

interdisciplinarity in academic usages. The former connotes the critical characteristics among disciplines, and the latter is about actual practices or steps involved in addressing a problem. This study relied on and used an intentional definition of interdisciplinarity reflected in theories and methods. This also means that interdisciplinarity used in this thesis is a departure from the instrumental or extensional position of McNeil et.al. (2001). An interdisciplinary study is often contrasted with multidisciplinary and transdisciplinary studies. The former approach a research problem in different disciplines separately and the latter focuses research problems across each other. In a nutshell, the goal of an interdisciplinary approach is to integrate different disciplines to address or understand complex problems.

This study adopted CSR and EMT frameworks from business and environmental fields of study. In analysing this study's findings, some were more appreciative of either business or environmental perspectives. Of particular importance are the findings of inadequate physical infrastructures, business leadership, improper coordination of regulation between the NPA and EPA, and business strategies discussed in the framework of EMT, whereas challenges concerning costs and personnel are discussed in CSR. Remarkably, this researcher also found out that qualitative and quantitative methods deepen inquiries about environmental issues (Alcamo, 2008; Arthur, 2020). This realisation led to quantifying the impacts of the challenges on practices through the regression analysis. Indeed, using a qualitative approach only could have indicated how individual businesses experience environmental challenges, albeit with smaller sampling. These challenges have been analysed and understood through the quantitative approach, and it is a fair representation of all the downstream petroleum businesses in Ghana. This is particularly significant due to the paucity of research work in Ghana's downstream sector, as earlier indicated. This researcher believes that interdisciplinarity involves using common methods and theories from different disciplines to undertake and study a complex problem (Kinnebrew et al., 2021; McNeill et al., 2001; Onwuegbuzie & Johnson, 2006). The nature of this research problem among businesses and regulators with different and complex idiosyncrasies calls for an interdisciplinary approach to understanding the environmental sustainability implementation challenges.

6.4 Recommendations of the study

This sub-section of the study's discussions contains the study's recommendations for practice, policy decisions, and further research.

6.4.1 Recommendations for practice

The findings of this study have several important implications for future practice. The downstream sector needs to make some changes for smooth environmental sustainability practices.

First off, to protect the environment from damage, downstream businesses must engage, educate, train, and remunerate human resource personnel to adopt, track, and concentrate on environmental conservation. Put differently, managers of downstream petroleum sector businesses should strengthen their environmental sustainability practices by strategically integrating environmental sustainability into the visions and operations of the businesses core activities.

Second, cleaner-burning fuels, such as biofuels and renewable energy sources like solar and wind, would be beneficial to the downstream petroleum sector businesses in strengthening their environmental sustainability practices. This will help them to reduce energy costs, making available funds for investments in environmental sustainability practices. More so, recycling of waste petroleum products produced during operations should be done wherever possible. Water management strategies such as reducing the use of fresh water and treating water to eliminate toxic products before disposal can also help the downstream petroleum sector businesses in Ghana to perform better.

Finally, continuous research and development that enables the distribution of improved environmental sustainability practices should be a goal of the downstream petroleum sector businesses in Ghana. The businesses can embark on this research and development internally and/or in partnership with academic institutions and individuals.

6.4.2 Recommendations for policy decisions

The study's findings revealed that the high cost of implementation was one of the main challenges confronting the environmental sustainability practices of the downstream petroleum

sector businesses in Ghana. To assist in this area, the government should promulgate policies that give tax incentives and credits to businesses that engage in environmentally sustainable practices. This will help reduce operation costs and ensure that downstream petroleum sector businesses in Ghana have enough investment capital for the implementation of environmental sustainability practices.

Second, the key regulators – NPA and EPA, should be well-resourced and financed for them to be able to effectively and resourcefully carry out their mandates. Nonetheless, to ensure effective monitoring and evaluation of environmental sustainability practices, the government should consider merging environmental compliance provisions in both NPA and EPA statutes. The uncertainty characterising which specific regulator ensures downstream environmental practices create a lacuna for businesses not implementing sustainable practices. As a matter of policy, the regulators should task the downstream petroleum sector businesses to forge a partnership with their key stakeholders, especially in the communities in which they operate. This will help to ensure effective and efficient environmental sustainability practices.

