A Study of Sustainability in the Oil and Gas Supply Chain

by

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Declaration

I declare that while registered as a candidate for the research degree, I have not been a registered candidate or enrolled student for another award of the University or other academic or professional institution.

I declare that no material contained in the thesis has been used in any other submission for academic award and is solely my own work.

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Abstract

There is a general consensus that human activity has significant impact on global climate change with significant consequences to the environment. Although there has been relatively limited research on the relationship between corporate environmental performance and corporate financial performance, empirical of the relationship between proactive corporate climate change strategies and economic performance is still in need of clear delineation. It is in light of this hat this research examines the impacts of sustainability adoption on competitive performance of oil and gas companies. The research explores the explores the notion of market driven sustainability by establishing an empirical link between sustainable supply chains characteristics and organisational competitiveness. The overall aim is to develop an empirical model of sustainable supply chain characteristics that improves resource utilisation, profit maximization and competitiveness in the oil and gas industry. The research reviews existing literature on supply chain management, sustainability and competitive objectives in order to generate an appropriate and adequate context for relevant analytical investigations. Primary data on sustainability and its impacts on organisational performance were collected from UK and gas industry through survey by questionnaire. The results show that the most significant drivers of sustainability are the desire to conserve energy, increase market share and improve competiveness. However, legal and regulatory pressure, in contrast to common perspectives in the literature, was not seen as strong drivers of sustainability. The most significant inhibitors of sustainability are inappropriate infrastructural facilities, higher take-up costs, shortage of information on sustainability and employees lack of environmental awareness. The results further indicate that, though sustainability strategies implemented by the respondent firms varied in scopes, these strategies were being extensively and successfully implemented. Generally, the adoption of sustainability in oil and gas supply chain leads to improved economic performance and environmental performance, which, in turn, positively impact organisational competitiveness. These results are of particular importance to managers, government policy makers' environmentalists and researchers.

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ABBREVIATIONS

A

AS: Absorbed Sustainability

AIDS: Acquired Immune Deficiency Syndrome

AMT: Advanced Manufacturing Technology

ANOVA: Analysis of Variance

B

BC/BCE: Before Common Era

BAE: British Aerospace

BP: British Petroleum

C

CAPEX: Capital Expenditure

CBA: Cost Benefit Analysis

CC: Carbon Credit

CDS: Commission on Sustainable Development

CERES: Coalition for Environmentally Responsible Economics

CEO: Chief Executive Officers

CSR: Corporate Social Responsibility

CSRI: Corporate Social Responsibility Indicators

CSCS: Carbon Sequestration on Continental Shelf

CWRT: Centre for Waste Reduction Technologies

CES: Centre for Environmental Strategy

CSPI: Composition Sustainability Performance Index

CEQ: Council on Environmental Quality

D

DC: Distribution Centre

DCs: Developed Countries

DDSNI: Demand Driven Supply Network Ideal

DTI: Department of Trade and Industry

DC: Distribution Centre

DOS: Director of Studies

DJSI: Dows John Sustainability Index

F

EDP: Environmental Adjusted Net Domestic Product

ESI: Economic Sentiment Indicator of the European Commission

EFP: Ecological Footprint

ECOSOC: UN Committee on Economic and Social Affairs

EFRA: Environment, Food Management

EPI: Environmental Performance Indicators

EFP: Environmentally Friendly Practices

ESI: Environmental Sustainability Index

EPI: Environment Performance Index

EWI: Ecosystem Wee-Being Index

F

FAO: Food and Agriculture Organization

FAME: Financial Analysis Made Easy

G

GHGE: Greenhouse Gas Emission

GHG: Greenhouse Gas

GSCM: Green Supply Chain Management

GNNP: Green Net National Product

GRI: Global Reporting Initiative

GDP: Gross Domestic Product

GNP: Gross National Product

H

HDI: Human Development Index

HWI: Human Well-Being Index

I

ICHEME: Institution of Chemical Engineers

IISC: Indian Institute of Science

IEA: International Energy Agency

IIASA: International Institute for Applied System Analysis

JUCN: International Union for the Conservation of Nature

IISD: International Institute of Sustainable Development

ISO: International Organisation for Standardisation

IUCN: International Union for the Conservation of Nature

ISEW: Index of Sustainable and Economic Welfare

J

JIT: Just-In-Time Production

K

KPMG: Klynveld Peat Marwick Goerdeler

KPI: Key Performance Idicators

K-S: Kolmogrov-Smirnov

L

LDGs: Less Developed Countries

LBS: Lancashire Business School

LCI: Life Cycle Index

LTDs: Limited Liability Companies

B

MBV: Market-Based View

MD: Managing Director

MMR: Mixed Methods Research

U

NRBV: Natural Resources Based View

NGO: Non-Governmental Agencies

NNI: Net National Income

NPV: Net Present Value

NEF: New Economics Foundation

O

OOA: Offshore Operations Association

OECD: Organisation for Economic Cooperation and Development

OPEX: Operating Expense/Expenditure; Operational Expense/Expenditure

OPI: Operational Performance Index

P

PSI: Pound per Square Inch

PLCs: Public Limited Liability Companies

R

ROI: Return on Investments

RBV: Resource Based View

S

SA: Social Accountability

SAM: Sustainability Assessment Model

SC: Supply Chain

SCM: Supply Chain Management

SPSS: Statistical Package for the Social Sciences

SS: Strong Sustainability

SCO: Supply Chain Orientation

SSCM: Sustainable Supply Chain Management

SEEA: System of Environmental-Economic Accounting

SMEs: Small and Medium Enterprises

SEM: Structure Equation Model

SPI: Sustainability Performance Index

LPI: Living Planet Index

T

TFP: Total Factor Productive

TBL:	Triple Bottom Line
TBLI:	Triple Bottom Line Index
TDM:	Total Design Method
TER:	Total Energy Required

<u>U</u>

CLAN:	University of Central Lancashire
UK:	United Kingdom
UKCS:	Carbon Sequestration on Continental Shelf
UN:	United Nations
USA:	United States of American
USCEQ:	United State Council on Environmental Quality
UNGA:	United Nations General Assembly
USGS:	United States Geological Survey
UNSC:	United Nations Scientific Conference
UNCED:	United Nation Conference on Environment and Development
UNCOSOCA:	United Nation Committee on Economic and Social Affairs
UNCSD:	United Nation Commission on Sustainable Development
UNFCCC:	United Nation Framework Convention on Climate Change
UNESCO:	United Nation Economic and Social Council
UKOOA:	United Kingdom Offshore Operations Association
UNEP:	United Nations Environmental Programmes
UNIDO:	United Nations Industrial Development Organization
UNIEF:	United Nation International Environment Forum

UNCHE: United Nation Conference on the Human and Environment

W

WI: Well-Being Index

WBCSD: World Business Council on Sustainable Development

WCED: World Commission on Environment and Development

WCS: World Conservation Strategy

WCU: World Conservation Union

WHO: World Health Organization

WS: Weak Sustainability

WBI: Well-Being Assessment

WRI: World Resources Institute

WER: World Economic Report

WWF. World Wild Fund for Nature

3ES: Economics, Environmental and Equity

3Ps: Profits, Planet and People

3PL or TPL: Third Logistics Provider.

CHAPTER 1: INTRODUCTION

1.1: Introduction

The origin of production dated back to the period of the early man with extensive form of human activities that involved continuous movement of people and animals in search for food and animal feeds, taking along with them all their belongings. People of this time lived in a small household as the population was small. The increase in awareness led to the creation of permanent settlements and new production systems. The production system involved each family producing what they could eat throughout the year. The farming implement were simple and primitive. As people settled in one place, there was increase in family and marriages, which eventually led to increase in population. Population growth made it difficult for many families to produce what their family needed throughout the year. In order to manage these deficiencies in production they started exchanging goods for goods (trade by barter). The problems of barter transactions were the uneasiness of the coincidence of wants and absence of standard measure in which both seller and buyer could exchange commodities according to their relative value.

The problems of barter trade encouraged some parts of the world to create their medium of exchange. As an example, in Rome, between 850 and 800 BCE, fines were paid in cattle, bull and sheep. Cattle remained a medium of exchange between 9000 and 6000 BCE onwards. At about 1200 B.C. ancient China, Africa and India used cowry shells, salt and skin as media of exchange. Trade in Japan's feudal system was based on the koku (a unit of rice). The shekel was an ancient monetary unit used in Mesopotamia around 3000 BC to define both a specific weight of barley and equivalent amounts of materials such as silver, bronze and copper.

Increased awareness and introduction of monetary system led to the development of individual business firms. Firms produce a whole set of products and sell directly to consumers. Firm production system made producers specialise in one production system, product or services. Specialisation in production improved the quality and efficiency of the products and services. Production became cheaper per product and because of this production levels increased. The ultimate success of individual businesses will depend upon management's ability to integrate the company's complex network of business relationships. Increase in competition made it apparent that individual businesses no longer compete as solely autonomous entities, but rather as supply chains (Lambert and Cooper, 2000).

Supply chain is a network of organisations responsible for production and distribution of products from conception to final customer. Many processes are involved in the production of products or services. These processes are managed in order to achieve optimal balance of business requirements, specifically profitability and a consideration of the wider impacts they may have on the environment. In supply chains each firm produces part of the total product. As the coordination of operations changes from the internal management of individual firms to the entire supply chains, the management of multiple relationships across the chain is referred to as supply chain management (SCM).

The industrial revolution occurred in the 18th century and served as a major shift in production process particularly in the western world. It marked a major turning point in history, as almost every aspect of daily life was affected in some ways, with substantial changes in the production processes. These changes led to the evolution of the methods of production by machines fuelled by wood, coal and petroleum.

Coupled with industrial revolution was sudden population growth, as in 1825 world population stood at one billion, whilst in 1927 it reached two billion and in 1960 it was put at three billion people. Population growth led to massive increase in production of goods and services by the industrialised world. Increased production shifted concern in the supply chain from supply of raw materials to consumption of goods and services. The impact of such a massive production of goods using sophisticated machinery was depletion of resources, air pollution and land degradation. There is also greenhouse gas emission, creating climate change, global warming and ozone layer depletion that endanger the existence of the present and future generations. Other by results of excessive production and consumption are economic and social costs to communities in loss property, diseases and social disequilibrium. There is no question that excessive use of chemicals, pesticides and fertilizers are destructive to soil, water and air. Clearly, soil is eroding much faster than it can be replenished whilst deforestation and biodiversity destruction have been well documented. These problems make industrial system of production unsustainable.

Today there are strong agitations from academics, pressure groups and the general public condemning the industrial method of production in favour of a sustainable production system. Acknowledging these agitations, United Nations (UN) general assembly established World Commission on Environment and Development (WCED), popularly known as Brundtland Commission in 1983. In 1987 the commission produced its report titled '*our common* *future'* where sustainability was recommended as the alternative to unsustainable industrialisation. Since the introduction of the idea of sustainability, there has been intensive debates among academicians and practitioners on how best organisations can integrate sustainability into their supply chains and what to expect from such integration. This thesis contends that integrating sustainability into oil and gas supply chain will improve their operational performance, which will in turn improve their environmental performance and profitability. The research reported in this thesis provided the empirical bases for the link between sustainability and performance in the oil and gas supply chain.

1.2: Background to the Study

The need for the study arises from pressures facing manufacturing companies to change their mode of production to one that is less harmful to the environment. These pressures necessitate corresponding changes in the method of producing goods and services. Over the years there has been evolution in the mode of production from traditional mass production to lean production and agile supply chain and to the present day sustainable production. The concept of supply chain management is receiving increased attention as a means of becoming and remaining competitive in a globally challenging environment. Studies have shown that businesses no longer compete as solely autonomous entities, but rather as supply chains. Instead of brand versus brand or store versus store, it is now suppliers-brand-store versus suppliers-brand-store or supply chain (Copper and Lambert, 2000). Croxton et al (2001) provide a framework for managers to use in executing supply chain management and provide researchers with a set of opportunities for further research in the field. Other researchers concentrated on how to make supply chain sustainably efficient and competitive. For example, Barratt and Oke (2007) explore antecedents of high levels supply chain visibility from resource based perspectives across different external supply chain linkages. They identified factors that can lead to a sustainable competitive advantage of a supply chain. Yusuf et al (2014a) examines supply chain ethical practices and demonstrates an empirical relationship between ethical practices and organisational performance. Gimenez et al (2012) study effectiveness of supply chain integration in different contexts and suggest that supply chain integration is only effective in buyer supplier relationships characterised by high supply complexity. Fawcett et al (2012) discuss supply chain collaboration successes and failures and provide guidelines for using collaboration to achieve improved performance of supply chain. Yusuf et al (2004) demonstrate how organisational competitiveness can be attained through agile supply chain. Garbie (2011) shows how to measure agility level of petroleum companies based on existing technologies, level of qualifying human resources, production strategies and organization management systems. Yusuf et al (2014b) assess the link between dimensions of agile supply chain, competitive objectives and business performance within companies located in the UK North Sea upstream oil and gas industry. They identified most important attributes of agile supply chain and provide deeper insight into those characteristics that are most relevant to attaining competitiveness in the oil and gas industry. Falasca et al (2008) demonstrates how to incorporate concepts of resilience into supply chain design processes. Zhao et al (2011) study resilience of supply networks against disruptions and provide insights to supply chain managers on how to construct resilient supply network from perspective of complex network topologies. Whilst Christopher and Holweg (2011) question the fundamental premise upon which current supply chain models are built and propose an alternative approach to build structural flexibility into supply chain decision making, which would create the level of adaptability needed to remain competitive in times of turbulence. Following Christopher and Holweg (2011), environmental and social implications of supply chains operations are some of the more serious global problems today. It is on this base that this research investigated sustainability in the oil and gas supply chain.

Sustainability has three components of economics, environmental and social equity. Environmental component seemed to have received the greatest attention from the literature on sustainability. This may be related to the fact that environment is worst affected by human economic activity whilst it is where the present and future generations live. It has become increasingly evident that environment plays a role in the wider agenda for sustainable development and social inclusion. The main causes of environmental destruction is the affluence and growing expectations for personal comfort and convenience in developed countries that led to consumption patterns that are unsustainable whilst citizens in less developed countries are often victims of this exploitation (Sibbel, 2007). These situations led to a number of environmental problems, such as depletion of resources, destruction of biodiversity, depletion of ozone layer, global warming, climatic change, pollution and a number of social problems (diseases, climatic disaster etc.). In order to reduce the effects of these problems to the environment, sustainability was introduced. Sustainable production processes efficiently manage resources and do not cause destruction to the environment.

Therefore, sustainability needs to be integrated into supply chains of organisations as supply chains operations involve emission of greenhouse gases.

Achieving sustainability requires changes in industrial operation processes, in the type and quantity of resources used, in the treatment of waste, in the control of emissions and in the products produced (Krajnc and Glavič, 2003). These indicate that paths leading to environmental sustainability in each industry may differ but the goal remains constant (Goodland, 1995). Companies adopt a number of sustainability strategies in order to improve economic, environmental and social performance. These strategies are expensive to adopt but have profitable returns on investment (Stead and Stead, 1995). Although production activities and associated supply chain operations are necessary for inherent business benefits, there are indications that they are not sustainable at the current level of activities. Therefore, the major challenge today is ensuring supply chain sustainability. As a result of the current economic down turn causing organisations to cut back on costs and lured into relegating investment in sustainable practices to the background, there is an even greater challenge in demonstrating market justification for sustainability. Several studies have explored potential benefits and roles of sustainability in improving organisational competitiveness' (Linton et al, 2007; Sarkis, 2007; Newell, 2009) in limited scenarios and without consideration to the oil and gas industry, given that this is an industry that is strongly linked to the global energy and environment concerns. This research examines the level of sustainability implementation in the oil and gas supply chain and establishes link between sustainable supply chain characteristics and organisational competitiveness.

1.3: Aim of the Research

The aim of this research is to investigate the impacts of sustainability implementation on corporate competitiveness of oil and gas supply chain. The research is different from previous studies in that it explores the notion of market driven sustainability by establishing empirical links between sustainable supply chains characteristics and organisational competitiveness. The majority of previous studies focussed on environmental sustainability and emissions reduction of greenhouse gases. The focus of this research is justification of market driven sustainability in the oil and gas supply chain.

1.4: Objectives of the Study

In order to achieve the overall aim of the research, the aims are broken into a set of specific target objectives. The objectives of the research are:

1) To identify the most important drivers and inhibitors of sustainability in the UK oil and gas industry.

2) To evaluate the level of sustainability implementation in the UK oil and gas supply chains.

3) To assess the types of sustainability strategies implemented in the UK oil and gas industry.

4) To examine the impacts of sustainability on the competitiveness of organisations across the UK oil and gas supply chain.

5) To develop a conceptual framework of sustainability implementation on organisations supply chains with link to competitive advantages.

1.5: Research Questions

In view of the preceding discussion, aim and objectives, the following are the research questions:

1. What are the most important drivers and inhibitors of sustainability in the oil and gas industry?

2. What is the level of sustainability practices in the oil and gas industry?

3. What types of sustainability strategies have been implemented in the oil and gas industry?

4. What are the revenue and investments implications of sustainability strategies of the oil and gas companies?

5. What is the overall impact of sustainability implementation on the competitiveness of the oil and gas companies?

1.6: Research Methodology

This research adopted quantitative research method. Data was collected via survey by questionnaire from oil and gas companies in the UK. The questionnaire was pilot tested and the results of the pilot study were used to review the questionnaire. The reviewed questionnaire was then used to undertake a general survey of organisations drawn from the oil and gas supply chain. The questionnaire was administered through postage as they were mailed directly to sampled organisations. This research adopted mail questionnaire because it is easy and efficient to administer. Mail questionnaire also has the advantage of reaching very busy executives as well as large number of respondents over short period of time. The Chief

Executive Officers (CEOs) of oil and gas companies were the target respondents of this research; because CEOs are individuals who have widest knowledge and experience within the firm toanswer all aspects of the survey. More so, sustainability implementation is considered as a managerial responsibility that only CEOs are best placed to give account of its implementation in their companies. The data collected was analysed using the software, Statistical Package for Social Science (SPSS).

1.7: Structure of the Thesis.

This thesis consists of six chapters structured as follows: Chapter 1 is the introduction. It states the background of the research, aim, objectives and research questions. Chapter 2 reviews the development of supply chain management from operational and strategic perspectives. Also in Chapter 2, an account was given of sustainability as a dominant operations strategy for survival of business organisations in an increasingly environmentally conscious marketplace. Chapter 3 provides some sustainability initiatives developed by UK government in partnership with UK Offshore Operations Association (UKOOA's). Chapter 4 discusses different research methods, methodology adopted in this research and concluded with justification of the methodology adopted. The Chapter 4 also presents and justify conceptual framework of this research. Chapter 5 reports the survey by questionnaire where the data collected was analysed using SPSS. Both descriptive and inferential statistics (correlation, t-test and regression analysis) were presented in this chapter. The aim was to show relationship between research variables as well as cause and effect among the variables of the study. Chapter6 reviews the research questions in light of the results presented in Chapter 5. The contribution to knowledge and limitations of the research were also discussed and the chapter ended with direction for further studies and a summary.

1.8: Summary

The history behind the development of production systems have been presented in this chapter. After giving the background of the research, attempt was made to justify the need for it. The aim of the research was then stated followed by its objectives and research questions. The methodology adopted in was summarised and justified. The next chapter reviews the literature on supply chain, sustainability, sustainable supply chain and competitive priorities.

CHAPTER 2: LITERATURE REVIEW

2.1: Introduction

This chapter reviews relevant literature on supply chain management (SCM), sustainable supply chain management (SSCM) and competitive priorities. Further, Section 2.2 reviews definitions of supply chain management (SCM). In addition, Section 2.3 examines definitions of sustainability. Section 2.4 discusses development of sustainability. This is followed by sustainability campaigns in section 2.5. Triple bottom line of sustainability was treated in Section 2.6 of this thesis. Similarly, Section 2.7 reviews relevant literature on drivers of sustainability. Furthermore, Section 2.8 addresses inhibitors of sustainability. Sustainability investment is presented in Section 2.9. In addition, sustainability strategy is reviewed in section 2.10. Sustainability performance assessment is discussed in Section 2.11. Sustainability indices are on section 2.12. An overview of sustainability indices is addressed by Section 2.13. Consequently, sustainable supply chain management is reviewed in Section 2.14. Section 2.16 addresses competitive objectives of sustainability. Finally, section 2.17 concludes the chapter.

2.2: Definitions of Supply Chain Management (SMC)

Some authors describe SCM as operational term involving the flow of materials and products. Others see it as management philosophy, yet to some others it is interpreted as management process (Mentzer et al, 2001a). These conceptions of individuals' shape their definitions on SCM. The following are some of the definitions of supply chain management.

SCM is an integrative idea that controls the flow of distribution channel from supplier to ultimate user (Cooper and Ellram, 1993).

SCM is a management of networks of interconnected organisations involved in the provision of products and services to end customers (Harland, 1996).

SCM is a method of managing relationships, information and materials flow across company border to deliver enhanced customer service and economic value through synchronized management of the movement of physical goods and associated information from sourcing to consumption (La Londe, 1997).

According to Tyndall et al (1998) SCM is a total flow of materials, from procurement of raw materials to delivery of finished products to customers, as well as related counter flows of information that both control and record material movement.

SCM is systematic and strategic coordination of the traditional business functions within a particular company and across businesses within supply chain, for the purposes of improving long term performance of individual companies and supply chain as a whole (Mentzer et al, 2001b).

SCM can be defined as the configuration, coordination and continuous improvement of a sequentially organized set of operations (Chima, 2007).

SCM is management of interconnection of organisations that relate to each other through upstream and downstream linkages between processes that create value to ultimate consumer in form of products and services (Slack et al, 2007).

SCM is 'a business philosophy that strives to integrate subsidiary activities, actors and resources between different levels of points, from origin to consumption in channels' (Svensson, 2007, pp. 263).

Stadtler (2008) defined SCM as task of integrating organisational units along supply chain and coordinating material, information and financial flows in order to meet customer demands with aim of improving competitiveness of supply chain as a whole.

SCM is a combination of internal practices, those that are within the organization and external practices, those that are across organisational boundaries, integrating an organization with its customers and suppliers (Kaynak and Hartley, 2008).

SCM is an integration activity with primary responsibility of linking key business functions and business processes within and across companies into a cohesive and high-performing business model (Council of Supply Chain Management professional (CSMP), 2001 cited in Stadtler, 2008).

SCM is managing upstream and downstream value added flows of materials, final goods and related information among suppliers, company, resellers and final customers (Kotler and Armstrong, 2008).

SCM is a set of activities for managing and coordinating the transformational activities from raw material suppliers to ultimate consumers (Heikkila, 2002 cited in Kotzab et al, 2011).

SCM is a process of integration of supply chain activities and information flows associated with it, by improving and coordinating supply chain activities in manufacturing and product supply (Biniazi et al, 2011).

SCM is the 'degree to which a firm strategically collaborates with its supply chain partners and collaboratively manage intra and inter organization processes in order to achieve effective and efficient flows of products and services, information, money and decisions to provide maximum value to the customer' (Flynn et al, 2010. P. 58).

Definitions show that SCM structure requires different material functions for coordinating the entire materials process, as well as requiring collaborative relationships with suppliers across multiple tiers (Monczka et al, 1998). Looking at the above definitions, it can be observed that SCM is a managerial responsibility of co-coordinating and integrating all the tasks of the supply chain members in order to achieve the purpose of producing products/services. It is only through this that customers will be satisfied; leading to profitability and competitiveness of the entire supply chain. This thesis takes further the issues of profitability and competitiveness of supply chain in a sustainable environment within the context of the oil and gas industry.

2.2.1: Development of Supply Chain Management

In the beginning of industrial age, production was simply manufacturing that occurred within a single firm. Companies would take raw material and manufacture a product entirely within a single firm (Harland, 1995; Fandel and Stammen, 2004; Hines, 2006; Kotzab et al, 2012). Craft production was the standard, as each individual craftsman created one product from the beginning to the end (Zacharia, 2001a). Increased marketing and environmental pressures forces organisations to form supply chains networks in order to satisfy increased customer demand (Zacharia, 2001a; Fandel and Stammen, 2004; Vonderenbse et al, 2006). From the

1970s to the 1980s materials flow from source of supply to customers was called pipeline (Hunter et al, 1993; Lambert and Cooper, 2000) whilst in the 1990s supply networks became a more preferred phrase (Christopher, 1996).

Business environment in the 1990s became increasingly dynamic in terms of increasing technological complexity, demanding markets, explosion of knowledge and increasing global competition (Peter, 1996). Increased global competition inspired the development of supply chain (Zacharia, 2001). One significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather as supply chains (Bhattacharya et al, 1995; Christopher, 1996; Lambert and Cooper, 2000; Schary and Skjøtt-Larsen, 2001; Zacharia, 2001a; Spekman et al, 2002; Hines, 2006; Vonderenbse, 2006; Stadtler, 2008). The shift in competition from among individual business organisations to amongst supply chains makes supply chain management imperative in modern production and operations management (Vonderenbse, 2006; Stadtler, 2008; Ellinger et al, 2012). The success of an organization depends on how well its entire supply chain competes with competitors' networks (Schary and Skjøtt-Larsen, 2001; Kotler and Armstrong, 2008; Attaran and Attaran, 2009). SCM is now a key component of business organizations' strategies (Ellinger, et al, 2006). Improving supply chain effectiveness is vital to individual firm and entire supply chain profitability (Cooper and Ellram, 1993; Dyer, 2000; Slack et al, 2007; Stadtler, 2008). Therefore, developing a supply chain production system and utilizing a supply chain orientation lead to greater opportunities for lower costs, improved customer value and differential advantage in the future (Zacharia, 2001).

SCM was originally espoused by Oliver and Webber in 1982 as a range of activities coordinated by organization in obtaining and managing supplies (Harland, 1996; Lambert and Cooper, 2000; Hines, 2006; Halldorsson et al, 2007; Svensson, 2007; Stadtler, 2008; Kotzab et al 2011). SCM first appeared in logistics literature in around 1982 as inventory management process (Bowersox et al, 1985; Cooper and Ellram, 1993; Christopher, 1994; Mentzer et al, 2001; Min, 2001a; Hines, 2006).

The evolution of SCM can be viewed in two parts. The first starting from 1800s and proceeding to today, covering craft production, mass production, lean production, just-in-time (JIT) production, tiered production, dispersed production and build-to-order production. The second are intra company production, intercompany production and eventually supply chain production (Zacharia, 2001a).

In the early part of the 20th century, the focus was on quality whilst the production method was craft production. In the 1930s and 1940s, cost was the overriding factor; mass production was the dominant production paradigm. In the 1980s, quality combined with low cost was the critical factor; lean production emphasizing supplier partnerships was the dominant production paradigm. The fundamental change between mass production and lean production is the increase in flexibility in workers and machines. In the 1990s and beyond, the critical factor was flexibility and the dominant production paradigm was SCM (Zacharia, 2001a). These show that practical field of SCM is constantly changing, as the competitiveness of global companies increasingly depend on their capability to produce and deliver customized products and services fast and efficient all over the world. At the same time, an increasing percentage of value creation takes place outside boundaries of individual firm (Bruce et al, 2004; Halldorsson et al, 2007; Kotzab et al, 2011). Supply chain production systems have a significant role to play in many companies because selection of appropriate production system can directly affect strategic capability of firms (Zacharia, 2001).

2.2.2: Objectives of Supply Chain Management (SMC)

One of the primary objectives of SCM is integration and management of the sources and control of the flow of materials (Monczka et al, 1998; Mckone-Sweet and lee, 2009) using complete system approach across various functions and multiple tiers of suppliers (Mentzer et al, 2001a; Mckone-sweet and Lee, 2009). As supply chain links company to its suppliers upstream and to its distributors downstream in order to serve customers (Chima, 2007).

Another objective of SCM is creation of value to satisfy customers demand (Porte, 1985; Langley and Holcomb, 1992; Giunipero and Brand, 1996; Tyndall et al, 1998; Fawcett et al, 2008; Mentzer et al, 2001a). Provision of maximum customer service at lowestcosts can improve customers' satisfaction (Chima, 2007). Product value is consumers' assessment on how well their needs were satisfied by particular goods or services (Goodstein and Butz, 1998 cited in Mentzer et al, 2001b) whilst customer satisfaction is a measure that shows how successful an organisation provides products or services to the market place for customers' acceptance (Anderson et al, 1997; Olsen and Johnson, 2003). Value dictates customers' desires (Porter, 1985). Organisations are expected to satisfy customers by providing what customers want at the time they want it (Fawcett et al, 2008). Understanding the entire process of supply chain is essential in identifying and delivering value (Slater and Narver, 1994; Mentzer et al, 2001a): Customer satisfaction increases market share and profitability (Ellinger et al, 2012; Daugherty et al, 2008); return on investment and productivity (Anderson et al, 1997); market value added (Ittner and Lacker, 1996); shareholder value (Anderson et al, 1997); stock market performance (Fornell et al, 2006 cited in Ellinger et-al, 2012) and customer loyalty (Oliver et-al, 1992; Ellinger et al, 2012). On the other hand, SCM minimizes total cost needed to provide required stocks at reduced order cycle time (Cooper and Ellram, 1993; Leonard and Cronan, 2002 in Fawcett et al, 2008). This will in turn create competitive advantage (Bowersox and Closs, 1996; Cooper and Ellram, 1993) and reduce inventory at improved delivery services (Fawcett et al, 2008).

2.2.3: Supply Chain ManagementProcesses

SCM processes involve activities and methods that are used in coordinating the flows of materials, information and finance from supplier to final customers. These activities include SCM orientation, integration, partnerships, leadershipand SCM competency.

Organisations implementing SCM should have supply chain orientation (SCO) (Mentzer et al, 2001b). Supply chain orientation (SCO) is 'the recognition by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain' (Mentzer et al, 2001b, p. 11). SCO is the idea of viewing the coordination of the supply chain from an overall system perspective, with each of the tactical activities of distribution flows viewed within a broader strategic context. SCO is an organizational mind-set required by an organization to leverage SCM competency into superior performance (Mentzer et al, 2001b; Min, 2010). Thus, an organization has SCO if its management (in its entirety, not just one or two individuals) can see the implications of managing the upstream and downstream flows of products, services, finances and information across their supplier and their customers (Zacharia, 2001a).

SCO occurs when the focal firm starts to consider it supplier's supplier and its customers' simultaneously (Zacharia, 2001a). It requires organisations to control SCM competency into better performance (Min, 2001). SCO depends on reliable information without which, right decisions cannot be taken (Slack et al 2007). SCO implementation requires SCO across several companies directly connected in the supply chain.

SCO and SCM are inextricably linked. SCO is the “management philosophy” that recognizes SCM within the firm, while SCM is the ‘sum total of all the overt management actions undertaken to realize that philosophy’ (Mentzer et al., 2001b, p. 11). In other words, SCM is the implementation of SCO across supplier and customers. Research shows that supply chain oriented firms successfully align their marketing and supply chain strategies more than those that are not (Defee et al, 2009; Ellinger et al, 2012). It better implement flow coordination mechanisms with supply chain partners (Fugate et al., 2006) and improve the effectiveness of supply chain processes (Trent, 2004; Mollenkopf et al, 2007).

Prior to implementing SCM in an organization, internal (supply chain readiness) and external (joint) conditions for adopting SCM have to be satisfied. Internal conditions are requirements for adopting SCM within the organization. They are commitments that involve human resources, financial resources, top management support, internal vision and goals, staff’s technical experts, central IT systems, guidelines for information exchange, education, project setup groups, processes and integration (Cooper et al, 1997; Stuart, 1997; Lambert et al, 1998; Mentzer et al, 2001b; Causins and Lawson, 2007). The External (joint) SCM conditions are requirements for adopting SCM processes between organisations within the supply chain. They includes shared production structures, joint project groups, systems perspective, trust, long term oriented relationships, power, shared profits and risks, mutual dependency, shared information on inventory status, forecasts, product development, organisational culture and corresponding control methods (Lambert et al, 1998; Mentzer et al, 2001b; Harland et al, 2004). Kotzab et al (2011) empirically indicated that SCM requirements either internally or externally (jointly) play no significant role in changing the position of SCM implementation. Joint SCM conditions’ comprising both transactional and relationships related characteristics for supply chain partnerships are key requirement for adopting SCM related processes. Kotzab et al (2011) developed hierarchy of activities toward adopting SCM:

1. Develop organization’s internal SCM conditions

2. Work with external partners on developing joint SCM conditions both downstream (customers) and upstream (suppliers)

3. Adopting SCM related processes thereby executing SCM.

Effective Integration is the basic requirement of SCM practices. Similarly, integration and coordination are used interchangeably (Hodges et al, 1997; Min, 2001b). Integration made supply chain operates as corporate entity, spans into a virtual enterprise without reference to traditional company boundaries and can be driven directly by customer demand (Cottrill, 1997). SCM involves integrating processes from raw materials sourcing to manufacturing and to distribution across entire supply chain (Cooper et al, 1997; Fandel and Stammen, 2004; Biniazi et al, 2011; Kotzab et al, 2011).This facilitates knowledge sharing that connects sourcing and manufacturing operations with market requirements to better match supply with demand (Ellinger et al, 2012). Integration is 'attempting to elevate the linkages within each component of the chain, to facilitate better decision making and to get all pieces of chain interact in a more efficient way (and thus) . . . create supply chain visibility (and) identify bottlenecks' (Putzger, 1998 cited in Power, 2005, p. 253). Integration encompasses coordination of both internal and external suppliers toward pursuing common goals (La Londe and Masters, 1994; Dobler and Burt, 1996;Hodges et al, 1997; Mentzer et al, 2001b). It coordinates all functions of distinct operations in order to achieve overall goal of the supply chain (Schary and Skjøtt-Larsen, 2001; Stadtler, 2008; Mckone-Sweet and Lee, 2009; Biniazi et al, 2011; Kotzab et al, 2012). As such integration manages entire supply chain as a single entity (Ellram and Cooper, 1990; Haulihan, 1998; Power, 2005); where every member organization is an integral partner (Haulihan, 1998; Mckone-Sweet and Lee, 2009); such that actions of one firm directly affects overall channel performance (Cooper et al, 1997; Mckone-Sweet and Lee, 2009); through a suitable information sharing system (Power, 2005). These indicate that integration is an operational perspective that allows organization to standardize operational procedures among different parts of organization and between organisations as a whole (Hines, 2006).

There are many types and classification of integration. A well-known distinction is between internal and external integration (Gimenez et al, 2010). Another distinction is between upstream and downstream integration – integration with suppliers or buyers – (Flynn et al., 2010). Cooper and Ellram (1993) and Dobler and Burt (1996) classified integration into three ways: across functional boundaries (production, inventory holding and transport), organisational boundaries (manufacturers, carries, distributors and customers) and geographic boundaries (global supply and markets). Kotzab et al (2012) classified integration in both forward and backward directions. Flynn et al, (2010, p. 59) argues that supply chain integration is a multi-dimensional concept and 'the diverse dimensions of supply chain integration can ultimately be collapsed into three dimensions: customer, supplier and internal'.

Integration involves dispute resolution as different organisational interests may have conflict over resources, status and other factors (Lysons and Farrington, 2006). Organisational conflict can be reduced through effective information sharing and collaborative integration between internal and external supply chain members (Tracey et al, 2005; Biniazi et al, 2011; Ellinger et al, 2012). Moreover, collaborative integration between internal and external supply chain participants focuses on better aligning supply chain participants' incentives and reward systems (Fawcett et al., 2008), so as to reduce duplication and non-value creating activities (Ellinger et al, 2012).

Integration makes supply chain effective through keeping low inventory in the downstream of the network (Cooper and Ellram, 1993; Slack et al, 2007; Stadtler, 2008), increase customer services and building competitive advantage for the network (Cooper and Ellram, 1993). Integration in supply chains is implemented through partnerships, network organization/inter-organisational collaboration and leadership.

The general consensus in most SCM literature is that the more integration – the higher the performance of the supply chain; whether the integration is with customers or with suppliers (Huber and Sweeney, 2007; Gimenez et al, 2010). The basis of integration can be characterised by cooperation, collaboration, information sharing, trust, shared technology, partnership and fundamental shift from managing individual functional processes, to managing integrated chains of processes (Akkermans et al, 1999 cited in Power, 2005). 'Integration improves firm profit and competitiveness . . . Since supply chain represents 60% to 80% of a typical company's cost structure, just a 10% reduction can yield a 40% to 50% improvement in pre-tax profits' (Wood, 1997, P. 26). Therefore, effective integration increases channel competition and lower costs (Bowersox and Closs, 1996; Monczka et al, 1998; Skjott-Larsen et al, 2005; Mitra and Singhal, 2008).

Supply chain integration dimensions improve service and cost performance in high supply complexity situations. Cooperative behaviour is the integration concept that is positively related to most performance measures when supply complexity is high. Cooperative behaviour is associated with attitudes, the intentional and relational aspects of supply chain integration. Once some aspects (represented by our constructs) of SCM are in place and have become beneficial, a positive effect on cooperative behaviour might be the result, thus reinforcing the overall relationship performance (Gimenez et al, 2012).

In 1980s, SCM focus shifted to supplier partnership (Zacharia, 2001a). He explained that, successful SCM is made up of a series of partnerships that are built and maintain in a long term relationship (Cooper et al, 1997; Ellram and Cooper, 1990; Schary and Skjøtt-Larsen, 2001). ‘Partnership is when two or more firms in a supply chain reach a long term agreement . . . the development of trust and commitment to the relationship . . . the integration of logistics activities involving sharing of demand and sales data . . . and a shift in the locus of control of logistics process’ (La-Londe and Masters, 1994, p. 25). Organisations increasingly become interested in influencing what is happening outside the firm (Zacharia, 2001a). External interactions require building partnership with suppliers, resellers and customers of company’s supply chain (Kotler and Armstrong, 2008).

Buyers and sellers collaborate to build buyer-seller partnership and strategic alliance (Double and Burt, 1996; Fandel and Stammen, 2004; Attaran and Attaran, 2007). Partnerships and strategic alliances are not legally binding (Double and Burt, 1996). The collaboration is based on mutual trust and confidence among members (Kotzab et al, 2011). This collaboration evolves economically independent and mutually connected organisations harmonising their individual course of action (Attaran and Attaran, 2007; Chauhan and Proth, 2005). To partnership to be effective, the partnership should be adequate in scope and include all aspects of supply chain (Man and Burn, 2006; Kotzab et al, 2012). Effective partnership improves reduction of overall inventory level, decreases product obsolescence, lower transaction costs, reacts more quickly to market changes and responds more quickly to customer request (Man and Burn, 2006; Markley and Davis, 2007).

Furthermore, partnership gains should be appraised against investment in time and resources that has been spent in making partnership function (Ellram, 1991; Graham et al, 1994; Ellram, 1997). Time spent on partnership is an important factor in achieving desired outcome (Graham et al, 1997). Example of partnership in production processes is JIT production system (Richeson et al, 1995). As organisations seek to develop partnerships and information links with trading partners, the internal processes become interlinked and span the traditional boundaries of firms (Power, 2005). A partner is expected to bring in special expertise regarding production process or knowledge of products and their development (Stadtler, 2008). Selection of partners is based on the future potential of the partner to support competitiveness of the supply chain as partnership consists of loosely joined, independent actors of equal rights. Supply chain may combine the best features of perfect market interaction and hierarchy, each entity in the partnership concentrates on its core competencies whilst information and expertise are shared openly among members (Stadtler, 2008).

The levels of cooperation and integration between partners increases confidence, lowers costs and improves efficiency and effectiveness, increases profit/ revenue and market share (Vurro et al, 2000; Satyaveer and Proth, 2005). Partnerships (suppliers, intermediaries and customers) with long term inter business relationships improve competitive advantages through creating customer value (Langley and Holcomb, 1992; Ellram and Cooper, 2009).

Managing supply chain needs a leader as much as an organization needs a leader. A supply chain leader is an organization (focal company) with large size, economic power, customer patronage, comprehensive trade franchise or orientation of inter-firm relationships (Bowersox and Closs, 1996). Others view focal company as a member having largest financial asset, best technical know-how of products and processes or has greatest percentage of values created in the order fulfillment. Yet to some focal company is the founder of the supply chain. At times management of supply chain is by a Steering committee which is a representative of all members of the supply chain, the decision making rules are subject to negotiation (Stadtler, 2008). The focal company will act like a channel captain and plays a role in coordinating and overseeing the entire channel (Ellram and Cooper, 1990).