Third, most downstream petroleum sector companies cited a lack of regulation in some key environmental sustainability practices, such as lack of guidelines or standardization on procurement of technology and other infrastructures impeding environmental sustainability implementations. The government should introduce guidelines about procurements of infrastructures or technologies acceptable in the downstream petroleum sector industry. This will help to ensure standards in the implementation of environmental sustainability practices. This will also assist in effective monitoring and evaluation.

Finally, the downstream petroleum businesses placed human resources central to addressing environmental sustainability challenges in the sector. However, due to a lack of technical personnel internally, some companies, instead of training their staff directly, hire technical people from outside the business. This increases the business operational costs. The government or regulators can reverse this trend by training all the petroleum businesses about environmental sustainability issues.

6.4.3 Recommendation for future research

The primary purpose of this study was to explore the challenges facing the implementation of environmental sustainability practices in Ghana's downstream petroleum sector. As one of the objectives of the quantitative part of the study, the study investigated the impact the challenges confronting the environmental sustainability practices have on the environmental sustainability in the downstream petroleum sector in Ghana. Many research studies have been conducted to examine the impact of environmental sustainability practices on profitability in the petroleum industry in other countries (Epstein & Buhovac, 2014; Schneider et al., 2011; Vormedal & Ruud, 2009). A natural progression of this study is to investigate the impact of environmental sustainability challenges on the profitability and performance of the downstream petroleum sector businesses. Put differently, what are the opportunities associated with the implementation of environmental sustainability practices? I, therefore, recommend that further study be conducted to examine the impact of the challenges faced by the downstream petroleum sector on the performance and profitability of the businesses. This research will help gain more insight into the impact of the environmental sustainability challenges on Ghana's downstream petroleum sector business.

6.5 Limitations of the study

Like any other type of inquiry, this research is not without limitations. Some of the limitations of this research are presented below:

One of the limitations of this study has to do with the self-reported data. It is known that self-reported data have inherent limitations. The participants may be biased in terms of their responses to the questions. The study participants may have responded to the questions to favour their businesses. This may not give a true reflection of the situation on the ground. An improvement to this research approach would be to record the information through observation by the researcher.

Another limitation of this study is the sample size selection. The downstream petroleum sector businesses are located over the country, with their head offices and major branches located in Accra- the capital city. However, due to the Covid-19 pandemic, the sample for the study was selected from the employees located in Accra. The employees located outside Accra could have

possibly added inputs that would have given a wider insight into the issues investigated. However, I assumed that the responses given by the employees of the downstream businesses in Accra are similar to all the other branches of the company located outside Accra since the head office is where significant decisions are taken before they are communicated to the other regional branches.

A third limitation of this study is related to the measurement scales used in this study. The questionnaire and the interview guide used in this study were new and designed by the researcher. As a result, these research instruments may have been prone to error and bias. In order to overcome this limitation, the questionnaire, as well as the interview guide, was pilot tested among the industry practitioners. In addition, rigorous statistical methods and other procedures were used to examine the reliability, validity and trustworthiness of these data collection instruments.

Methodologically, combining qualitative and quantitative methodologies in a single study suggests using different praxes. One example worth mentioning is finding a suitable structure and style in this mixed-method study. Presentation styles in positivist and interpretivist traditions follow traditional formats and styles (O'Leary, 2017). However, in a mixed-methods paradigm, there is a debate about presenting a study (Lunenburg & Irby, 2008). Settling on the best-fit structure and style was troubling in the initial stages of this research but was mitigated in the final part through repeated reorganisations of the text. Sections in this thesis that are exclusively quantitative and qualitative are presented dominantly in their praxes, such as numbers and words, respectively. Put differently; this researcher was torn between presenting the findings deductively or inductively. However, when presenting a mixture of findings or contents reflecting both paradigms, I blended the presentation styles in both paradigms.

6.6 Conclusion

To gain a deeper understanding of the challenges facing implementing environmental sustainability practices in the downstream petroleum sector, I investigated the challenges facing the implementation of environmental sustainability practices in Ghana's downstream petroleum sector. Through a mixed-methods convergent-parallel design, the study identified seven main challenges confronting the implementation of environmental sustainability practices in Ghana's

downstream petroleum sector. The challenges are (a) high cost of implementation, (b) lack of technical personnel or expertise, (c) lack of proper understanding of environmental sustainability, (d) lack of leadership commitment and employee engagement, (e) inadequate infrastructure, (f) lack of proper coordination and (g) lack of uniformity and standards in some key areas.

The study's findings also revealed that qualitative data supported the results of the quantitative data analysis. In particular, the study revealed the support of the qualitative data in understanding the quantitative data better when it comes to (a) the current environmental sustainability practices of the downstream petroleum sector, (b) the goals of the environmental sustainability practices of the downstream petroleum sector, (c) the extent of achievement of environmental sustainability goals of the downstream petroleum sector, and (d) the impact of the challenges of the environmental sustainability implementation of the downstream petroleum sector. Linear regression analysis revealed that there is a positive effect on the challenges businesses face and implementation challenges.

For better comprehension of the challenges facing the implementation of the environmental sustainability practices in the downstream petroleum sector in Ghana, an interdisciplinary approach comprising Business and Environmental fields theories guided the study. These theories are ecological modernization and corporate social responsibility. Significant findings from this study corroborate the major assumptions of these theories, which guide environmental practice and policy.

It is worthy to note from the findings of this study that there is a need to continue to strengthen the environmental sustainability policies and practices put in place by the government and ensure that the downstream petroleum sector businesses strictly embrace those policies and practices. Unless these environmental sustainability practices are strictly embarked on, the downstream petroleum sector in Ghana will continue to suffer from minor or even no progress. I believe that proper accountability and continuous measurement of the challenges to provide a panacea to those challenges is key to ensuring resilience, success and longevity for present and future generations.

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Appendices

Appendix A: Questionnaire

ENVIRONMENTAL SUSTAINABILITY QUESTIONNAIRE

Purpose of Study: This study is being conducted to investigate the “challenges in implementing environmental sustainability practices in the downstream petroleum industry in Ghana”, for the purpose of a Master’s Degree. You are kindly requested to complete this questionnaire which forms part of the study.

Confidentiality of Information: The information provided for this study as a result of your completing this questionnaire will be used for *academic research purposes only. No one will disclose any information you will provide or try to sell any information to any institution or leak it to your competitor.*

Voluntary Participation: Your participation in this study is *voluntary*. By completing the questionnaire and handing it over to the researcher, you are voluntarily agreeing to participate in the study. You are free to decline answer to any particular question you do not wish to answer for any reason. Please feel free to contact the researcher using any of the contact details below should you have any questions or concerns regarding the study or the questionnaire.

Name: Osei George

Tel: +233(0)246413800/+4797363943

Email: oseiGeorge805@gmail.com

SECTION A: COMPANY CHARACTERISTICS

Kindly please provide some demographic information about your company by ticking (√) the appropriate box or writing in the space provided.

DEM1. What is the average turnover (per annum) of your company in the year 2019 in USD?
.....

DEM 2. How many employees does the company have?.....

DEM 3. What is your job title?

DEM 4. What is your specialty?.....

DEM 5. How many years has the company been in operation?.....

DEM 6. What legal form of classification of companies does your company falls in?

Sole proprietorship	
Public limited Company (PLC)	
Private limited company (Ltd)	
Partnership	
Private Unlimited company	
Other, please specify	

SECTION B: ENVIRONMENTAL SUSTAINABILITY PRACTICES

1. What is the extent of implementation of Environmental Sustainability Practices in your company?
Please tick (√) the appropriate boxes provided).