SCM competency is another key component of SCM process (La Londe, 1994; Tracey et al, 2005). Maintaining SCM competency is essential since SCM expenditures is 75 per cent of total company revenues (Trent, 2004; Johnson and Templar, 2011 cited in Ellinger et al, 2012). SCM competency is a function of integration between and within supply chain member firms (Kim, 2006; Fawcett et al, 2008). Furthermore, Lu et al (2001) defined SCM competency as a set of skills and resources that were developed through strategic approach. These skills and resources include domestic and external organisational skills, resources and functional proficiencies (purchasing, manufacturing, sales, marketing, research and development) (Bowen et al, 2001; Lu et al, 2001; Teece et al, 1997). To create competent SCM, partners must develop a single virtual organization (Satyaveer and Proth, 2005).

Gartner Supply Chain Group's Demand Driven Supply Network Ideal (DDSNI) proposed four key areas of SCM competency: Supply (supply chain execution, supply management and manufacturing), Information (sales and operations planning, use of technology, infrastructure and business management), Demand (service management, demand sensing and demand shaping) and Product (life cycle management, lunch and innovation) (Ellinger et al, 2012). SCM competency plays major role in building or destroying shareholder value (Green et al, 2006). The literature regularly associates SCM competency with higher levels of customer satisfaction. As SCM competency enables firms to create value by better meeting customer expectations, customer satisfaction increases (Ellinger et al, 2012). Competent SCM creates customer satisfaction, through value creation that satisfies customers' desire (La Londe, 1994; Tracey et al, 2005; Green et al, 2006; Ellinger, et al, 2012). Competency is the key driver of a company's financial performance such as: revenue growth, operating costs, working capital efficiency, higher profit and higher return on investment (Hines, 2006; Attaran and Attaran, 2007; Ellinger et al, 2012). Added up together, supply chain competency is a source of supply chain competitiveness (Ellinger, et al, 2012)

2.3: Definitions of Sustainability

Since its introduction to date sustainability has been defined in dozens of different ways in different contexts and disciplines (Filho, 2000; Hoffman and Bazerman, 2005; Shrivastava, 2010). The first internationally recognised definition of sustainability is that of World Council of Environment and Development (WCED) (Du Pisani, 2006). That defines sustainability as 'the development that meets the needs of the present generation without compromising the ability of the future generations to meet their own needs' (WCDE, 1987, P. 8). This means today's actions have corresponding effects to future generations (Bell and Morse, 1999). Sustainability adoption is modern way that may solve current environmental crisis and that may ensures that production does not degrade resources beyond point of renewal (WCED, 1987). This definition receives mixed reactions from people, some people agreed and accepted it (Liverman et al, 1988; Dally, 1991; Goodland, 1995; Du Pisani, 2006; Aras and Crowther, 2009) whilst others accepted the idea of sustainability but rejected the definition offered by WCDE (Daly, 1989; Goodland, 1995; Holling, 2000).

Notwithstanding, whatever criticisms levelled on this definition, it provides a head way for sustainability concept. Sustainability is like truth and justice concepts not readily captured in a concise definition, everybody wants truth and justice, but what they mean can vary greatly among individuals and between societies (Schaller, 1993). Debates on sustainability definition allowed sustainability to attain higher heights (Bell and Morse, 1999). There are numerous numbers of definitions on sustainability so far, these definitions have exposed range of approaches which differed though they are linked (Turner et al, 1994). There are up to 300 definitions of sustainable development in literature (Dobson, 1996). UN’s International Environment Forum (UNIEF) founds that no less than 1000 distinct definitions of sustainability had been offered all over the world (Ricketts, 2010). Some definitions of sustainability available in literature include:

Sustainability Definitions in 1980s:

Redclift (1987) defined sustainability as the ability of the system to maintain productivity in the face of some major disturbances, such that are caused by soil erosion, indebtedness and unanticipated danger.

Liverman et al (1988) defined the concept as an indefinite survival of human species (with a quality of life beyond mere biological survival) through the maintenance of basic life support system (air, water, land, and biota) and the existence of infrastructure and institutions which distribute and protect the component of the system.

Sustainability is a development strategy that manages all assets, natural resources, human resources, financial and physical assets for increasing long-term wealth and well-being (Robert, 1988 cited in Pearce et al 1990).

Sustainability is a meeting point for environmentalists and developers (O’Riordan, 1988).

Sustainability involves devising a social and economic system which ensured that these goals are sustained, i.e. that real income rises, that educational standards increase, that the health of the nation improves, and that the general quality of life is advanced (Pearse et al, 1989).

Lynam and Herdt (1989) suggested that sustainability is the capacity of systems to maintain output at a level approximately equal to or greater than its historical average, with the approximation determined by the historical level of variability.

Definitions in 1990s:

Sustainability is the development without material growth beyond environmental carrying capacity and which is socially sustainable (Dally, 1990 cited in Goodland 1995).

According to Pearce and Turner (1990) sustainability is the development that involves maximizing the net benefits of economic development, subject to maintaining the services and quality of natural resources over time.

Costanza (1991) elucidated that sustainability is the amount of consumption that can be sustained indefinitely without degrading capital stock including natural capital stock.

Sustainability was also defined as improving the quality of human life while living within the carrying capacity of supporting ecosystem (World Conservation Union, 1991).

Sustainability is adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future (IISD, 1992).

Pearce (1993) interpreted that sustainability is concerned with the development of a society, where the costs of development are not transferred to future generations, or at least an attempt is made to compensate for such costs.

Consequently, sustainability was defined as the development that secures increase in the welfare of the current generation provided that the welfare in the future does not decrease (Pearce and Warford, 1993).

Sustainability is the path of development that would not lead to declines in average levels of well-being in the future (Pezzy 1994 cited in Dresner, 2008).

Sustainability is a practice of the best use of the existing resources and interconnections between all the parties involved (Kubani, 1996 cited in Guy and Kilbert, 1998).

Sustainability was also defined as the improvement in the quality of human life within the carrying capacity of supporting ecosystem (World Wildlife funds for nature 1993, cited in Goodland, 1997).

Sustainability means to balance the limits to growth and the need for development (Mitcham, 1995 cited in Du Pisani, 2006).

***Definitions in the Millenniums*:**

'Sustainability … cannot be simply a 'green' or 'environmental' concern, important though 'environmental' aspects of sustainability are. A truly sustainable society is one where wider questions of social needs and welfare, and economic opportunity are integrally related to environmental limits imposed by supporting ecosystems' (Agyeman et al 2002 cited in Agyeman and Evans 2004, p. 157).

Hyclick and Hockerts (2002) defined corporate sustainability as 'meeting the needs of a firm's direct and indirect stakeholders (shareholders, employees, clients, pressure group and communities), without compromising its ability to meet the needs of future stakeholders as well' (P. 131).

Sustainability was defined as the need to ensure better quality of life for all, now and into the future, in a just equitable manner whilst living within the limits of supporting ecosystem (Agyeman et al, 2003 cited in Agyeman and Evans, 2004).

Sustainability is 'developments that improve economic efficiency, protect and restore ecological systems, and enhance the well-being of all peoples' (IISC, 2003 cited in Du Pisani, 2006).

Sikdar (2003) defined sustainability as 'a wise balance among economic development, environmental stewardship and social equity'.

Sustainability is the business commitment to contribute to sustainable economic development, working with employees, their families, the local community, and the society to improve their quality of life (WBCSD, 2003).

Sustainability was also defined as creating shareholders and societal value while reducing the environmental footprint (Dupont, 2004 cited in Tebo 2005).

Eherenfield (2004) highlighted that, 'all life forms will flourish for ever' which, 'for humans means survival and maintenance, as well as dignity and authenticity'.

Wheeler (2004) described sustainability as the development that improves the-long-term health of human and ecological system.

It is also defined as '. . . equal weightings for economic stability, ecological compatibility and social equilibrium' (Goncz et al, 2007 cited in Cater and Rogers, 2008, P. 363).

Labuschagne et al, (2005, P. 1) concluded that business sustainability is 'adopting business strategies and activities that meet the needs of the enterprise and it stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future'.

Savitz and Weber (2006) contested that sustainability is not simply a matter of good corporate citizenship-earning brownie point for reducing noxious emissions from your factory or providing health care benefits for your employees. Sustainability is a fundamental principle of smart management.

According to Sigma (2006) organisations pursue sustainability by actively managing and enhancing five assets: natural capital (the environment), human capital (people), social capital (social relationships and structures), manufactured capital (fixed assets) and financial capital (profit, sales, shares, and cash).

Hasna (2007) deduced that sustainability refers to development of all aspects of human life affecting sustenance.

Aras and Crowther (2009) stressed that sustainability is 'development that attempts to bridge the gap between economic growth and environmental protection, while taking into account other issues traditionally associated with development' (P. 282).

The point is not what sustainability means, but understanding it (Dresner, 2008). If a concept is contestable does not mean it has no meaning at all, words have meaning when there is a consensus among a language community about what they mean (Jacob, 1991). Sustainability has many definitions because it depends on economic, environmental and social components and each may have its own definitions (Brown et al, 1997). Sustainability may also has many definitions because it is directly linked to different disciplines and each discipline may have it definitions (Kidd, 1992; Clark and Dickson, 2003).

2.4: Development of Sustainability

Sustainability and sustainable development are used interchangeably (Dresner, 2008). Having market driven sustainability practices in oil and gas industry as a focal point, this thesis prefers to use sustainability as opposed to broad spectrum of sustainable development. Sustainability is globally accepted as the only sustainable development paths (Goodland, 1995; Du Pisani, 2006; Newel, 2009). Sustainability is the twenty first century guiding principle of policies in organisations (Goodland, 1995; Turner II, 1997; Agyeman and Evans, 2004; Newel, 2007; Linton et al, 2007). It has become an important marketing force affecting long term financial viability and competitiveness (Presley et al, 2007). Operations management as core source of value added has been the focus of a serious sustainability concern (Markley and Davis, 2007).

Industrialization beside its benefits is also associated with some environmental and social problems that have negative impacts on the planet. Some of these environmental problems are: land degradation, global warming, emissions, resource depletion, depletion of the ozone layer, destruction of habitat and deserts consuming agrarian land (WCDE, 1987; Goodland 1995; Du Pisani, 2008; Faber et al, 2010). These effects stimulated agitations all over the world that development paths of industrialised nations are unsustainable (WCDE, 1987; Meadows et al, 1992; Hart, 1995; Goodland, 1995; Turner II, 1997; Agyeman and Evans 2004). Based on these agitations on problems caused by industrialisation, sustainability was proposed as alternative development paths to industrialisation.

At introduction, sustainability was viewed as: 'long term', 'durable', 'Sound' and 'Systematic' (Brown et al 1997; Filho, 2000). It is seen as vibrant, reliable and holistically new area that needs individual, corporate and public collaborative efforts (Clark and Dickson, 2003; Faber et al, 2010). Sustainability is viewed as a link between development and environment (Rogers et al, 2008). Sustainability is associated with resource conservation, long term continuity, corporate survival and competitiveness (Brown et al, 1987; Marinova, 2005). Sustainability is processes and goals as well as unique methods of conducting business operations (Preston, 2001; Sibbel, 2008). It involves transformation of set of technical concepts into political and business policies and practices that are directly linked to organisational performance (Linton et al, 2007; Schweitzer, 2011). Other researchers opposed sustainability as a very difficult concept that cannot be operationalized (Turner 11, 1997; Clift, 2003; Agyeman and Evans, 2004; Redclift, 2005; Marshall and Toffel, 2006;Sibbel, 2008). These debate leads to a need for sustainability research in order determine its merits and demerits on organisations and on survival of the planet (Turner II, 1997). This research work is tailored toward this direction, which is to assess level sustainability implementation and contributions of sustainability practices on oil and gas industry supply chain competitiveness.

2.5: Global Sustainability Campaign

'In the 1970s the existing notions of 'progress', 'growth' and 'development' were being challenged' (Du Pisani, 2006, P. 91). The assumption that development problems of developing countries will be resolved by the world-wide economic growth became impossible. This necessitated a paradigm shift to a new notion of development; 'at the beginning of 1970s the term 'sustainable development' was coined, by Barbara Ward (Lady Jackson), founder of the International Institute for Environment and development (Du Pisani, 2006, p. 91). The conceptual underpinnings the current use of 'sustainability' were consolidated in the early 1970s (Kidd, 1992; Wheeler, 2004; Du Pisani, 2006; Strong and Hemphill 2006; Ricketts, 2010). Goldsmith et al (1972, p. 23) argued that 'the principal defect of the industrial way of life with it philosophy of expansion is that it is unsustainable . . . . Sustainable change is not only necessary but also inevitable because the present population growth and per capita consumption, by disrupting ecosystem and depleting resources, are undermining actual human survival . . . . Indefinite growth of whatever type cannot be sustained by limited resources'.Furthermore, Meadows et al, (1972, p. 23-24) maintained that'if the present growth trends in the world population, industrialisation, pollution, food production and resource depletion continue unchanged, the limit to growth on this planet will be reached sometime within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity. It is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has equal opportunity to realise his individual human potential'.

Concern on the effects of technology on the environment and indiscriminate transfer of technology in the early 1970s from was expressed by the critique of technology school of thought (Du Pisani, 2006). The Conservation Foundation (1972) sponsored a conference on the ecological aspects of international development. The proceedings were published in a book titled *The Careless Technology: Ecology and International Development.* The 1,000 page volume consists of 50 essays, most of which are case studies of wide variety of unsuccessful or harmful development projects. This is the first time 'sustainability' was mentioned as goal of the society. These environmental concerns shared by Western European countries and Japan, were influential in leading to the 1972 UN Stockholm Conference (Kidd, 1992).

2.5.1: Stockholm Conference

Environmental concerns shared in Western European countries, Japan and UNESCO agenda of 1968 was endorsed by General Assembly of the United Nations (UN). This led to 'First Earth Summit' known as UN Conference on Human and Environment Stockholm in 1972 (Kidd 1992; Noorman et al, 1998; Wheeler 2004; Du Pisani, 2006; Strong and Hemphill 2006). A first of its type, where issues of sustainability of human activity on environment was evaluated (Kidd 1992; Wheeler 2004; Du Pisani, 2006; Strong and Hemphill 2006). The conference stressed problems caused by industrialisation such as pollution, resource depletion, environmental destructions, danger to species and decline of the living standards of people (Kidd, 1992; Du Pisani, 2006). At this conference, environmental problems in developed and developing countries were clearly stated before the representatives of these countries for the first time in the history. This is the beginning of articulating environmental problems to top policy makers of different nations (Kidd, 1992; Noorman et al, 1998; Chechov, 2007). The agreements reached at the conference were:

1. Twenty one principles to be adopted by member countries to resolve the global environmental problems (Noorrman et al, 1998; Chechov, 2007)

2. Environmental Protection and eco-development are connected directly to one another (Strong and Hemphill, 2006; Chekhov, 2007)

3. UN to Establish United Nations Environmental Programmes (UNEP) (Kidd, 1992; Noorman et al, 1998).

Further, the conference declares that:

"A point has been reached in history when we must share our actions all over the world with a more prudent care for the environmental consequences. Through ignorance or indifference people can do great harm to environment on which our life depends. Equally, through fuller knowledge and wiser action, we can now achieve for ourselves and our posterity a better life in an environment, more in keeping with human needs and hopes . . . . To defend and improve the environment for present and future generations has become an imperative goal for mankind" (UN, 1972).

United Nations (UN) endorsed all the conference recommendations and accepted the conference declaration. This led to establishment of United Nations Environmental Programmes (UNEP). UNEP was charged responsible for executing Stockholm conference recommendations (Kidd, 1992). Over time, UNEP developed various protocols and conventions with different focus towards fulfilment of 1972 decisions. Stockholm Conference was followed by a ‘Symposium on resource use, environment and strategies’ in 1974 in Mexico. This symposium addressed among others the 1973 oil crisis and growing pressure for a new international economic order (Kidd, 1992). In 1972, International Union for the Conservation of Nature (IUCN) Year book used the word ‘sustainability’ in the context of environment. This year book defined conservation of resources as ‘management of the resources of the environment so as to achieve the highest *sustainable* quality of human life’;this was repeated in 1973 and 1974 issues of IUCN year book’ (Kidd 1992, p. 13). Other publications where the concept *sustainability* appears are: Robert, L. Stivers’s (1976) book titled ‘the *sustainable* society: Ethics and Economic Growth’.

The work of Lester Brown and others at the World Watch Institute Washington (1974) is another source of sustainability literature; the institute publishes extensive series of papers and books that treated the concept of sustainability (Wheeler, 2004; Rogers et al, 2008). The institute’s issue of 1984, ‘State of the world’ described *sustainability* in simple language that everyone can understand (Kidd, 1992) whilst Woodlands Conferences in 1975, 1977, 1979 and 1982 produce books where the word *sustainable* was used in their tittles, for example:

Dennis, Meadows (1977) *Alternatives to Growth 1: A Search for Sustainable Futures.*

James, C. Coomer (1979) *Quest for a Sustainable Society*

Harlan, Cleveland (1979) *The Management of Sustainable growth*

In 1980s ‘sustainability’ went out of text books, articles and reports into wider popular sphere and operational planning of organizations (Kidd, 1992). Sustainability was first proposed as alternative of the unlimited economic growth at IUCN conference (Dashmann, 1985; Chambers, 1986; Pearce et al, 1990; Noorman et al, 1998; Du Pisani, 2006; Orr, 2008; Dresner, 2008). The Conference proceeding titled ‘world conservation strategy’ (WCS), emphasised sustainability in ecological terms (Wheeler, 2004; Strong and Hemphill, 2006; Du Pisani, 2006). The objectives of the strategy are:

1. To maintain the essential ecological process and life support systems.

2. To ensure sustainable use of species and ecosystem.

3. To preserve generic diversity (IUCN cited Strong and Hemphill, 2006).

According to this strategy, development is a means of achieving conservation. The strategy gave guideline to government policy-makers on how to operate it (Strong and Hemphill, 2006).

2.5.2: World Commission on Environment and Development (WCED)

In response to agitations, publications and conferences all over the world on environmental destructions and the needs to protect the environment for the best interest of the present and future generations. United Nations General Assembly (UNGA) in 1983 established World Commission on Environment and Development (WCED), popularly known as Brundtland Commission (WCED, 1987; Kidd, 1992; Wheeler, 2004; Strong and Hemphill, 2006; Dresner, 2008; Ricketts, 2010). WCED objectives are: 'To re-examine the critical environmental and development issues and to formulate realistic proposals for dealing with them; to propose new forms of international co-operation on these issues that will influence policies and events in the direction of needed changes; and to raise the levels of understanding and commitment to action of individuals, voluntary organisations, businesses, institutes and governments' (WCED, 1987, p. 3 - 4).

Similarly, WCEDorganised public hearings in countries and received inputs from people and organisations from all parts of the world (WCED, 1987; Kidd, 1992; Bell and Morse, 1999; Wheeler, 2004; Du Pisani, 2006). In 1987 WCED submitted its report to UN General Assembly, titled '*Our common future'* where '*sustainability*' was proposed as the development path that could sustain human progress now and in future (WCED, 1987; Kidd, 1992; Wheeler, 2004; Du Pisani, 2006; Ricketts, 2010). The report maintains that: 'Humanity has the ability to make development sustainable-to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply limits-not absolute limits but limitations imposed by the present state of technology and social organisation on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organization can be both managed and improved to make way for a new era of economic growth. The commission believes that spread poverty is no longer inevitable. Poverty is not only an evil in itself, but sustainable development requires meeting the basic needs of all and extending to all the opportunity to fulfil their aspirations for a better life. A world in which poverty is endemic will always be prone to ecological and other catastrophes. . . . Sustainable global development requires that those who are more affluent adopt life-styles within the planet's ecological means–in their use of energy, for example. Further, rapidly growing populations can increase the pressure on resources and slow any rise in living standards; thus sustainable development can only be pursued if population size and growth are in harmony with the changing productive potential of the ecosystem' (WCED, 1987, P. 8-9).

The Brundtland report acknowledged the misfit between economic growthand environmental protection. It concluded that economic growth is essential, particularly in the developing countries, but there should be a switch to 'sustainable development', whichwould be environmentally sound (Euractiv, 2002 cited in Du Pisani, 2006). 'The international impact of this report was strengthened by a series of ecological disasters at that time, which highlighted the threat to the environment; henceforth sustainable development was discussed as a major political goal and defined in a way that drew the attention of the world' (Du Pisani, 2006, p. 93). This report gave sustainability an international reputation and instantaneous authority (Ricketts, 2012). The report was supported by some international conferences and seminars as follows:

2.5.3: United Nations Conference on Environment and Development (UNCED)

UNCED was held at Rio-de-Janeiro in Brazil, in June 1992, titled 'the Earth Summit', this summit provides support of literature to Sustainability concept (Jickling, 2000; Ricketts, 2010). More than one hundred heads of countries met for the first time to address environmental protection, social and economic growth problems (Guy and Kilbert, 1998; Dresner, 2008). The agreements reached at the conference include;

- Agenda 21
- Earth Charter (Rio declaration on environment and development)
- Convention on climatic change, biodiversity, and forest
- Strengthen UN Institution such as Earth Council and
- Agreement of how to finance the implementation of Agenda 21 (Bradley and Kilbert, 1998; Bell and Morse, 1999; Filho, 2000; Chechov, 2007; Dresner, 2008)

UNCED led to the establishment of Commission on sustainable development (CDS) which reports to UN committee on economic and social affairs (ECOSOC). Responsibilities of CDS include progress review in implementation of Agenda 21 and Rio-declaration on environment and development (Dresner, 2008). This conference is also instrumental to the establishment of the World business council on sustainable development (WBCSD) which is responsible for monitoring sustainability practices in manufacturing organisations (Dyllick and Hockerts, 2002; Dresner, 2008).

2.5.4: Tokyo Protocol

After noticing that many countries failed to limit their greenhouse emissions from the level agreed in 1990, heads government met in Tokyo (Japan) in 1997 and discussed problems of global warming (Dresner, 2008). The Kyoto Protocol provided for a reduction in the emission of GHG, including Hydro flora carbons (HFCs), per fluorocarbons (PFCs), sulphur hexafluoride (SF6), carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) (Yusuf et al, 2012). In Tokyo new target of greenhouse emissions limit was decided. By 2012, emissions of six major greenhouses should be reduced by a minimum of 5% from 1990 levels. These reductions are to be made during the Kyoto commitment period of 2008 through 2012. Fifty five nations comprising developed countries and developing countries signed the agreement (Hill, 2001). In this regard, so much is required of the developed and developing countries. Developed countries and those on transition to being developed are specifically listed by the UN Framework Convention on Climate Change (UNFCCC) (Yusuf et al, 2012).

Furthermore, countries were given different targets on emissions for example USA - 2%, Japan - 6%, European Union - 8%, whilst Russia, Ukraine and New Zealand had no cut on emission (Dresner, 2008). To motivate countries to achieve these targets, carbon credit (CC) was introduced. Carbon credit (CC) is a financial instrument in tons of carbon dioxide. One ton of carbon dioxide is equivalent to one carbon credit. Every country has specific allowance to emit. Carbon and receive certain amount of carbon credit to trade with (Lutz, 1999). Few years after, USA, Australia and Japan withdraw from the agreement and proposed lower rates for themselves. This action made implement of the protocol difficult to achieve (Dresner, 2008).

Moreover, many writers observed that, climate change has become so apparent that the goals and agreements provided by the Kyoto Protocol are viewed by many, especially by the developing countries that are likely to be impacted more severely by climate change, as insufficient. There is, therefore, the urgent need to apply more stringent measures to curb over exploitation of the environment by man and the related matter of climate change, but the means to doing so has eluded humanity. No nation appears ready to forsake its economic wellbeing for the environment, the positive pronunciations of governments around the world notwithstanding (Yusuf et al, 2012).

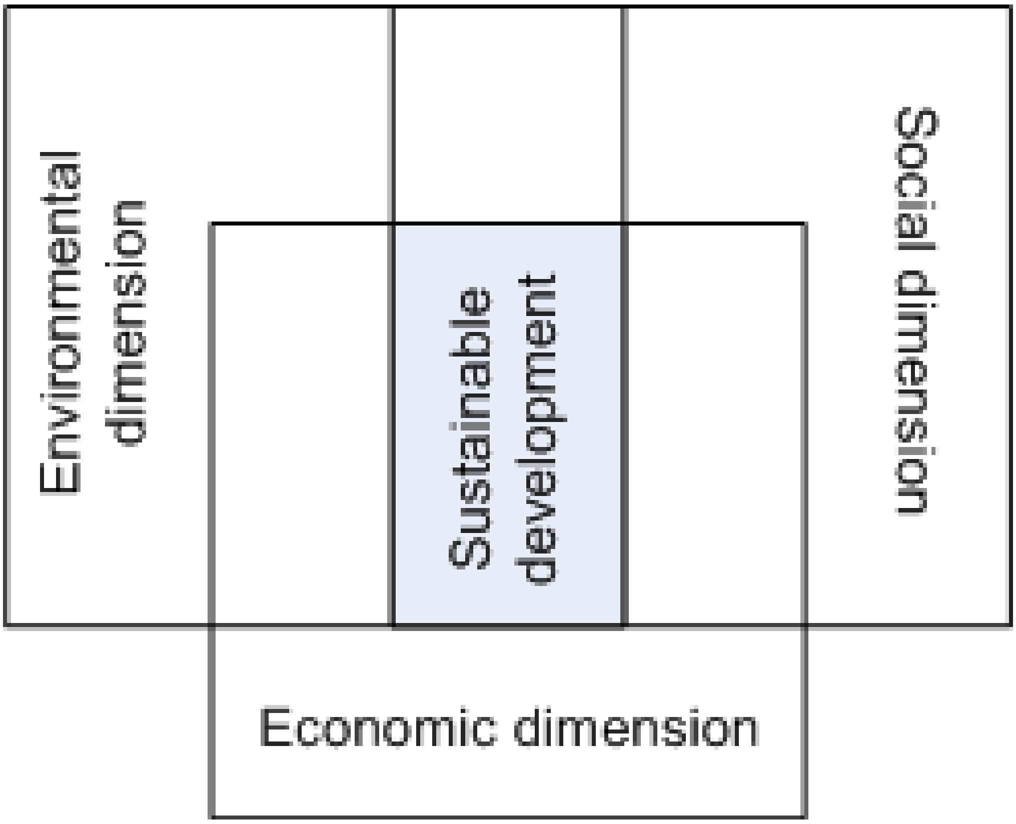
2.6: Triple Bottom Line (TBL or 3 BL) of Sustainability

Triple bottom line (TBL) is sometimes called pillars of sustainability, constituents of sustainability, components of sustainability, elements of sustainability, 3Es' (Economic, Environmental and Equity) and 3Ps (Profits, Planet and people) of sustainability. TBL originated in 1990s at the Earth Summit in Rio de Janeiro in 1992 articulated in 27 principles (UN, 1995; Markely and Davis, 2007; Gopalakrishnan et al, 2012). Triple bottom line indicates giving equal attentions to economic, environmental and social bottom line of sustainability in company's operations. Economic, environmental and social bottom lines are linked in a complex system of cause and effect. Because development cannot exist in deteriorating resource and environment cannot be protected when growth leads to environmental destruction (Dyllick and Hockers, 2002). Therefore, there is a need of an agenda (sustainability) for the integration of environment policies and development strategies (WCED, 1987).

In addition, the distinctive nature of triple bottom line assists in organising actions on sustainability implementation (Goodland, 1995). Sustainability could be achieved through integrating development plans into economic, environmental and social policies (WCED, 1987; Dyllick and Hockerts, 2002; Wheeler, 2004; Carter and Rogers, 2008; Markely and Davis, 2007; Presley et al, 2007; Bohringer and Jochem, 2007; Townsend, 2009; Arena and Azzone, 2010; Gopalakrishnan, et al 2012). Each component in triple bottom line is interdependent but they are mutually supporting one another (Aras and Crowther, 2008; Rogers, Jalal and Boyd, 2008; Batres et al, 2010). Sustainability implementation needs an extensive, integrated and planned approach that requires long term view of development at the triple bottom line (World Bank, 1990; Wheeler, 2004). If organisations cannot integrate their financial performance into environmental and social components; their competitiveness might be undermined (Elkington, 2001; Aras, 2002; Blackburn, 2007).

The main challenge is how to integrate these three dimensions of sustainability in industries' supply chains (Sharma and Henrinques, 2005; Linton et al, 2007). This is important because of the increased dependence of businesses on other business partners and organisations, resulting in vertical integrations and strategic alliances. In reality the integrated approach to the triple bottom line is still fragmented (Gopalakrishnan et al, 2012). Because of the fragmented nature of triple bottom line (3BL), it is obvious that the environmental impacts due to procurement decisions, inventory operations, transportation, waste accumulation, extensive pollution, resource depletion and carbon emissions are on the rise, thereby leading to climate change and global warming (Sathiendrakumar, 1998; Markley and Davis, 2007). Organisations should contribute to environmental sustainability through redesigning products and services, aligning core company values by making production environmentally friendly, executing environmental programmes that assist in resource alteration, recycling, efficient waste disposal and compliant to government legislations (Stead and Stead, 1995; Wheeler, 2002; Manzini and Vezzoli, 2003; Yusuf et al, 2012).

Figure 2.1: Triple Bottom Line



Source: Adapted from of Gopalakrishnan, et al 2012.

World summit 2005 reconciled the TBL in a diagram (UNGA, 2005; Forestry Commission Britain, 2009; Barbier, 1987 cited in Townsend, 1999). Figure 2.1 shows the relationships among the TBL of sustainability. The diagram shows that sustainability can be achieved at the intersection of economic, environmental and social components.

In respect of social dimension, the growth of corporate social responsibility (CSR) in organisations improves the infusion of ethical trading by businesses, safety, human rights, equal employment opportunities, local and regional development initiatives as well as diversity into core strategic values (Beske et al, 2008; Ehrgott et al, 2010).Owing to needs to integrate the three dimensions of 3BL, sustainability in operations has been seen as very costly investment. This lead to perception of an inverse relationship between the sustainability dimensions implicated in the third party logistics provider (3PL) (Gopalakrishnan et al, 2012).

Accordingly, Mollenkopf et al, (2010) argued that environmental initiatives increase efficiency and productivity; reduce risks and costs, thereby increasing profits for businesses. These initiatives include reduced packaging, carbon emissions accounting for energy efficiency and use of renewable sources and social programmes like increased employee involvement, workplace benefits, diversity and equality for workers and contribution to communities around the organisations (Keating et al., 2008; Hervani and Helms, 2005). Similarly, successful integration of triple bottom line (TBL), economic benefits could be gained through social standards and preserving the environment for the future generations (Johnson and Greening, 1999 cited in Kaynak and Montiel, 2009; Gopalakrishnan, et al 2012). Bose and Pal (2012) analyse 104 announcements related to GSCM using an event study and determine that there is statistical significant gain in stock prices for those firms who are implementing sustainability. In their case study of British Aerospace (BAe) Systems, Gopalakrishnan et al, (2012) found that there is relationship between environmental consciousness and a firm's competitiveness. Consequently, in a survey research of oil and gas firms in the United Kingdom, Yusuf et al, (2012) discovered positive relationships between measures of sustainability deployed by firms and operational performance metrics.

2.6.1: Economic Dimension of Sustainability

Economic sustainability is achieving economic growth while protecting and safeguarding the environment and individuals that live in the environment (Yusuf et al, 2012). It refers to consumption of resources in an effective way in order to produce long term positive effects though minimising adverse impacts of resource exploitation. Economic sustainability is more than just positive returns on investment but also ensuring that the activities of organisations do not result in any form of environmental or social degradation (Tsai et al, 2009). In addition, economic sustainability deals with natural resource base that stores physical inputs to firms, monetary valuation of resources and the effectiveness of resources use which is necessary for the long-term survival of organisations that leads to sustainable economic growth (Goodland, 1995; Doane and McGilivray, 2001; Wheeler, 2004; Tsai et al, 2009; Sarkis et al, 2011). However, it is an organisation's financial impacts at micro (internal) level such as minimisation of cost and maximisation of value for stakeholders returns (GRI, 2002) and at macro (external) level that include company's contributions to social responsibility (Labuschagne et al, 2004; Azapagic, 2004). 'Economically sustainable companies guarantee at any time cash flow sufficient to ensure liquidity while producing a persistent above average return to their shareholders' (Dyllick and Hockerts, 2002, p. 133).

Economic sustainability require firms to manage different types of capitals such as, financial capital (equity and debts), fixed capital (machinery, land, furniture and stocks) and in-tangible capital (reputation, inventions, know-how and organizational routine) (Dyllick and Hockerts, 2002). Economic theory focussed on appropriateness of the use of goods and to a much lesser extent on equity of distribution (Goodland, 1995). Furthermore, economics are primarily concerned with economic growth and efficient resource allocation whilst sustainability is concerned with sustainable scale, fair, equitable distribution and allocation of resources (Daly and Farley, 2004; Costanza et al, 2007). Therefore, to achieve sustainability economic records keeping systems must reflect ecosystems resources (Costanza and Lissa, 1991). Since ignoring environmental and social factors is an obstacle to achieving economic sustainability and that mere fact that a company is making profit does not guarantee its long term survival, nor does it indicate a positive effect on its immediate social factors and the environment (Doane and McGilivray, 2001).

Similarly, economists became concerned about the conservation and effectiveness of resources after the world wars as a result of the resources shortages (Bromley, 1998). The concern was to develop a system where growth would not deplete the environment and to create a costs and benefits system that would have a linear relationship on the future of the organisations (Aras and Crowther, 2008). Economics view ecosystems as externalities (Hardin, 1968). Treating environment as an externality may lead to a short term profit

(Kinsley, 1977). Companies try to internalise the externalities using market system mechanisms (Scott-Cato, 2009). This is done by monetising the natural resources, which cause problems in valuation of the natural capital. Natural resources cannot be monetised because;

Firstly, some natural resources services cannot be monetised example forest services (Goodland, 1995).

Secondly, the use of gross national product (GNP) as a measure of the economy efficiency, GNP overlooks the contribution of nature in production (Costanza and Lissa, 1991; Dresner, 2008).

Thirdly, the volume of goods and services produced has no relationships with the overall social and ecological wellbeing, yet quantitative increase in output is the bottom line of the economic growth (Henderson, 1991). These are the causes that make some economists to criticize sustainability and argued that the aim is to maintain income not capital (Dresner, 2008). As in sustainability organisations must account for ecosystems and social impact costs (Townsend, 2009). This resulted to the emergence of environmental economics (Scott-Cato, 2009).

Additionally, integrating economic bottom line with environmental and social bottom lines of an industry, lower costs, positive effect on value (Hand field et al, 1997; Sisto, and McBain, 2008) and asset utilisation could be achieved (Theyel, 2000; Lin et al, 2010). Jennings and Zandbergen, (2005) and Walker et al, (2008) discovered that by integrating environmental processes into their supply chain reduce operating cost and improved customers' service could be attained.

Further, sustainable supply chain management involves long run improvement of an organization's economic bottom line, the activities that fall within economic bottom line include cost savings associated with reduced packaging and more effective design for reuse and recycling; lower health and safety costs, as well as reduced turnover and recruitment costs due to safer warehousing and transport and improved working conditions; reduced labour costs in form of higher levels of motivation and productivity and less absenteeism resulting from improved working conditions; lower costs, shorter lead-times, improved product quality, and lower disposal costs resulting from the implementation of ISO 14000 standards and the use of design for disassembly and reuse; as well as an enhanced organizational reputation, which can make a firm more attractive to both customers and suppliers (Carter and Rogers, 2008), others include buying from local suppliers to boost local economic redevelopment (Walker and Jones, 2012), while reducing material use is performance indicator for environmental sustainability (Walker and Jones, 2012; Carter and Easton, 2011).

2.6.2: Environmental Dimension of Sustainability

Environmental sustainability is what many sustainability advocates has historically focused on (Wheeler, 2004). Environmental issues have been the leading focus of research over the past 20 year (Carter and Easton, 2011) and are becoming the main concern of many organisations in today's world (Chaabane, 2011; Kuik et al, 2011). Environment is a key component of sustainability and has been in leading attention concerning climate change, global warming and rising energy prices. Because of this the terms sustainability and environment has interchangeably being used by researchers and managers (Carter and Easton, 2011). Environmental sustainability relates to preserving natural resources such as minerals and the atmosphere amongst others, in the absence of which man cannot exist (Yusuf et al, 2012). Environmental sustainability is the protection of sources of raw materials needed to satisfy human needs. Man should not create more waste than the environment can accommodate and that human consumption should recognise and emphasise sustainability. Therefore, environmental sustainability is a set of constraints on the four major activities regulating the scale of the human economic subsystem: the use of renewable and non-renewable resources on the source side, and pollution and waste assimilation on the sink side(Goodland, 1995**).**

Environment is considered differently among people depending on how they use it (Redclift, 1987). Examples, some people consider it as natural environment or environmental capital that is stock of natural assets and services, such as soil, atmosphere, forest, water, oceans, biomass, minerals, fossil energy and wetlands (Goodland, 1995; Noorman, 1998). To some other people, environment includes every element of the world around us such as food, local street traffic, public places excellence in cities and towns, buildings etc. (Wheeler, 2004). Still some other scholars view it as the core value of nature. Yet to others, it is the environmental limits (Wheeler, 2004).

Despite its significance to human and organisational survival, environment is under increased destruction since creation (Turner and Ali, 1996 cited in Turner 11, 1997; Walker and Jones, 2012).The needs for sustainability arose from wasteful nature of natural resources (Daly and Cobb, 1989; Costanza, 1991; Meadows et al, 1992; Hardin, 1993; Brown et al, 1995; Shrivastava, 2010). Some consequences of population growth are consumerism and endless search for resources to satisfy the needs of growing population. Environments were being destructed in search of resources for industrial production. The results of this destruction are:depletion of freshwater supplies, deterioration of natural resources, ozone layer depletion, energy use, pesticides, toxic chemicals, nuclear power and urban growth (Goodland, 1995; Wheeler, 2004; Gopalakrishnan, et al 2012). The consequences of global warming include flooding, drought and famine, amongst others, which will lead to scarcity of food and disruption of economic activities (Bracho, 2000). These problems have escalated the kind of attention given to environmental sustainability (Yusuf et al, 2012).

Others consequences of environmental destruction are globalwarming, climate change, carbonemissions,land, water and air pollutions (Wheeler, 2004). The issue of global warming grows larger in scale almost daily and can no longer be viewed in the rather limited purview of environmental or economic imperatives (Parry, 2007). These problems contaminated air, land and fresh water supplies all over the world. The composition of the atmosphere has been altered in the past 100 years through use of fossil fuel, agricultural practices and deforestation than in the previous 18,000 years (Graedel and Crutzen, 1989; Markley and Davis, 2007). If the current consumption rates continue, all tropical forest will be lost in 50 years with a loss of 50 per cent or more of the world's species (Wilson, 1989); owing to the evidence that the condition of natural resource is in danger (Markley and Davis, 2007). These show that most of the existing ecological problems originated from dysfunctional social systems (Bookchain, 2005).

Environment is both the supplier of inputs and a sink of wastes (Daly, 1977; Redclift, 1987; World Bank, 1993). On the sinks side, there is the need of 'holding wastes emissions within the assimilative capacity of the environment without impairing it. On the source side, harvest rates of renewables must be kept within regeneration rates' (Goodland, 1995, p. 3). Economic activities must be within the ecosystem limits (Daly, 1980; Daly, 1988; Dresner, 2008). Since if business uses more energy and materials and produce lower quantities of output or emits more gasses than it can absorb through natural sinks the organisation become unsustainable (Ayres, 1995). It is on these bases that most extractive industries are viewed as unsustainable in the long run (Schweitzer, 2011).

Sustainable organisations are those that use natural resources lower than the natural reproduction or below the development of substitutes (Dyllick and Hockerts, 2002; Markley and Davis, 2007; Townsend, 2009). Sustainable organisations are less risky than unsustainable organisations (Aras and Crowther, 2009; Bravo and Tamburino, 2011).

Today corporate survival depends on the level at which organisations integrate environmental aspects in their supply chains (Buyukozkan and Cifci, 2010). Integrating sustainability in industry's supply chain will assist organisations on waste reduction, emission reduction, energy efficiency and conservation (Buyukozkan and Cifci, 2010). Pollution prevention activities are value added to organisations as they reduce costs through material use reduction or through avoidance of waste management costs (Rothenberg, 2003; Buyukozkan and Cifci, 2010).Organisations that excel on environmental protections are not only doing it to gain societal acceptance but is also a business strategies that produce enormous profits (Madu, 1996). Therefore, technologies developed should maintain the protection of environment while helping to improve our quality of life (Madu, 1996).