Environmental sustainability implementation	TICK
No plan for environmental sustainability practices now and in future	
Will adopt in future	
Recent and on-going implementation	
Made significant progress in implementation	

2. How strongly do you agree or disagree with the following environmental sustainability practices in your company? **Please tick (√) the appropriate boxes provided).**

Scale: [1 – Strongly disagree, 2 – Disagree, 3 – Neither agree nor disagree, 4 – Agree, 5 – Strongly agree].

Environmental Sustainability Practices	1	2	3	4	5
Environmentally friendly processes					
Considering for ways to reduce waste					
Engaged in free emission processes					
Used renewable resources in operations					
Reused scrap materials					
Reprocessed defective end products					
Use outsourcing ecological guidelines					
Engaged employee in environmental programmes					

SECTION C: ENVIRONMENTAL SUSTAINABILITY GOALS

What is the intent or goals of the Environmental Sustainability Practices of your company? **Please tick (√) the appropriate boxes provided).**

Scale: [1 – Strongly disagree, 2 – Disagree, 3 – Neither agree nor disagree, 4 – Agree, 5 – Strongly agree].

Environmental Sustainability Goals	1	2	3	4	5
To reduce cost.					
To enhance revenues/profits.					
To achieve competitive advantages.					
To conserve energy.					
To conserve resources/resources pressures.					
To reduce pollution.					
To reduce waste.					
To reduce consumer risk.					
To conform to legal/regulatory pressures.					
To meet investors' demands.					

To improve organizational performance.					
To meet the demands of marketing pressures.					
To meet the demands of environmental advocacy pressures.					
To enter into new markets.					
To increase market share.					
To Increase sales turnover.					

SECTION D: ACHIEVEMENT OF ENVIRONMENTAL SUSTAINABILITY GOALS

On a scale of 1 to 5, to what extent have these goals of environmental sustainability practices been achieved by your company? **Please tick (√) the appropriate boxes provided).**

Scale: [0 – Not at all, 1 – To a small extent, 2 – To some extent, 3 – To a moderate extent, 4 – To a great extent, 5 – To a very great extent]

Environmental Sustainability Goals	0	1	2	3	4	5
To reduce cost.						
To enhance revenues/profits.						
To achieve competitive advantages.						
To conserve energy.						
To conserve resources/resources pressures.						
To reduce pollution.						
Reduced waste.						
Reduced consumer risk.						
Conformed to legal/regulatory pressures.						
Meet investors’ demands.						
Improved organizational performance.						
Meet the demands of marketing pressures.						
Meet the demands of environmental advocacy pressures.						
Ability to enter into new markets.						
Increased market share.						
Increased sales turnover.						

SECTION E: CHALLENGES TO ENVIRONMENTAL SUSTAINABILITY

How strongly do you agree or disagree to the following challenges confronting the implementation of environmental sustainability practices in your company. **(Please tick (√) the appropriate boxes provided).**

Scale: [1 – Strongly disagree, 2 – Disagree, 3 – Neither agree nor disagree, 4 – Agree, 5 – Strongly agree].

Challenges to Environmental Sustainability	1	2	3	4	5
Problems of stakeholder pressures					
Costs of adopting sustainability and economic conditions					
Lack of consensus at the CEO level					

Lack of sustainability standards and appropriate regulations					
Misalignment of short and long terms strategic goals					
Lack of human resources					
Difficult to change current company practices					
Lack of communication and coordination					
Lack of appropriate information					
Lack of necessary infrastructures					

Appendix B: Qualitative Data Instrument



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CHALLENGES IN IMPLEMENTING ENVIRONMENTAL SUSTAINABILITY PRACTICES IN GHANA'S DOWNSTREAM PETROLEUM SECTOR

INTERVIEW GUIDE

SECTION A: GENERAL BACKGROUND

1. What is your job title?
2. How long have been working here?
3. How long have you been working in the oil sector?

SECTION B: ENVIRONMENTAL SUSTAINABILITY PRACTICES

4. How does the authority/business understand the term environmental sustainability practices?
5. What do you think are the environmental sustainability practices of the downstream petroleum sector?
6. What do you consider to be the most important environmental sustainability practices of the downstream petroleum sector?