2.6.3: Social (Equity) Dimension of Sustainability

Social sustainability is development or growth that is compatible with harmonious evolution of civil society, fostering an environment conducive to the compatible cohabitation of culturally and socially diverse groups' whilst at the same time encouraging social integration, with improvements in the quality of life for all segment of the population (Polese and Stren, 2000).

Social sustainability is given, if work within a society and the related institutional arrangements satisfy an extended set of human needs and are shaped in a way that nature and its reproductive capacities are preserved over a long period of time and the normative chains of social justice, human dignity and participation are fulfilled (Letting and GrieBler, 2005).

Social sustainability deals with the relationship between human rights and human development, corporate power and environmental justice, global poverty and citizen action, responsible global citizenship in an in-escapable element of what may at first glance seen to be simply matters of personal consumer or moral choice (Blewitt, 2008).

Whilst socially sustainable organizations are those that add value to the communities within which they operate by increasing the human capital of individual partners as well as furthering the societal capital of these communities. They manage social capital in such a way that stakeholders can understand its motivations and can broadly agree with the organization's value system (Dyllick and Hockers, 2002).

Social sustainability is viewed as the means of achieving economic and environmental sustainability goals. This requires improving and maintaining people's quality of life without damaging the environment and over exploiting the resources contained in it (Hoffman and Bazerman, 2005). Social sustainability requires values, such as ethics, tolerance, compassion and honesty to upheld (Townsend, 2008) maintenance and replenishment by shared values and equal right (Goodland, 1995). Social sustainability involves ensuring political and economic rights of citizens, the rights of the communities in which there sources are located, proper and socially conscious corporate governance structures, labour rights, community culture, sustainable human development etc. (Yusuf et al, 2012). These may lead to higher level of trust among the employees working together in organisation which likely help in achieving may lower operating cost (Elkington, 2001). Socially responsible companies are those that integrate their operational activities, social, ethical and environmental concerns beyond those required by law (Dyllick and Hockers, 2002) and whose outcomes may result in an improved quality of life for most corporate stakeholders (Garriga and Maler, 2004 cited in Batres et al, 2010; Labuschagne et al, 2004; Kaynak and Montiel, 2009).

2.7: Drivers of Sustainability

Drivers of sustainability are potential benefits or opportunities that an organisation expects to gain when it implemented sustainability (Gopalakrishnan et al., 2012; Yusuf et al, 2012). There are unlimited numbers of enablers' of sustainability in the literature (Stead and Stead, 1995; Seuring and Muller, 2008). Many companies are undertaking some initiatives to transform their supply chain processes in response to government regulations and rising public awareness of the effects of industrial production on the environment, (Lu and Kuo, 2007). Some of the main drivers of sustainability include supply and demand characteristics surrounding energy consumption (Carter and Easton, 2011).

Drivers of sustainability practices were classified differently by different scholars. Example, Walker and Jones (2012) identified factors that enable or inhibit organizations to implement green supply chain management initiatives as internal drivers such as organizational factors and external drivers such as regulation, customers, competitors, society and suppliers. They further classified inhibitors of sustainability practices into internal and external inhibitors. Internal inhibitors are those challenges from within the organisation; they include factors such as cost and lack of legitimacy whilst external inhibitors include factors such as regulation, poor supplier commitment and industry specific barriers.

According to Stead and Stead (1995) drivers of adopting sustainability strategies could be classified into economic, environmental and legal enablers. What is not clear from the previous research is whether certain types of organisations are more internally or externally motivated to integrate sustainability into their supply chains or not (Walker and Jones, 2012).

The context and circumstances that organisations operate influences their approaches to sustainable supply chain management (Walker and Jones, 2012). While the degree at which organisations pursue these drivers may vary depending on their size, location and number of supply chain players involved. Drivers of sustainability issues are relevant to managers, because their stakeholders – customers, regulatory bodies, non-governmental organizations and even their employees are increasingly demanding that organizations should address and manage the environment (Carter and Easton, 2011; Walker and Jones, 2012; Gopalakrishnan et al, 2012).

These authors (Stead and Stead, 1995; Anderson and Bateman, 2000; Haake and Seuring, 2009; Burch, 2010; Walker and Jones, 2010; Mann, et al., 2010; Diabat and Govindan, 2011; Giunipero et al, 2012; Gopalakrishnan et al., 2012; Wu et al., 2012; Yusuf et al., 2012; Zhu and Geng, 2013) acknowledged the following drivers of sustainability practices in organisations;

2.7.1: Government Regulations/Legislations

Environmental problems such as climatic change and global warming forced governments all over the world to enact laws to enforce organisations to control their operations to reduce their environmental and social impacts. Studies show that legal enabler is one of the most influential enabler of sustainability implementation in all types of business organisations. As the 'mother of all enablers', legislation leaves no option for a firm then to comply with it or to exit the market. These Legislations may be driven by government's concern for environmental degradation, public opinion or pressure, interest groups, shortage of resources, preferred modalities of a nation’s development, which may at the same time, act directly as enabler of sustainability. Despite the differences in government legislations from one country to another country, proactive approaches to legal compliance with climate related legislations seem to be more economically beneficial to companies and societies than reactive approaches.

The coercive and deterministic requirements of the regulatory pressure could make the organizational support for implementing sustainability more efficiently. Rising penalties, fines and legal costs have emphasised the importance of complying with legislation. Furthermore, organizations can avoid expensive capital refits by keeping ahead of the regulation. This means that many organisations that adopt sustainability do so because of the law of their countries. It is also important to note that not all countries enforced these legislations appropriately. Thereby giving multinational companies an opportunity to behave differently in different countries depending on the extent to which the law of that country is being enforced.

Despite its impacts on forcing companies to adopt sustainability, government regulations alone may not guarantee complete success on sustainability implementation. In most cases government regulations come in form of take-back and closing the loop laws targeting the main products of a company. In many cases most of the government regulations only apply to a restricted number of products, which one can claim that it meets the standards of sustainability throughout the life cycle of the products. Research shows that government regulations are much less relevant in the upstream of the supply chain because it does not always enforce clean production or free emission production.

2.7.2: Involvement of Top Management

Top management is one of the most powerful agents in mobilising companies to assess their role in the community because they are accountable for the firms’ environmental management. Top managers are strong internal political force that can foster corporate environmentalism. Top management support and commitment is critical in successful implementation of sustainability practices. If managers are proactive on environmental policies, companies will have more legitimacy to implement sustainability practices.

Management support and commitment to sustainability improves cross departmental communication and collaboration. Sustainability implementation influenced by top managers will be more effective than that influenced by operation of law. Sustainability implementation influenced by top managers will judiciously be more executed than if it influenced by operation of law. It is common now for employers to take steps to educate their employees on how they can work and live more sustainability, at home as well as in the workplace.

2.7.3: Reversed or Closed Loop Supply Chain

Sustainable practices, such as reverse logistics may lead to better financial performance and higher profitability. Organisations are attracted to adopt reverse logistics practices because reverse logistics activities lead to cost reduction and savings. A number of researchers find that effectively managed reverse logistics can lead to cost reduction, savings, benefits and effectiveness. Others incentives are energy cost reduction, reduction in cost of disposal, reduction in cost of quality, reduction in holding cost, reduction in waste and reduction in redundancy in operations. Further economic benefits that are realise from the development of closed loop supply chains are better operational performance, newer markets, recapture of value from recovered products, improved profitability and higher revenue.

2.7.4: Company Reputation

Company public image is usually more associated with the main product of the company; while company reputation depends on many magnitudes more on the product being seen as consumer friendly than some background processes. Therefore, the more the product is environmentally friendly the more the purchases and the more the company reputation. If the company production process is environmentally friendly, it is expected that its finish product will be consumer friendly. This might lead to societal acceptance of the company.

2.7.5: Internal Business Process/Firm Specific Capabilities

Internal business process or operational consideration is one of the most important drivers of sustainability, example reverse logistics and their integration into forward supply chain. Organisations can implement sustainability if their processes and resources can coupe up with the costs of sustainable operations. Organisational specific capabilities such as professional knowledge, cross departmental communication and environmental management system enable companies to implement environmental management. Companies should also have human and financial resources that are necessary in implementing sustainability practices.

Among these organizational resources, human and financial resources are the most essential for organizations to adopt proactive environmental strategies. Professional knowledge sharing and environmental management training can enhance employees' ability and company's performance. Sustainability practices require expert knowledge on environmental management. That is why some research suggested having sustainability management department in organisations. The responsibility of the unit is to monitor sustainability implementations in such organisations.

2.7.6: Stakeholder Pressures

Stakeholders play a key role in increasing corporate responsiveness with regards to ecology. Stakeholder theory recognizes existence of other stakeholders separately from owners, which directly or indirectly affect organisational performance. The theory specifies the rights of, and interactions between, various stakeholders. The stakeholders may be classified as primary stakeholders (employees, customers, suppliers, technology consortia, complementary innovators, policymakers and regulators) and secondary stakeholders (local communities, activist groups, religious organizations, trade associations, environmental groups, social advocates, community representatives, safety advocates). In many countries middle managers, employees, pressure groups, customers and investors played significant role in influencing organisations to implement sustainability practices.

Workers morale is directly proportional to the efficiency and efficacy of any organisational change. In many organisations employees have been associated with effort to implement sustainability. On the other hand, worker resistance can lead to the failure of an organisation to implement sustainability.

Furthermore, customers have also been recognised as agent of sustainability practices in many organisations. Consumer concerns were viewed as a more critical force on sustainability practices in companies outside USA and Europe. Customers and markets play an important role in providing an incentive to the growth of sustainability operations. Individual consumer's belief that they can help solve environmental problems was found to be the best predictor of ecologically conscious consumer behaviour. Customers today are less tolerant on defects and poor quality products. Most customers are unwilling to pay a premium price for an environmentally friendly product or process.

The ability of the firm to convince customers that its processes and products are environmentally friendly through advertisement or trade fairs/industrial show may attract attention of many green consumers. Large companies producing final products attract consumers' attention more than SMEs that they may be operating as suppliers to large companies, which may not face customers' pressure. Large retailers are sensitive to environmental concerns of the public, much as suppliers of large retail chains may be persuaded by the retailers in adopting sustainable systems and processes.
Similarly, sustainability practices in organisations increased with increasing refinement in technology, awareness of consumer rights, social activism, focus on commoditizing environmental sustainability, quality control, liberal return policies, higher education, green customers' movement, green investors, greenmarkets and increasing expectations of stakeholders all play important roles in adaptation of sustainability in different companies and countries.

These show that stakeholders have played a key role in increasing corporate responsiveness with regards to ecology. Howsoever ambiguous, social considerations and pressures is one of the important forces that press implementation of sustainable practices; unwillingness of the organisation to become environmentally friendly could directly cause reputational damage; while willingness of the organisations to implement sustainability will ensure effective production of customer friendly products.

2.7.7: Environmental Standards

It may not be reasonable to assume that organisations would take environmental concerns seriously only when forced by legislation or by customers. The anticipation is that socially responsible firms may willingly have schemes in place to take into account environmental sustainability. An increased demand for customer friendly products, stakeholders' pressures, needs to preserve natural resources and legal regulations have made environmental issues and standards vital to industries and their supply chains. International Organisation for Standardisation (ISO) introduced ISO 14001 in 1996 to assist companies in mitigating risks resulting from the environmental impacts of their actions. ISO 14001 set a benchmark for industries, to assist them achieve their environmental objectives. It also offers measures in areas of procurement decisions, reduction of waste, packaging material and logistics solutions.

Many organisations choice suppliers based on environmental performances of supplier and motivate suppliers to adopt ISO standards. Some companies have even compelled their suppliers to become ISO 14001 certified so as to increase operational efficiencies and improve environmental performances. Publication of ISO1400 standard has led to increased pressures on industries' supply chains to address environmental performance through the use of environmental management systems.

2.7.8: Marketing Pressures

Market is where manufacturers and customers meet to exchange products for cash. Market is also where companies compete with one another. Market pressure is powerful factors in stimulating organisation's environmental activities. Increased customers awareness on environmental consciousness makes competition among companies based on environmentally friendly products. Companies are compelled by customers and market to produce customer friendly products or exit the market. Market pressure generated by environmental issues yielded normative isomorphism because customers expect companies to abide by environmental protection standards. So, market pressure on environmental protection would strengthen top managers' commitment to environmental protection.

2.7.9: Competitive Pressures

Competitive pressure play important role among manufacturers because most of them are export oriented either at supply side or at market base. They compete among themselves for orders from international brands or sale at international market. Competitive pressure made companies learn from and emulate competitors' environmental management policies. Companies were influenced under high competitive pressure to imitate competitor's business model. Additionally, competitive pressure could make organisations employ resources more judiciously to strengthen company's competitive advantage and improve its performance.

An increasing number of firms are engaging in ‘‘green marketing’’ to gain or maintain a competitive advantage. Research found that excelling on environmental protection creates opportunities to achieve competitive advantage. Proactive approach on sustainability has potential on improved firm’s competitive capability. It could also help the firm determine government policy, since early adopters are often seen as good role models. Supply chain managers can have a major impact on ability of a company to establish and maintain competitive advantage though environmentally friendly practices (EFP).

The literature categorises different types of competitive environmental strategies that can be utilised by managers to optimize economic returns on environmental investments and transform these investments into sources of competitive advantage. Managers need to identify circumstances that favour the generation of both public and corporate benefits of sustainability initiatives.

2.7.10: Resource Depletion

Resource depletion has generally been accepted as an enabler of sustainability. There have been concerns on the rate at which the natural resources are being extracted by organisation for production purpose. The fear is that if existing resources depletion continuous, existence of the present and future generations is in danger. It is therefore, necessary for proactive sustainability measures to be implemented to safeguard these resources for the present and future generations. Cost reduction as a result of resource efficiencies by means of energy efficiency, waste recycling, competent use and reuse of raw materials and resources, creating standard workplace culture and improvement in safety standards can act as drivers of sustainability implementation.

It is worth noting that sustainability awareness arises because of wasteful nature of resources by industrialisation policies, this give rise to the idea of keeping these resources for future generation. As such many companies adopt sustainability in order to reduce the rates of their resource consumption. Organisations that are interested to ecological issues perform better in market place. Enhanced economic performance may arise through better operational performance, recapture of value from recovered products, costs reduction, newer markets, higher earnings, improved profitability and reduction in liability risks. Example, cost saving is one of the driving forces leading firms to adopt sustainability practice.

2.7.11: Low Carbon Economy

Carbon emissions have been responsible for the current global warming and climatic changes. Carbon emissions are directly relative to size, growth and cost factors of the company. This needs some urgent action by governments and corporations to reduce the rate of carbon emission by manufacturing companies. Low carbon economy is an economy with little rates of per capita carbon emissions. Some companies adopt sustainability in order to reduce their carbon foot print to the environment.

Steady relationships between carbon emissions and costs must be sustained. If both costs and carbon emissions increase beyond a threshold, sustainability operations prove inefficient. There are three measures used to maintain steady relationships between carbon emissions and costs by organisations as follows;

1.) Periodic lifecycle assessments on carbon footprints must be calculated to ensure a judicious balance between costs and carbon emissions.

2.) Engaging carbon management institutions like Carbon Trust to assist in calculating carbon footprint of supply chain.

3.) Maximum utilisation of logistics services such as efficient transportation system, reduction of business travel, etc. results in diminishing costs, carbon emissions and fuel consumption.

2.7.12: Social Responsibility

Financial opportunities can drive corporate ecological responsiveness in many manufacturing organisations. The literature has shown that corporate social responsibility could lead to financial viability in organisations. Recent studies have provided evidences that point to the fact that economic and environmental sustainability have become the most dominant dimensions of the 3BL, but social responsibility has been neglected. There is the need to give publicity and attention to social accountability standards like SA 8000 and ISO 26000, which are intended to ensure viable working conditions, fair trading practices and a sense of righteousness to society.

2.8: Inhibitors of Sustainability

While there are factors motivating organizations to adopt sustainability, at the same time, there are also other factors that affect organization's effort to implement sustainability. Considering oil and gas companies sluggish and responsive sustainability activities, the pressures, though considerable, have not fully persuaded oil and gas companies to undertake sustainability activities. Many researchers have pointed out that lack of financial resources is a critical inhibitor preventing organisations from pursuing environmental activities (Azzone and Arena, 1997, Filho, 2000). Among various kinds of resources, this research focuses on financial resources, information, human resources and environmental attitudes of CEO and employees as the inhibitors of sustainability.

The research of (Azzone et al., 1997; Filho, 2000; Smith et al., 2000; Hillary, 2004; Hoffman and Bazerman, 2005; Haake and Seuring, 2009; Walker and Jones, 2010; Zhang et al, 2011; Giunipero et al, 2012; Gopalakrishnan et al. 2012; Wu et al, 2012; Dashore and Sohani, 2013; Muduli et al, 2013; Zhu and Geng, 2013) identified the following as inhibitors of sustainability implementation:

2.8.1: Problems of Other Stakeholder Pressures

Pressure from other stakeholders such as local residents, interest groups and general public is an important factor motivating companies to pursue environmental activities. However, this only occurs when the local community is able to identify and assess company's environmental performance.

Moreover, although government assistance programmes can provide benefits to companies such as environmental knowledge and financial assistance, limited number of such programmes may make them difficult to access. Additionally, if the programmes are not implemented by experienced consultants and based on sector specific tools and examples; they could work as obstacles and be considered as giving poor information and guidance.

2.8.2: Costs of Adopting Sustainability and Economic Conditions

Sustainability implementation has often been viewed to be expensive to undertake in many companies. Cost of adopting sustainability is one of the reasons advanced by some previous studies that defied companies from adopting sustainability practices. Cost of implementing sustainable practices remains an open question. Additionally, some research argued that the more investments on sustainability practices, the less the profits and the more it erodes the competitiveness of the organisation. Example, costs for implementing 'green' are not at all 'clear' and it is difficult to clearly realise return on investments (ROI) from required capital investments to support 'green' initiatives.

Lack of financial resources can weaken organisations' ability to undertake environmental activities. Financial constraints can make it impossible to implement a number of diverse environmental activities. In addition, it was reported that costs of attaining ISO 14001 were relatively high, compared with ISO 9000 certification, because ISO 14001 environmental certification is more demanding and require extra paperwork; consequently, significant financial resources are required to implement environmental activities. Insufficient financial resources might discourage management attention on sustainability practices

2.8.3: Lack of Consensus at the CEO Level

Decision makers can directly influence operations and behaviours of employees. Company sustainability strategies can be established and facilitated entirely by CEO's. If CEO is aware of the environmental issues and has adequate sustainability knowledge, sustainability activities can be effectively planned and controlled. On the other hand, if the CEO considers environmental issues irrelevant or has inadequate knowledge, the activities might not be effectively implemented or controlled. Relationship between top managers and employees is closer in SMEs than in large companies and the enterprises decided objectives are often implemented through a top down process.

Research found that in the Canadian oil and gas industry, environmental strategies were associated with managerial interpretations of environmental issues as either threats or opportunities. If sustainability implementation is perceived as an opportunity, it will be effectively implemented and controlled and if sustainability practices is assumed to be threat to the organisation it will never be implemented.

In addition, the extent to which sustainability practices is associated with threats or opportunities cannot be unconnected with the corporate motives of profit maximisation. And probably the urge of short time cost recovery/profit making which is not possible in sustainability practice. Returns on sustainability practices are not clearly and concretely defined and not collectively understood in most organization. Often there is no understanding of how to measure progress once actions are undertaken.

2.8.4: Lack of Sustainability Standards and Appropriate Regulations

Every continent has different acceptable standards of sustainability, as do the varying countries that comprise it. Various regions of the world face their own unique challenges to building and sustaining a global supply chain because of different environmental circumstances in various locations. Organisations' operating in different countries face challenges of different laws and regulation. Since, enforcement of environmental legislation and environmental standards are operating differently in countries, Organisations may face difficulties in adopting sustainability in different parts of the world.

2.8.5: Misalignment of Short Term and Long Term Strategic Goals

The debate that sustainability is short term or long term goal is not yet resolved. Still, many people see it as short term while others view investments in sustainability as long term that require much longer time horizon to yield returns. Having profits maximisation in as much prudently short time scales as possible as the key objective of any firm. It is often not immediately apparent that sustainability can help achieve this goal. Many organisations may reject sustainability because of the fair that it is a long term phenomena. Research found that majority of businesses did not have a strong business case for sustainability and some firm managers lack understanding of what sustainability means to a company. Reasons for this include:

1.) Managers lack common fact base about the full suite of drivers and issues that are relevant to their companies and industries

2.) Companies do not share common definition of language for driving sustainability as a definition can vary from narrow to broad, to none at all; and

3.) The goal of sustainability effort is often defined very loosely and not collectively understood within the organization.

2.8.6: Lack of Human Resources

Lack of expertise to monitor the environmental problems that arise in the operation process and to cope with external demands for new environmental technologies is also a critical inhibitor preventing many companies from undertaking environmental activities. Sustainability practices need managers and employees to be expert on sustainability operations. Highly educated employees would easily understand sustainability issues and find appropriate options to deal with these problems.

Many organisations suffer lack of trained personnel to take care of the management, control and implementation of waste management programmes as well as other additional environmental programmes. Financial limitation can make many companies unable to employ skilled staff on sustainability practices. In order to increase employees' skills on addressing environmental problems, additional training programmes may be necessary; still such training programmes may be difficult due to lack of financial resources. Employees' lack of environmental awareness in SMEs are often more widespread than in large companies, except in the high-tech industry sector. On the other hand, when employees are well educated on sustainability issues, organisations will be able to pursue higher level environmental activity.

2.8.7: Difficult to Change Current Company Practices

Implementing sustainability involve a change process in all parts of the organisation. Implementing changes may always meet challenges internally and externally among the stake holders who may view it as a threat to them. Sustainability has no exception may be challenged as a threat in the organisation. If challenged organisations may find it extremely difficult to adopt it.

Due to complex environment where companies operate couple with lack of experience, it takes long time and effort to implement any change against certain inertia. While inertia might be lower in small departments, companies will concentrate on areas they know well and may have more knowledge on technical implementation of sustainability in their core business fields.

2.8.8: Lack of Communication and Coordination

Efficient communications and coordination among members of the supply chain is very essential for sustainability and improved organisational performance. Recent studies show that overlapping communication is a good supporting factor for sustainable supply chain management. Some instruments of exchange such as shared information technology infrastructure and quality control team are very effective in supporting sustainability implementation in manufacturing organisations.

2.8.9: Lack of Appropriate Information

Obstacle impeding organisations wishing to implement sustainability is lack of necessary information. Relevant environmental information is necessary to translate environmental attitudes into reality. In many cases, organisations have little or no knowledge of how to implement sustainability and are unable to introduce appropriate options to improve performance.

Lack of environmental information may face organisations in form of information type and flow. Massive amount of environmental information is available from government, NGOs and the mass media and is easily accessed through internet. However, even for large companies, managing large volumes of information is a problem and many SMEs suffer from information overload. This overloading tends to occur because SMEs often seek environmental information only it is needed.

2.8.10: Lack of Necessary Infrastructures

Infrastructures such as new technology that emit less gas during production and that will produce products that are less harmful to the land field (environment), are either very scarce or very costly. This made it difficult for many companies to install these types of technology in their production process.

The literature provides other inhibitors of sustainability such as sustainability is too abstract; sustainability is too broad; no personnel to look after sustainability implementation; the resources needed do not justify it. Other inhibitors of sustainability include unfavourable public policy, uncertain business environment, culture, reputational risk, organisational size, internal integration/strategic issues, NGOs, competitors and customers.

Dashore and Sohani (2013) through extensive literature review and expert opinion of academics professionals identified a total of 14 inhibitors to GSCM implementation as follows: lack of top level management commitment; lack of integration of information technology system; lack of acceptance of advancement in new technology; poor organizational culture in GSCM; lack of skilled human resource professionals in sustainability and GSCM; lack of energy management and waste management system; uncertainty and competition in market; lack of government initiatives system for GSCM practitioners; lack of knowledge, experience and training to personals in GSCM; lack of green architects, consultants, green developers and contractors in the region; cost of implementation for GSCM; Supplier's flexibility to change towards GSCM; lack of management initiatives for transport and logistics and lack of customer's awareness towards GSCM and green products.

Based on the drivers of sustainability companies might be motivated to adopt sustainability for one advantage or the other. After a company has decided to implement sustainability in its production process, the company will choose sustainability strategy it wants to implement. The strategy chosen will determine the amount of capital to be invested in transforming the strategy into action. Some strategies require more capital investments than others. Example process driven sustainability strategies require more capital investment than market driven sustainability strategies.

2.9: Sustainability Investment

Sustainability investment is the sum of money a company spends in the implementation of sustainability in its operation. Financial investment is required to implement sustainability strategies in all manufacturing companies (Stead and Stead, 1995). Size and nature of the company determine the capital outlay it requires to implement sustainability. Generally, sustainability practices require long term capital investment commitment (Carter and Rogers, 2008).

Sustainability in manufacturing operations has been viewed as a costly investment (Gopalakrishnan et al, 2012). Implementation of sustainability in organisations requires huge expenditure for innovation and for changes of operational structures and processes (Yusuf et al, 2012). Innovation and process change needed for sustainability in oil and gas sector induce significant costs (Nidumola et al, 2009). It has been doubted for a number of years sustainability practices can bring economic benefits to the practicing firms' (Gopalakrishnan et al, 2012). Firms expect to recoup their investment in reasonable periods of time (Stead and Stead, 1995).

The investment made by companies is mostly on buying equipment and facilities that will be used to change the firm's current production process to environmentally friendly production process. The changeover from current production process to a sustainable production process requires complete transformations of the entire production system. Sustainability strategy chosen will guide the type of equipment to acquire and install into the production process.

2.10: Sustainability Strategies

Sustainability strategies are adopted based on some purposes. Motives for implementing sustainability strategies are multiple (Stead and Stead, 1995). The motivation for companies to engage in environmentally responsible practices includes; increased reputation, energy and water cost savings, enhanced value, capital cost savings, brand differentiation and improved marketability (Newell, 2009).

In addition, motives of sustainability implementation are mostly ecological motives such as conserving resources, reducing pollution and reducing wastes (Ayres, 1989; Williams et al, 1993; Stead and Stead, 1995, Robins, 1997; UN, 2004). Two of these motives reducing wastes and pollution occur at the output end of the production cycle whilst the other two motives conserving energy and resources involve decisions that occur at the input end of production cycle (Stead and Stead, 1955; Gopalakrishnan et al, 2012). Sustainability strategies can broadly be classified into two categories as follows:

2.10.1: Process Driven Sustainability Strategies

These are sustainability strategies designed to upgrade the organisations' production process in order to improve their environmental efficiencies and competitive advantages (Stead and Stead, 1995). Process driven sustainability strategies in the literature include:

Redesigning pollution control systems, waste disposal systems, air and water treatment systems, recycling resources derived from external sources, use scrap materials, recycle defective end products in production process; redesigning production processes to be less polluting and more energy and resource efficient; as well as using renewable energy sources in production processes (Ayres, 1989; Hooper and Rocca, 1991; Stead and Stead, 1992; 1995; Wheeler, 1992; Buchholz, 1993).

2.10.2: Market Driven Sustainability Strategies

These are sustainability strategies designed to provide organisations with competitive advantages through environmentally differentiating products and/or markets from their competitors (Stead and Stead, 1995). A number of different devices have been proposed in the literature for market driven sustainability strategies.

These strategies include: redesign product packaging; advertising the environmental benefits of products; redesign exiting products to be more environmentally sensitive; developing new environmentally sensitive products; entering new environmentally sensitive markets and selling donated scrap once considered wastes (Hooper and Rocca, 1991; Ottman, 1992; Stead and Stead, 1992 and 1995; Buchholz, 1993; Williams et-al, 1993; Gopalakrishnan et al, 2012).

Other initiatives are carbon emissions accounting; energy efficiency and use of renewable resources; social programmes such as increased employee involvement, workplace benefits, diversity and equality for workers (Holmes et al, 1996; HervaniandHelms,2005; Keatingetal.,2008; Gopalakrishnan et al, 2012).

Depending on the type of company, sustainability strategies require reasonable capital investments; generate reasonable returns on investment and pay back in reasonable periods of time. It is possible that the specific motives, content and outcomes of sustainability strategies may vary among different firms (Stead and Stead, 1995). Sustainability is becoming significant component of operational and competitive strategies in an increasing number of firms (Shrivastava, 1995; Hart, 1995 and 1997; Mann et al, 2010).

Moreover, organisations implementing sustainability in their operations enjoy distinct advantage over their competitors and this advantage is expected to increase in size and frequency in future (Cerin and Dobers, 2011). Proactive in sustainable operations will improve company's competitiveness because their initiatives will be difficult to imitate (Carter and Denser, 2001 cited in Gopalakrishnan, et al 2012).

Therefore, there is a strong link between environmental awareness and a firm’s competitiveness (Leal et al, 2003). Through pollution prevention companies can realise significant savings resulting in a cost advantage relative to competitors (Romm, 1993; Markley and Davis, 2007).

2.11: Sustainability Performance Assessment

Sustainability assessments recently emerged as a policy tool whose fundamental purpose is to direct planning and decision making towards sustainability (Singh et al, 2011). Sustainability assessment is now gaining more attention in scientific research and in practical application to policy making and management of organizations (Streimikiene et al, 2009). The objective of sustainability assessment is to give decision makers an assessment of global and local integrated nature–society systems in short and long term perspectives in order to help them to decide which actions should or should not be taken in an attempt to make society and companies sustainable (Ness et al, 2007).The fundamental reasons of sustainability implementation in organisations are ecological such as conserving resources, reducing pollution and reducing wastes. Others are economic motives such as increase in sales turnover, increase in profit level, market growth and competitiveness. After implementing a given sustainability strategy, companies are expected to assess whether the objectives of implementing such strategies are achieved or not. Sustainability assessment can be performed for polices, technologies, projects, products, organisations etc. covering different levels (Streimikiene et al, 2009).

Indicators are used to measure progress on sustainability performance. It use measurable overview of trends and it also involves action by all actors, especially the industrial system, which play an important role in the attainment of sustainability goals (Krajnc and Glavič, 2003). Indicators and indices are the first among all kinds of sustainability assessment tools.

In addition, sustainability assessment can best be done through indexes or set of indicators to help decision makers to assess company sustainability performance and provide information for future plan of action (Streimikiene et al, 2009; Takahashi, 2011). If indicators and indices are continuously measured and calculated they can determine long term sustainability trends which could be used to project future on short term basis (Streimikiene et al, 2009). Indicators have to reflect wholeness of the system as well as the interaction of its subsystem

(Guy and Kilbert, 1998; Krajnc and Glavič, 2003). To know whether organisations are meeting the goal of sustainability, we need to measure progress (Krajnc and Glavič, 2003).

Moreover, indicators can be used alone or in thematic sets, which are useful for demonstrating the links between issues and for analysing the reasons behind trends (Krajnc and Glavič, 2003; Martins et al, 2003). Currently accounting approaches in these areas have been developed and in some cases, related to corporate financial accounts (Ekins and Vanner, 2007). Companies first begin with simple and easy to implement measures of compliance and resource efficiency and then moves toward more complex indicators, addressing supply chain social effects and life cycle impacts (Krajnc and Glavič, 2003; Guy and Kilbert, 1998).

Several initiatives have been proposed to assess sustainability performance of organisations and to report the results to the firm's stake holders examples; the Institution of Chemical Engineers (IChemE) developed sustainability metrics covering three dimensions economic, environment and social which are further sub-divided into set of indicators (Labuschagne et al., 2005). This metrics was initiated to assess the sustainability performance of process industry. United Nations Commission on Sustainable Development (CSD) devised a framework of monitoring various sustainability indicators for evaluating the performance of government towards sustainable development goals (Labuschagne et al, 2005).

The structure of framework comprises four dimensions viz. economic, environment, social and institutional and it is broken down into 38 sub-indicators and 15 main indicators (Singh et al, 2011). Global Reporting Initiatives (GRI) developed a framework of sustainability assessment and reporting covering economic, environmental and social indicators of sustainability (GRI, 2002). This shows that indicators of sustainability are massively being used to assess organisational sustainability performance (Labuschagne, 2005; Streimikiene et al, 2009; Singh et al, 2011).

Over the years, there have been consistent efforts at local, regional, national and international level to identify appropriate sustainability indicators as per the sustainability context and coverage (Singh et al, 2011). There is also similar effort at industry level to develop frameworks of sustainability assessment covering economic, environmental, social and environmental dimension of sustainability for specific industrial sector.

2.12: Sustainability Indices

Indices are called differently under different situations they are known as: sustainability indicators, sustainability metrics, performance indicators, sustainability report indicators and environmental performances indicators. Indicators and matrices of sustainability are used inter changeably (Martins, et al 2007).

Furthermore, indicators of sustainability originated from the 1992 Earth summit at Rio-de-Janeiro that recognised the important role that sustainability indicators can play in helping countries and organisations to make informed decisions concerning sustainability. This recognition is articulated in Chapter 40 of Agenda 21. The conference recommended governments, non-governmental organisations and companies to develop indicators that will to measure their sustainability practices (Bell and Morse, 1999; GRI, 2002; Parris and Kates, 2003; Bohringer and Jochem, 2007; Martins, et al 2007; Dresner, 2008;Streimikiene et al, 2009; Singh et al, 2012).

Moreover, Agenda 21 specifically calls for the harmonization of efforts to develop sustainability indicators at the national, regional and global levels, including the incorporation of a suitable set of these indicators in common, regularly updated and widely accessible reports and databases (CDS, 2002). In response to this from 1995 and 2000 UN commission on sustainable development (CSD) developed and tested a set of 134 indicators in 22 countries drawn from economic, environmental, society and institutional components of sustainability (UN, 2001; CDS; 2002; Bohringer and Jochem, 2007). This set was revised twice and finally it was published in 2006; the document consists of 50 core indicators which form part of the larger set of 98 indicators of sustainable development use today all over the world (Colantonia, 2008; Singh et al, 2012). Two third of these sustainability indicators addressed environmental concerns, very recently this technical lists have been enlarged to include social indicators (Therivel, 2004; Colantonia, 2008).

Krajnc and Glavič (2005) defined indicators as simple measures most often quantitative with the ultimate aims of assessing the key sustainable concern. According to Worrall et al (2009, P. 23) sustainability indicators ‘are measures of change … overtime, they are descriptive tool that enable assessment of a system or phenomena under consideration’. While Streimikiene et al (2009) define indicators as simple measures, most often quantitative, representing a state of economic, social and/or environmental development in a defined region at national levels or in organizations.

Indicators are instruments for reporting and measuring the progress of sustainability performance in organisations (Liverman et al, 1988; Crabtree and Bayfield, 1988; GRI, 1992; Delai and Takahashi, 2011). The aim is to determine whether corporate actions have positive or negative impact in meeting sustainability practices (Rogers et al, 2008). Measuring sustainability involves recording the progress of the indicators (piece of information), which when composed will give an overview of the organisation affairs (Claro, 2006; Bohringer and Jochem, 2007). This will enables the organisations to know how far they have gone, set their goals and determine the value of their business.

Today many international organisations are monitoring and reporting their sustainability practices using sets of indicators (Liverman et al, 1988; Krajnc and Glavič, 2005). Some oil and gas companies including British petroleum produce sustainability reports with triple bottom line (Rogers et al, 2008).

2.13: An Overview of Sustainability Indices

Sustainability indicators can broadly be classified into three that are economic indicators, environmental indicators and social indictors. Under each of these broad classifications there are a number of composite indicators.

2.13.1: Economic Indicators

Economic indicators are those indicators that illustrate variations on financial capability of the system under review. Economic indicators describes all aspects of organizational operations in relation to its stakeholders financially, they shows the organisation's financial system, financial validity and other aspects of economic interactions (GRI, 2002).

They are economic trend indicators that are analyse using two approaches viz: valuation of discount rates of resource depletion and total factor productive (TFP). Discount rates concept of in the context of sustainability was first initiated by Barbier (1989) and Pearce et al, (1990). Discount rates are derived from concept of intergenerational equity or more from its predecessor concept of limited non-renewable resources (Meadows et al, (1972). Some economic indicators include:

2.13.1.1: Economic Sentiment Indicator (ESI)

The economic sentiment indicator of the European commission (ECESI) aggregates business surveys into one cyclical indicator. This indicator reduces the risk of false signals and it is used as a forecasting and tracking tool to assess individual components (Nilsson, 2000). The economic sentiment indicator (ESI) comprises of four components viz: industrial confidence indicator, construction confidence indicator, consumer confidence indicator and share price index.

2.13.1.2: Green Net National Product (GNNP) or (EDP) and SEEA

Green net national product (GNNP) takes care of both environmental degradation and flow of earnings. This eliminates the flaws in GDP. The environmental adjusted net domestic product (EDP) has been developed within the purview of SEEA. Bohringer and Jochem (2007) describe three different versions of the EDP viz: the EDP-I is evaluated by subtracting depreciations of natural resources from the net national income (NNI). The EDP-II is determined by subtracting from the NNI costs required to reach the same state of the environment at the end of the period as existed at the beginning of the period. The EDP-III is calculated by subtracting the costs of environmental pressure and destruction using willingness-to-pay method

2.13.1.3: Index of Sustainable and Economic Welfare (ISEW)

Centre for environmental strategy (CES) and new economics foundation (NEF) developed the Index of sustainable and economic welfare (ISEW) (Singh, 2012). The main goal of this index is to measure the component of economic activity that leads to welfare to the society. It is aimed to replace GDP as an indicator of progress, because of its ability to show the relationship between economic activities and their direct effects on the quality of life (CES, 2000 cited in Singh, 2012).

Furthermore, the index consists of seven economic activities divided into set of twenty sub indicators. The core seven components that relate to economic activities comprise: adjusted consumer expenditure, services from domestic labour, services from consumer durables, services from streets and highways, public expenditure on health and education, net capital growth and net change in international position. The thirteen indicators that related to reduction in welfare are: consumer durables (difference between expenditure and value of services), private expenditures on health and education, commuting costs, personal pollution control, automobile accidents, water pollution, air pollution, noise pollution, loss of natural habitats, loss of farmlands, depletion of non-renewable resources, costs of climate change and costs of ozone depletion (Singh et al, 2012).

2.13.2: Environmental Indicators

These indicators are used to analyse the rate of resources extraction and environmental degradation by manufacturing companies.Environmental indicators describe the organizational activities impacts on living and non-living organisms such as eco-system, land, water and aid (Crabtree and Bayfield, 1998; Azapagic, 2003; Labuschagne, 2004; Martins et al, 2007; Delai and Takahashi, 2011). Environmental indicators became popular in the early 1970s after the formation of US council on environmental quality (CEQ) (Rogers et al, 2008).

The technique use to analyse environmental indicators is appraisal of discount rates of resource depletion. The computation of discount rates of resource depletion and pollution can be used as an environmental, as well as economic, trend indicator. In this case, the dimension would not be monetary values but physical units (e.g., tons or parts per million). Similarly, this approach is applied mainly for extensive resource extraction and long-term pollution, such as gaseous emissions or global warming. Frequently, these physical calculations are used as a basis for economic valuation, primarily to extrapolate the potential and limitations of industrial development. Physical indicators should be given more priority; monetary indicators should be used as complementary. Examples of environmental indicators include the following;

2.13.2.1: Sustainability Performance Index (SPI)

The SPI is developed by Narodoslawsky and Krotscheck in 1994 for process industry to measure sustainability (Singh et al, 2012). It uses process data at the early stage of planning and data of natural concentrations of substances (not on their presumable impact which is usually not known). The SPI appraisal comprises of calculation of the area needed to embed a process completely into the earth. Furthermore, the SPI for the unit process is equivalent to the total area required for production of raw material, process, energy and provision of installations for process as well as area needed for staff and for accommodation of products and by products (Lundin, 2003 cited in Singh et al, 2012).

2.13.2.2: Living Planet Index (LPI)

Living planet index (LPI) was developed by WWF (1998) which is used as global bio-diversity indicator. LPI measures trends in over 2000 populations of more than 1100 species of vertebrates in derestrict, freshwater and seawater ecosystems. The LPI calculates the sub-index for the three spheres (Singh et al, 2012). LPI is the ratio between its populations for each sphere for every successive year. The geometric mean of all ratios of different species multiplied with the index value of the former year provides the biodiversity index for respective sphere. The base year is considered as 1970 and index value is scale for 1970 is unity (Bohringer and Jochem, 2007).

2.13.2.3: Triple Bottom Line Index (TBLI)

The triple bottom line index (TBLI). This is an aggregate index that assesses sustainability performance of companies. Sustainability is the balance between financial growth, ecological improvement and ethical equity (Wang, 2005 cited in Delai and Takahashi, 2011).

2.13.2.4: Ecological Footprint (EFP)

The ecological footprint (EFP) quantifies for any given population the mutually exclusive, biotically productive area that must be continuous use to provide its resource supplies and to assimilate its wastes (Wackernagel and Rees, 1997 cited in Singh, 2012). EFP uses bio productive area as unit of measurement. The footprint accounts the resource supply chains and disposal management options (Booysen et al, 2002).

This analysis calculates whether the land and sea area required per year to sustain the current consumption by the help of prevailing technology are within the available resources. Land and sea are divided into five components viz. bio-productive land, bio productive sea, energy land, built land and biodiversity land for non-human species. Footprints are calculated based on either compound or component or combination of these methods. EF is used to estimate environmental sustainability at national and global level (Ness et al, 2007).

Ecological footprint is a global and country by country calculation of consumption and waste relative to the Earth's capacity to create new resources and absorb waste. It is constructed from impact measures for managing the use of crop lands, grazing lands, forests, fisheries, infrastructure and fossil fuels. These measures are then compared with the global stock of each resource. The result is a trend that steadily increases from 0.68 Earth consumed in 1961 to 1.22 in 1999, which indicates that consumption now exceeds the renewable supply of resources (Ness et al, 2007; Singh et al, 2012).

2.13.2.5: Life Cycle Index (LCI)

Life cycle index (LCI) is a composite index developed for decision making of process and products considering its entire life cycle attributes. The objective of this index is to help companies to provide decision support system in assessing various design and technological considerations of processes and products (Singh, 2012). Life cycle index (LCI) comprised of four components namely environment, cost, technology and socio-political factors. It takes care of both aspects where targets have to be met separately (fixed) and trade-offs between different impacts are allowed (flexible). This model provides flexibility in reaching the target by considering cost of increased need for preference information collection and modelling (Ness et al, 2007).

2.13.2.6: Environment Sustainability Index (ESI)

The 2002 environmental sustainability index (ESI) was developed for 142 countries to measure the overall progress towards environmental sustainability (Singh et al, 2012). Environmental sustainability index is a composite index derived from 68 indicators for 148 countries (Bohringer and Jochem, 2007; Henri and Journeault, 2008).

Furthermore, these indicators are aggregated into 5 components and 21 core indicators: environmental systems (air quality, water quantity, water quality, biodiversity, and land); reducing environmental stresses (air pollution, water stresses, ecosystem stresses, waste and consumption pressures, and population growth); reducing human vulnerability (basic human sustenance and environmental health); social and institutional capacity (science and technology, freedom to debate, environmental governance, private sector responsiveness, and Eco-efficiency); and global stewardship (participation in international collaborative efforts to reduce greenhouse gas emissions and trans boundary environmental pressures). Every variable in the data set scaled between 0 (low sustainability) and 100 (high sustainability) (Singh, 2012).

2.13.2.7: Environmental Performance Index (EPI)

The environment performance index (EPI) was developed to measure the impact of policy which results in reduction of environmental stresses on human health and promoting ecosystem vitality and sound natural resource management (Henri and Journeault, 2008). The aims of EPI is to evaluate a set of environmental issues monitored through six policy categories for which all governments are liable to undertake (Ness et al, 2007). Environmental performance indicators (EPIs) may have the capacity to improve environmental performance (Henri and Journeault, 2008).

Publiccorporations place more importance on the measure of EPIs than privately owned organisations. More so, large companies may devote more attention to measurement of EPIs to help manage environmental issues (Henri and Journeault, 2008). Large organisations may have more resources to invest in the development of EPIs; those resources are not necessary allocated to environmental issues. Instead, top management may assign those resources to other organisational priorities or critical uncertainties (Henri and Journeault, 2008). All the indicators are scaled from 0 to 100.Weights of indicators are evaluated using principal component analysis and finally it is aggregated in the form of weighted sum (Booysen et al, 2002).

2.13.3: Social Indicators

Social indicators are intended to translate aspects of intergenerational equity into measurable quantities or at least into operationalized terms (Singh et al, 2012). The social impacts indication described the overall organisational relationships with it employees, suppliers, contractors and customers (Azapagic, 2003; Delai and Takahashi, 2011). However, approaches to quantification and operationalization of social dimensions must be carefully restricted to those aspects that can be described meaningfully by numerical or analytical tools and methods (Hardin, 1991). The most direct quantification of equity involves computation of wealth distribution in a society (Ness et al, 2007; Singh et al, 2012).

Such a numerical expression seems may have several shortcomings that must be considered. This is because it is based on a static perception of social and cultural values and conditions and pretends total uniformity of people, which is clearly not valid. People differ in the way they use and appreciate their resources, in their endowment and they are conscious of social justice (Azapagic, 2003; Delai and Takahashi, 2011). Some common social indicators in the literature include;

2.13.3.1: Well-Being Assessment (WBI)

The Well-being assessment developed by Prescott-Allen (2001) comprises of arithmetic mean of Human Well-being index (HWI) and an ecosystem well-being index (EWI). HWI has 5 subcomponents while EWI comprises of six sub-components. The various sub components of HWI are namely health and population, welfare, knowledge, society and equity index (Ness et al, 2007; Singh et al, 2012).The EWI consists of sub-components for resources deployment, land, water, air, species and genes. HWI has a total of 87 indicators divided into 36 indicators and while EWI has 51 indicators (Bohringer and Jochem, 2007). Indicators are judged based on subjective assessment, normalized a by a proximity to target approach and aggregation is carried out by a weighted arithmetic mean (Singh et al, 2012).

2.12.3.2: Wellbeing Index

World conservation union (IUCN) sponsored the development of the "Wellbeing Assessment" that was published in *the wellbeing of nations*: *a country-by-country index of quality of life and the environment*. The Wellbeing index consists of a composite of 88 indicators for 180 countries. The indicators are grouped into two sub-indexes (human wellbeing and ecosystem wellbeing). The human wellbeing index is in turn a composite of indices for health and population, wealth, knowledge and culture, community, and equity. The ecosystem wellbeing index is a composite of indices for land, water, air, species and genes, and resource use (Parris and Kates, 2003)

2.13.3.3: Human Development Index (HDI)

The human development index (HDI) was developed by UN it comprises of three basic components viz. long and healthy life, GDP per capita as well as knowledge (UN, 2001). Long and healthy life is measured based on life expectancy at birth. GDP per capita is measured in terms of PPP US$. Knowledge is evaluated on adult literacy rate (with two-thirds weight) and the combined primary, secondary and tertiary gross enrolment ratio (with one-third weight). All the indices are appraised based on minimum and maximum values for each indicator and performance in each component is expressed as a value between 0 and 1 (Singh et al, 2012).

2.13.3.4: Corporate Social Responsibility Indicators (CSRI)

This is a set of indicators launched in 2002 designed to help companies 'to learn and assess company management with regards to business social responsibility (BSR) practices, business strategy and the monitoring of company general performance' (Ethos, 2005, p. 3). It is a self-evaluation and report guideline that focuses mainly on social aspects of sustainability and considers corporate social responsibility (CSR) as a way to manage while addressing competitiveness, sustainability and societal requirements (Delai and Takahashi, 2011). Corporate social responsibility indicator of sustainability measurement is not fully matured and is facing challenges (Martins et al, 2007; Delai and Takahashi, 2011).

2.14: Sustainable Supply Chains Management (SSCM)

Sustainable supply chains management (SSCM) extends the scope of SCM by environmental and social issues and it attempts to consider all the dimensions of sustainability in designing and optimizing supply chain (Seuring and Müller, 2008a; Bai and Sarkis, 2010; Gold et al., 2010). The integration of sustainability practices in supply chains is relatively new but growing for overa decade and the concept is receiving global acceptance (Kleindorfer et al, 2005; Seuring et al, 2008; Seuring and Muller, 2008b; Pagell and Wu, 2009; Vermeulen and Seuring, 2009; Buyukozkan and Cifci, 2010; Kuik et-al, 2011; Gopalakrishnan et al, 2012). Additionally, sustainable supply chain management is also a process of integrating sustainability into the market, current approaches have some shortcomings in their ability to be comprehensive (Haake and Seuring, 2009). A focus on supply chains is a step towards the adoption of sustainability, since supply chain deals with the product from initial processing of raw materials to delivery to the customer. Sustainability also must integrate issues and flows that spread beyond the core of supply chain management: product design, manufacturing by-products, by-products produced during product use, product life extension, product end-of-life, and recovery processes at end-of-life (Linton et al, 2007). Thereforeresearch into the operational implications of various policies and how business can integrate sustainability in their supply chains is required (Linton et al, 2007).

Furthermore, enhancing integration of sustainability in supply chain, through optimising loads and backloads or producers vertically and horizontally sharing their customers, suppliers and co-producers is timely (Browitt, 2009). Principally, it is limited to vertical aspects, while the horizontal aspects are ignored from a business point of view (Svensson, 2007). ‘The dilemma with most of the current research and literature on sustainable supply chain management is that there is no satisfactory emphasis and connection described between first, second and n-order supply chains. They are interpreted as separate supply chains; it is essential that this is brought up in discussions on sustainable supply chain management’ (Svensson, 2007, pp. 264).

Sustainable supply chain management is where the first-order supply chain of new brand goods goes beyond the traditional point of consumption. This point of consumption connects thereafter into the point of origin in the second-order supply chain, namely the second-hand goods market. The second-order supply chains should really be considered in business practices from the point of origin in the first-order supply chains. In reality, many products in the marketplace are not made completely out of non-renewable resources any more, but consist of renewable and recycled resources, even though the products themselves are considered brand new(Svensson, 2007)..

The main feature of a supply chain deploying sustainability is the relationship between suppliers and focal companies. A healthy supply relationship can result in operational efficiency, positive environmental impacts, cost reduction, flexibility in adapting to ever changing demands, technological innovations, energy efficiency and reductionin carbon emissions (Simpson and Power, 2005). An effective sustainable supply chain should cover core quality management practices, supplier quality management, environmental management practices, green supply management, customer relations management, human resource sustainability, code of conduct within the company and extended code of conduct

(Kaynak and Montiel, 2010). Other aspects connected to sustainable business practices are: product returns; source reduction; recycling; material substitution; reuse of materials; waste disposal; refurbishing; repair; and re-manufacturing (Stock, 1998). ‘The common denominator is that they all require an extended approach beyond the restricted point of origin and end boundaries in descriptions of supply chains in literature’ (Svensson, 2007, pp. 263).

Reducing environmental impacts were initially based on improving the image of the products through ‘green supply chain’, ‘green logistics’ and ‘green products’ (Seuring and Muller, 2008b; Chaabane, 2011). Recently the focus shifted to concerns on the wider environmental issues including ethical and ecological concerns, ethical sourcing, purchasing and supply (Linton et al, 2007; Buyukozkan and Cifci, 2010; Vurro et al, 2010; Chaabane, 2011). Sustainable supply chain is entrenched in a set of developing capabilities such as waste minimization, green product design, technology cooperation in the developing world, rising energy prices, scarcity of resources (not renewable), climate change, emissions reduction (liquid, solid, and gaseous), and improving the quality of life (Kleiner, 1991; Hart, 1993, 2000; Kleindorfer et al, 2005; Carter, 2008; Chaabane, 2011). These shows that each stage in supply chain from sourcing raw material through product processes to disposition of used products have environmental effects (Costanza, 1991; Daly and Cobb, 1989; Azapagic, 2003).

Therefore, organisations should not only be evaluated on their supply chains’ impact on traditional financial bottom line but also on impacts of their chain on environmental and social/ethical performance (Gladwin et al, 1995; Jennings and Zandbergen, 2005; Maloni and Brown, 2006; Markley and Davis, 2007; Pagell and Wu, 2009; Gopalakrishnan et al, 2012).

Sustainable supply chain includes delivering economic, environmental and social benefits – or what has been termed “the triple bottom line” (Johnson, 1991; Norman and MacDonald, 2004;Sharma andHenriques,2005; Lintonetal,2007; Markley and Davis, 2007;Baske, 2012; Gopalakrishnan et al, 2012). Demand for sustainable supply chain arose as the result of ‘the scarce non-renewable resources that businesses are confronted with currently and the increasing scarcity of these resources in the future, will strengthen the need to search for renewable and recycled resources . . . in order to address genuine aspects of sustainable supply chain’ (Svensson, 2007, pp. 262). And the movement of competition beyond single firm into the supply chains makes integration between sustainability and supply chain worthwhile (Linton et al, 2007). Likewise the institutional changes in developing markets drive organisations to adopt sustainability in their supply chains (Batres et al, 2010).

Moreover, managers acceptance that pollution originates from inefficient use of human and material resources in production processes (Hart, 1995; Carter and Rogers, 2008; Kaynak and Montiel, 2009; Walker and Jones, 2012), make organisations concerned on exploring total solution on the reduction of the waste generated from their production operations (Chaabane, 2011). Started focusing on pollution prevention to minimize or eliminate emissions, effluents and wastes from their operations (Markley and Davis, 2007).

Pollution prevention can lead to significant savings that will lower cost of production relative to competitors (Hart and Ahuja, 1994; Markley and Davis, 2007). Some organizations have already made move and they are reducing their harmful impact on the environment while reducing different logistics costs. For example, Texas Instruments save 8 million USD each year by reducing its transit packaging budget for its semiconductor business through source reduction, recycling and use of reusable packaging systems (Chaabane, 2011). Chemical companies are aware of their carbon foot prints and this is shown in logistics tenders that show 'commitments to quality carriers and use of assessment systems that incorporate safety and environmental standards (Browitt, 2009).

The key interfaces that sustainability has with supply chain management, strongly suggests that sustainability is the license to do business. And supply chain management is an integral component of this license (Carter and Easton, 2011; Gopalakrishnan et al, 2012). The license could be obtained through product stewardship that stops firms from environmentally harmful businesses and external orientation that strengthen and differentiate the firm's position through positive effects of a good reputation (Markley and Davis, 2007). Organisations have identified that the most conceivable way to excel in business is to adopt sustainability in supply chains (Markley and Davis, 2007).

The degrees to which organisations collaborations and sustainability concerns are prioritised and implemented along the supply chain vary (Cooper et al, 2000; Clodia-Vurro et al, 2010). Working proactively on sustainability issues with their supplier and contractors, can ensure availability of supplies and services on a going basis and that supply chain costs are properly controlled (Kaiser, 2007). Efficiency in sustainable supply chain leads to high competitive advantage because its inventions willbe difficulttoduplicate(Carter andDresner, 2001; Zhu et al, 2005; Markley and Davis, 2007; Pagell and Wu, 2009; Buyukozkan and Cifci, 2010), it also helps to manage reputational and environmental risk (Carter and Carter, 1998; Schwartz, 2000; Hall, 2001; Cousins et al, 2004; Clodia-Vurro et al, 2010).There are also business added values and benefits for implementation of sustainability in manufacturing along supply chain (Stuart et al., 2005; Baske, 2012).Competitive advantage depends strongly on the proper match between distinctive internal (organizational) capabilities and fluctuating external (environmental) circumstances (Andrews, 1971; Chandler, 1962; Penrose, 1959 cited in Markley and Devis, 2007). Sustainable supply chains consider and use the interrelationships between the actors (supply chain players), resources and activities, and interfaces comprising of coordination, interaction, cooperation and competition (Svensson, 2007). Kleiner, (1991) and Hart, (1993, 2000) predicted that environmental opportunities in the future may become a major source of revenue growth and competitive advantage to organisations.

Stead and Stead (1995) survey research on sustainability strategies implementation discovered that sustainability leads to increased profitability and competitiveness. Lealetal (2003) in their survey of Spanish firms found that there is a strong relationship between environmental consciousness and a firm's competitiveness. Walker and Carter, (2012) empirically discovered that sustainable supply chain operations in the companies will significantly increase in the future. Gopalakrishnan et al (2012) case study research found that sustainability implementation in manufacturing companies lead to increase in the companies' financial performance. Yusuf et al (2012) survey research on sustainability measures adopted in the UK oil and Gas companies, found significant correlations between sustainability measured implemented and corporate competitiveness.

2.14.1: Definitions of Sustainable Supply Chains

Sustainable supply chain management though is new phenomenon has recorded a number of definitions, some of such definitions includes;

According to MacDonald's (2004) sustainable supply chain is one that realizes development by acknowledging the social, economic and environmental aspects of their policies and actions; and that while creating financial benefits and attending to stakeholder's preferences, supply chains must also care to shield the environment from the detrimental effects of theirpolicies and actions.

Sustainable supply chain is one that performs well on both traditional measures of profits and loss as well as on triple bottom line (Jennings and Zandbergen, 2005).

Similarly, sustainable supply management is strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter organizational business processes for improving the long-term economic performance of the individual company and its supply chains (Carter and Rogers, 2008).

Sustainable supply chain is the management of material, information and capital flows as well as cooperation among companies ailing the supply chain while taking goals from all three dimensions of sustainability i.e. economic, environmental and social, into accounts which are derived from customer and stakeholder requirements (Seuring and Muller, 2008).

In addition, sustainable supply chain management is the specific managerial actions that are taken to make the supply chain more sustainable with an end goal of creating a truly sustainable chain (Pagell and Wu, 2009).

Sustainable supply chain refers to all forward processes in the chain, like procurement of materials, production and distribution, as well as reverse processes to collect and process returned used or unused products and or parts of products in order to ensure a socio-economically and ecologically sustainable recovery (Bloemhof and Nunen, 2005; Huang, Yan and Qiu, 2009).

Sustainable supply chain management is the integration and coordination of economic, environmental and social practices throughout the supply chain to improve firms' economic, environmental and social performance along the supply chain (Kaynak and Montiel, 2010).

It has also been defined as, the pursuit of sustainability objectives through the purchasing and supply process, incorporating social, economic and environmental elements (Walker and Jones, 2012).

2.14.2: Sustainability Implementation and Organisational Competitiveness

Potential economic advantages on the intersections of economic with environmental and social performance include the following:

1. Organisations could save cost through reduced packaging waste and their capacity to design for reuse and disassembly of scrap products (Hart, 1995; Shrivastava, 1995; Mollenkopf et al, 2005; Rosenau et al, 1996).

2. Organisations operating harmless warehousing/transportation and better working conditions would achieve reduced health and safety costs and lower recruitment and labour turnover costs (Brown, 1996; Carter et al., 2007). These will reduce their costs and enhances their revenues.

3. Improved working conditions can increase motivation and productivity and reduce absenteeism of supply chain personnel; this assist organisations to obtain labour at lower costs, increase corporate productivity. Increased productivity will increase sales turnover and profitability (Holmes et al., 1996; McElroy et al., 1993).
4. Proactively shaping future regulation; companies that proactively address environmental and social concerns can influence government regulation, when this regulation is modelled after a company's production and supply chain processes, lead to difficult-to-replicate competitive advantage for companies and their suppliers (Carter and Dresner, 2001).
5. Reduced costs, shorter lead times and better product quality related with the execution of ISO 14000 standards, which provide a model for environmental management systems (Hanson et al, 2004).
6. Enhanced reputation; engaging in sustainable behaviour can make an organization more attractive to suppliers and customers, thereby becoming accepted by the local community, prospective workers and the shareholders (Klassen and McLaughlin, 1996; Capaldi, 2005; Ellen et al, 2006).
7. Couple with economic objectives to develop a clear, long-term strategy, the integration of sustainability in a firm's supply chain management activities may create a longer lasting and less imitable set of procedures (Carter and Rogers, 2008)

2.15: Competitive Objectives/Competitive Advantage

Competitive advantage is economic value created by organizations (Helfat, 2007). Competitiveness is organizational condition of superior performance which arises when a firm successfully competes either on price or by charging a premium for differentiation. It grows out of the customer value of what a firm creates and its aims to establish a profitable and sustainable position against the forces that determine industry competition (Porter, 1985). Additionally, value is determined by the extent of satisfaction that is subjectively realized by a consumer (Lepak et al, 2007 cited in Baske, 2007). It can be achieved through innovation, efficiency and effectiveness in production leading to lower cost or higher quality (Pitelis, 2009). Competitiveness might best be secured through setting a position early that competitors will find difficult to imitate (Ghemawat, 1986; Lieberman and Montgomery, 1988). It can be measured by both financial indicators and customers' perceived benefit (Baske, 2007).

Globalization and customisation growth has led to increased competition in manufacturing sector (Vokurka, et al, 2002; Christiansen et al, 2003). Organizations are now competing on both their capabilities and their supply chain (Vokurka et al, 2002; Hult et al, 2007). Therefore, competitiveness is now applicable across the whole industry (Porter, 1997). As competitive conditions grow ever more turbulent, the need for developing and sustaining competitiveness increased rapidly (Harris and Ogbonna, 2001). The intensifying significance of developing competitive advantage is apparent in the rapidly expanding body of practitioner-oriented texts and theoretical articles which expound the merit of acquiring sustainable competitive advantage (Crockett, 1999). Oil and gas industry provide a fertile domain for the study of sustainable competitive advantage (Stead and Stead, 1995; Schweitzer, 2011).

Competitive advantage has been addressed by many researchers, including resource based view (the routine based view) and market based view, whilst others have focussed on the need to develop dynamic capabilities that will lead to competitive advantages. This thesis addressed resource based view (RBV), market based view (MBV) and organisational capabilities/competitive priorities. This thesis uses resource-based view because it focuses is on sustainability application in oil and gas companies which require enough resources for sustainability implementation.

2.15.1: Fundamentals of Competitive Priorities/Objectives

Competitive priorities is also refers to competitive dimensions and/or 'competitive capabilities/competences' (Hendry, 2010). Competitive objectives represent an essential internal contingency factor of operations capabilities (Peng et al, 2011). Competitive priorities are goals and objectives that guide management actions on competitiveness (Koufteros et al, 2002). They are critical success factors that impact on profit for competitive firms (Snaddon, 1996). Therefore, they are the primary basis for competition and the foundation, creating, combating, and sustaining competitiveness (Gunasekaran and McGaughey, 2002). 'Effective programs and action plans are built to achieve those priorities, concerned with improvements in the manufacturing strategy decision process such as, capacity, facilities, vertical integration, quality management, human resource management and manufacturing planning and control systems' (Hallgren et al, 2010, p. 513).

In operations strategy the concerned is cumulative approach towards attaining the enhanced capabilities. Consequently, cumulative model has been presented differently by different researchers with common fundamental structural element of successive progression (Hallgren et al, 2010). For example, cost, quality, delivery and flexibility (Boyer and Lewis, 2002). Others list them as: cost, quality, delivery, flexibility and service (Miller and Roth, 1994; Christiansen et al, 2003: Corbett and Van-Wassenhove, 1993; Frohlich and Dixon, 2001). Hill (2000) presented them in order of: delivery, speed and unique design capability. According to Gunasekaran and McGaughey (2002) competitive dimensions are: cost, speed, dependability, quality and flexibility. Slack (1991) explains that speed, dependability, quality and flexibility contribute directly and indirectly to low-cost manufacture.

Similarly, an empirical finding from North America and Japan presented the first sequence as: quality and delivery followed by cost and flexibility (Nakane, 1986: Ferdows et al, 1986; DE Meyer et al, 1989). Few years later the finding of Ferdows and DE Meyer (1990) discovered them in a reverse order as: flexibility, cost, delivery and quality. The sequence for building sustainable supply chain capabilities is quality, dependability, flexibility, agility, and finally, efficiency (Vokurka et al, 2002).

While quality and on-time delivery are important capabilities for all manufacturing companies, some companies emphasize cost efficiency and flexibility (when competing on price), while others emphasize flexibility through low emphasis on cost efficiency (when competing on differentiation and a wide product range with high profit margins). However there is a debate concerning additional elements (Christiansen et al, 2003). For example, Miller and Roth (1994) added a construct on service related variables in order to better grasp the competitive environment confronting the companies. In addition, Hendry (2010) added customisation and repeat order. The emphasis is on how the competitive priorities guide decisions regarding management practices, technology, production process and capacity (Peng et al, 2011). Operations management research uses cumulative approach of competitive priorities (Hallgren et al, 2010).

Cost:

A low-cost position enables firm to use aggressive pricing and high sales volume (Hart, 1995). Companies can realize significant savings resulting in a cost advantage relative to competitors (Hart and Ahuja, 1994). Firms seek position through defendable cost or differentiation position in an attractive market and keeping their rivals off balance through strategic investments, pricing strategies and signals (Day, 1994).

Speed:

Speed is the ability of the firm to provide fast deliveries, meet delivery promises, and reduce production lead times (Boyer and Lewis, 2002). Speed provides firms with reliable and timelier information about product orders and needs. Shorten the lead times between firms by removing the difficulties to time compression. Synchronise lead times and capacities among the levels or tiers of supply chain more work can flow up and down the chain in a coordinated manner (Peng et al, 2011).Increasing speed means material spends less time in inventory, thereby reducing both direct material and overhead storage costs (Richardson and Snaddon, 2011).

***Flexibility*:**

Flexibility is the ability of the firm to change strategies from low-cost producer to rapid product development relatively quickly with minimal resources (Hayes and Pisano, 1994). It is an adaptive reaction to environmental uncertainty; firms use it to respond quickly and efficiently to a dynamic market (Gupta and Goyal, 1989; Gerwin, 1993: Vickery et al, 1999). Flexibility is the ability of the manufacturers' to make rapid design and changes volume, quickly adjust capacity, offer a large number of product features and varieties, product mix and changeover (Slack, 1991; Ward et al, 1996; Boyer and Lewis, 2002). Changing from the manufacture of one product to another results in little loss of output (Richardson and Snaddon, 2011).

Quality:

Quality is the ability to satisfy the customer stated and implied needs or simply customer satisfaction and loyalty (International Organization for Standardization, 2000 cited in Gryna, 2001). Others view it as conformance to requirements (Crosby, 1996). Quality is a multi-dimensional, it can be interpreted in different ways: Garvin (1988) acknowledged eight components of quality: performance, features, reliability, perceived quality, conformance, durability, serviceability and aesthetics.Quality has internal and external dimensions (Juran and Godfrey, 1999). Quality capabilities are the foundation of other capabilities related to cost (efficiency), delivery (responsiveness) and flexibility (Ferdows and DeMeyer, 1990; Fisher, 1997; Rosenzweig and Roth, 2004; Selldin and Olhager, 2007). Quality reduces rework, scrap, and waste (Koufteros et al, 2002; Richardson and Snaddon, 2011).

An empirical finding shows that customers renew contracts with a firm because of its capability to create high-quality service at reasonable price (Perunovic´ et al, 2012). Similarly, quality planning starts with discovering the customers and their needs and produce products that respond to those needs (Forker et al, 1996; Godfrey, 1999). The primary objective of quality planning process is determination of a sourcing strategy. Mutual trust between supply chain members is also necessary to the quality planning, control, and improvement (Donovan and Maresca, 1999).

Quality Control:

Quality control is the contribution that every functional area in business makes to product quality. Therefore, it is a process of assessing actual performance; comparing the actual performance with the customer's needs, and taking action on the difference. Means of quality measurement needs to be established, where the critical performance metrics and processes for capturing this information are determined (Richardson and Snaddon, 2011).

Quality Improvement:

Juran and Godfrey (1999) defined quality improvement as the process of raising quality performance to an excellent level. Firms are therefore, expected to continuously improving the quality of their products and services for them to survive global competition (Richardson and Snaddon, 2011).The key process improvement practices that affect quality, includes: top management support and quality policy, employee training, employee relations, product and process design management, supplier quality management, management of processes and operating procedures, the role of the quality department and the collection and usage of data on quality shortfalls (Forker et al, 1996).

Innovation:

Opportunities for innovation exist both within firms (process, product and service innovation) and between firms (co-innovation). Because firms do not operate in isolation; partnerships between firms give rise to the opportunity for co-innovation. Co-innovation arises when there is a shared vision between the partners, compatible structures and processes, opportunities for mutual benefits and co-operation and presence of trust and commitment (Bonney et al, 2007)**.** Innovativeness may make organizations sustainable (Pagell and Wu, 2009). Different competitors have mastered different capabilities and can offer higher quality, more responsive service or more innovative products and a parity business may lower its prices to offset the competitors (Day, 1994)

Dependability:

The focus of dependability should be to meet the required delivery conditions decided by the firm from the supplier to the customer. Processes and procedures for planning ahead with suppliers and customers, managing internal firm and supplier capacity effectively and synchronisation between firms are necessary in meeting delivery conditions (Slack, 1991). Greater dependability may results in reduced overhead costs from chasing late deliveries and rescheduling production (Richardson and Snaddon, 2011).

Customisation:

Customisation received much attention in recent years; mass customisation along with associated build to-order supply chain may lead to increased competitiveness (Gunasekaran and Ngai, 2005). Increased level of customisation in supply chains that previously produced standard products has emerged due to increasing desire for customers to receive degree of individualism in either the products received or the manner in which they are delivered to them (Hendry, 2010).

Relationship Management:

Relationship management has been described by dimensions like commitment, coordination, interdependence, trust, participation, communication/information and knowledge sharing (Mohr and Spekman, 1994; Lee and Kim, 1999; Lee, 2001).

2.15.2: Competitive Priorities Scales

Boyer and Lewis (2002, P. 19) in their finding developed competitive priorities scale as follows:

Cost:

- Reduce inventory
- Increase capacity utilization
- Reduce production costs
- Increase labour productivity

Quality:

- Provide high-performance products
- Offer consistent, reliable quality
- Improve conformance to design specifications

Delivery:

● Provide fast deliveries

● Meet delivery promises

● Reduce productions lead time

Flexibility:

● Make rapid design changes

● Adjust capacity quickly

● Make rapid volume changes

● Offer a large number of product features

● Offer a large degree of product variety

● Adjust product mix

Table 2.1: Competitive Objectives

Authors	**Competitive priorities**
Gerwin, 1987	Innovation, cost, delivery and flexibility
Miller and Roth, 1994; Christiansen et al, 2003; Frohlich and Dixon 2001 Corbett and Van-Wassenhove, 1993	Cost, quality, delivery, flexibility and service
Noble, 1995	Quality, dependability, delivery, cost, and flexibility
White, 1996	Conformance quality, delivery dependability, delivery speed, product flexibility, cost
Nakane, 1986; Noble, 1997	Quality, dependability, cost, flexibility and innovation
Skinner, 1978; Hayes et al, 1988; Roth and Miller, 1992; Santos, 2000	Quality, delivery, flexibility, and cost
Hill, 2000	Delivery, speed and unique design capability
Dangayach and Deshmukh, 2001	Cost, quality, delivery and flexibility
Ghosh, 2001; Schroeder et al, 2002	Operations level capabilities
Peng et al, 2011; Ward et al, 1998; Boyer and Lewis, 2002	Quality, flexibility, costs, reliability and delivery
Hallgren et al, 2010; Hendry, 2010	Repeat order and customisation
Hallgren et al, 2010	Quality, delivery, cost efficiency and flexibility
Lillis and Szwejczewski, 2010	Cost management, quality, delivery, flexibility, dependability, delivery and speed
Hunt and Jones, 1998; Perunovic´ et al, 2012	Cost management and Relation management
Gunasekaran and McGaughey, 2002	Cost, speed, dependability, quality and flexibility
Slack, 1991	speed, dependability, quality and flexibility
Richardson and Snaddon, 2011	speed, dependability, quality, flexibility and cost
Lambert and Schwieterman, 2012	Cost, innovation, quality and environment
Carvalho et al, 2012	Product quality, customer service and time to market

Table 2.1 demonstrates various authors and their perceived scale of preference of competitive priorities for companies' implementation. This table shows that no priority can be neglected as a result; manufacturing firms cannot afford to adopt the trade-off stance (Hendry, 2010). Therefore, table 2.1 signifies that it will be to the best interest of all manufacturing companies to use cumulative approach in building their competitive priorities.

2.16: Conclusion

The first section of this chapter reviewed literature on supply chain management. Thesection further discussed supply chain management objectives and processes. Others are supply chain management component such as supply chain orientation, integration, partnership and supply chain competency.

The section following SCM is Sustainability concept in operations management. Definitions of sustainability, development and essence of sustainability were clarified. Triple bottom line of sustainability was also explained. Others are drivers and inhibitors of sustainability, sustainability investments, sustainability strategies (process and market driven), sustainability performance assessment and sustainability indices. The last item in this section is SSCM, it essences and its contribution to environmental performance and attainment competitiveness were elucidated.

The last part of this chapter explains competitive priorities and how the competitive objectives were priorities. Sources of competitive objectives, fundamentals of competitive priorities and competitive priorities scales were discussed.

CHAPTER 3: UK OIL AND GAS SECTOR SUSTAINABILITY STRATEGIES

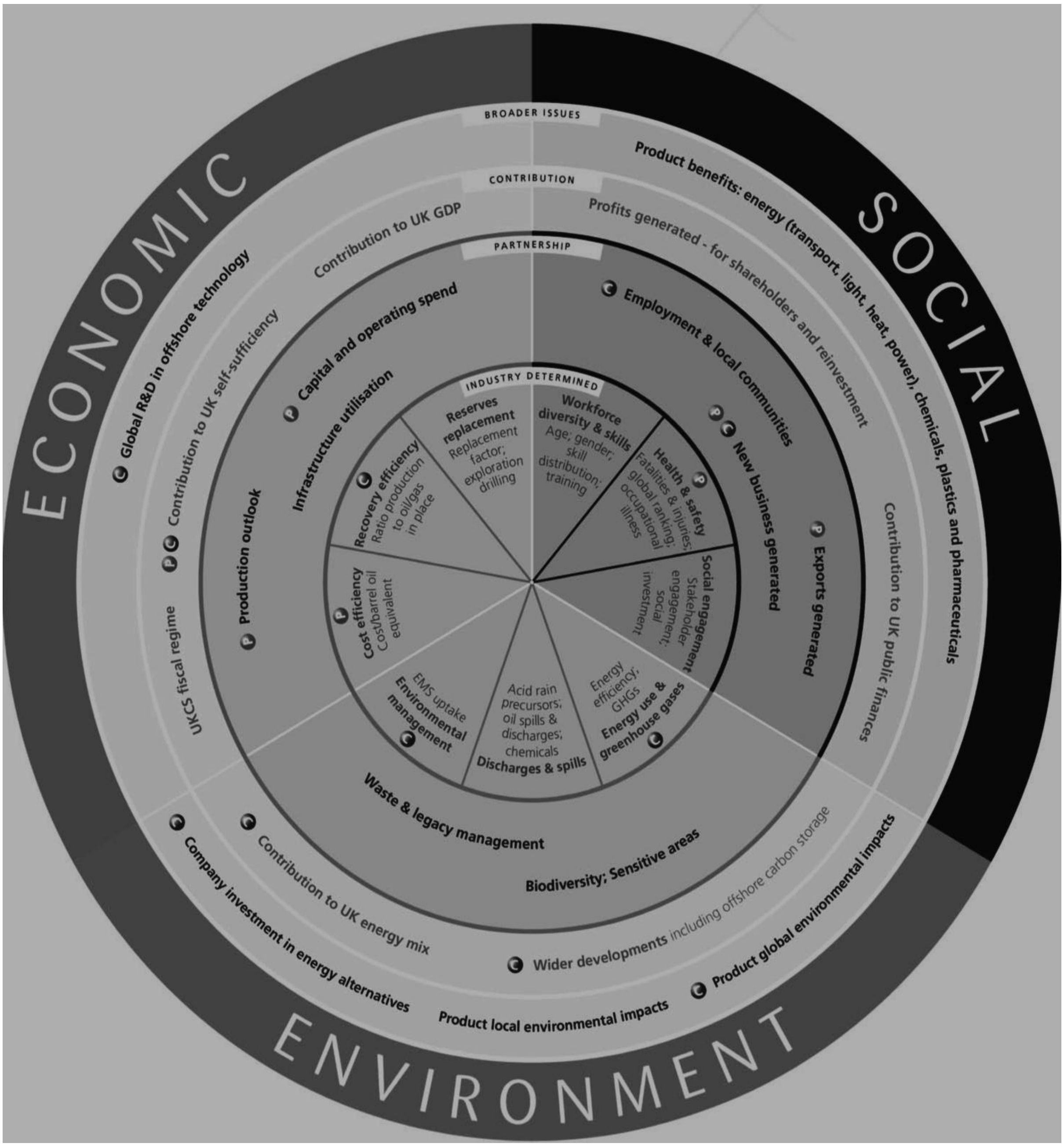
3.1: Introduction

This chapter explores sustainability strategies formulated by the UK government in relationship with trade association. Three sustainability strategies were established in partnership with UK Offshore Operations Association (UKOOA's) and UK government for the UK oil and gas industry. These strategies is referred to as sustainability assessment model (SAM), Author D. little sustainable development assessment tool and PSI Assessment Methodology. Details of each of these strategies are explained in this chapter. While the second part of this chapter covers the oil and gas supply chains.

3.2: UKOOA Indicator 'Wheel'

UKOOA is the representative organisation for leading companies in the UK offshore oil and gas industry. The members are licensed by the UK government to explore and also produce oil and gas in UK waters (UKOOA, 2005). UK government has supported trade associations to encourage sectorial sustainability strategies which will promote a framework for integrating action and setting priorities to develop business performance on economic, environmental and social components of sustainability (DETR, 1999). Department of trade and industry (DTI) and Environment, food and rural affairs (EFRA) in partnership with UK government came together and they developed various sectorial sustainability strategies (Ekins and Vanner, 2007). These can been seen in one of the early works on sustainability in UK oil and gas sector that was published in April, 2001 titled 'sustainability development strategy, striking a balance' published by UK offshore operations association (UKOOA's) (Ekins and Vanner, 2007). The key performance indicators (KPIs) chosen by the offshore oil and gas industry are categorised in a helpful manner and presented in 'wheel'. The indicators are divided into three categories namely economic, environmental and social dimensions (Ekins and Vanner, 2007). The wheel makes it clear to what extent the industry can deliver performance in different areas and the degree to which this depends on action outside the industry. The objective of UKOOA sustainability strategy is 'to find a way to balance the economic and social benefits with good stewardship of the world's natural resources and environmental care (UKOOA, 2005). Figure 3.1 shows 'UKOOA indicator wheel'. The wheel is divided into the following layers;

Figure 3.1: UKOOA Indicator 'Wheel'



Source; Ekins and Vanner (2007, p. 95)

First Layer: Is the inner most circle called *industry-determined indicators*. These indicators are made up of metrics relating to issues that are under company influence such as safety, workforce structure, operational costs and operational environmental performance (Ekins and Vanner, 2007). This concept requires an operator to demonstrate (in document form) that proper safety arrangements, including an effective management system, are put in place on their installation and that all major accident hazards are effectively controlled (UKOOA, 2005). Investigations of major accidents show that technical, human, operational and organizational factors influence the accident sequences (Vinnem et al, 2012). Safety, skills and standardization are the main issues now facing the UKOOA (Beazant, 2005). UKOOA issued a joint industry guide in the form of Guidelines for the Management of Safety Critical Elements.Health and safety is a very important part of any industry, particularly in the hazardous offshore sector and an integral part of any sustainability strategy. The industry is making great effort to ensure that it preserves a suitably sized and skilled workforce to meet future challenges. The UKCS has provided employment for around 260,000 with 30,000 directly employed by E&P companies and 155,000 as contractors or in the supply chain. An additional 75,000 induced jobs are sustained through the investment and wages from the industry (UKOOA, 2005).The environmental impacts associated with oil exploration and productions are subsequently variable, as the mining methods used to extract oil shale by open and underground methods result in different environmental impacts. This part contributes in preventing undesired collapses and hazards related to them, emission to atmosphere and aquifer (Sabanov et al, 2011).