SECTION C: ENVIRONMENTAL SUSTAINABILITY GOALS

7. From the authority's opinion, what are the main goals intended to be achieved by having specific environmental sustainability practices in the downstream petroleum sector in Ghana?
8. From the authority's/ business opinion, what do you think is the main motivation for initiating environmental sustainability practices in the downstream petroleum sector in Ghana?
9. How does the authority/business determine progress of environmental sustainability practices in the downstream petroleum sector in Ghana?
10. Which category of stakeholders supervise how the environmental sustainability practices are being implemented in the downstream petroleum sector in Ghana?

SECTION D: ENVIRONMENTAL SUSTAINABILITY CHALLENGES

11. What do you consider to be the largest challenges in terms of environmental sustainability practices in the downstream petroleum sector in Ghana?
12. What about in the downstream sector specifically – what are the largest challenges in terms of environmental sustainability?
13. What needs to be done to mitigate these challenges?
14. Who should be responsible for mitigating these challenges
15. What should be the responsibility of the authorities/ business?
16. What should be the responsibility of the businesses themselves?

SECTION E: IMPACT OF ENVIRONMENTAL SUSTAINABILITY CHALLENGES

17. To what extent do you think the environmental sustainability challenges impact on the economic aspect of the downstream petroleum sector?
18. To what extent do you think the environmental sustainability challenges impact on other important areas of the downstream petroleum sector?
19. To what extent do you think the customers of the downstream petroleum sector impacted by the environmental sustainability challenges of the downstream petroleum sector?
20. Anything else you would like to add? Anything else we should have discussed?

Thank you

Appendix C: Letter of Introduction

Uio University of Oslo
Centre for Development and the Environment

To whom it might concern

LETTER OF INTRODUCTION

George Kwabena Osei is a master student at Center of Development and Environment, University of Oslo, Norway. He is currently undertaking his data collection in Ghana, conducting interviews and surveys regarding environmental sustainability practices in the downstream petroleum sector.

The survey will be carried out between August and September 2020, with the help of two research assistants. It takes about 20-30 minutes to complete the survey, and it would be very helpful if the survey could be completed within two weeks upon receipt. The interview follows the survey in October and November 2020.

The study is carried out as part of Osei's MPhil degree at the center, and the results will be published for academic purpose as MPhil thesis. Anonymity of all respondents, businesses and institutions will be ensured throughout the process. The study aims to contribute to a better understanding of environmental sustainability challenges in downstream petroleum businesses in Ghana, as well as other sustainability issues in the sector.

I would be grateful for any assistance you can provide to George Osei in carrying out his research project. If you have further queries, you can contact him on +233246413800 or email at georgeos@student.hf.uio.no

Thank you very much for your time and support.

Yours sincerely



Ulrike Wetzel (Ph.D.)

Supervisor, postdoctoral fellow



Postal address: Postboks 1145 Blindern, 0317 Oslo
E-mail: info@sum.uio.no
Telephone: 22 85 89 00

Appendix D: Information Letter

**Are you interested in taking part in the research project
”(*Challenges in Implementing Environmental Sustainability Practices in Ghana’s
Downstream Petroleum Sector: A mixed-method study*)”?**

This is an inquiry about participation in a research project where the main purpose is to contribute to a better understanding of environmental sustainability challenges in downstream petroleum businesses in Ghana, as well as other sustainability issues in the sector. In this letter I will give you information about the purpose of the project and what your participation will involve.