Second Layer:Is referred to as *partnership indicators*. These are indicators relating to issues which are controlled by UKOOA members or offshore industry. They include legacy, community development and management of infrastructure (Ekins and Vanner, 2007). There were also 100 new apprentices were recruited onto this Modern Apprenticeship scheme for the industry in September 2004. A further 100 places are to be offered this September, bringing the total that has been involved in the scheme to more than 500 by the end of 2005. A Graduate attraction programme, started in 2002, has resulted in a mobile exhibition of industry career opportunities visiting up to 29 universities and colleges each year to 2005, with between 2500 and 3300 students attending annually. UKOOA has launched infrastructure code of practice (ICP) in September 2004. Over 50 companies have signed the CoP, including all UKOOA members, who cover all currently operating systems. Technical/operational information is publicly available on over 20 systems through the DEAL website (www.ukdeal.co.uk). Many transactions have been registered with the DTI and are now reaching the time for resolution. UKOOA member’s funding of the Earth Science Education Unit, ESEU, is now in the fourth year of its initial 5 year agreement. Since its launch in 2002, the ESEU central team and their 49 facilitators across England, Scotland and Wales, have provided in-service training, through interactive workshops, to 3701 teachers and 3246 trainee teachers who, in turn, will influence more than half a million pupils. Teachers value the ESEU workshops with high feedback scores reporting improved background knowledge, confidence and teaching strategies (UKOOA, 2005). Most indicators in the first and second slices are numerical

Third Layer: Is called *contribution indicators*. It consists of indicators that illustrates the industry's contribution to larger issues such as UK gross domestic product (GDP), taxation, energy mix, and potential development of carbon sequestration on UK continental shelf (UKCS) (Ekins and Vanner, 2007). Corporation tax (CT) applies to all company taxable profits at a rate of 30%. Since the introduction of 100% first fear allowances in 2002, all costs are effectively tax deductible as incurred, with the exception of long life assets which secure a 24% first year Allowance and 6% of the remaining balance on a reducing balance basis (UKOOA, 2004). Example 'in 2003, the latest year available, the oil and gas industry contributed 13% of total gross value added (GVA) and 22% of the total industrial investment of the UK's production industries' (UKOOA, 2005). Tax receipts have been on the increase since 2003 and rose by £1 billion to £5.2 billion in tax year 2004/5. However, if current prices persist, tax receipts for 2005 could reach £10 billion (UKOOA, 2005). There was an increase on taxes paid by oil and gas companies to the UK government recently because of the current financial problems that the country is facing (Smith, 2002).UKOOA talks on high costs and punitive tax in Great Britain's oil and gas industry (Rita, 2007).UKOOA were lobbying hard to have the decision changed.The tax changes could cost the industry £8bn, exploration and production spend in the UK could fall by up to 20% over the next eight years and as many as 50,000 jobs could be put at risk. Contie showed how the production value of fields would decline if the tax changes go ahead (Contie, 2001 cited in Smith, 2002).

Fourth Layer: Is *called broader issues*. This is the outermost circle as seen on the diagram above it involves issues that are managed by parent company. It comprises offshore technology, research and development, investment in alternative sources of energy and downstream sector impacts (environmental impacts of power generation and transport). This level is concerned with broader issues related to sustainable development (Ekins and Vanner, 2007). The discharge of chemicals presenting risk to the marine environment has been significantly reduced. For example, the discharge of the highest risk category has been reduced by 99% since 1999 (UKOOA, 2005). The development of the UK continental shelf (UKCS) may be in danger due to lack of skilled engineers and technologies. UKOOA urged participants to recruit more women into the industry to address the skills shortage (UKOOA, 2006).The quantity of waste sent to landfill continues to fall with 63,780 tones being disposed of in 2004. Waste recycled remains relatively constant; with efforts to increase this e.g. by treating cuttings to remove oil based fluids so they could be used for other purposes like making concrete, falling outside the legislation and having to be disposed of in landfill. Waste to energy is increasing and incineration remains low at 205 tones for 2004 (UKOOA, 2005, p. 41). Most indicators in the third and fourth slices are qualitative in nature; qualitative descriptions are used to present progress being made in these indicators. The wheel captures the full range of current key sustainability issues for the oil industry. It provides a format to enable industry leaders to debate trends, it points where action needs to be taken, and most importantly signals which players need to be involved to improve performance (Ekins and Vanner, 2007).

3.3: UK oil and Gas Sector Sustainability Assessment Methodologies

Legislative requirements are being placed on businesses to incorporate sustainability into their activities and operations. Firms operations have a number of environmental and social impacts to a variety of stakeholders. The impacts are both internal and external to the business. Where such impacts have effects on people that are not associated to the firm transactions, they are referred to as 'externalities' (cost/benefits). Conventional accounting systems fail to reflect such externalities and therefore give an incomplete figure of economic, environmental and social performance of the company (Ekins and Vanner, 2007). All sustainability assessment methodologies have two main components. The assessment of the magnitude of the impacts quantitatively (numerical) and qualitatively (descriptions) is the first component. Secondly, assessment of relative importance of the impacts to facilitate decision-making, different decisions will lead to different trade-offs between the impacts (Ekins and Vanner, 2007). Sustainability assessment methodologies in the UK oil and gas sector include the following as seen below.

3.4: Sustainability Assessment Model (SAM)

Sustainability assessment is a comprehensive, integrated and well thought out approach to making decision; its basic demand is that all important undertakings must make a positive contribution to sustainability (Sabanov et al, 2011). Sustainability assessment model (SAM) is a tool for engaging people within organisations in sustainable development thinking and to estimate the sustainability of projects (Baxter et al. 2002; Bebbington and Frame, 2003). Any form of business decisions has economic, environmental, resources, and social effects. Decisions made and activities performed tend to maximise economic and financial benefits and at the same time have corresponding environmental and social costs (Baxter et al, 2004). Managing these effects by the organisations is not easy as they are not covered by accounting decision making tools (Baxter et al, 2004, Bebbington and Frame, 2011). SAM is a tool that helps organisations to appraise the impacts of their operations (Bebbington and Frame, 2011). SAM was developed by British Petroleum (BP), Geneses Oil, Gas Consultants, Inch ferry consulting and the University of Aberdeen, to take account of the externalities and assist progress towards sustainability (Baxter et al, 2004; Cavanagh et al, 2006; Bebbington and Frame, 2011). SAM was developed over three years from a combination of research, conceptual work and applied experience with actual projects at BP.

SAM follows four steps full cost accounting approach (FCA) to a discrete project and considers the full lifecycle, including identification and monetisation of the project's impacts (Cavanagh et al, 2006; Bebbington and Frame, 2011). SAM has been used to measure performances of several UK hydrocarbon developments as well as assessing trends in the UK oil and gas industry (Baxter et al, 2004). The development of the SAM is something that must be attained in true partnership with the main project stakeholders. It is much less effective if it is seen as a process conducted separately to the project by consultants or researchers (Cavanagh et al, 2006). A mix of projects used SAM including many oil and gas field developments, gas generation from landfill and forestry planting schemes; it was recently being used on several projects in New Zealand. SAM assesses the performance of distinct project and tracks the sustainability impacts of a project over its full life cycle (Baxter et al, 2004; Bebbington and Frame, 2011).

In oil and gas development, this begins with exploration, drilling, design of drilling and production platform, construction, installation and commissioning of platform, oil and gas production and eventual decommissioning of the platform. SAM assesses the impacts beyond extraction of oil and gas and assesses the external impacts from refining, products manufacture, and use of the products (Baxter et al, 2004). SAM was viewed as providing a point of connection between various partiesbecause environmental, social and economic concerns could all be articulated and accepted as being part of the same evaluation. Further, SAM provides an opportunity for technical specialists to think more broadly than their area of concern and focus. Several individuals highlighted that this aspect of SAM could be particularly helpful in the likes of consent awarding, community planning, or stakeholder engagement processes (Bebbington & Frame, 2003, p. 8).

3.4.1: Outline of the SAM

FCA provides information about externalities that are not currently shown in pricing systems. Therefore, FCA is part of an approach where information about the externalities is generated to increase understanding the full impacts of a particular activity (Cavanagh et al, 2006).The costs generated by FCA are not real as they will be borne by the organisation from which the externalities originate.The costs are notional and provide indication ofthe total costs (and benefits) of an activity over some defined boundary (Baxter et al, 2004). Therefore, the main benefit of FCA is the information that it generates which are previously not accessible to decision makers (Cavanagh et al, 2006; Bebbington and Frame, 2011).

The four steps full cost-accounting approach that SAM includes (Cavanagh et al, 2006; Bebbington and Frame, 2011).

First, it defines focus of cost exercise (cost objective) as being a discrete project (an oil and gas field development). This is because oil and gas companies operations are planned based on project basis.

Second, SAM's modelling exercise limits are clearly outlined. It tracks project's sustainability impacts over its full life cycle. Oil and gas development starts with exploration, drilling, design of drilling, production, platform construction, installation and commissioning of the platform, the oil and gas production and decommissioning of the platform. This shows that SAM evaluates projects from cradle-to-grave of oil and gas development (Baxter et al, 2004; Bebbington and Frame, 2011). In steps one and two, the SAM tracks the sustainable development impacts of a project over its full life-cycle; for example, in the case of an oil and gas installation, from exploration and design, through construction, installation and commissioning, to the 'production' phase and eventual decommissioning. The SAM extends theanalysis beyond extraction of oil and gas and traces the external impacts from processing, manufacture of products from oil and gas and eventual product use. Thus the SAM can examine cradle-to-grave impacts of a project (Cavanagh et al, 2006).

Third step is to ascertain and evaluate the total impacts of the whole project. These impacts are evaluated under economic, environmental, resource use, and social impacts. The actual activities of the project will provide an activity data example, hours worked on the project, total number of workers employed, number of barrels of oil produced, amount of water used, amount of materials used in fabrication, waste produced, and estimated financial performance of the project. This data is then either used directly in the model or used to impute the economic, environmental, resource use and the social impacts (Bebbington and Frame, 2011). It is worth noting that environmental impacts assessment requires the services of experts (consultants) due to their complications (Ekins and Vanner, 2007). The third step is to identify and measure the impact of a project. Impacts have currently been categorised in 22 fields grouped under four headings: economic, resource use, environmental and social impacts. The data from which to impute impact has been drawn from the actual activities of a project (such as hours worked, people employed, barrels of oil produced, materials used in fabrication, waste produced and estimates of the project's financial performance). This activity data is then either used directly in the SAM or used to impute the economic, resource use, environmental or social impacts (Cavanagh et al, 2006).

The fourth step is the monetisation of the externalities discovered in the oil and gas field development. First is to allot monetary values to the impacts so that they can be compared on basis of cost-benefit analysis (CBA). This enables the impacts to be traded off against each other in simple way such that best result may be chosen (Ekins and Vanner, 2007). The performance indicators must be monetized so as to allow for comparison among common items in the data. The disadvantage of this approach is that, assigning currency values to non-market (social and environmental) values is complex and may generate wide range of values that are difficult to understand by non-experts (Bebbington and Frame, 2011, Ekins and Vanner, 2007). Monetisation of the externalities involves expert judgment and does not permit stakeholder engagement beyond disclosure of their willingness-to-pay for benefits or willingness-to-accept costs (Bebbington and Frame, 2011). SAM uses damage cost estimates to monetise externalities in the oil and gas field development (Bebbington, et al, 2001; Cavanagh et al, 2006).The externalities are initially measured in physical terms and are then translated (by some method) into financial figures. The resulting data is then brought together with existing financial information about a project to ascertain whether or not the internal accounting data, in combination with the externalities data, results in a net positive or negative outcome (Cavanagh et al, 2006).

What is being modelled is the outcome of transformative measures (development and use of oil and gas field) as it affects capital categories. Natural resource capital (oil and gas) is transformed into economic benefits (for firm extracting oil and gas) and social benefits (in form of mobility, heating and products produced from oil and gas); at the same time social costs (road death and congestion costs) and environmental costs (global warning) also occur. SAM model changes in capitals that arise from transformative events (Bebbington et al, 2001).

3.4.2: SAM Performance Indicators

SAM uses twenty-two indicators divided into economic, environmental, resource use and social impacts which arise from activities of the project. These indicators could be profits or costs (Baxter et al, 2004). Among these four components, only the economic component is internal and provides revenue to the organisation. Others are external and present costs to the organisation. They are external because they have a range of environmental and social impacts that have effects on people and the environment (Ekins and Vanner, 2007).

3.4.2.1: Economic Component

Economic objectives include investment to achieve continued UK production, robust supply chain for UK and export markets, cost efficiency, reserves maximisation and infrastructure utilisation (UKOOA, 2005). This is the point SAM begins. The economic component gives total income generated from the project. The total number of crude oil produced by the development is multiplied by prevailing crude selling price over the life of the project. Economic indicators are divided into CAPEX and OPEX, taxes, dividends, social investments and profits. These impacts are reflected within the operator's accounting systems (internal costs). The remaining impacts according by SAM relate to external cost and profits (Baxter et al, 2004). In the case of BP, total income has been divided according to who receives income: shareholders (dividends), government (taxation), operators (capital and revenue spending on the project) and the social investments made by the project and BP (the amount reinvested in the business). Economic indicators may have resource, environmental, and social impacts, but they are not identified under this category of indicators. They are captured under the remaining categories (Bebbington and Frame, 2011).

3.4.2.2: Environmental Components

The environmental objectives are reduction in oil spills, chemical discharges and atmospheric emissions and improvements in energy efficiency and waste consumption and disposal (UKOOA, 2004, 2005). These are external factors that give total environmental damages caused by the activities and use of oil and gas resources. The resources use and environmental damage are categories of impacts that fall on natural environment, due to nature of these impacts, SAM identifies their impacts separately (Bebbington and Frame, 2011). There is low level control that the project have on environmental damage as factor such as reservoir recovery ratio is more within control of the project than pollution impact from final oil and gas products use (transportation) (Bebbington and Frame, 2011). Environmental indicators are divided into four: Pollution impacts (combusting fossil fuels through product use), nuisance impacts (noise, odour and visual impact), footprint impacts (land area unavailable for use due to installations) and wastes created in process of developing an oil and gas field. Pollution impacts and wastes impact are the most significant for an oil and gas field development (Baxter et al, 2004; Bebbington and Frame, 2011).

3.4.2.3: The Resource-Use Indicators

Principal resources used in this model are oil and gas others are infrastructure, water, intellectual capital, and energy (Baxter et al, 2004; Bebbington and Frame, 2011). These resources represent negative externality (overall external cost) as the net effect of their use reduces their availability for future use. While overall impact is negative, there are positive flows in this subcategory; for example, development of intellectual capital of individual or organisation that offset the negative impacts. These indicators attempt to capture the real value of the resources used to the extent that payment made do not fully account for the use of resources during life time of the project (Babbington on Frame, 2011). The economists value of environmental change arising from resource use on basis of 'economic rent' of depleted resources is estimated in a variety of ways (user cost method, net price approach and Net present value) (Ekins, 2000 cited in Bebbington and Frame, 2011). In SAM model, the figures of resource use are drawn from UK environmental accounts (Bebbington and Frame, 2011).

3.4.2.4: Social Indicators

Social objectives of UKOOA sustainability strategies are improving health and safety, maintaining skilled employment, workforce diversity and skills, enhancing stakeholder engagement and social responsibilities (UKOOA, 2004, 2005). Modelling social cost of an oil and gas field in SAM is the most difficult aspect (Babbington on Frame, 2011). Social impacts are divided into three categories.

Firstly, estimate of positive social value arising from direct and indirect jobs created in the project. Subtracted from this value is associated negative health and safety impact of the jobs. The positive externality of employment is the multiplier effect that arises from direct employment. This benefit is offset by negative impacts of deaths and accidents during the employment. Costs of accidents and deaths are deemed to exist above the costs paid by the entity itself (compensation to employees or their families) (Baxter et al, 2004). It is difficult to identify how a project contributes to socially sustainable society, since it is difficult to determine what constitutes a socially sustainable. As a result of this, SAM draws on UK Government's Strategy on Sustainable Development to outline the characteristics of socially sustainable society. This resulted in four categories of indicators that are: tackling poverty and social exclusion, equipping people with the skills to fulfil their potential, reducing the proportion of unfit housing stock and reducing both crime and the fear of crime. SAM suggests that if the project results in impact upon these four indicators, then it will affect (in either negative or positive manner) the social sustainability of the project (Bebbington and Frame, 2011).

Secondly, indirect link between taxes generated by the project and social benefit arising from use of the taxes on government spending on health, education, infrastructure, housing and security. The social benefit is obtained by multiplying the taxes spent in each area by relevant factors (Baxter et al, 2004). The total taxation paid is proportioned to spending department (health, education and transportation) using taxation data published by the government (Bebbington and Frame, 2011).

Thirdly, estimate of external benefit arising from use of the products. In oil and gas there are three primary benefits generated which include, mobility (refined fuel), oil and gas based products (plastics, chemicals and pharmaceuticals) and heating (combusting oil and the use of oil and gas in power supply) (Baxter et al, 2004). The social impacts of use of products are therefore a combination of two factors, one positive and one negative. The positive factor relates to the difference between the crude price and the current selling price of fuel, which measures the market's best estimate of the value people assign to mobility. The negative factor is the social costs of mobility which was not captured by SAM (Bebbington and Frame, 2011). These costs relate primarily to the cost of congestion and road accidents (Samson, el al 2001 cited in Bebbington and Frame, 2011).

Delivering improvements on these objectives involves collaboration between the exploration and production companies and its supply chain and an effective partnership with government. Oil & Gas UK's sustainability reporting framework will enable on-going monitoring and assessment of the industry's performance in meeting these objectives (UKOOA, 2004, 2005).

3.5: SAM Signature

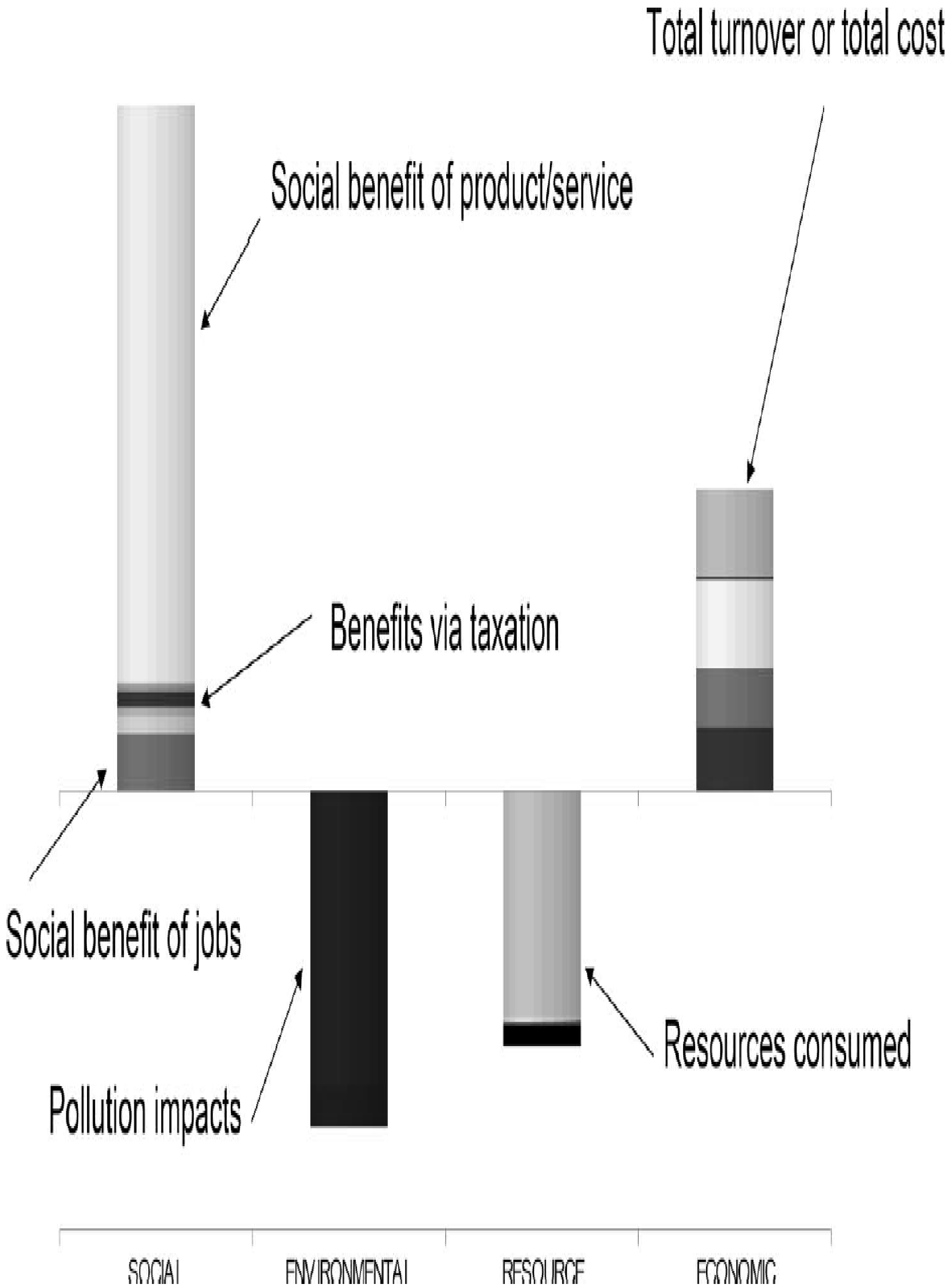
Once all the indicators have been recognised and integrated the resulting data will give a pattern of positive and negative impacts arising from a project. When these positive and negative values are plotted in a graph it gives a SAM 'signature'. SAM signature provides an elegant presentation of the internal (economic) and external (the remaining categories) impacts of an oil and gas development (Baxter et al, 2004).

Figure 3.2 shows that all the bars above the horizontal line represent positive benefits for a capital sub-category while those below the horizontal line represent the cost for a capital sub-category (measured in monetary terms). The various colours in each bar represent one element in the capital sub-category (Bebbington and Frame, 2011). The signature shows the externalities (positives and negatives) that arise over the full lifecycle of an oil and gas field development.

Three aspects of the signature dominate all others: the use of oil and gas resources (grey shaded bar under resource use), air pollution impacts of combusting oil and gas (black shaded bar under environmental impacts), and the social benefit arising from the product (social impacts bar). The economic benefit bar is the only visible account of an oil and gas field development for the organisation that is undertaking the development (Baxter et al, 2004; Bebbington and Frame, 2011). This shows that the transformative process of oil and gas field development involves processes where financial and social benefits are obtained at the expense of environmental and resource usage costs (Bebbington and Frame, 2011).

The signatures describe the transformative process of the oil and gas field development. The major benefits and costs of the project represented (in social and environmental sub-categories) arise after the extraction of oil and gas. Therefore, they are beyond the direct control of the operators but are heavily dependent on how the society uses the products (Baxter et al 2004; Bebbington and Frame, 2011).

Figure 3.2: SAM Impact 'Signature' for Hydrocarbon Field Development



Source; Ekins and Vanner (2007, p. 99)

From an upstream position, the key determinant of the project performance is the efficiency of the hydrocarbon extraction. A higher recovery factor will yield a better overall signature using this model. The analysis shows that there are both positive and negative outcomes from an oil and gas field development.

3.5.1: Sustainability Assessment Model Index (SAMi)

SAMi is sum total of the negative and positive impacts of the internal and external indicators. To calculate the SAMi, a total is computed by summing all the absolute values of the impact in each category, and then expressing each category's impact as a percentage of this, with the appropriate sign. The SAMi is than calculated by adding the percentages, taking account of the signs. 100% will be the outcome if no category has an overall negative impact (Baxter et al, 2003 cited in Ekins and Vanner, 2007). This index provides an indication of how a project is contributing to the sustainable development. A SAMi of 100% indicates that a project was 'sustainable', that is, it has no negative sustainable development aspects (Baxter et al, 2004).

3.5.1.1:Break Down of the SAM Impact Categories

At the UK government's request, Department of Trade and Industry evaluated the performance of the UK oil and gas industry for 1999, 2000 and 2001).

Table 3.1 shows that the social impacts are about £61 billion per year; the environmental impacts are about £26 billion per year; and the impacts of resource usage are about £9 billion per year and the economic impacts are about £22 billion per year. It can be seen that the industry performance improved over the three-year period. This was primarily due to increased prices of oil and gas at that time, which increased the positive economic impacts (Baxter et al, 2004).

Table 3.1: SAM Output for UK Oil and Gas Sector

Impacts/Years	Social %	Environment %	Resource use %	Economics %	SAMi
1999	53.2	-23.5	-8.2	15.1	36.5
2000	50.2	-21.1	-7.5	20.9	42.8
2001	50.9	-20.8	-7.4	21.0	43.7

Source: Baxter et al (2004)

3.6: The Author D. Little Sustainable Development Assessment Tool

British petroleum (BP) in conjunction with the consulting firm of Author D. Little developed assessment methodology for oil and gas industry (Ekins and Vanner 2007). The aim of the assessment tool was to provide a method for project managers to translate Statements Company's made by their organisations 'into action at the project management coal face'. The justification provided is that a clear presentation of these complex issues allows project teams to make wise decisions about how best to balance conflicting requirements (Thomason, 2003). The specification for the methodology was that its output would need to:-

* Be concise

* Be easily understood by managers who are not experts

* Avoid losing the important details

* Enable project manager to maintain a trade-off between positive and negative impacts (Ekins and Vanner, 2007).

The methodology further asks questions on each of the components of sustainability about project's impacts as follows:-

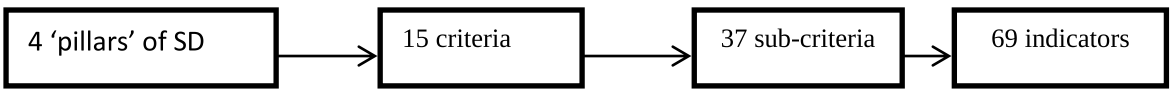
* Economic: will the project generate prosperity and enhance the affected economies?

* Environment: will the project cause long term damage to the environment?

* Social: will the project be executed in a socially responsible manner and benefit the affected communities in fair and equitable ways?

The methodology uses the figure below to summarise the method it developed.

Figure 3.3: Sustainable Development Assessment Tool



Source: Ekins and Vanner (2007, p. 105)

The four pillars of sustainability are: economics, environmental, resource use, and social. The methodology used and sixty-nine indicators to assess their alignment with the principles of sustainability. From figure, it shows that the alignment was achieved via fifteen criterions under four components (pillars) and thirty-seven sub-criteria performance against which is measured by the sixty-nine indicators.

3.6.1: Author D. Little SD Alignment Assessment Methodology Matrix

Table 3.2 shows that the methodology assessment team is required to score performance against each factor (design, supply, construction, operation and decommissioning). The scoring scale is 1 – weak and 5 – strong alignment with the sustainability principles. If the assessment is done accurately, the outcomes will present a summary of the project's impacts in each of the thirty-seven sub-criteria. This will give the managers an opportunity to balance each negative impact with the positive impact arising from the development of the project. This methodology is intended to be part of, and be carried out in all stages of the project execution.

The Author D. Little assessment methodology does not involve stakeholders in either assessment of impacts or decisions to which these assessments will give. This is an orderly and systematic way in which organisations can ensure that their principles and values (drawn up after agreement with stakeholders) are translated into practice at a project level (Ekins and Vanner, 2007). One can see that it is difficult to engage 'stakeholders' at all individual project level as it will be financially costly and time consuming; stakeholders could be involved for decisions of policy or of strategic importance to the organisation (Ekins and Vanner, 2007).

Table 3.2: Score Matrix for the Author D. Little SD Alignment Assessment Methodology

4 'pillars' of sustainable development	69 Indicator	37 sub criteria	Score for Project Phase					Overall Score
			Design	Supply	Construction	Operation	Decommissioning	
Economics	Taxes and jobs		Score for each indicator: The scoring scale = 1 to 5 1 = weak, 5 strong alignment with the principle of sustainability					For each sub criteria
Environmental	Waste and risk							
Resource use	Energy and water							
Social	Health and safety							

Source; Ekins and Vanner, (2007, p. 106)

3.7: The PSI Assessment Methodology

UK oil gas offshore sector in association with DTI and DEFRA developed SPI to help with some of the oil and gas industry environmental challenges (Ekins and Vanner, 2007). The PSI methodology provides a practical means to apply sustainability in all decision making. It is important that public policy decisions are taken in view of full/adequate understanding of the facts (UKOOA, 2005).PSI were decommissioning system of different offshore structures and extent to which they should be returned to shore after use; management of oil in produced water; and management of energy use and emission offshore. All these are of responsibility of the industry's stakeholders (Ekins et al, 2006; Ekins and Vanner, 2007). Through a number of case studies, PSI developed social dimension by exploring the industry's relationships with its stakeholders at a time of transition (UKOOA, 2005). Decommissioning of petroleum installations is a relatively new challenge to most producer countries. It is natural to expect that industry's experience in building platforms is much greater than the one of the dismantling (Parente et al, 2006).

In decommissioning a project, both financial and non-financial issues arise. In most times, non-financial issues are the source of disagreement (Ekins and Vanner, 2007). Projections of future decommissioning activities remain highly uncertain. In part this is a mark of the industry's continued success in extending the economic life of much of the UKCS infrastructure. This has been achieved both by the drive to reduce operating costs and the success in attracting new incremental developments (UKOOA, 2004). It is not clear that the removal of the topsides and jackets of large steel structures to shore, as currently required by regulations, is environmentally justified; that concrete structures should certainly be left in place; and that leaving footings, cuttings and pipelines in place, with subsequent monitoring, would also be justified unless very large values were placed by society on a clear seabed and trawling access (Ekins et al, 2006). Both local marine ecology and political climate play a role in decommissioningoffshoreoil production platforms. Additional scientific needs in the decommissioning process include further assessment of platform habitat quality, estimation of regional impacts of decommissioning alternatives to marine populations, and determination of biological effects of any residual contaminants. The principal management need is a ranking of environmental priorities (e.g. species-of-interest and marine habitats). Because considerable numbers of economically important species reside near oil platforms, National Oceanic and Atmospheric Administration Fisheries should consider the consequences of decommissioning alternatives in their overall management plans.

Management strategies could include designating reefed platforms as marine protected areas. The overarching conclusion from both ecological and political perspectives is that decommissioning decisions should be made on a case-by-case basis (Schroeder and Love, 2004). It is likely that estimates of decommissioning costs will remain highly uncertain until the industry has removed a number of the key deep water installations in the northern North Sea. The latest forecasts show some slight delay in decommissioning timings compared with 2002; however costs to 2030 are projected to rise by £600 million to circa £ 9.1 billion (2003 money) (UKOOA, 2004; Parente et al, 2006).Table 3.3 shows the nonfinancial issues during decommissioning.

Table 3.3: Non-financial issues in decommissioning

Quantitative issues	**Qualitative issues**
Material inputs; Material endpoints (of the material being decommissioned); Total energy required (TER); Total gaseous emissions.	A clear seabed; Health and safety of personnel directly involved in the decommissioning process; Jobs in the UK; Impacts on the marine environment; Conservation of non-renewable resources; Impacts on resources extraction; Impacts of landfill; Impacts on the fishing industry and Impacts on fish (and other marine life)

Source, Ekins and Vanner (2007, p. 100)

Table 3.3 shows a number of quantitative and qualitative non-financial issues that causes conflict among stake holders during decommissioning of any oil and gas project. Conflict may arise because there is no way of expressing these different issues and concerns in money values such that the results would be accepted to different stake holders. It is likely that any attempt to do so would cause disagreement over the methodology that would divert attention from the issue itself. This is one of the issues that PSI methodology was developed to address (Ekins and Vanner, 2007).

‘The methodology first seeks to get insights into the environmental impacts of an activity through material and energy flow analysis and assessment of environmental impacts associated with those flows. The flow analysis provides a systematic framework for this assessment because all environmental impacts are connected with such flows (although of course the impacts of different flows vary greatly), and the analysis of the flows (using mass balance techniques) from resource extraction through to waste disposal ensures that all impacts are considered’ (Ekins and Vanner, 2007, p.101).

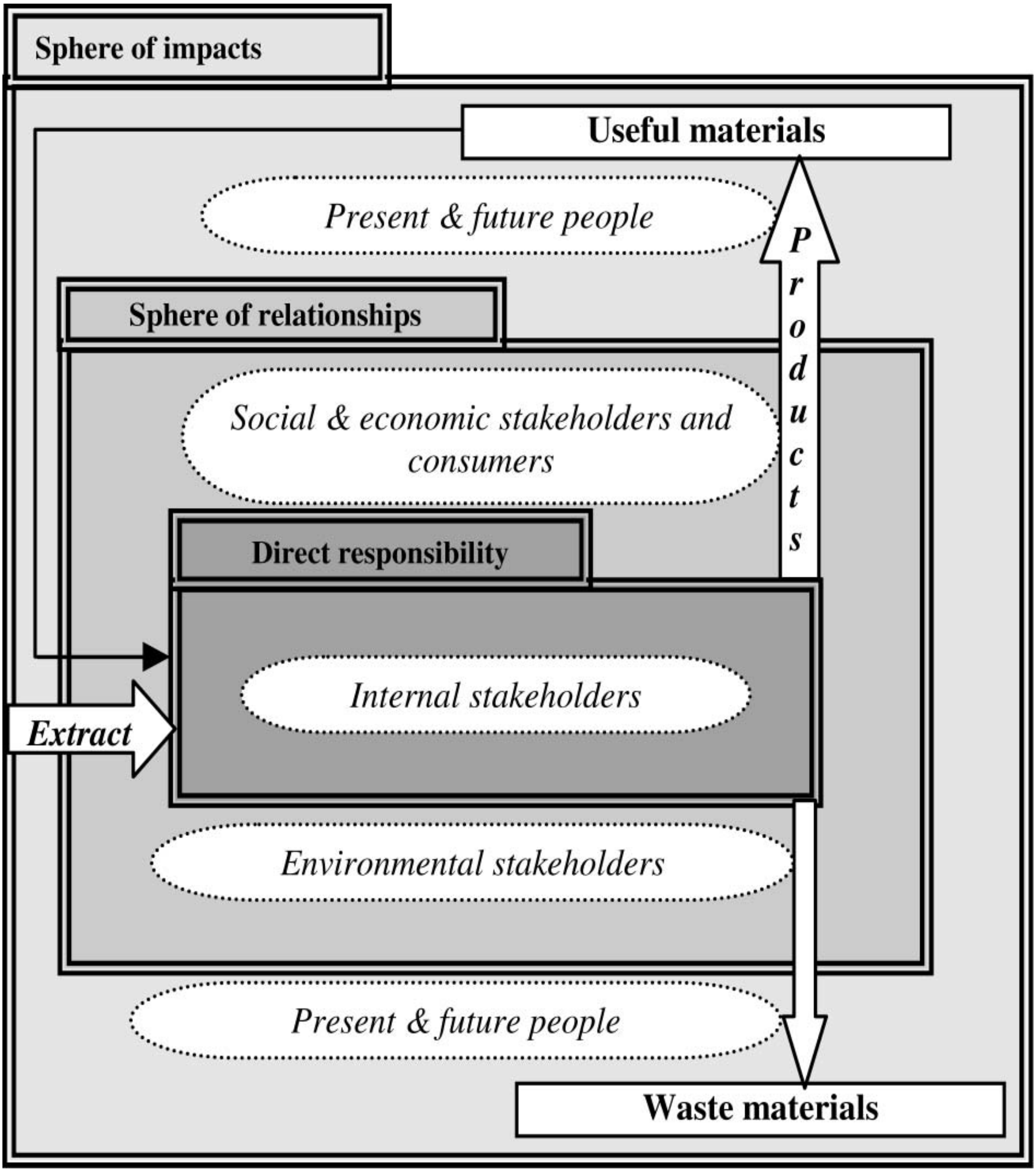
The flows are usually associated with monetary expenses, and these flows of money are tracked along with the material and energy flows. This allows the net present value (NPV) costs of several options being considered to be computed. By comparing these costs, and the non-financial impacts and outcomes such as those included in Table 3.3, against a common baseline, an ‘implicit value’ is generated of what these non-financial impacts and outcomes would need to be worth to society, at a minimum, for the choice of that option to be justified. It should be noted that this is different from the result of SAM-type analysis, which seeks from the outset to establish what each of the outcomes and impacts are worth in money terms (Ekins and Vanner, 2007).

In PSI analysis of several material, energy and value flows the PSI methodology seeks to keep at all times an awareness of the stakeholders to whom these flows, and their related impacts, matter and why. The flow analysis is complemented by a stakeholder analysis as illustrated in Figure 3.4. The company causes the extraction of the resource and its transformation into products, which are used and after multiple recycling, end up as wastes. The flow affects both the company’s internal and external stakeholders and the present as well as future population (Ekins and Vanner, 2007).

Figure 3.4 distinguishes between different spheres relating to a sector’s stakeholder relationships:

3.7.1: *Sphere of direct responsibility* (internal stakeholders: employees and shareholders). The sector is directly responsible for the risks and impacts its processes have on its employees, and for the returns it generates for its shareholders. How the business manages these impacts is both a core responsibility of management and can be a matter of competitive advantage (Ekins and Vanner, 2007).

Figure 3.4: Key Material Flows, Impacts and Relationships



Source; Ekins and Vanner (2007, p.101)

3.7.2: *Sphere of relationships* (external stakeholders: consumers, suppliers, competitors, government, civil society groups, and local communities). The impacts of the company's operations on those outside certainly drawn into external stakeholder relationships, the management of which may be a source of benefits (brand reputation and licence to operate and grow the business, and an improved operating environment) or risk. The relationships may be mainly commercial or social, but are likely to have both elements. An example of developing a social relationship, with resulting commercial benefits, would be investment in local communities to improve the wellbeing and productivity of the workforce (Firebrace et al., 2005).

With regards to licence to operate, there are different groups representing the environmental aspects of the sector's operations (associated with the waste flows in Figure 3.4), and the social, economic, and the consumer aspects. The people they represent may or may not be the same. For instance, some stakeholder groups will only be interested to involve on issues of environmental concern, and may not give muchweight to the broader implications of what is being proposed. Whereas a national regulator such as the DTI has the responsibility to consider both environmental impacts from the sector and the requirement to provide supplies of energy and economic returns on the nation's oil and gas reserves (Ekins and Vanner, 2007).

3.7.3: *Sphere of impacts:* 'The operations of a company will impact on people generally, and some of these will not be able to exert direct influence on the company. Examples may be poorer people in countries different to those where decisions are taken, and future generations who may experience the impacts and the benefits from the company's operations, but are unable to directly represent their own interests. Relationships with groups representing such interests of others are required if a company is to manage the full range of its impacts on society' (Ekins and Vanner, 2007, p 102).Considering a company's sustainability strategy through its relationships with its stakeholders provides insights into the benefits and rationale of the strategy and in turn might define boundaries of the company's corporate responsibility (Ekins and Vanner, 2007). The vision underlying the sustainable development strategy of the offshore oil and gas sector combines maintaining a competitive industry with respecting our workforce and local communities, constant improvement in safety and environmental performance and judicious use of natural resources (UKOOA, 2001).
Stakeholders' appraisals of such issues can differ broadly. In order not to obscure these differences, the methodology restricts the cost data it provides to actual market financial costs. However, the methodology does generate an overall 'implicit cost' of these (positive and negative) non-market outcomes of different options, which represents for any given option the minimum social valuation of these outcomes relative to some reference, were the option to be chosen. The cost to the UK taxpayer of any option is also computed, and that depends on the tax position of the industry. In decommissioning, it was estimated that 50% of

any industrial expenditure on decommissioning or produced water management would be efficiently paid by the taxpayer because of lost tax revenues (Ekins and Vanner, 2007).

3.8: Oil and Gas Industry

Crude oil and natural gas are the raw materials of the petroleum industry. The production of crude oil can either be found deep underground or in offshore areas (Hussain et al, 2006). Petroleum is the second largest consumable resources in the world – second only to water (Nnadili, 2006). Oil and gas is part of people's daily activities that will be hard to stop appreciating its global significance (Yargin, 2008). Currently oil and gas are among the most important resources in the world. Since oil is a commodity that is closely interweaved with national strategies and global politics and power (Nolan and Zhang, 2003; Yargin, 2008; Garbie, 2011). Oil and gas industry has great interest in developing their countries through improving their resources to be more competitive (Garbie, 2011). Oil is a large generator of wealth for individuals, companies and the entire nations. 'Out of the top twenty companies in the Fortune 500, seven are oil companies' (Yargin, 2008, p. 13). The regional distribution of world oil and gas reserves, production and consumption is highly unequal (Nolan and Zhang, 2003). This explains the reason why countries with huge deposit of crude oil are among the richest nations of the world. Public controlled oil and gas companies are about three quarter of the world's oil production while private sector companies' rank in the top 10 amongst the world's oil companies and rank in the top 10 of all corporations (Yargin, 2008).

No modern society can survive without oil and gas. Since the functionality of the modern societies depend on efficient supply of oil (Brigs et al, 2012). Oil and gas are highly demanded in industries as well as for commercial and domestic purposes. The products are used for driving of machineries to the production of plastics and fertilizers (Hussain et al, 2006). The quantity demanded of oil and gas products made its prospecting and production costs one of the highest in the world (CRINE Network, 1999; Aspen technology, 2005). Increases in the cost of oil and gas products affect the costs of other commodities in the market. This makes it very important to regulate the cost of oil and gas in order to ensure that the costs of other goods and services are kept at optimal (Yargin, 1991).

Every oil company originated from different countries and has a long history of mergers, acquisitions and other transformations. Their fundamental business is the same, their perceptions on sustainability issues may therefore be shaped by their historical origins. These differences may likely shape their corporate structure and values (Schweitzer et al, 2011). Oil industry has experienced many evolutionary stages and paradigm changes in going from low production based on demand to mass production due to increased market demands, then to lean production (to decrease and/or control oil prices), to agile oil production (Garbie, 2011) and to sustainable production in the twenty first century. 'They are also trying to maintain a high level of responsiveness to achieve agility and to remain competitive in the global marketplace especially after instability of oil prices and global financial crisis' (Garbie, 2011, p. 203). Examples, Exxon Mobil originated from United States of America. It is a successor of John D. Rockefeller's Standard oil company founded in 1870 and has undergone many transformations in past 100 years, most recently the merger between Exxon and Mobil in 1999 (Yargin, 2008). BP has also undergone many changes in the past century; it originated from United Kingdom, with its headquarters in Westminster, London (Yargin, 2008). BP of today is the result of a merger of British Petroleum, Amoco and Arco in 2000. Royal Dutch Shell's historical roots trace back to companies originating in Great Britain and Netherlands: the Royal Dutch Petroleum Company (founded in 1890 in Netherlands) and "Shell" Trading and Transport Company (founded in Great Britain in 1897). Currently, Royal Dutch Shell headquarters are in The Hague, Netherlands (Levy and Kolk 2002; Yargin, 2008).

3.8.1: Oil and Gas Industry Supply Chain

The petroleum industry supply chain is like the supply chain of any other industry with little differences, oil and gas supply chain involve complex entities that extend from the oil fields to the petrol stations. Oil and gas supply chain consists of upstream, central firms and downstream activities. This categorisation is similar to other industries supply chain structure comprising of suppliers, producer and customers represented by the supply chains of manufactured goods (Peters and Hood, 2000).

The distinction between the petroleum industry supply chains and manufacturing supply chains is that there are intermediate markets where crude and/or products can be bought or sold between upstream crude oil production and final retail delivery at service stations and other end users. The upstream petroleum supply chain is more complex compared to other process industries, such as pharmaceuticals. Nevertheless, the logistics function is one of the areas that affect supply chain performance in the petroleum industry (Brigs et al, 2012).

The oil and gas supply chain also differs from the supply chain of low value, high volume commodity products in the mode of its organisation upstream to extract crude. The structure of the petroleum upstream supply chain is more discrete than that of other industries supply chain; because oil and gas supply chain including independent operations starting with exploration and logistics involved in trading and extending to variable modes of transportation, which depend on source to the refining process (Nolan and Zhang, 2003; Garbie, 2011).

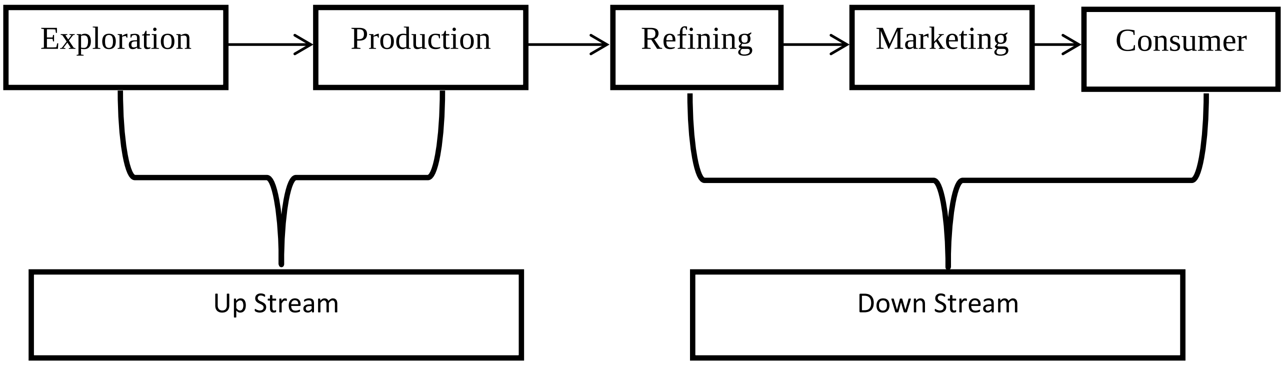
Oil and gas industry is involved in global supply chain that includes national and international transportation, ordering, inventory visibility and control, materials handling, import/export facilitation and information technology. Thus, the industry offers a classic model for implementing supply chain management techniques. In a supply chain, a company is linked to its upstream suppliers and downstream distributors as materials, information and capital flow through the supply chain (Chima, 2007). There are more opportunities for coordinating activities across a supply chain even in such complex operations as oil and gas, because of improving information systems and communication technologies. The main challenge facing oil and gas industry is not availability of oil and gas resources, but putting these reserves into production and delivering final products to consumers at minimum possible cost (Chima, 2007).Oil and gas industry supply chains also have inherently uncertain process (Garbie, 2011).

The oil and gas supply chain begins with worldwide exploration and extraction of crude oil. Secondly, vertical segment, firms transport crude by pipeline or tanker. Thirdly, the oil reaches a refinery, most likely one of the most nearest refinery. Fourthly, after refining the crude oil into motor petrol, the product moves, typically by pipeline to the wholesale racks. Fifthly, trucks bring it to approximately gasoline stations. Sixthly, consumers purchase and pump the petrol into private and commercial registered motor vehicles for industrial and private use (Mansur, 2010).

Oil and gas industry supply chain is divided into three: the upstream, midstream and downstream sector (Peters and Hood, 2000; Weijermars, 2010; Schweitzer et al, 2011; Briggs et al, 2012; Briggs and Tolliver, 2012). Regardless of this classification major oil companies engaged in exploration and extraction, transportation, refining, wholesaling and retailing (Yarrow, 1991; Mansur; 2010).

Figure 3.5 shows that oil and gas industry supply chain is divided in six production processes: exploration, production, refining, marketing and consumer. The links shown signify the main supply chain connection in the oil and gas industry. The links show the interface between companies and materials that flow through the supply chain. Oil and gas companies use group of vendors to keep their systems continuously re-supplied. In each stage, there are many operations (Chima, 2007).

Figure 3.5: Supply Chain of the Oil and Gas Industry



Source; Chima (2007, p. 28)

Table 3.5 shows that oil and gas supply chain begins with the exploration and production of crude oil, which subsequently are transported to the refinery where it is refined into different products such as jet fuel, petrol, diesel, electricity, and petrochemicals and then transported through pipelines to storage terminals for distribution to end users.

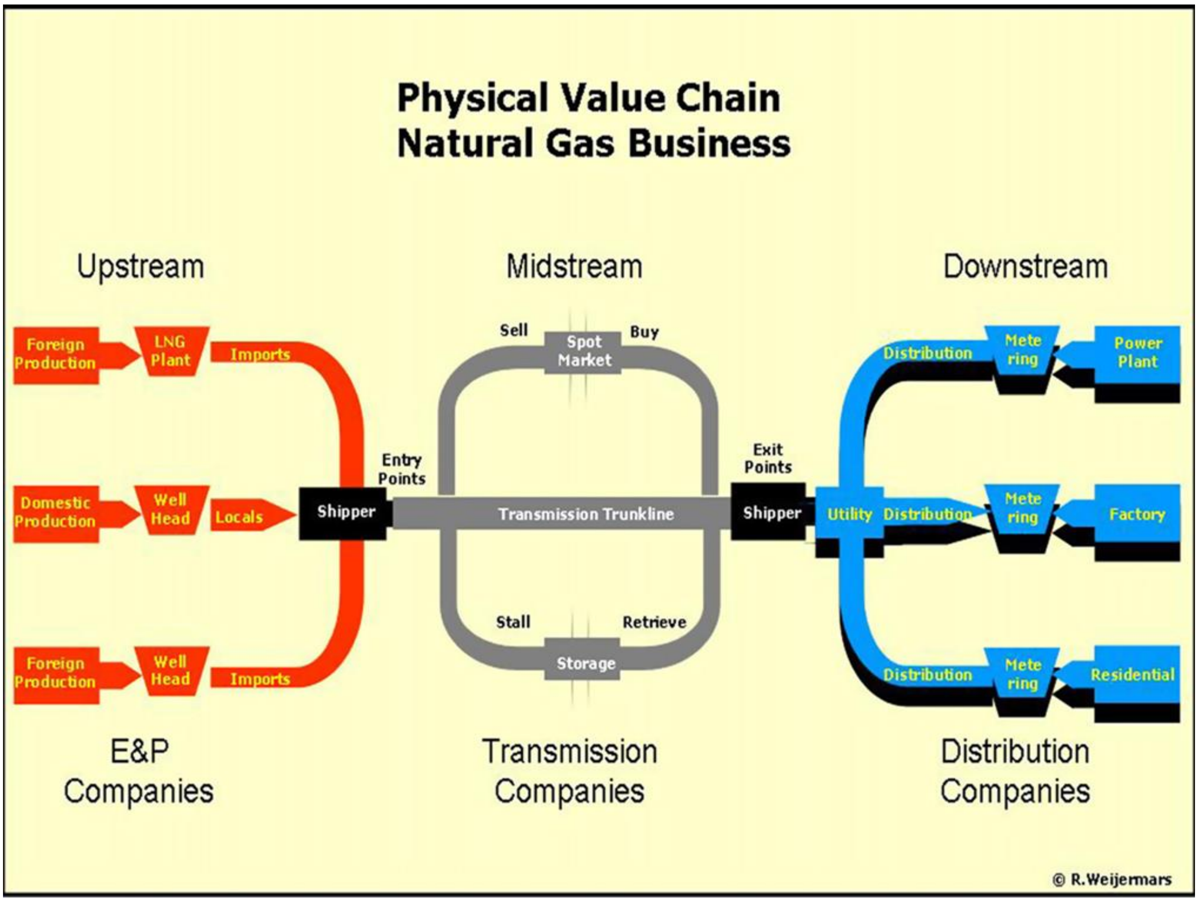
3.8.1.1: Up Stream Sector Oil and Gas Supply Chain

Upstream oil sector is normally refers to the searching for and the recovery and production of crude oil and natural gas (Weijermars, 2010). The upstream of the oil industry is concerned with the exploration and extraction of crude oil and natural gas from the ground to the pipeline (OPITO, 2002; Weijermars, 2010;Schweitzer et al, 2011). The upstream petroleum industry is characterised by frequently shared asset ownership, an extensive international supplier industry dominated by three or four international companies (Acha, 2000). Historically, the upstream sector has remarkable influence on the operation of the overall supply chain since it has the ability to ‘push’ large quantities of crude oil through the chain (Brigs et al, 2012).The upstream supply chain activities consist of various operations such as; explorationsfor potential underground or underwater oil and gas fields; which involve seismic, geophysical and geological studies. Production operations involve drilling, production, facility engineering and reservoir (Ribas et al, 2011; Briggs and Tolliver, 2012). This means upstream operations deal primarily with the exploration stages of the oil and gas industry, with upstream firms taking the first steps to first locate, test and drill for oil and gas.

Later, once reserves are proven, upstream firms will extract any oil and gas from the reserve to the surface (Hussain et al, 2006).

Weijermars (2010) further split the operations processes in oil and gas supply chain into series of activities that are undertaken in upstream, midstream and down stream sectors. Figure 5.6; shows physical value chain oil and gas; oil and gas produced by the upstream business segment is sold by shippers and traders to end-users in the downstream segment. The transmission and storage segment (Midstream) provides transport capacity to shippers. In the US for example, the returns of utility companies and natural gas transmission companies are regulated, principally by state regulators and a federal regulator, respectively. The black path behind the blue fork illustrates that shippers and in some cases, producers, can sell gas directly to the retailers and can bypass the LDC network when a dedicated pipeline serves the end consumer (Weijermars, 2010).

Figure 5.6: Physical Value Chain of Natural Gas Business



Source; Weijermars (2010)

Operations at the upstream oil and gas supply chain can be divided into two. Firstly, the fabrication of the equipment to be used in oil production and secondly, the production of crude oilandgas; oil equipment is manufactured by contractors and suppliers of specialised equipment on behalf of oil operators. A project system of organisation is used in oil equipment fabrication. After the equipment for the oil extraction is fabricated and installed, the crude oil production will be undertaken until all the oil and the well (reservoir) has been depleted. Organising to undertake the activities of crude oil production involve three key players; operators, contractors and suppliers. A high level of innovation is a necessity in the activities of the contractors and suppliers in undertaking their tasks (Crabtree et al, 1997; Crabtree et al, 2000)

Exploration: This stage involves seismic and geological, magnetic, electrical and gravity operations (Chima, 2007; Garbie, 2011). Once discoveries are made, the corporate will seek for field development project approval, which can be obtained from approved government agencies. At each subsequent step in the value chain, corporate decisions determine whether or not to develop any new assets (Weijermars, 2010).In exploration, once a required geological structure has been identified, which is the presence of hydrocarbons, thickness and internal pressure of a reservoir, the next step is to drill exploratory boreholes. A pad for a single exploration occupies between 4000-15000 square meters. When exploratory drilling is successful, more wells are drilled to determine the size and the degree of the field. The appraisal stage aims to assess the scope and nature of the reservoir (oil field). The number of wells required to exploit the hydrocarbon reservoir varies with the size of the reservoir and its geology. Large oilfields can require up to 100 or more wells to be drilled whereas smaller fields may require ten or so. Additional, wells known as injection wells are required to maintain constant production rate (Garbie, 2011). Exploration is a very hard process and therefore needs the service of experts in the field. Additionally, information technology plays important roles in the exploration or searching of crude oil in order to easily discover new grounds where oil is located so as utilise it (Jenkins and Wright, 1998; Stabell, 2001).

Production: this is the exploitation of the crude oil from the reservoir by drilling. Production operations include; drilling, reservoir, production and facilities engineering. Drilling contractor is required and forty five or more different services are required to drill and complete each well (Chima, 2007). Production requires highly qualified engineering work and it also links to other activities such as procurement and transportation (Ribas et al, 2011). Drilling requires comprehensive oil field services such as seismic services, specialty chemical production, petro physical and data acquisition, processing and analysing services. In the drilling process, mechanical or electrical errors may exist where diverse fields of engineering professionals have to be available. Therefore, project engineers should have comprehensive knowledge and background in every field to ensure reliability, operability and maintainability (Ribas et al, 2011). Similarly, communications within wide-ranging engineering fields is important in all operations and production. At the offshore operations, there are additional constraints that have to be considered such as the deepness of the water, weather conditions and the distance of the logistical base. A drilling could cost a company average of hundred thousand dollars daily till the drilling process reach the oil and gas reservoir, then the production is completed (The oil and gas industry, 2014).

In exploration and production, most of the activities are repetitive. The product is also exactly the same for all competing firms; oil and gas with very slight differentiation. Therefore, many of the firms cannot differentiate themselves from one another by introducing a new product. Exploration and production companies can only differentiate themselves on the ability to economically find and produce oil and gas more efficiently than their competitors. Though, exploration and production companies are unique in many respects, a differentiating factor lie on the ability to adapt a sound supply chain management program (Chima, 2007).

Exploration and drilling activities are different and reliable on the type of weather. As there is an offshore and onshore operation, scientists and engineers have to consider risk, complexity and other natural scientific factors. Exploration, extraction and pipelines require substantial investments and transportation technologies in conjunction with spatial pattern of sources of supply and demand mean that there is considerable asset specificity. Example, pipelines have to be constructed to serve particular gas fields and particular customers or groups of customers (Yarrow, 1991).

3.8.1.2: Midstream Sector Oil and Gas Supply Chain

Midstream is a second segment called midstream (although in most cases is considered in the upstream sector), midstream consists of the distribution system such as tankers and pipelines that carry crude oil and petroleum products to various refineries and storage tanks around the world (Schweitzer et al, 2011; Ribas et al, 2011Brigs et al, 2012). This indicates that midstream sector of oil and gas industry is not a production process. Because it does not modify or alter the petroleum in any form but simply transport it by pipelines or oil tankers to the terminals for storage. From where it is either transported directly to the refinery or exported to other companies' refineries. Therefore, midstream as the name implies is a place where the petroleum products are temporarily stored before further delivery to customers and or procession to various kinds of petroleum products.

Transport and Storage: petroleum products are of transported in many ways: ocean shipping, barges, railways and pipelines. Transportation of petroleum products attracts higher costs (Briggs and Tolliver, 2012). This cost varies depending on the situation and quality of the crude oil. Oil storage tanks are usually in a cylindrical shape and they consist of control system instrument in order control the prevention of extraction or contradiction of the tank in loading or uploading processes due to over or under pressurizing Hydrogen or Sulphuric Acid corrosion. Liquefied natural gas tanks (LNG) are usually in a spherical shape to better store the gas on its liquid or gaseous matter (Schweitzer et al, 2011). Thus, this is applied in the transportation of oil and gas at shipping and uploading stages to the oil and gas tankers. The tankers and ships are provided with full protection of corrosive materials and any other exterior influence to the gas or oil tankers. All of these tankers and storage tanks have to be inspected daily in order to be protected again fire disasters. Oil Ocean Tankers are designed with new systems where every ship has an average of fifteen oil tanks separated from each other inside the ship (The Oil and Gas Industry, 2010).

Pipelines: Pipelines differ in sizes and the oil composite one area to area are based on the quantity of oil and gas going to be pumped. When installing pipelines routes, engineers identify the shortest distances from the production area to the end user to facilitate an ease flow in shorter time and distance. Pipelines could be buried under ground, under the sea for loading and for distribution. Therefore, ISO and API have certain standards to follow when designing and installing the pipelines to prevent any fire, corrosion or leak issues (The Oil and Gas Industry, 2010).

3.8.1.3: Downstream Sector Oil and Gas Supply Chain

Downstream organization is a continuation of the upstream and midstream process. A crude oil gets carried out to be for further processing and refining. The downstream operations comprise of the refining/processing, transportation, marketing and distribution of petroleum products (Briggs and Tolliver, 2012). Downstream industry includes refining, marketing, supply, trading and transportationand distribution of oil products. The downstream sector of the industry is the sector that directly relates with the consumers (Hussain et al, 1998;

OPITO, 2002). Some of the products derived from the refining of crude oil may include; diesel oil, liquefied petroleum gas (LPG), asphalt, petroleum coke, gasoline, fertilizers, antifreeze, plastics, rubbers, pesticides, synthetic rubber, jet fuel and many more (Hussain et al, 1998; Bala, 2012).Facilities involved in this sector include petrochemical plants, oil refineries, natural gas distribution companies, retail outlets and the end customers (Jenkins and Wright, 1998; Schweitzer et al, 2011). The downstream specifically serves two different customers; the wholesale customers such as, petrochemical facilities, power plants, airlines, shipping companies and other industrial customers; while the retail customers comprised consumers essentially for domestic heating and transportation (Brigs et al, 2012; Briggs and Tolliver, 2012). In the downstream parts of the industry, national transmission, local and regional distribution, and sales of gas were maintained as an integrated monopoly, although since the Oil and Gas (Enterprise) Act 1982 other firms had theoretically been free to supply large consumers and to make use of British Gas's pipeline facilities (Yarrow, 1991). Downstream sector is usually characterized as developed, competitive and complex industry (Briggs and Tolliver, 2012).

Refining: The first stage in downstream sector is the refining process which is based on demand projecting and triggers the procurement and the logistics activities in order to supply crude oil to the refinery and distribute its by-products to the customers (Jenkins and Wright, 1998). Refining is a valued stage where crude oil gets treated and heated up to be separated from water and to produce chemical products, kerosene, gasoline, jet fuels and other power supplement products, residential and other chemicals that are used as basic industrial manufacturing. Refining is a complex, well planned process which involves the transformation of the crude oil into different types of derivatives based on demand forecasting. Therefore, Refining has a tight link to the marketing activities and also involves inventory management. In refining crude oil gets pumped through pipes with a specified pressure. The oil goes into boiler with super-heated steam. Then, it goes into a distillation column to facilitate the cracking of the molecules (Hussain et al, 2006). Then, it goes into cracking and Alkylation process where they get cracked from Hydrogen or other type of molecules. Fuel gas, liquefied petroleum gas, kerosene and naphtha are some examples of the main by-products of the crude oil which are transferred to the refineries as a feedstock (Jenkins and Wright, 1998; Consumer Energy Report, 2010). This is followed by the cracking process and new products can be extracted for the petrochemical industry such as olefins and aromatics. Later, out of for instance ethylene, propylene, butadiene, benzene, toluene and xylenes, petrochemical plants can produce more specified products such as plastics, soaps, detergents and healthcare products, synthetic fibres, furniture, rubbers and paints (Hussain et al, 2006). There is various customers' demand where some of them require gasoline only, jet fuel or other petrochemicals that are used as raw materials for manufacturing and further production. SABIC (Saudi Basic Industrial Company) is specialized in gas liquefying (Consumer Energy Report, 2010).

Currently there are issues related to lowering of costs of operations associated with oil extraction, and long lead time in delivering services by contractors, all of which affect the competitiveness of operations of the oil and gas supply chain generally and in the North Sea oil and gas cluster in particular (Dauda, 2008).

Marketing: Marketing is the wholesale distribution of final petroleum products to variable business needs ranging from government, public customers, private consumers and other businesses worldwide. Marketing deals with selling different crude oil by-products to the right customers (Chima, 2007). Marketing petroleum products depends on accurate knowledge about the current inventory level and refinery activities in order to manage its sale function. Petrol and kerosene service stations handle the volume of the wholesale processes and oil industries distribute oil products directly to manufacturing, marine services, power plants, aerospace industries, automobiles and other related petroleum products consumers (Prescott, 2005; the oil and gas industry, 2014). The oil and gas business is controlled by monetary economics and political conditions. Generally crude oil and gas products get transported to suppliers that provide the most granted and high value. Thus, the closest customer is the most profitable to the supplier because it would provide the lowest transportation cost and high returns. The rate of the product flow is also affected by the demand of the products, refining and quality specifications (Prescott, 2005; The Oil & Gas Industry, 2010). Exploration, production, marketing, transportation, distribution and consumption of oil and gas are maintained by a capital intensive asset base. The prospect of reasonable and fair returns on investment in its asset base justifies growth of the natural gas industry (Weijermars, 2010).

In oil and gas industry, almost all essential operations are planned before time. Thus, the whole process can be manipulated and adjusted. The goal of supply chain management is to provide maximum customer satisfaction at the lowest cost. In oil and gas industry supply chain, exploration operations create value through seismic analysis and identifying prospects.

Production operations become the customers that use the output of exploration. In the same way, refining is the customer of production while marketing is the customer of refining and the user of refined products such as gasoline, kerosene and diesel is the ultimate customer. Types of shipments made vary widely from gloves to pipes, valves, cranes, chemicals, cement, steel and drilling rigs etc. (Chima, 2007). Technology plays important role in the promotion of a petroleum company. The implementation of new technologies will 'concentrate on the following: the latest available modifications, quality of implementation drilling process, applying preventive maintenance of equipment to make machines more reliable, use of mobile rigs (e.g., jack ups, semi submersibles, drill ships) in onshore and offshore (shallow and/or deep water), ability to implement new exploration and drilling technology, use new material handling system in moving and transporting oil, ability for internal design changes, easy access to information technology throughout processes on the shop floor and so on' (Garbie, 2011, p. 207).

Tubes and tubular goods are among the necessary goods supplied to the oil and gas industry every day. These goods are essential and form part of the supply chain link. Supply of tubular goods is a process through which oil field tubular goods such as pipes, tubing and casing are ordered, manufactured, transported, stored, prepared and then delivered to the well site for installation into a well. Delays in supply of these goods can result in extensive rig downtime and consequently high operating costs. If suppliers could be made more reliable, there would be less need for inventories of raw materials, quality inspection systems, rework and other non-value adding activities resulting in lean production (Chima, 2007).

3.9: Oil and Gas Industry Shareholders

All kinds of businesses activities depend on a variety of stakeholders. A stakeholder is anybody who can affect or is affected by an organisation, strategy or project. They can be internal or external and they can be at senior or junior levels. According to Eden and Ackermann (1998, p. 117) Stakeholders are 'People or small groups with the power to respond to, negotiate with, and change the strategic future of the organization'. Whilst Walker (2003) and OPITO (2002) define stakeholders as individuals or groups who have interest in the decisions made by an organisation or some aspect of rights or ownership in the project and can contribute to, or be affected by, either the work or the outcomes of the project. Stakeholders are not equal on their rights and interests on organisations undertakings. A company's customers are entitled to fair trading practices but they are not entitled to the same consideration as the company's employees. Industry stakeholders benefit from a systemic value network analysis because it identifies key areas in the value network where constraints and opportunities for improvements arise. Natural gas value chain is foremost a physical supply line of natural gas connecting production centres (wellhead) and end-consumers (burner pit) (Weijermars, 2010). The key stakeholders involve in upstream and downstream operations includes: creditors, debtors, directors, employees, government, government agencies, owners (shareholders), suppliers, unions, investors, customers, NGOs, business partner, contractors, oil industry, analyst, the international and local community where oil companies draws their resources and sale their products (BP, 2011; Statoil, 2013).

In oil and gas industry the principal stakeholders are the operators. The dominant operators in upstream sector of oil and gas supply chain are Schlumberger, Baker Hughes and Stoitel. Schlumberger, Baker Hughes and Stoitel companies are experts in high-technology drilling instruments; exploring and offshore installation of equipment of oil and gas exploration early phases (Acha, 2000: BP Global, 2004). Nevertheless, vertical integration is found throughout all the stages of the oil and gas supply chain and major oil companies are typically engaged in exploration and extraction, transportation, refining, wholesaling and retailing (Yarrow, 1991). Majority of the oil and gas companies have invested heavily forward in the natural gas chain, backwards into gas production and sideward into electricity generation and supply. Generally, in oil product marketing, BP, Shell and Total have strongest implementation of downstream natural gas strategies in Europe. ExxonMobil and Hydro have limited downstream business sphere while Statoil had no downstream oil product marketing activities in countries hosting core gas markets (Eikeland, 2007). Chevron, Texaco, Arco, ExxonMobil, Amoco, BP, Total, Royal Dutch Shell, Eni, Centrica, Gassco, Petoro, ConocoPhillips, Dong energy and AMEC plc. are the key operators in oil and industry all over the world (Yarrow, 1991; Acha, 2000).

Historically, all international oil companies are vertically integrated since they are involved in more than one petroleum operation; supplying its own crude to the company owned refinery and selling the petroleum products through its own distribution channels (Nolan and Zhang, 2003). In 1990s, major European upstream oil and gas business (BP, ExxonMobil, Hydro, Shell, Statoil and Total) formulated strategies of forward integration in the natural gas supply chain and sideward into electricity production (Eikeland, 2007). Some petroleum companies are fully integrated in all three petroleum operations while others may be active in one or two of the industry segments (Briggs and Tolliver, 2012). This indicates that UK oil and gas companies' mergers and acquisitions involve both horizontal and vertical integration as well as diversification across energy sectors (Brigs et al, 2012). The micro-economic value of the horizontal integration lies in the economies of scale associated with increasing the production of a single product type. On the hand, the horizontal integration can be a strategic move to create a dominant market position. Neo-classical approaches tend to focus on vertical integration primarily as a response to pre-existing market power problems or as a strategic move to create or enhance market power in upstream or downstream markets. Additionally, vertical integration can be seen from a more strategic management perspective as an instrument of risk management. Liberalisation in many markets can change locations in the supply chain where the value will lie in the future and possibly cause margins to migrate downstream (Eikeland, 2007). However, establishing a stable downstream retail customer base could be perceived as a strategy to secure demand and prices for upstream assets (Thomlinson et al, 2004).

3.10: Upstream and Downstream Response to Sustainability

One of the common concerns on environmental problems is the production of energy from fossils fuel and massive energy consumption in manufacturing companies. Currently, about 85–90% of the world's energy is obtained through burning fossil fuels. Another concern is the effects of carbon dioxide emissions to the atmosphere. Studies show that the level of carbon dioxide in the sky has increased from the beginning of the industrial age to date and currently it contributes about 73% to the potential for global warming. Additionally, there is a problem of water management, which is likely to be the major problem in this century (Grossmann, 2004).

Furthermore, studies also show that 30 to 80% of the environmental impact of product or service originated from the design stage (Clark, 2007). Therefore, design stage intervention is the most effective method in reducing environmental impact; understanding this, made many companies to find better ways of converting waste from one industry, which can be used in another industry (Ayres, 1989). Currently, companies are trying to reuse, remanufacture and recycle used products to reduce their harmful effect on the environment (Gunasekaran and Spalanzani, 2012). Other environmental problems resulting from oil and gas companies operations are oil spills in the water or on the land, biodiversity destruction, resource consumption and human rights abuse.

3.10.1: Sustainability Practices in the Upstream Oil and Gas industry

The upstream responsibility issue is usually expressed in terms such as footprints, life-cycle of the products/services and energy use. That means the production of our suppliers' products, which in turn causes emissions (Lenzen and Murray 2010). Internal measures to reduce greenhouse gas (GHG) emissions consist of changes in the production process enabled by technological developments. Other measures involve new product development, improved products (in terms of energy efficiency) and change in organisational culture (improving employee awareness of climate change issues). Internal measures appear to be the most common method currently used companies (Kolk and Pinkse, 2004). The following are some upstream responses to sustainability;

3.10.1.1: Environmental Laws and Regulations

Upstream operations of oil and gas companies are associated with major damages to the environment. These disruptions come in form of land degradation, water and forest disruption. In addition the upstream oil and gas operations emits substantial amount of gas to the atmosphere. Governments all over the world responded through promulgating laws governing oil and gas extraction and production. The aim of the laws is to reduce the environmental disruption and gas emissions.

USA, UK, Switzerland, Germany and Australia governments have been active in forcing companies to emission reduction agreements. To participate in the market for emission credits, a company have to be located in a country where such a market exists (a ‘country-of-location’ effect). Currently only limited number of emission markets exists (Kolk and Pinkse, 2004).

Upstream laws could significantly reduce environmental destruction and gas emissions in the following ways; first upstream laws could significantly decrease transactions costs. Regulating few thousand fossil fuel producing companies would account for 80 percent of gas emissions reduction. Second, if all countries do not harmonize carbon prices, incomplete regulation will affect the types of goods produced, traded and consumed. The magnitude of regulatory leakage depends on whether policy regulates firms upstream or downstream. Third, incentives have been given to companies facing upstream regulation to choose some downstream options to reduce emissions. While these incentives may result in lower overall abatement costs, they may also have unintended consequences that result in less overall abatement (Mansur, 2010).

3.10.1.2: Environment

More than 91 per cent of AMEC personnel are working on an environmental management system of ISO 14001 compliant whilst the entire AMEC businesses in the UK are gaining third party certification (AMEC, 2011). Major BP's company operating sites with the exception of recently acquired ones are ISO 14001 certified compliant (BP, 2011). All Shell company main installations (refineries, chemical plants, gas plants and permanently staffed oil and gas production facilities) are also ISO 14001 certified compliant (Shell, 2013).

Shell volume of oil spills decreased from 2.1 thousand tonnes in 2012 to 0.9 thousand tonnes in 2013. While the number of times operational oil spills occurred in Shell decreased from 207 in 2012 to 174 in 2013 (Shell, 2013). Statoil's total number of accidental oil spills reduced from 306 in 2012 to 219 in 2013 (Statoil, 2013). ExxonMobil spills about 11 million gallons of crude oil in pristine waters of Alaska's Prince William in 1989. Clean up processes commenced instantly. The clean-up work costs ExxonMobil about $2.2 billion between 1989 and 1992 (Bell and Lundblad, 2011). In 2011 BP surveyed more than 4,300 miles of Gulf Coast shoreline. Out of these miles, 635 miles require some clean up measures. In 2011, BP in conjunction with the Unified Command commenced work to meet the commitments of the Gulf Coast shorelines that was affected by the oil spills in 2010 (BP, 2011).

BP spent $500 million in 10 years in support of independent research to improve knowledge of the Gulf ecosystem, to better understand and mitigate the potential effects of oil spills in the region and elsewhere (BP, 2011). While from 1990 to 1991 AMEC spent $3bn on environmental remediation projects to restore regions damaged during the first Iraq war (AMEC, 2013). In 2013, Statoil merged the environment, climate and social performance functions into a new function titled "Sustainability". This gave the company the opportunity to develop a framework for a holistic approach to carbon, natural resource efficiency, environmental protection, local value creation, human rights and transparency (Statoil, 2013).

3.10.1.3: Natural Resources Conservation

BP is working in collaboration with state and federal government agencies to identify the nature and degree of damages done to natural resources as result of the Deep water Horizon accident. As at 31 December 2011, BP had paid over $600 million for assessment efforts.

Additionally, BP has committed to provide up to $1 billion to finance restoration of natural resources in the Gulf (BP, 2011).

Shell reduced consumption of fresh water by around 50% at Pinedale tight gas project in Wyoming, USA through recycling water produced with the gas. While at Groundbirch, western Canada Shell invested C$10 million to build waste-water treatment facility in partnership with the Dawson Creek city authorities. The plant reclaims 4,000 cubic metres of waste water per day, which are adequate enough for Shell daily operations. In the north-east USA, Shell recycles almost all the water it needs for production with gas at the Marcellus shale gas project (Shell, 2011). The amount of fresh water used decreased from 209 million cubic metres in 2011 to 203 million cubic metresin 2012. The reduction is due to less river water withdrawn for Shell oil sands operations (Shell, 2012). In 2013, the amount of fresh water Shell used decreased to 198 million cubic metres, down from 203 million cubic metres in 2012 (Shell, 2013). No water used in Shell mining and extraction processes is returned to the river and Shell recycle rate of water is more than 75%. While Shell has permits to withdraw 0.6% of the Athabasca River's average annual flow, the company used less than 0.08% in 2013. Around 90% of waste water from the upgrading is reused in operations (Shell, 2013).

3.10.1.4: Renewable Resources

Renewables resources are the fastest growing energy source. In the future renewables resources such as biofuels and wind will be important in addressing energy security challenges and climate change (BP, 2011; UN Global Compact, 2012). Oil and gas industry is seen as a key component of renewable energy generation. Many oil and gas companies consider that they are also energy supply companies and are bringing diverse set of products that create and supply energy to the market (BP, 2010; UN Global Compact, 2012).Many oil and gas companies have and are investing in new renewable fuels and renewable energy generation. In 2010, global biofuels production increased by 13.8 percent, constituting one of the largest sources of liquids production growth in the world (BP, 2011). Oil and gas companies are also using their core capabilities and current business positions to create profitable positions in renewable energy generation such as geothermal and offshore wind (UN Global Compact, 2012).

Shell international renewables was set up in 1998 to consolidate existing businesses. The new investment of $500 million over five years in renewables, primarily in PV and wind can boost its power generation and distribution plan. Shell has planned to reposition itself more broadly as an energy company (Levy and Kolk, 2002). Whist in 2000 Texaco spent $67 million in to acquire 20 percent of Energy Conversion Devices (ECD), which has technological capabilities in advanced batteries and PV (Levy and Kolk, 2002).

Natural gas is the cleanest and most hydrogen-rich than any hydrocarbon energy sources and it has high energy conversion efficiencies for power generation (Economides and Wood, 2009). Currently, natural gas accounts for about 23% of the world energy demand. Many oil and gas companies' are making large capital investments in infrastructure to enable increased gas consumption. Several new LNG facilities are being built, there is a growing recognition that unconventional sources of gas, such as shale gas, coal bed methane (CBM) and deep tight gas can contribute significant component of future gas supplies as technologies evolve (Economides and Wood, 2009). Shell is a pioneer on producing liquefied natural gas (LNG) more than 40 years ago. LNG has become an important means of supplying gas to people and industries located far away from natural gas resources (Shell, 2011). Shell is producing more natural gas and accessing energy resources in increasingly challenging environments. The quantity of liquefied natural gas supplied rose again in 2011 (Shell, 2011).

3.10.1.5: Carbon Dioxide (CO_2) Emission

Carbon dioxide **(**CO_2) emission is produced from oil and gas production operations directly or indirectly. Direct CO_2 emissions come from burning fossil fuels while indirect CO_2 emissions are generated by the use of electricity and heating. The relative importance of these two emission sources differs per industry and has consequences for companies' ability to reduce emissions and for the type of measures taken (Kolk and Pinkse, 2004). 17% of worldwide CO_2 emissions from fossil fuels arise from road transport (Shell, 2011; Yusuf et al, 2013). Since transportation companies are the main consumers of oil and gas industry products.

Oil and gas industry reduce gas emission through emission trading. Oil and gas industry have progressed most in emission trading. BP and Royal Dutch Shell have not only participated in the UK scheme, but also launched an internal emission trading scheme. Companies focus either on innovation (reducing emissions through improvements in processes, products or product/market combinations) or compensation (external or internal emission trading). In 1997 BP in partnership with Environmental Defence develop internal carbon trading scheme and joined the Pew Centre for Global Climate Change, which advocates for early action on global climate change (Levy and Kolk, 2002). BP is purchasing carbon credits from low-carbon development projects globally (BP, 2011). The indirect GHG emissions from the energy Shell purchased (electricity, heat and steam) were 9 million tonnes on a CO2-equivalent basis in 2012, a decrease from 2011 (Shell, 2012)

AMEC was ranked the industry leader for oil equipment and services in worldwide Dow Jones Sustainability Index (DJSI) for 2012-13 (AMEC, 2012). AMEC total carbon emission in 2012 was 27,747 tons making up 34% total emission. In 2013 AMEC total carbon emission was reduced to 15% (AMEC, 2013).

Statoil in 2013 as a result of successful implementation of CO2 emission reduction initiatives for heavy oil, carbon intensity decreased from 17kg CO2/boe in 2012 to 14kg CO2/boe. Emissions of CO2 were 15.1 million tonnes in 2013 compared with 16.1 million tonnes of 2012. Methane emissions decreased from 38.3 thousand tonnes in 2012 to 37.0 thousand tonnes in 2013. The decrease was mainly due to reduced methane emissions per unit of gas flared in Statoil US onshore operations. Non methane volatile organic compounds (nmVOC) emissions decreased from 59.8 thousand tonnes in 2012 to 57.6 thousand tonnes in 2013. The decrease was mainly attributed to installation of more efficient flares in US onshore operations in 2013 (Statoil, 2013).

In 1998 BP reduced internal emissions by l0Vo by 2010, even while output was expected to grow 50Vo (Levy and Kolk, 2002). BP saved around 6 million tons of CO2 emissions each year. BP is constructing a full scale CO2 storage project at one of its sites, the In Salah gas field in Algeria, resulting in the storage of 900,000 tons of CO2 annually. BP also heads the plans for the world’s first gas fired hydrogen power station in Scotland, incorporating CO2 capture and injection for enhanced oil recovery (Sæverud and Skjærseth, 2007). In 2004 BP started the world’s second system of full scale CO2 separation from a production field’s gas stream in Algeria. The separated CO2 is subsequently stored in a geological formation (BP, 2005).

BP new Zhuhai 2 purified terephthalic acid (PTA) unit in China has the highest energy efficiency and smallest environmental footprint in its sector, producing around 65% fewer CO2 emissions than a conventional PTA facility (BP, 2011). Since the formation of its alternative energy business in 2005, BP invested $1.6 billion in alternative energy, more than any other year (BP, 2011). During London 2012 Olympic and Paralympic Games, BP offsets CO2 emissions from travel to the games for ticketholders to those who register with BP target neutral programme. BP direct GHG emissions were 61.8 million tonnes (Mte) in 2011, compared with 64.9Mte in 2010. The net effect of acquisitions and divestments is a decrease of 1Mte, primarily the result of the sale of assets as part of BP disposal programme (BP, 2011). BP direct GHG emissions were 49.2 million tonnes (Mte) in 2013, 59.8Mte in 2012 and 61.8Mte 2011(BP, 2013).