Purpose of the project

The study is carried out as part of the student’s, Osei George MPhil degree at the Centre for Development and the Environment, University of Oslo and the results will be published for academic purpose as MPhil thesis. Anonymity of all respondents, businesses and institutions will be ensured throughout the process. The study aims to contribute to a better understanding of environmental sustainability challenges in downstream petroleum businesses in Ghana, as well as other sustainability issues in the sector by using mixed method design.

Who is responsible for the research project?

Centre for Development and the Environment, University of Oslo

Why are you being asked to participate?

Businesses and actors in the petroleum downstream sector of Ghana would be sampled. Specifically, businesses in the distribution and marketing of petroleum products and the regulators of the sector would be the population in the study. About 150 sample is being considered in the study. The businesses would be sampled based on randomisation and the regulators would be purposively sampled.

What does participation involve for you?

Paper-based survey and interview would be used. Informants would be asked to describe their organisations environmental sustainability practices and challenges associated with their implementation. While the survey will be paper-based the interview will be recorded electronically (sound). It will take approximately 30 to 60 minutes for either the survey or the interview in case it is applied to you (the organisation).

Participation is voluntary

Participation in the project is voluntary. If you chose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be made anonymous. There will be no negative consequences for you if you chose not to participate or later decide to withdraw.

Your personal privacy – how we will store and use your personal data

We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act). Fred Håkon Johnsen is the co-supervisor in the project who may have access to the paper-based survey data. No personal name of the respondent would be indicated in the thesis project. Indeed, no personal

view from the informant would be sought. All questions will be related to the organisations the informant represent. To help with the survey questionnaires administration, two research assistants would be recruited in this respect (see confidentiality agreement attached in addition to the consent form). Though the sample list of the regulators may be indicated, it will be anonymized in the discussion section so that a specific regulator or business would not be identified when quoting from the data. Also, I will replace businesses names with codes. I will also store the sound data on a recorder with codes and a paper-based survey in a bag secured with keys. No participant will be recognisable in the project final write up.

What will happen to your personal data at the end of the research project?

The project is scheduled to end in June, 2021. At the end of the project, sound recordings will be deleted and destroyed. Paper-based survey will also be shredded and destroyed. Data would be anonymized in the project.

Your rights

So long as you can be identified in the collected data, you have the right to:

- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data

What gives us the right to process your personal data?

We will process your personal data based on your consent. Based on an agreement with Centre for Development and the Environment, University of Oslo , NSD – The Norwegian Centre for Research Data AS has assessed that the processing of personal data in this project is in accordance with data protection legislation.

Where can I find out more?

If you have questions about the project, or want to exercise your rights, contact:

- Centre for Development and the Environment, University of Oslo via Wethal, Ulrikke Bryn

Email: ubwethal@sum.uio.no; Phone number +4722858951

- Student: Osei George Kwabena; Email: georgeos@student.hf.uio.no Phone number:0246413800
- Our Data Protection Officer: [Roger Markgraf-Bye](#)
- NSD – The Norwegian Centre for Research Data AS, by email: personverntjenester@nsd.no or by telephone: +47 55 58 21 17.

Yours sincerely,

Project Leader
(Researcher/supervisor)

Student

Appendix E: Consent Form

Consent form

I have received and understood information about the project [*Challenges in Implementing Environmental Sustainability Practices in Ghana's Downstream Petroleum Sector: A mixed method study*] and have been given the opportunity to ask questions. I give consent:

- to participate in *an interview*
 - to participate in *paper-based survey(questionnaire)*
-

(Signed by participant, date)

Appendix F: Confidentiality Agreement

CONFIDENTIALITY AGREEMENT FOR THESIS PROJECT

Thesis Project Title: *Challenges in Implementing Environmental Sustainability Practices in Ghana's Downstream Petroleum Sector: A mixed-method study*

Student Researcher: George Kwabena Osei

Signature.....

Before I can engage you as a research assistant in the administration and collection of survey questionnaires, I must seek your consent not to reveal the content of the survey nor disclose the identities of the research informants (downstream businesses). If you are in agreement with these conditions, please write your name and sign below:

Name

Signature.....