Currently, oil industries are facing problems with regards to oil extraction out of the wells. Due to the environmental concern of crude oil extraction, a new era of oil well simulation technology has been initiated. The new invention is to inject steam under the ground to facilitate its movement out of the well (Chevron, 2014). Shell well simulation technology captures up to 35% of the current CO2 emissions from the Scotford Upgrader, Alberta. The captured CO2 is compressed to a liquid state. It is transported 60 km through an underground pipeline to three wells north of the Upgrader in Thornily County. The CO2 is injected into an underground porous rock formation, below multiple layers of impermeable rock (Shell, 2013). Chevron has also implemented this technology in Wafra Oil wells in Kuwait and Bakersfield in Bakersfield California (Chevron, 2014). BP, Sonatrach and Statoil in a joint venture partnership have worked on a large scale direct carbon abatement technology: carbon capture and storage (CCS). In seven year period, the partners worked to execute and monitor a demonstration project in southern Algeria. 3.9 million tonnes of CO2 were injected into the deep saline reservoir of Krechba gas field at In-Salah production facility, instead of releasing this CO2 into the atmosphere (BP, 2013).

The Shell upstream production of oil and gas accounted for around 40% of gas emissions, and the shipping activities for the remaining 5% (Shell, 2011). The direct greenhouse gas (GHG) emissions from facilities operated were 74 million tons of CO2-equivalent bases in 2011, a decrease of around 3% from 2010. The main reasons for this slight drop were divestments in downstream businesses and reduced flaring in Nigeria (Shell, 2011). Flaring of natural gas in Shell upstream business decreased in 2012 to 7.7 million tonnes of CO2, from 10.0 million tonnes of CO2 in 2011 (Shell, 2012). Shell made progress in reducing flaring in Nigeria in 2012. Flaring emissions were down by around 25% in Nigeria from the previous year, to 4.6 million tonnes of CO2 equivalent (Shell, 2012).

Investments associated to consumption patterns in the energy markets that reduce gas emissions generally take the form of investments in other energy sources (renewables, coal). BP and Shell reveal high degree of consistency between the companies’ proactive climate strategy formulations, their measures and their investments for reducing greenhouse gas emissions. Both companies have introduced general measures that intended to trigger GHG reducing investments at company production facilities, including internal emissions trading schemes in the periods 1999–2002 BP and 2000–2002 Shell (Sæverud and Skjærseth, 2007).

3.10.1.6: Energy

Oil and gas industry is one of two industries (the other being utilities) that produce and supply largest quantity of energy used all over the world (UN Global Compact, 2012). Demand for energy is increasing and this growth is expected to continue due to increase of population, economic growth and higher standards of living (OECD/IEA, 2009; BP, 2011). The world's population is projected to increase by 1.4 billion over the next 20 years. The corresponding world primary energy consumption is expected to increase by as much as 40% in the next 20 years (BP, 2011).

BP and Shell have divested their investment on coal mining and made significant investments in renewable energy. In 2003 Shell and BP were the main manufacturers of solar power, each responsible for around 20 percent of total solar power installed globally. In addition both companies have committed resources on wind energy (Eikeland et al, 2004).

Oil and gas industry is dedicated to investing in new technologies to satisfy energy demand and the challenges of sustainability. The industry is investing heavily in the research and development of new technologies to improve efficiencies in operations. The industry is also at the forefront of creating the next generation of advanced biofuels and large scale offshore wind; developing and advancing renewable technologies from pilot project to scale (UN Global Compact, 2012). The oil and gas industry has a more specific measure: the reduction of gas flaring. Companies can also focus on the type of energy sources. The most important measure is the substitution of fossil fuels by carbon free renewable energy (Kolk and Pinkse, 2004). Using gas turbines on platforms can improve efficiencies in exploration and production operations. Sourcing electricity from land based grid for offshore platforms rather than gas turbines will provide opportunity to utilize grid based renewable energy, reduce CO2 emissions and improve energy efficiency. This technology is currently being deployed in the North Sea and on the Norwegian Continental Shelf. Solar energy is also being piloted for steam generation to augment steam produced from natural gas for oil recovery (UN Global Compact, 2012).

Wind power is expected to continue to rise as one of the worldwide energy mix.For more than a decade Shell has been is involved in wind power projects in Europe and North America. Presently, Shell's has 507 megawatts from wind power. Most of this comes from around 720 turbines at eight wind projects in the USA (Shell, 2011). At Waterton in Canada Shell invested nearly C$2 million to improve energy efficiency of its 50 year old gas processing site (Shell, 2011). A new energy monitoring system of CO2 and energy management used across 20 Shell manufacturing sites has improved energy efficiency. This system has led to savings of more than $20 million in 2013 (Shell, 2013). Statoil Sheringham Shoal offshore wind farm is now on full production with 88 turbines and an installed capacity of 317 megawatts (MW). Statoil also purchased 70% shareholding in the Dudgeon wind farm project in October 2012 together with Statkraft. The project is located near Sheringham in the Greater Wash Area off the English east coast. The expected installed capacity Dudgeon wind farm is 402MW, pending a final investment decision in 2014. The wind farm will provide renewable energy to approximately 400,000 households in the UK market (Statoil, 2012).

Gas is a lower carbon fuel that is increasingly secure and affordable. If gas replaces coal for supply of power, it could reduce CO2 emissions by half. BP believes that oil will remain the dominant source for transport fuels, accounting for as much as 87% of demand in 2030 (BP, 2011). BP Energy was the first foreign company in the Spanish market in 2000, serving 10% of the commercial and industrial market segment by 2002 (Eikeland, 2007). Currently BP, Chevron, Shell and Statoil produce more natural gas as it emits less CO2 than fossil fuel and coal when used in generating electricity (BP, 2011, Chevron, 2011, Shell, 2011 and Statoil, 2012). BP is playing major role in the growth of gas with production in countries such as the US, Trinidad, Indonesia and Egypt and important supply chains such as those serving China, India and Europe (BP, 2011).

BP's acquisition of Amoco has greatly increased its investment in solar energy. This investment makes BP-Solarex the largest photovoltaic (PV) company in the world, which revenues expected to climb to $1 billion in 10 years period.BPbelieved that competitive advantage could be attained through a positioning that is distinctive in the eyes of governments, consumers and regulators (Levy and Kolk, 2002).

AMEC energy plant uses geothermal steam extracted from wells over 7,500ft deep to power a steam of turbines; the energy plant Produces 49.8 megawatts of renewable energy that can supply electricity to 7,500 homes. Furthermore, AMEC developed zero emission discharge site with regards to storm water (AMEC, 2013). Geothermal power is the most important sector of Chevron renewable energy portfolio. Chevron geothermal operations generate more than 1,250 megawatts of electricity per year, which is enough to meet the needs of 16 million people (Chevron, 2011).

Shell, BP and ExxonMobil divested themselves of all or most of their coal mining activities, Shell and BP replaced them on investments in renewable energy sources. Total, Statoil and Hydro have moderate investments on renewable energy (Eikeland, 2007). In electricity supply chain, Shell is a major investor in independent electricity generation projects during the 1990s. BP and ExxonMobil investments in electricity generation were smaller and mostly tied to installation of co-generation at their industrial premises. Yet BP substantially engages in electricity trading activities. Total made substantial investments in electricity generation in the period. Statoil and Hydro realised a few electricity generation projects and were modestly engaged in electricity trading activities (Eikeland, 2007).

3.10.1.7: Climate Change Strategies

Climate change is a global environmental problem that has increasingly attracted corporate attention in the past decade. Because of its actual or potential strategic effect on many companies; many oil and gas companies adopted proactive climate strategies. Corporate support for climate measures is evident in the wave of activities and initiatives to reduce emissions through product and process improvements. A decade of business interest in climate change has led to a clear shift in the strategies adopted (Kolk and Pinkse, 2004).

BP and Shell have made efforts to exploit new market opportunities for a viable climate policy, setting an example in corporate GHG reporting and verification as well as developing internal emissions trading schemes that have partly inspired the initiation of the EU emissions trading scheme (EU ETS) (Sæverud and Skjærseth, 2007).

Shell has developed CRI Catalyst, which is a technology that reduces emissions of nitrous oxide (N_2O), powerful greenhouse gas at large industrial plants. This technology efficiently converts N_2O into naturally occurring nitrogen (N_2) and oxygen (O_2), which do not contribute to climate change. In 2011, CRI Catalyst installed three systems using this technology in chemical plants for customers. These systems are expected to reduce emissions at these plants in total by more than 1 million tons of CO_2 equivalent a year (Shell, 2011).

3.10.2: Downstream Sustainability Activities

Downstream responsibility is often associated with the emissions from refining petroleum products in refineries, burning the refined products and disposing phases of a product. Downstream responsibility includes selling of products that directly cause emissions during their use and disposal. The downstream interactions is initiated and supported by sale, including associated emissions that would have occurred differently (Lenzen and Murray 2010).

3.10.2.1: Energy Consumption

Refining petroleum products consumes large amount of energy. Refineries spend 50 percent of their operating costs on energy purchase (UN Global Compact, 2012). Oil refining processes are energy intensive requiring considerable amounts of direct or indirect heat (Szklo and Schaeffer, 2007). Around 55% of Shell gas emissions came from the refineries and chemical plants in the downstream (shell, 2011). Therefore, any solution that improves the conservation, recovery and use of heat will increase the refinery's efficiency; techniques such as enhanced heat integration, increased automation, energy management systems and the use of modern catalysts improve energy efficiency of refinery. Cogeneration plants (combined heat and power) generates electricity almost twice as efficiently as the average power supplied by local utility company, they are the key energy efficiency technologies in refineries (EIA, 2009).According to the International Energy Agency (AIE) the energy intensity in oil refining has fallen by 13 percent since 1980 in OECD countries as the results of improvements in processing efficiency (IPIECA, 2007).

From 1970 to 2005 ExxonMobil had installed around 3300 MW of co-generation at its refineries, chemical plants and natural gas processing plants worldwide. The company has also made investments aim at reducing flaring; about 73 percent reductions at the Baytown refinery in Texas which also has resulted in the development of a flaring reduction manual (Sæverud and Skjærseth, 2007).Royal Dutch Shell launched energy efficiency program, energise TM, to help downstream operations reduce their energy consumption. Majority of savings are made through improving operational practices. Shell estimated that 350,000 tons of CO_2 is being avoided every year in its refineries worldwide (Shell, 2005). In medium to long terms a target of 15–20% reduction in energy use (and consequently in CO_2 emissions) from US refining sector was achieved. Chemical plants and oil refineries in Brazil have experience in optimizing heat networks for saving fuels (Szklo and Schaeffer, 2007).

Alternative treatment processes are designed to save the amount of energy consumption in the refineries. Organic sulphur compounds are present in almost all oil cuts leaving the distillation tower (straight-run streams). Cuts with higher boiling points (or higher cut-off temperatures) contain relatively higher sulphur levels and their sulfur compounds have heavier molecular weights. There are also differences in the sulfur compound reactivity, affecting the efficiency and efficacy of their removal during the hydro treatment process (Szklo and Schaeffer, 2007).Desulfurization techniques, which are applicable in the near-to-midterm, can reduce this energy use by 32 PJ (and CO2 emissions by 0.57 MtC). The decrease of sulfur content of diesel and gasoline affects not only the energy use but also the CO2 emissions in the refineries worldwide (Szklo and Schaeffer, 2007). Energy can efficiently be utilised in oil and gas refineries through the use of: (a) Alternatives energy saving in the refineries. (b) Less severe or non-conventional treatment process alternatives (replacing severe hydro treating) and (c) Oil gasification and the removal of CO2 at the refinery (Szklo and Schaeffer, 2007).

Consumers' perceptions about energy efficiency and about the oil and gas industry may vary. In general oil and gas companies engage end consumers on type of efficient operational practices they are implementing as a company and what steps the end consumer can take to be more sustainable and energy efficient. In addition, oil and gas companies provide energy saving products to consumers such as lubricants and gasoline with fuel additives (EIA, 2009).

3.10.2.2: Emissions

The primary consumer of oil and gas companies' products is transportation sector. A lot of emission is produced by motorist all over the world (OECD/IEA, 2009). ExxonMobil has made significant investments in co-generation that have increased energy efficiency and accordingly reduced GHG emissions from its refineries (Eikeland et al, 2004). Many oil and gas companies reduce carbon footprint by reducing the rate of official trips embarked upon by members of staff, there by using alternative means such as meetings through teleconferencing (Yusuf et al, 2012).

3.10.2.3: Products

Shell develops advanced fuels and lubricants save petrol and diesel. Shell Fuel Save petrol and diesel are planned to assist motorists save fuel through reducing energy loss in the engine (Shell, 2011). In 2011 these products went to the markets of five more countries: Czech Republic, Greece, Hungary, Philippines and Slovakia. This makes the countries 15 in number where these fuels were available. The objective is to make transport more sustainable beyond the road (Shell, 2011). The aim is to continue to work on improving operational performance and energy efficiency to reduce GHG emissions (Shell, 2011). Statoil's has produced new environmentally friendly hydraulic oils with high performance. The oils trade names are: HydraWay Bio SE 46, HydraWay Bio SE 32 -68, HydraWay Bio SE 68, HydraWay SE 46 HP and HydraWay SE XLV (Statoil, 2014). Companies reuse, remanufacture and recycle used products to reduce the negative impact on the environment (Gunasekaran and Spalanzani, 2012).

Transportation sector also consumes large volume of energy through burning petrol in cars. Transportation accounts for approximately one quarter of global energy use. Energy demand is projected to increase by nearly 50 percent by 2030 and by more than 80 percent by 2050 (OECD/IEA, 2009). Many organisations in oil and gas industry have successfully reduced air pollution by using electric and hybrid vehicles in their operations (Yusuf et al, 2012). Using electric and hybrid cars drastically reduce energy consumption and gas emission in oil and gas industry.

3.10.2.4: Corporate Social Responsibility

Shell invested $1 billion in 2011 on safety and reliability of its refineries, chemical plants and distribution facilities (Shell, 2011). Additionally, Shell invested $6 billion on safety programme in its oil and gas production facilities from 2006 to date (Shell, 2011). In 2013 around $750 million was invested on the safety and reliability of Shell company refineries, chemical plants and distribution facilities (Shell, 2013).

In 2011, Shell paid $22.6 billion on corporate taxes globally, $4.4 billion in royalties (Shell, 2011). In 2012, Shell paid $21.0 billion in corporate taxes and $3.6 billion in royalties globally (Shell, 2012).In 2013, Shell paid $20.3 billion in corporate taxes and $4.1 billion in royalties worldwide (Shell, 2013). 'In 2012, Statoil paid NOK 19.4 billion in indirect taxes, NOK 127.6 billion in direct taxes, NOK 43.5 billion in profit oil in kind and NOK 9.4 billion in signature bonuses' (Statoil, 2012, p. 18).Internationally, BP paid $13.9 billion in corporate income and production taxes in 2013 (BP, 2013).

Shell spent $125 million and $149 million in 2011 and 2012 respectively on voluntary social investments worldwide. This rise was as a result of increase spending in Nigeria and countries in Middle East and North Africa (Shell, 2012). Shell spent $67 million and $74 million in 2012 and 2013 respectively on community development, disaster relief, education, health and biodiversity (Shell, 2013). BP's direct spending on community programs in 2011 was $103.7 million, which include contributions of $37.5 million in the US, $27.0 million in the UK, $2.6 million in other European countries and $36.6 million in the rest of the world (BP, 2011).In 2013 BP direct spending on community programs including disaster relief was $78.8 million (BP, 2013).

Chevron drilled 60 wells in 2011 and continues to increase operations in a ways that is beneficial to local economies while limiting negative impacts (Chevron, 2011). In 2010 Chevron launched Niger Delta Partnership Initiative (NDPI) and in five years spent $50 million on endowment. In addition more than 10,000 Nigerians, mostly from Niger Delta have jobs at Escravos Gas-to-Liquids (EGTL) and were trained on international safety standards (Chevron, 2011). Chevron has pledged $20 million in five years to a global plan to eliminate mother-to-child transmission of HIV, Tuberculosis and Malaria (Chevron, 2011). ExxonMobil provides social amenities such as roads, provision of potable water, provision of electricity, environmental protection activities, upgrading of educational and health facilities, sundry support to professions and civil society groups (MPN, 2006 cited in Mbat et al, 2013). ExxonMobil/NNPC Joint venture commissioned two fish preservation centers in Ibeno and Mbo Local Government Areas in Akwa Ibom State in Nigeria at the cost of N54 million. The centers have state-of-art facilities for modern day preservation of fish and other sea food products (Mbat et al, 2013).

Statoil recruit locally and provide training opportunities that build local capacity and skills in non-OECD countries. Statoil have achieved higher proportion of national staff, including management staff. 'In the company's workforce, the proportion of non-Norwegians increased from 18% in 2011 to 20% in 2012. The proportion of non-Norwegians among new hires was 41% in 2012' (Statoil, 2012, p. 18). In 2011 Statoil launched climate and energy leadership programme. In 2012, two cohorts of ten senior executives from different part of the company were nominated and participated in on-the-job and off-the-job training on climate change and energy (Statoil, 2012). Statoil actively involved in anti-corruption and transparency issues at both local and international level; through membership and participation in various business networks and non-governmental organizations. The organizations include the World Economic Forum's Partnering against Corruption Initiative (PACI), the UN Global Compact (including the 10th principle on anti-corruption), Business Principles for Countering Bribery (BPCP) and the OECD Guidelines for Multinational Enterprises (Statoil, 2012).

Some oil and gas companies are creating sustainability awareness through internal campaigns to make their employees accept and adopt sustainability in their daily activities (Yusuf et al, 2012). The aim is to sensitize employees to accept and adopt sustainability in their daily routine operations.

3.10.2.5: Green Consumers

Consumers are becoming aware of the adverse effects that companies create from their production operations and during product use. This led to establishment of green consumers group. The objective of this group is to influence companies to produce consumer friendly products. Green consumer is a non-governmental organization that mounts pressures on manufacturing companies to produce products and services that are not harmful to the customers and the environment after use. Consumer pressure is considered as one of the major drivers of environmentally friendly products.Consumers' awareness on environmental issues influences companies to focus on obtaining eco-labels that reduce product effect on the environment (Houe and Grabot, 2009).These pressures force Companies to develop interest on environmentally friendly manufacturing (Gunasekaran and Spalanzani, 2012).The focus in twenty first century is on manufacturing, unlike the traditional focus in terms of pollution control and life-cycle assessment (Gunasekaran and Spalanzani, 2012).

Shell starts training consumers on how to save energy; through face to face training, driving simulators and online tutorials. Shell has trained more than 200,000 drivers on how to use less fuel since 2009. More than 3,200 people in 10 cities in Europe and Asia took part in simultaneous training sessions. This training helps Shell to achieve Guinness World Record in 2011 for the "largest fuel efficiency lesson" (Shell, 2011).

3.10.2.6: Laws and Regulations

The major concern in many countries on environmental safety is leading to strict regulations regarding the impact of products and services during their manufacturing, use and end of life (Gunasekaran and Spalanzani, 2012). In Europe, EU policies and directives have increased the legal, financial and market related pressures on manufacturing industries to develop more sustainable products. These lead to the development of new standards for environmental management systems such as ISO 9001, ISO 14001 and OHSAS 18001 (Jorgensen, 2008).

3.10.2.7: Reverse Logistics

Reverse logistics is managing the flow of products that are intended for remanufacturing, recycling or disposal and to effectively utilize resources (Dowlatshahi, 2000). Logistics sustainability is critical not only for the downstream side of the supply chain but also for the upstream side (Gunasekaran and Spalanzani, 2012). Sustainable logistics operations include reduced use of space, energy, people, inventory/materials handling, easy tracking of materials, better turnover of stock, minimize transportation costs and reduce use of packaging materials that are recycled (Gunasekaran and Spalanzani, 2012).

The key technologies for energy efficiency in midstream include controls, enterprise software, instrumentation, low-voltage products, high pressure pipelines and efficient compressors, pumps, drives and motors. Software and analytics could also optimize downstream distribution logistics and reduce energy consumption (UN Global Compact, 2012). In the downstream, supply enables production of customers' products, this in turn causes emissions (Lenzen and Murray 2010). This shows the general pattern that emerge in sustainability practices in upstream and downstream of oil and gas companies. The keenest implementers of downstream natural gas strategies in Europe were also those most eager to diversify to new source of energy (Eikeland, 2007).

Organisations are now reporting their emissions responsibility from consumer perspective, which is known as carbon footprint analysis. Carbon footprints include greenhouse gas emissions originating directly from the organisation's premises, indirectly from power plants providing the organisation with electricity and indirectly from all supply chains connected to the organisation, that is, emissions across the entire life-cycle of all their operational inputs and outputs (Lenzen and Murray 2010).

Sundarakani et al (2010) suggest some ways to lessen carbon emissions across the supply chain which include: designing products and supply chains concurrently with carbon emissions in mind; add carbon emission rates to supplier selection criteria; develop green supply and purchasing policies; maintain acceptable carbon regulation at the manufacturing level; leverage innovation in logistics services to reduce carbon emissions; reduce inventory and increase visibility at the distribution level; have green packaging and distribution strategies; reuse and recycle at the consumption stage; create awareness among consumers on carbon emissions.

3.10: Conclusion

This chapter has three sections, section one discusses sustainability strategies developed in partnership between UK Offshore Operations Association (UKOOA's) and UK government for UK oil and gas industry. Strategies such as UKOOA Indicators**,** SAM,the Author D. Little Sustainable Development Assessment Tool and PSI assessment methodology were discussed extensively. Section two of this chapter explains the evolution and origin of oil and gas industries as well as oil and gas industry supply chains. The upstream, midstream and downstream operations of oil and gas industry were also discussed. This is followed by the stakeholders involved in upstream and downstream operations of oil and gas industry. The section ended up with discussion on upstream and downstream oil and gas industry response to sustainability issues. The third section is the conclusion of the chapter.

CHAPTER 4: RESEARCH METHODOLOGY

4.1: Introduction

This chapter describes the research methodologies and methods that are fundamental to the present study. It identifies the research philosophical assumptions that directed decision about the research approach adopted. In the context of these assumptions, the justification for the use of quantitative methodological research approach is made. The first section consist definitions of key terms, comparisons between qualitative and quantitative research, mixed methods research (MMR), types of research and methodology chosen for this research. Second section of this chapter discusses conceptual model of the study, including justification of the conceptual frame work. The chapter starts with definition of some research terms as follows:

Research is organised, systematic, data based, critical, objective and scientific inquiry into a specific problem undertaken with the aim of finding answers to the research questions or solutions to the problem (Sekaran and Bougie, 2001). Research methodology is a strategy, plan of action, process or design that shapes the choice and use of specific methods and linking the choice and use of methods to desired results (Crotty, 1998). In a similar vein, Bazza and Vandibe (2009) define research methodology as a blue print for researcher's activity which specifies how the researcher intends to carry out research from a beginning to an end. On the other hand, research method is a process of data collection, data analysis and interpretation that researcher performs during research work (Creswell, 2012). Research method is connected with different types of research design/strategy (Bryman and Bell, 2011).

4.2: Ontology (Theoretical Perspective)

Ontology is a Greek word meaning 'on' or 'being' (Thomas, 2004). 'Ontology is the study of being. It is concerned with 'what is', with the nature of existence, with the structure of reality as such' (Crotty, 1998, p. 10).It expresses a way of understanding, which is the reality that researcher investigates (Crotty, 1998; Wisker, 2008). Ontology is central element of metaphysics that attempt to answer question such as: what kind of creature is human being? What is the nature of reality? 'Ontological scheme proposes that the world contains four distinct but overlapping levels of being: the material, the vegetable, the animal and the human' (Thomas, 2004, p. 36). Material level consist of non-living objects: stones, sand, water and so on. Vegetable level comprises all plants, such as trees and flowers. Animal level consists of entities that are alive and also possess consciousness, being able to respond to their environments and move within them. The highest level of being is the human, because human beingspossess self-awareness, sense of reasoning, consciousness, exchange meanings (through language), produce art, literature and music whilst others cannot (Crotty, 1998; Thomas, 2004; Bryman and Bell, 2007). The ontological scheme has several epistemological implications. Each level of being can be known through methods most appropriate to that level (Thomas, 2004; Bryman and Bell, 2011). Ontological assumptions describe different epistemological and methodological positions (Morgan and Smirich, 1980). Some ontologists claimed that reality exist, which we may not be aware because of our limited perceptual equipment. The reality exists but we have no complete knowledge about it. Others argued that only publicly observable phenomena are to be considered real and mental states are held not to quality (Crotty, 1998; Thomas, 2004; Wisker, 2008). Based on these expressions ontology could broadly be classified into objectivism (realism) and Interpretivism (constructionism) (Burrell and Morgan, 1979; Bryman and Bell, 2007).

4.2.1: Realism (Objectivism)

Realism has been the dominant approach in sciences and social sciences research for more than 30 years (Sayer, 1992, 2000; Maxwell and Mittapalli, 2010). Real means whatever are in universe (forces and structures) that cause phenomena that we perceive with our senses. Example, society, institutions, feelings, intelligent, poverty, disability, people, groups, institutional, social levels, events, structures and meanings are as real as sun in the sky (Schwandt, 2007; Robson, 2011). Realism maintains that reality exist independent of our perceptions or our theories about them (Bryman and Bell, 2007; Maxwell and Mittapalli, 2010). That is real world is complex and stratified (Robson, 2011). Such that objects and reality can exist independent of our mind with or without our knowledge (Blaikie, 1993; Crotty, 1998; Sayer, 2000; Thomas, 2004; Schwandt, 2007; Scoot, 2007). Social actors have no control over social phenomena and their meanings (Creswell, 2012). What it means to know, understanding and values are considered to be objectified in people we are studying and if we go about it in right way, we can discover the objective truth (Crotty, 1998; Schwandt, 2007). Therefore, scientists' conceptualisation is simply a way of knowing the reality (Bryman and Bell, 2007). In realism social and natural sciences can use similar type of approach in data collection and analysis (Bryman and Bell, 2007; Schwandt, 2007). 'Social phenomena are produced by mechanisms, that are real, but that are not directly accessible to observation and are discernible. The task of the researcher is to construct hypothesis about such mechanisms and seek out their effects' (Bryman and Bell, 2007, p. 628). The guiding descriptions are of structures and mechanisms rather than phenomena and events.

An organisation represents social order and force inhabitants to follow the requirements of the organisation. That is organisation comprised of consistently real process and structures (Bryman and Bell, 2007; Creswell, 2011). 'In both organisation and culture, the social entity in question comes across as something external to the actor and as having almost tangible reality of its own. It has characteristics of an object and hence of having an objective reality' (Bryman and Bell, 2011, p. 15). It is possible to view research designs as entities not simply a model for research but also as actual conceptualisations and practices employed in a specific study. Relationships between researcher and participants in a study can also be seen as real component of design–in-use of a study, because it is critical to actual functioning of study (Maxwell, 2005 cited in Maxwell and Mittapalli, 2010). Realist perspective and approaches can make important contributions to mixed methods research. These contributions includes, overall perspective in which quantitative and qualitative methods and assumptions can better be integrated and specific insight and strategies that enable mixed methods researchers to understand the contexts and processes they study (Maxwell and Mittapalli, 2010).

4.2.2: Subjectivism (Constructionism/Interpretivism)

Subjectivism sometimes called constructionism orinterpretivismis interpretivists view signifying focus on how social world is interpreted by those involved in it (Robson, 2011); 'elements of interpretivism, postmodern, critical theory, constructivist and participative inquiry, fit comfortably together with one another'(Niglas, 2010, p. 218). Constructionism emphasises world of experience as it occurs, felt and undergone by people acting in social situation (Schwandt, 2007). Through communication and interaction with people researcher becomes part of the study (Easterby-Smith et al, 2002). Meanings does not have an independent existence; meaning is not 'objective' or 'out there' awaiting discovery. Rather, meaning is created through interaction with others and through historical and cultural norms that operate in individual lives (Schwandt, 2007; Robson, 2011). 'Social phenomena and their meanings are not only produced through social interaction but they are in constant state of revision' (Bryman and Bell, 2007, p. 23).People construct meaning and social reality from their experience. Meaning is directed toward some objects or things (Thomas, 2004; Creswell, 2011). People behaviour can only be understood if the researcher understands those meaning and such meaning have to be interpreted according to context in which they occurs (Thomas, 2004). Therefore, a participant's and researchers personal, cultural and historical experience influences their interpretation of 'reality'. There can be as many realities or meanings as possible as there are participants and researchers on a single phenomenon (Creswell, 2011; Robson, 2011). 'Our experience, thought and speech about reality and/or reality itself are a function of the particular conceptual scheme/framework (culture, form of life, language, game and paradigm) in which we live and that different conceptual schemes yield incommensurable understanding of experience and reality' (Schwandt, 2007, p. 40). Researchers always present specific version of social reality, rather than that can be regarded as definite, showing that knowledge is viewed as indeterminate (Bryman and Bell, 2007). That is meanings are often negotiated socially and historically (Robson, 2011). The focus is on individual or in specific context which people live and work. The concern is to understand historical and cultural settings of participants and how individuals construct and make sense of the world (Creswell, 2011; Robson, 2011). The aims are understandings (Robson, 2011), multiple construction of meanings and knowledge (Creswell, 2011). 'Constructionism is naturalistic perspective and most research under it use qualitative research process largely inductive with the researcher generating meaning from the data collected in the field' (Creswell, 2011, p. 9). The researchers use observation and interview methods which provide multiple perspectives (Robson, 2011). The more opened the questioning the better, as the researcher listen carefully to what people say or do in their life setting (Creswell, 2011).

'An organisation is a socially constructed product, a label used by individuals to make sense of their social experience, so it can be understood only from the point of view of individuals who directly involves in its activities' (Bryman and Bell, 2007, p. 26). Researchers with this theoretical orientation always reject the notion of objective reality of an object (Bryman and Bell, 2007). They argued that whatever the underlying nature of reality (there are differing views amongst them about this) there is no direct access to it (Robson, 2011). Constructionism frequently results in an interest in the representation of social phenomena (Bryman and Bell, 2007). We cannot take for granted, as the natural scientist does, the availability of a pre-constituted world of phenomena for investigation and must instead examine the processes by which social world is constructed (Walsh, 1972 cited in Bryman and Bell, 2007). Therefore, everything in the world and about the world is nothing but a sociolinguistic product of historically situated interactions (Schwandt, 2007). 'The precise difference between objectivism and subjectivism is the sharp split between viewing the social world as an objective reality and as subjective reality in a continuous state of flux' (Bryman and Bell, 2007, p. 24)

4.3: Epistemology (Philosophy)

Epistemology is philosophical theory of knowledge of how we know what we know (Dictionary of Sociology, 2000). 'Epistemology is a pivotal issue in any form of research for it is about how we know whether or not any claim; including our own, made about the phenomena we are interested in, is warranted. That is, what do we mean by the concept 'truth' and how do we know whether or not some claim is true or false? In other words, what is our theory of truth?' (Saunders et al, 2009, p.191). Epistemology is the study of the nature of knowledge, its possibility, scope and general basis. It deals with how we create new knowledge or validate the existing knowledge. The aim is to provide philosophical grounding for deciding what kinds of knowledge are possible and how we can confirm that they are adequate and legitimate (Maynard, 1994 cited in Crotty, 1998). Philosophical ideas have great influence on research practices and therefore they must be identified (Creswell, 2009). Epistemology distinguishes knowledge from opinion, belief or falsehood (Creswell, 2009) and provides justification for methodologies (aims, functions and assumptions of method) (Schwandt, 2007; Crotty, 1998). It specifies the relationship between the researchers and the reality (Maynard, 1994 cited in Crotty, 1998). While ontology deals with the nature of being (the nature of reality/knowledge) epistemology deals with how to acquire and understand the knowledge (Guba and Lincoln, 1994). Social sciences research epistemology is broadly divided into two: empiricism/positivism and rationalism/constructionism (Crotty, 1998; Thomas, 2004; Zikmund, 2010; Bryman and Bell, 2007, Creswell, 2012). Below is a brief account of positivism assumptions:

4.3.1: Positivism

Positivism was coined in nineteenth century by Auguste Comte (Thomas, 2004). Positivism is also called scientific method or doing science research, positivist/post-positivist research, post positivism andempirical science (Niglas, 2010; Creswell, 2011). Positivism is an epistemology linked with empiricism, behaviourism, naturalism or scientific status to social research (Wisker, 2008; Robson, 2011). Others view it as an ordered universe made up of atomistic, discrete and observable events (Blaikie, 1993; Crotty, 1998). The assumption of Positivism is that legitimate knowledge is those that are obtained directly from experience or scientific observation (Crotty, 1998; Thomas, 2004; Schwandt, 2007; Creswell, 2011;

Robson, 2011). That is meaning and reality or causes of social phenomena exists freely from the operation of our consciousness; meaning/reality exists only if they can be proved (Crotty, 1998; Patton, 2002; Thomas, 2004; Wisker, 2008); Positivism rejects speculation, theoretical entities (invisible or unknowable view), theological and metaphysical explanations (Newman and Benz, 1998). Their belief is that 'a real world with verifiable patterns that can be observed and predicted-that reality exists and truth is worth striving for' (Patton, 2002, p, 91). 'The world is essentially knowable; that it consists of knowledgeable facts; and that, if we ask the right question in the right way, use the right research methods, carry out the right kind of experiments and processes, we will discover these facts or truths'(Wisker, 2008. p. 65). The world is big variables net of kinds and these variables directly and indirectly interrelate to each other (Thomas, 2004). Positivists' social scientist adopts natural sciences methods of doing research where results are expressed on empirical generalisations (Cohen et al, 2007; Walliman, 2011). In positivism human behaviour is studied the same way as natural objects such as stones or fishes (Thomas, 2004). Subject to fixed laws, behaviour can be determined and there is no room for multiple interpretations (Wisker, 2008). The researcher is an observer of social reality and cannot manipulate the result of the research (Cohen et al, 2007). Positivism largely uses quantitative data derived from the application of strict rules and procedures (Robson, 2011). Often use experiment, observation, survey and statistics to collect and analyse data (Neuman, 1997). Data obtained from experiment and surveys are used to prove the relationships between variables. In which some variables are isolated and their interactions are observed, and/or use correlational methods to discover their statistical relationships. Through these processes behaviour of the net or part of it, selected for study can be understood, explained and predicted. Observations are expressed as descriptions; descriptions are only valid if they objectively depict the properties of object and exclude any elements that cannot be verified by multiple observers (Thomas, 2004). There is fairly sharp division between theory and research. The role of research is testing theories (hypothesis) and providing material for the development of laws (Bryman and Bell, 2007, 2011). Organisations are viewed as concrete entities from which data can be collected (Bryman and Bell, 2007).

4.4: Epistemological Perspectives in Social Sciences

'A particular issue in this context is the question of whether or not social world can and should be studied according to the same principles, procedures and ethos as the natural sciences' (Bryman and Bell, 2011, p. 15). Positivism dominated social sciences research from late 1800s through early 1900s (Newman and Benz, 1998). Others are on the view that the dominant epistemologies in social sciences are positivism and constructionism with several alternatives within each orientation (Thomas, 2004). In 1940s and 1950s, quantitative research dominated social sciences. In mid-1960s, while quantitative perspective continues to get social science research acceptance; there was a doubt on positivism domination on social sciences research and evident chasm between human social systems and mathematical logic grew (Newman and Benz, 1998; Thomas, 2004). 'New epistemologies began to emerge that acknowledged the value-laden nature of human social interactions. That human beings construct reality for themselves and that knowledge itself is transmitted in social ways were beginning to be assumed. Questions arose about the tenability of applying natural methodology to these complex human dynamics' (Newman and Benz, 1998, P. 5). This shows that qualitative research methods originated from quantitative research in social sciences. 'Having both qualitative and quantitative methods on ground; the debate begins of which is more scientific: the deductive methods of the logical positivists (quantitative researchers) or the inductive methods of the naturalists (qualitative researchers)? Can the results of qualitative research be generalised as are the results of quantitative research? Can science be value laden (qualitative) or only legitimate if value free (quantitative)? What epistemological assumptions are violated by adopting one paradigm or the other?' (Newman and Benz, 1998, P. 7)

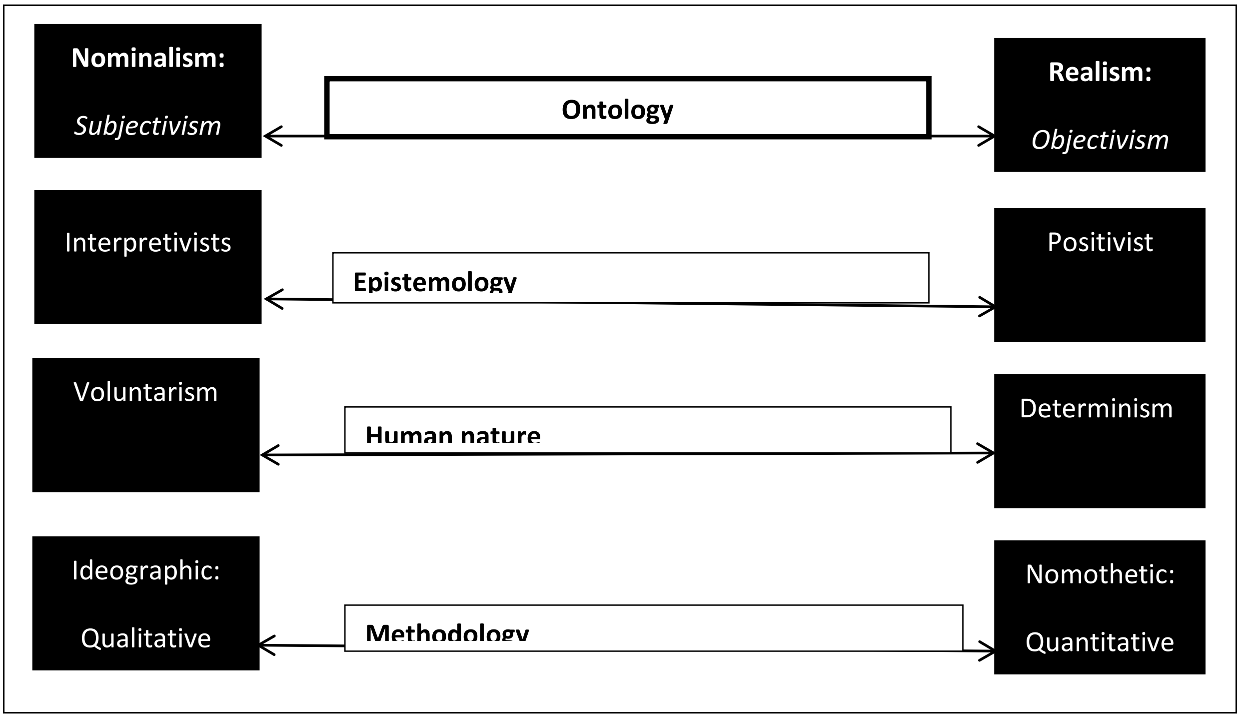
4.5: Research Designs

In carrying out social research a choice has to be made between the three alternatives research methods, which are: quantitative, qualitative and mixed methods research (MMR). Morgan and Smirich (1980) proposed a diagram that can guide researchers on making decision towards their choice on ontology, epistemology and methodology when conducting a research.

Figure 4.1 illustrates that the ontology of any research would either be Nominalism or realism. The corresponding epistemology is Interpretivism or positivism and the methodology can either be quantitative and qualitative research methods or both. This figure shows major division of ontology and epistemology. Figure 4.1 shows that if the researcher's world view is subjectivism, the likely epistemology will be Interpretivism and the methodology will be qualitative methods of data collection and analysis. Likewise, if the world views of the researcher is realism; his most suitable epistemology will be positivism. The methodology will be quantitative data collection and analysis.

Figure 4.1: Classification of Ontology and Epistemology in Research

Subjective Approach ⟷ *objective Approach*



Source: Morgan and Smirich (1980, p. 492).

4.5.1: Qualitative Research Methods

Qualitative research methods originated from Universities in late 1960s in Anglophone world, particularly in sociology and anthropology (Schwandt, 2007; Newman and Benz, 1998). Qualitative research emphasised phenomenological basis of a study, which is elaborate description of 'meaning' of a phenomena or culture under study (Newman and Benz, 1998). It has emergent processes which may change after the researcher begins to collect data (Creswell, 2003, 2009). Qualitative inquiry is a set of multiple practices in which words in methodological and philosophical vocabularies acquire different meanings in their use or in particular acts of speaking about the meaning of the practice. These different ways of speaking form something more like a collection of contested practices than an integrated. There are multiple sources and kinds of disputes, but generally they involve different ways of conceiving of the aim of qualitative inquiry stemming from different traditions of thought' (Schwandt, 1997, p. xiv).

Qualitative researchers study objects in its natural settings (Denzin and Lincoln, 1994; Schwandt, 2007). 'Qualitative research is carried out when we want to understand meanings, interpretations, and/or to look at, describe and understand experience, ideas, beliefs and values – intangibles such as these' (Wisker, 2008, P. 75). The aims of Qualitative research is discovering and understanding meanings individual or group give to a problem or issue (Creswell, 2009). The researchers through observing participants behaviours or taking part in their activities interpret phenomena in terms of meanings people give to them (Denzin and Lincoln, 1994; Schwandt, 2007; Creswell, 2003, 2011). The researchers' background, culture, history, reasoning and experience influence their interpretation (Mouly, 1970; Creswell, 2009). This kind of research is conducted on one subject or object, one case or one unit over a long period of time (Newman and Benz, 1998; Cohen et al, 2007).

Qualitative research uses many methods such as: empirical, materials-case study, personal experience, introspective, life history, interview, observational, historical, interactions and visual text (Denzin and Lincoln, 1994). These methods are interactive and humanistic. Data collection methods are growing and involve active involvement by participants (Creswell, 2003). The strategies are ethnography, case studies, field studies, grounded theory, document studies, naturalistic inquiry, observation studies, interview studies and descriptive studies. Others are action research, phenomenology, feminist research, narrative research, focus group, critical research and discourse analysis (Newman and Benz, 1998; Schwandt, 2007; Creswell, 2012). Qualitative research theories include: naturalism, ethnomethodology, emotionalism and postmodernism (Gubrium and Holstein 1997 cited in Bryman and Bell, 2011). Qualitative research can either be inductive, constructive or interpretive (Bryman and Bell, 2007). In qualitative research'the theory emerged from the data; it is not imposed on the data' (Patton, 1990, p. 278). Newman and Benz (1998, p. 17) argue that'theory does not emerge independent of the person interpreting the data. Data do not develop theory; people do'. This means that the researcher develop a grounded theory by entering field work with no hypothesis; describing what happens; based on the observation formulate explanations on how and why the event happens (Patton, 1990). Yet, there is no universally accepted way of analysing qualitative data, as the procedures are not mechanistic (Tesch, 1990).

4.5.2: Quantitative Research Methods

In late 19th and 20th century, quantitative research strategies dominated social sciences research and raised positivism and post positivism (Creswell, 2003; Bryman and Bell, 2007; Robson, 2011). Quantitative research methods are also called statistical studies, empirical studies and or hypothesis testing research (Whisker, 2008; Robson, 2011). The aim is to generalise from sample to population on attitude or behaviour of the population (Creswell, 2009; Robson, 2011). Quantitative research adopts research methods of natural sciences such as physics, chemistry and biology (Bryman and Bell, 2007; Robson, 2011). This research is characterised by collection of numerical data, demonstrating relationship between theory and research and having objectivist conception of social reality (Bryman and Bell, 2007). In quantitative research real knowledge is what the researcher logically deduced from theory, operationally measured and empirically replicated (Patton, 2002). The reduction to a parsimonious set of variables, tightly controlled through design or statistical analysis, provide measures or observations for testing the theory, where the theory or concepts were tested and reflects on its confirmation or disconfirmation by the results (Newman and Benz, 1998; Bryman and Bell, 2007; Robson, 2011). The theory is a framework for the entire study such as data collection methods and analysis (Creswell, 2011). 'The study begins with statement of theory from which the hypotheses are derived. Then an experimental design is undertaken in which the variables in question (the depended variables) are measured while controlling for the effects of independent variables. The subjects included in the study are selected at random; this is to reduce error and to cancel bias. After the pre-test measures are taken, the treatment conducted and post-test measures are taken, a statistical analysis reveals finding about the treatment's effects. To support repeatability of the findings, one experiment is usually conducted and statistical techniques are used to determine the probability of the same differences occurring over and over again. 'These tests of statistical significance result in findings confirm or counter the original hypothesis' (Newman and Benz, 1998, p. 19). The problem is best addressed by understanding what factors or variables influence the outcome. Research problem is one in which understanding the factors that explain or relate to an outcome helps the researcher to understand and explain the problem (Creswell, 2009; 2011).

Quantitative research methodsstrategies include: experimental studies, quasi-experimental studies, pre - test and post-test designs, self-administered questionnaire, structured interview schedules and structured observation schedules (Creswell, 2009, 2011; Schwandt, 2007; Bryman and Bell, 2007). Quantitative research has four distinctive pre-occupations that are:

measurement, causality, generalisation and replication. Measurement and quantification is central; accuracy and precision of measurement is required in quantitative research (Bryman and Bell, 2007, 2011). Quantitative researchers also frequently address meanings. A wide spread inclusion of questions about attitudes in survey suggests that quantitative researchers are interested in matters of meaning (Bryman and Bell, 2007 p. 630). Survey research practices of asking respondents reasons for their action imply that quantitative researchers are concerned to discover issues of meaning (Marsh, 1982 cited in Bryman and Bell, 2007). To study meanings, quantitative researchers frequently use attitude scales (e.g. Likert scaling technique) and other similar technique (Bryman and Bell, 2007).

4.5.2.1: Distinction between Qualitative and Quantitative Research Methods

Table 4.1 summarise some of the differences between qualitative and quantitative researches. ‘The distinction between qualitative andquantitative research occurs at the level of methods. It does not occur at epistemology and theoretical perspectives level. What occur back at those exalted levels is a distinction between objectivist/positivist research, on one hand, and subjectivist/constructionist research on the other. Yet, in most cases, it is qualitative and quantitative researches that are set against each other at opposite direction’ (Crotty, 1998, p. 14). Qualitative and quantitative researches have philosophical roots in the naturalistic and the positivistic philosophies respectively. Virtually qualitative researchers, regardless of their theoretical differences, reflect some sort of phenomenological perspective. Quantitative research approaches regardless of their theoretical differences tend to emphasise that there is a common reality on which people can agree (Newman and Benz, 1998).

Difference between quantitative and qualitative research is based on what reality is and whether or not it is measurable. That is differences of opinion about how we can best understand what we know, whether through objective (realism) or subjective (constructionism) methods.

Quantitative researchers believe that reality is one and can undoubtedly be defined while qualitative researchers argued that reality can be constructed from different viewpoints. Therefore, from one phenomenon a number of realities can exist (Seale and Barnard, 1998).

Quantitative research use standardised and statistical measures, so that different responses and experiences of people can fit into the predetermined response categories to which numbers are assigned. Qualitative research uses descriptions and explanations of issues in depth and in detail, because they use strategies and methodologies (Patton, 2002).

Table 4.1: **Some Common Dichotomies in Methodological Literature**

Quantitative research methods	**Qualitative research methods**
Objective	Subjective
Numbers	Narrative/ words
Deductive	Inductive
Predictive	Descriptive
Generalizable	Detailed/deep/Contextual
Causal	Teleological
Standardised	Open
Mechanistic	Finalistic
Explanation	Understanding
Confirmatory	Exploratory
Rationalism	Empiricism
Value neutral	Value laden
Theoretical	Atheoretical
Positivism	Naturalism
Realism	Relativism
Sociology	Anthropology
Macro	Micro
Science	Art

Source; Niglas, K. (2010, p. 220).

In qualitative research, researchers and subject interact with one another and influence one another; therefore, the research is value-bound (subjective). In quantitative research the researcher is an observer of the reality (Seale and Barnard, 1998).

Qualitative (naturalistic) approach is used when observing and interpreting meaning aim at developing theory that will explain what was experienced. Quantitative (positivistic) approach is used when one want develop hypothesis and test for the confirmation or disconfirmation of that hypothesis (Newman and Benz, 1998).

Quantitative methods measure responses of large number of people using set of questions, thereby facilitating comparison and statistical aggregation of data. This give broad, generalizable set of findings (macro) whilst qualitative methods typically produce detailed information about much lesser number of people and cases (Micro) (Bryman and Bell, 2007; Patton, 2002).

Qualitative research methods are under category of ethnography whilst quantitative research methods are under category of empirical studies. Therefore, in quantitative research generalisation (deduction) is made, whilst in qualitative research working hypothesis is produced from which theory is developed (grounded theory) (Seale and Barnard, 1998; Patton, 2002).

Quantitative research starts from conceptual level to empirical level; qualitative research begins at empirical level (data collection) to conceptual level (Newman and Benz, 1998).

In quantitative research statistical (number) analysis is used in reducing the amount of the data collected, whilst in qualitative research coding, analytical induction and grounded theory (words) are used to make large volume of data easily readable.

4.5.2.2: Similarities between Qualitative and Quantitative Research

According to Bryman and Bell (2011) qualitative and quantitative researches have some common features as follows:

Both are concerned with data reduction; researchers in both qualitative and quantitative research collect, analyse and interpret data to make it meaningful and easy to understand.

Both researches are concerned with answering research questions. Though research questions asked in qualitative and quantitative research differs; both types of researches are concerned with answering questions about the nature of reality.

Both qualitative and quantitative researchers are concerned with how to relate their findings to existing literature.

In both type of research, the researchers seek to discover and then to represent variations that they discover. That is both of them are interested on exploring how organisations differ and what factors are connected with variations.

In both researches the researchers seek to be clear about their research procedures and how their findings were arrived at. That is transparency in both types research is paramount. This enables others to judge the quality and importance of their work.

In both researches, research methods should fit the research questions. That is researchers ensure that, they select research methods that are appropriate to the research question.

Both researches are interested in what people do and what they think. Qualitative research interpret 'people's behaviour' in terms of norms, values and culture of groups or organisation in question, whilst quantitative research use scales of different types to report behaviour of people. Therefore, the degree to which behaviour versus meaning contrast coincides with qualitative and quantitative research should not be overstated.

Comparing differences and similarities between qualitative and quantitative research shows that the gap between the two researches is not as much as is thought. And there is a tendency for qualitative and quantitative research to be associated with ontological and epistemological positions in some cases (Bryman and Bell, 2011).

4.5.2.3: Limitations of Quantitative and Qualitative Research

More so, both quantitative and qualitative researches have some shortcomings. Table 4.2 shows that while quantitative research always replicate what was always known; qualitative research is not systematic.

Quantitative research has limited scope of knowledge whilst qualitative research has limited generalisation capacity to a larger group of people. Finally, while quantitative research has maximum inferences beyond the data; qualitative research has minimum inferences. Table 4.2 shows that quantitative research is scientific research, where variable are viewed objectively and are assess as they are presented to the researcher. Qualitative research is more of viewing a phenomena based on human interpretation and feelings.

Table 4.2: Limitations of Quantitative and Qualitative Research

Quantitative	Qualitative
Proves what one already believes	Less systematic
Limited range or scope of knowledge	Limited generalizations to broader groups of people
Restricted demonstration of the meaning of findings to people's lives.	Barely replicable findings.
---- ---- ---- --- --- ---	Minimized possibility of inferences beyond the data.

Source: Francisco et al. (2001)

4.5.6: Mixed Methods Research (MMR)

Mixed methods research (MMR) is also called integrating, synthesis, quantitative and qualitative methods, multiple methods, mixed methodology, combine method, convergence and more recently mixed methods research (Tashakkori and Teddlie, 2003; Bryman, 2006). Mixed methods research (MMR) arises in 1959 when Campbell and Fisk used multimethods in study of validity in psychological traits and motivate other researchers to use their multimethods matrix to examine multiple approaches to data collection (Creswell, 2012). After their work, approaches such as interviews and surveys were combined in one research (Sieber, 1973).). In the past researchers assumed that qualitative and quantitative researches are at polar opposite of one another (Burrell and Morgan, 1979; Layder, 1988). MMR emerged from triangulation literature, which is commonly associated with convergence of results (Tashakkori and Teddlie, 2010). In early 1990s, the idea of mixing research moved from seeking convergence to actually integrating qualitative and quantitative data (Creswell, 2012). Qualitative and quantitative researches signify different ends on a continuum (Newman and Benz, 1998), where MMR is in the centre of this continuum (Creswell, 2012). Quantitative and qualitative researches complement one another in explaining different aspects of social world (Blaikie, 1991; Yeung, 1997; Tashakkori and Teddlie,1998).

MMR involves use of multiple methods in total to generate and analyse different kind of data in one study, so that overall strength of the study is greater than either qualitative or quantitative research (Schwandt, 2007; Creswell, 2012). By combining multiple observers, theories, methods and data sources, researchers can control inherent bias of single method, single observer and single theory studies (Denzin, 1989; Campbell and Russo, 1999;

Creswell, 2012). Since, the aim of qualitative researcher is theory building and the aim of quantitative research is theory testing. None of this research covers entire research process. Therefore, both are required to holistically conceptualise real world research (Newman and Benz, 1998; Patton, 2002). These led to growing recognition of value of MMR as an accepted approach of conducting business research and in social sciences (Bryman and Bell, 2011; Creswell, 2011; Robson, 2011). MMR has today acquire credibility in field of business studies and that it is being employed on fairly regular basis as distinctive research strategy (Bryman and Bell, 2011).

4.5.6.1: Characteristics of Mixed Methods Research

Some characteristics of MMR were demonstrated by research of Tashakkori and Teddlie (2010) as follows:

MethodologicalEclecticism: This is to select and synergistically integrate best techniques of quantitative and qualitative methods to study a phenomenon of interest more comprehensively.

Paradigm pluralism; this means that variety of paradigms serve as underlying philosophy for MMR. That is variety of conceptual orientation is associated with MMR such as pragmatism, critical theory, dialectic stance, realism etc.

MMREmphasis Diversity at all Levels of Research Enterprise: It simultaneously addresses diverse range of confirmatory and exploratory questions. Thereby, provides an opportunity for collection of divergent conclusion and inferences due to complexity of sources of data and analysis involved.

MMREmphasis on Continua Rather than Dichotomies**:** MMR presents variety of philosophical and methodological continua within multidimensional space and placement of specific research methods within the space.

MMR isbothIterative and Cyclical Approach to Research*:* it involves use of both deductive and inductive logic in one research. Research may start from any point in the cycle. Some may start from theories or abstract generalization, others start from observation or other data point.

MMR is Set of Basic'Signature': research designs and analytical processes may commonly be agreed upon, which have different names and diagrammatic illustrations. For example, *parallel mixed design, concurrent, simultaneous and triangulation.*

MMR isReliance on Visual Representations (Figures, Diagrams) and Common NotationalSystems: MMR design, data collection procedures and analytical techniques lend themselves to visual representations, which can simplify complex interrelationships among elements inherent in those processes.

4.5.6.2: Typology of Mixed Methods Designs

Creswell (2011) and Robson (2011) classified MMR design into six focusing on sequencing and status of data collection methods as follows;

Sequential Explanatory Design: it is characterised by collection and analysis of quantitative data in first phase followed by collection and analysis of qualitative data in second phase of research that builds on result of initial quantitative research. More weight is given to quantitative data and result. Qualitative findings are used to validate Quantitative result.

Sequential Exploratory Design: starts with qualitative data collection and analysis in first phase of research followed by quantitative data collection and analysis in second phase of research. More preference is given to qualitative findings. Quantitative findings are used to validate qualitative findings.

Sequential Transformative Design**:** under this design one method precedes another. It has initial phase (quantitative or qualitative) followed by second phase (either qualitative or quantitative) that builds on earlier phase. This design is guided by a theoretical perspective.

Concurrent Triangulation Design**:** in this design the researcher collects both quantitative and qualitative data concurrently and compare them to determine if there is convergence, differences or combinations.

Concurrent Nested/Embedded Design**:** this involves collection of both quantitative and qualitative data simultaneously. Given less priority to the secondary method (quantitative or qualitative) is embedded within the predominant method (quantitative or qualitative).

Concurrent Transformative Design: this approach is guided primarily by specific theoretical perspective as well as concurrent collection of qualitative and quantitative data. It is based on ideologies such as critical theory, advocacy, participatory research or a conceptual /theoretical framework.

4.6: Triangulation

Triangulation originated from land surveying. It strengthens research by combining methods, using different kind of approaches or data, including both qualitative and quantitative approaches (Patton, 2002). Triangulation is a system that involves comparing and combining data collected through quantitative methods with data collected through qualitative methods in study of single phenomenon (Newman and Benz, 1998; Bryman and Bell, 2007). Triangulation is based on the believe that 'no one method ever adequately solve the problem of rival causal factors, because each method reveals different aspects of empirical reality, multiple methods of observations must be employed' (Denzin, 1978, p. 28). Triangulation comprises using different methods to collect data, such as questionnaires, observation, interviews and documents (Caughlan and Caughlan, 2002; Denzin, 2006). Result of an investigation employing method associated with one research strategy are cross checked against results using method associated with other research strategy (Bryman and Bell, 2007, 2011). Triangulation is use to operationalize research question and constructs. By making sure that the research question is clearly focused and that methods chosen are complementary and appropriate for the nature of phenomenon being studied (Seale and Barnard, 1998). Triangulation is based on the assumption that all methods have strengths and weaknesses and weakness of one method can be counterbalanced by strength of another method (Seale and Barnard, 1998).

According to Denzin (1970) and Patton (2002) triangulation can be classified into four types with respect to research methods and designs as follows;

Data Triangulation: refers to data collection from different data sets/sources. It involves combining quantitative and qualitative data in single research design.

Investigator Triangulation: this is use of research group rather than one researcher or use several different researchers or different evaluators in one research.

Theoretical Triangulation: refers to use of multiple theories/perspectives rather than one theory to interpret data.

Methodological Triangulation: this is use of multiple methods to study single problem or program.

4.7: Types of Research

Research varies from one another by their nature (Walliman, 2011). ‘Different types of research, research strategies or methodologies as they are often called are commonly put into the following categories; exploratory, descriptive, hypothesis testing or case study depends on the stage to which knowledge about the research topic has been advanced’(Sekaran and Bougie, 2009, P.103).

4.7.1: Action Research

Action researchwas coined by Kurt Lewin (1890-1947) in 1940s to describe research that combine experimental approach of social science with programs of social action to solve social problems (Schwandt, 2007). This research is used to initiate changes in process of doing work in an organisation (Wisker, 2008; Robson, 2011). The researcher starts with problem at hand and collects data to provide solution to the problem (Sekaran and Bougie, 2009) or try hypothesis that could improve practical situation (Wisker, 2008; Walliman, 2011). It involves teamwork between researchers and those who are focus of the research and their participation in the process (Robson, 2011). It combines both qualitative and quantitative research methods (Wisker, 2008).

4.7.2: Descriptive Research

Descriptive study is undertaken in order to describe characteristics of variables of interest in a situation. It is also undertaken to understand characteristics of organisations that follow certain common practices (Sekaran and Bougie, 2009). The aims are to find more about an event and to capture it with detail information (Wisker, 2008). It uses observation (interview, questionnaire, visual records made, sound and smells recorded) to collect data, the responses are written down or recorded and subsequently analysed (Walliman, 2011). ‘It attempts to examine situations in order to establish what is the norm, i.e. what can be predicted to happen again in future under same the circumstances’ (Walliman, 2011, P. 12). ‘It is to offer to the researcher a profile or describe relevant aspects of the phenomenon of interest from an individual, organisational, industry-oriented, or other perspective. In many cases, such information may be vital before even considering certain corrective steps; for example, should the organisation consider changing its practices?’ (Sekaran and Bougie, 2009, P.106)

Quantitative data in terms of frequencies or mean and standard deviations become necessary for descriptive studies (Sekaran and Bougie, 2009).

4.7.3: Exploratory Research

Exploratory research 'is undertaken when not much is known about the situation at hand, or no information is available on how similar problems or research problem have been solved in the past. In such cases, extensive preliminary work needs to be done to gain familiarity with the phenomena in the situation and understand what is occurring, before we develop a model and set up a rigorous design for comprehensive investigation' (Sekaran and Bougie, 2009, p. 103-104). It asks both 'what?' and 'why?' questions (Wisker, 2008). This research is conducted to improve level of understanding on type of problem at hand. When data reveal some pattern regarding phenomenon of interest, theories are developed and hypotheses formulated for subsequent testing (Sekaran and Bougie, 2009); 'this research is commonly used when new knowledge is sought or certain behaviour and the causes for the presentation of symptoms, actions or events need discovering' (Wisker, 2008, P. 72). This research is exploratory in nature as not much is known about sustainability practices particularly in oil and gas industry. Extensive literature review was done to gain familiarity with sustainability practices in organisations, from which hypotheses were developed to be tested with questionnaire result.

4.7.4: Historical Research

Historical research is systematic and objective location, evaluation and synthesis of evidence in order to establish facts and draw conclusions about past events (Borg, 1963 cited in Walliman, 2011). It covers what happened in the past and reveals why and how it happened. Historical research uses historical data in form of historical artefacts, records and writing (Walliman, 2011). This research attempt to answer questions such as, where events took place. Which people were involved? When events occurred? And what kind of human activity was involved?

4.7.5: Survey Research

Survey research is method of collecting primary data based on communication with representative sample of individuals (Zikmund et al, 2010). Survey design provides quantitative description of trends, attitudes or opinions of population by studying sample of that population (Creswell, 2003, 2011). The purpose is to generalise from sample to population so that interpretations can be made about some characteristics, attitudes and behaviour of the population (Babbier, 1990). Surveys involve self-administered questionnaires or structured interviews through telephone or face to face (Neuman, 1997; Creswell, 2011). Surveys work better with standardized questions where we have confidence that the questions mean same things to different respondents (Robson, 2011).A survey is research approach of positivism paradigm, where there is no provision for manipulation of variables under investigation (Robson, 2011). One feature of surveys is its ability to describe large populations without bias within some measurable levels of uncertainty (Groves, 2006). This research is survey research in the sense that questionnaires were administered to the respondents (CEOs) by post. The findings were generalised to oil industry.

4.7.6: Case Study Research

Case study approaches originated from health, laws and others social works (Wisker, 2008). In case study, the case itself is at centre stage, not the variable (Schwandt, 2007). Case study is systematic analysis of a real situation that can lead to a new theory. It has high validity with practitioners – the ultimate users of the research (Yin, 2003). Cases can be chosen and studied because they are instrumentally useful in furthering understanding of a particular problem, issue or concept (Yin, 2002). It involves an empirical investigation of a particular contemporary phenomenon within its real life context using single or multiple sources of evidence (Ivanova, 2004; Robson, 2011). 'Case analysis involves organising the data by specific cases for in-depth study and comparison. Well-constructed case studies are holistic and context sensitive . . . the purpose is to gather comprehensive, systematic and in-depth information about each case of interest' (Patton, 2002, p. 447). It involves contextual analysis of similar situation in other organisations, where the nature and definition of the problem happen to be the same as experienced in the current organisation (Wisker, 2008; Sekaran and Bougie, 2009). Case study is one of the few methods available for studying unusual or unique events (Seale and Barnard, 1998).

4.8: Philosophical Position of this Research

'Researcher's world views are shaped by the discipline area of the student, the beliefs of the advisers and the faculty of the student's area and past research experiences' (Creswell, 2011, p. 6). In operations management the dominant ontological belief is that reality exists external from the researcher (Flynn et al, 1990). If the research's ontological believes is objectivism his corresponding epistemology will be positivism and the methodology is usually quantitative research methods (Morgan and Smirich, 2008). The ontological believe of this study is objectivism. The researcher believes that the reality exists independent of the investigator. Objectivism methods offer an opportunity to seek appropriate research methods in a broader scope and encourage researcher to obtain scientific knowledge by considering diverse data collection methods. The focus of this study is to understand what is happening and how it is happening. That there are causal mechanisms and structures that generate observed events. Nonetheless, social world is complex and open which involves real structures and mechanisms that make events and social objects to be investigated scientifically (Robson, 2002). The factors that constitute environmental problems and sustainability practices in oil and gas companies are evident of causal mechanism and structures inside and outside the organisations.

Example resource availability of the firm may lead the company to implement sustainability. Internal resources and sustainability strategies adopted by the company are the internal mechanisms while the company as an entity is the structure whilst the environmental impact of company's operations and the societal reactions on these impacts are the external mechanisms. Structure is a set of internally related objects external to human minds and is independent of human sense; experiences and mechanism are the ways of acting (Sayer, 1992). The aim is to identify these structures and mechanisms through experience and explain observable phenomena by means of theories which describe the underlying structures and mechanisms (Lawson, 1994). Among the attractions of objectivism is the ability to adopt quantitative or qualitative ways of carrying out social research (Lipscomb, 2008). Objectivism is adopted in this study as it is consistent with the research methodology, which is quantitative research.

Supply chain management is normative science whereby reality is viewed to be objective and measurable (Forza, 2002). This study adopts a research approach on the philosophical basis of positivist. The research proceeds by the development of research questions from existing theory and literature (Collins and Cordon, 1997; Flynn et al, 1990; Forza, 2002). This is based on the assumption that sustainability implementation improve the performance and competitiveness of an organisation.Research questions were developed from literature which is then answered from the data collected. Distance was maintained between the researcher and participants such that the researcher is an observer of social reality. Being objectivist research the data collection method adopted is survey by questionnaire and the data collected was analysed using SPSS 21'.

4.8.1. Research Methodology of the Current Study

The researcher's world views usually lead to the adoption of quantitative, qualitative or mixed method approach in their research (Wisker, 2008; Creswell, 2011). This research adopts quantitative research methods as it is compatible with objectivism philosophy. Objectivism is a natural partner of quantitative research method (McEvoy and Richards, 2006). Quantitative research paradigm is a research design of positivism/post-positivism (Robson, 2011). Quantitative research design involves developing and testing hypothesis or answering research questions (Saunders et al, 2003). This research is quantitative as survey by questionnaire method of data collection was adopted (Forza, 2002). The research is empirical in nature where scientific approach was strictly adhered to. The findings were generalised to oil and gas industry. 'Positivist paradigm and quantitative methods can provide wide coverage of the range of situations, they can be fast and economical and particularly when statistics are aggregated from large samples, they may be of considerable relevance to policy decisions' (Easterby-Smith et al, 2002, p. 42).

Research methodology is a systematic process of choosing appropriate methods to address the research questions raised. Research methods adopted depends on the discipline area of the study (Wisker, 2008). Survey by questionnaire is adopted in this research. Survey by questionnaire is adopted as it is consistent with the research methodology in operations management. Furthermore, sustainability attributes are both quantifiable and variable. When a research involves quantifiable attributes, survey by questionnaire is particularly suitable (Moser and Kalton, 1979; Collins and Hussey, 2003). Accordingly, sustainability is a real phenomenon that can simply be defined and universally understand. Survey by questionnaire is generally used when the research attributes can be clearly defined and commonly understood (de Vaus, 1999). Survey by questionnaire was adopted because the aim of the research is to determine the relationships between sustainability implementation and organisational competitiveness. Questionnaire survey is most appropriate for examining relationships between variables and regarded as an efficient method of collecting data from a large sample (Saunders et al, 2003).

Forza (2002) distinguishes three different methods of survey research that have been used by researchers as exploratory, confirmatory and descriptive survey researches. A brief explanation of each form of survey research is provided as follows:

Exploratory survey research; this is the first stage in a research process in which the aim is to gain initial insight on a topic and is used as a basis for further more in-depth studies on the subject.

Confirmatory survey research; this is another type of survey research in which the aim is to test theory through concepts, frameworks and prepositions. This research technique is adopted when knowledge in an area has ripe to the extent that a hypothesis linking constructs can be proposed and data collected to verify the linkages.

Descriptive survey research; this kind of research is used to gain more understanding on the adoption of a phenomenon and to provide description of the distribution of the phenomena in a population. Although the aim is not theory development, the facts described can be useful for theory building and refinement.

Based on these, exploratory research was adopted in this research. Exploratory research can be used to form categories in quantitative research. Sustainability practices in oil and gas industry is in its infant stage as there are few empirical researches in the area (Yusuf et al, 2012; Sarkis et al, 2012), which provides motivation to undertake research in this area. Exploratory research is commonly used when new knowledge is sought and the causes for the presentation of symptoms, actions or events need to be discovered (Wisker, 2008; Sekaran and Bougie, 2009). In designing the questionnaire to undertake the survey an extensive review of literature on topics of supply chain management, sustainability, sustainable supply chain and competitive priorities was carried out. The aim of the literature review was to collect information on adoption of sustainability in organisations' supply chains. The research also explored the link between sustainability practices and companies' competitiveness.

4.9: Sampling Frame

The oil and gas industry represents companies of different backgrounds. Within the oil and gas industry, there are companies of different sizes and activities. Examples, there are three types of companies according to their sizes, these are: small, medium and large scale companies. Classifications in terms of activities of the companies are: operators (oil companies), contractors and suppliers. Oil companies (operators) are customers while contractors and suppliers provide goods and services to the operators. The contractors and suppliers represent various industries. Diversity of contractors and suppliers is of importance to this research in order to decrease external validity problems, which are often associated with industry specific studies. Consequently, respondents for this study were drawn from operators (oil and gas firms), contractors and suppliers.

Sample frame is (physical) representation of all elements in the population from which sample is drawn (Sekaran and Bougie, 2009). This research used: Pegasus energy database (www.pegasusenergy.co.uk) and Subsea oil and gas directory (www.subsea.org) and obtained detail information of all oil and gas companies in UK petroleum industry. These databases provide profile of oil and gas companies in the UK petroleum industry, information such as: companies' name, e-mail addresses, postal addresses, telephone numbers, fax numbers and the product and/or services produced by the companies. Pegasus energy database and Subsea oil and gas directory are crossed checked with financial Analysis Made Easy (FAME) to determine their reliability and they were found reliable and up to date.

In selecting respondents (companies) from sample frames, simple random sampling was adopted because every company had equal chances to be selected into the sample. Sample should be selected as randomly as possible in order to control bias (Flynn et al, 1990; Saunders et al, 2003). Convenience sampling techniques were employed in selecting respondents from sampled companies. Convenience sampling involves choosing nearest and most convenient person to act as respondents. This process continues until required sample size has been obtained (Saunders et al, 2003; Robson, 2011). Convenience sampling is most often used during exploratory phase of research project and is perhaps the best way of getting basic information quickly and efficiently (Sekaran and Bougie, 2009). Chief executive officers (CEOs) of oil and gas companies were chosen as respondents of this research, because they are in better position to explain the position of sustainability adoption in their companies. Sample must be true representatives of the population (Walliman, 2011). CEOs are invariably the correct representatives of oil and gas companies. Representativeness of sample is of importance in interest of wider generalizability (Sekaran and Bougie, 2009; Walliman, 2011). The aim of this research is to make generalisation from sample to population.

4.10: Survey by Questionnaire

Questionnaire 'is a pre-formulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives' (Sekaran and Bougie, 2009, P. 197). It is most efficient data collection mechanism when researcher knows exactly what is required and how to measure variables of interest (Sekaran and Bougie, 2009). Questionnaire is popular data collection tool that is widely used in many aspects of human life research (Seale and Barnard, 1998). Survey by questionnaire was employed in this research to collect and analyse primary data from respondents (CEOs). CEOs are considered most suitable informants regarding firm-level activities.

Survey by questionnaire is most appropriate if research involves examining causal relationships between variables (Sounders, et al, 2003). Survey by questionnaire was employed in this research because the aim is to examine the relationships between sustainability practices in oil and gas companies and organisational competitiveness. Survey by questionnaire is chosen in this research as it is most frequently used research design in production and operations management research. 'Survey is undoubtedly the most commonly used research design in operations management. It relies on self-reports of factual data, as well as opinion. One approach is to administer a survey to a group which is homogeneous with respect to at least one characteristic, such as industry or use a common technology' (Flynn et al, 1990, p. 257). The adoption of survey by questionnaire is informed because this research is positivist. Surveys by questionnaire are favourites among those with positivistic world view and methodology (Whisker, 2008). Additionally, as positivist research design, the aim of this research is to make generalisation on the population from sample result. When focus of research is generalizability to entire population, administering survey to a large sample is more appropriate approach (Flynn et al, 1990). Survey by questionnaire however, added further understanding to knowledge base of the research by permitting the researcher access to oil and gas companies who were adopting sustainability.

4.10.1: Questionnaire Design

Questionnaire is standardised list of questions where order and wording of questions has been carefully planned (Seale and Barnard, 1998). Questionnaire enables researcher to organise questions and receive replies without necessarily talking to respondents (Walliman, 2011). It gathers information directly by asking people questions and using responses for data analysis (Sekaran and Bougie, 2009). Questionnaire collects information on three basic variables: opinion, behaviour and attitude (Dillman, 2007 cited in Saunders et al, 2009). This research work aims at evaluating level of sustainability application in oil and gas companies in the UK which links to organisational competitiveness. Literature on sustainability shows that there is no theoretical bases that clearly specify how organisations could integrate sustainability into their operations and/or what are characteristics of sustainable supply chain. In this kind of situation, extensive preliminary review should be undertaken to gain awareness with phenomena at stake and understand what is happening before a model can be developed and a rigorous design set for complete investigation in survey questionnaire designing (Sekaran, 1992).

Questionnaire design requires comprehensive approach in designing processes (Walliman, 2011, Bryman and Bell, 2003). This is known as total design method (TDM). Total design method (TDM) entails broad set of questions to be asked, taking into account type of data, analysis and research questions to be addressed (Nachmias and Nachmias, 1992). TDM consists of 18 step process including: avoiding bad formatting, illogical sequence, repetition, threatening and double barrel questions (Walliman, 2011). Other issues that are considered while designing the questionnaire includes:

1) Questions were made simple and easy, which could assist respondents to describe levels of sustainability practices in their organisations. Language of the questionnaire should be appropriate to level of understanding of respondents (Sekaran and Bougie, 2009; Robson, 2011). Additionally, questions asked were direct and specific that gives respondents opportunity to explain type's sustainability strategies they are implementing.

2) Questions were straightforward and clear that respondents can describe incentives for implementing sustainability and difficulties they face.Ambiguous questions can make it difficult for respondents to understand exactly what the question means (Sekaran and Bougie, 2009).

3) Leading and loaded questions were as much as possible avoided. This is to avoid bias because leading and loaded questions are sources of bias. Leading questions suggest certain answers and loaded questions suggest socially desirable answer or are emotionally charged (Sekaran and Bougie, 2009; Zikmund et al, 2010).

4) Open ended questions had been avoided as it makes questionnaire completion complex, time consuming, difficult to analyse and to compare with responses from other respondents (Robson, 1999). Most questions in the questionnaire were closed ended questions, this is because they take less time to complete and are easy to respond. Using closed ended questions, respondents would not have opportunity to provide irrelevant information (Sekaran and Bougie, 2009). Effort was made to make the questions and alternative responses standardized prior to data collection. Standardising alternative responses to question provides

comparability of answers; facilitate coding, tabulating and easy interpretation (Zikmund et al, 2010).

5) Length of questions was short and precise to particular variable being asked, this will motivate more respondents to complete the questionnaire. Simple and short questions are preferable to long ones. As a rule of thumb, question or statement in the questionnaire should not exceed 20 words or exceeds one full line in print (Oppenheim, 1992).

6) Form of questionnaire (paper copy, on-line form, e-mailed document, etc.) and way it were administered was also taken into consideration. Decision taken was to distribute the questionnaire by post in form of paper printout.

7) To analyse data easily, double-barrelled questions were avoided.‘When multiple questions are asked in one question, the results may be exceedingly difficult to interpret’ (Zikmund et al, 2010, p. 346)

8) All questions in the questionnaire were set in such a way that they provide answers to research questions. Researcher’s central task is to link research questions and questionnaire questions (Robson, 2011).

9) Avoidance of burdensome questions. Burdensome questions are questions that may task respondent’s memory (Zikmund et al, 2010).

10) Questions Sequence; order of questions in questionnaire should be such that respondent is led from questions of general nature to those that are more specific and from questions that are relatively easy to answer to those that are approximately difficult (Sekaran and Bougie, 2009, Zikmund, 2010).This is called funnel approach; funnel approach facilitates easy and smooth progress of respondents through items in questionnaire. ‘The progression from general to specific questions might mean that the respondent is first asked questions of a global nature that pertain to the organisation and then is asked more incisive questions regarding the specific job, department and like’ (Sekaran and Bougie, 2009, P. 203). Funnel approach was adopted in this research in order to maintain respondents’ cooperation and confidence. If opening questions are simple to understand and easy to answer respondents’ confidence, cooperation and involvement can be maintained (Zikmund et al, 2010).

11) Survey questions captured perceptual data using relative scores on a 1-5 Likert Scale (Oppenheim, 1992). For most of the questions, one (1) stood for Highly positive’, ‘Most

important' or 'Sharp increase' As well, Three (3) represented 'Neutral' or 'Modest' whilst Five (5) meant 'Highly negative', 'least important' or 'sharp decrease'. This research assumes that every factor, in ascending and descending order has equal weight or importance. And that change in factors had equal impact across companies and over time. It also assumes thatdirection is as important as magnitude of change, and that changes had equal impact regardless of current attainment.

4.10.2: Pilot Testing

Pilot testing is an integral part of questionnaire design. It provides feedback on how easy a questionnaire is to be completed. Which concepts are unclear or out of respondents' range of knowledge or responsibility. 'By administering the pilot study in person, researcher can determine whether there are systematic differences between the way the researcher views specific measures versus the respondents'(Flynn et al, 1990, p. 262). Questionnaire should be pre-tested so as to anticipate any problem of comprehension or other source of confusion (Whisker, 2008; Walliman, 2011). 'The purpose of pilot tests 'is to refine the questionnaire so that the respondents will have no problems in answering the questions and there will be no problems in recording the data, In addition, it will enable you to obtain some assessment of the questions' validity and the likely reliability of the data that will be collected**' (**Saunders et al, 2009, p. 394). Before the main survey, a pilot test was carried out. The purpose of the pilot test is to upgrade the questionnaire so that the respondents will have little or no problems in responding to the questions. There will also be no problems in recording the data as well as in obtaining some assessment of the questions' validity and the likely reliability of the data that will be collected (Saunders et al., 2003). The drafted questionnaire was pre-tested using some academics in and around UCLAN, who are experts in the field of questionnaire survey. They were politely invited to complete the questionnaire, and were encouraged by explaining the purpose of the survey and how the results could be of benefit to the general environment. The feedback received from these people assisted in redesigning the questionnaire to its present level (see appendix 2).

The comments obtained from the pilot test informed the revision of the questionnaire. The comments made by the experts that are included in the final drafted questionnaire include:

First, some words such as sustainability, sustainable development and 'ESCM' were used interchangeably. It was observed that oil and gas companies' managers might interpret them differently or might misunderstand their exact meaning. It was advised that sustainability be used throughout the questionnaire, particularly because the research is on sustainability implementation in oil and gas supply chain.

Second, one variable was added in the questionnaire. The variable added was the types of companies (Sole proprietor, Partnerships, unlimited liability companies and limited liability companies). This according to the observers will give the researcher alternative options to make more statistical analysis between some basic research variables and the nature of the companies. The question added is question 6 (appendix 2: survey questionnaire).

Third, alternative answers to question 10 were suggested as follows:

Table 4.3: Alternative Answers to Question 10a.

Sustainability Practices	**Tick**
Will implement sustainability in the future	
Will not adopt sustainability now neither in the future	
Currently implementing sustainability strategies	
Successfully implemented	
Neutral/indifferent	

TO:

Table 4.4: Alternative Answers to Question 10b.

Sustainability Practices	**Tick**
No plan for adoption of sustainability now and in the future	
Will adopt in the future	
Recent and on-going implementation	
Make significant progress on sustainability implementation	

Fourth, question 5 was set as 10 – 50 ☐ 51 – 100 ☐ . . . . . . Question 5 was advised to be changed to: up to 50 ☐ to 51 – 100 ☐ . . . . . .

Question 6 was set as less than £1m - £5m ☐ £1m - £5m . . . . . . Question 6 was recommended to read as: Up to £10m ☐ £11m - £50m . . . . . .

Fifth, Question 9 was initially set as: Please indicate by a tick (√) your company's attainment of competitive priorities. It was proposed to be changed to: Please indicate by a tick (√) the direction of change in the following measures of performance in your company in the last five years.

Sixth, question on environmental and social sustainability were initially merged as one question (having many environmental and social variables). The experts suggested that the question be separated into 2 independent questions. One question on environmental sustainability and the other question on social sustainability (see Questions 17 and 21 in appendix 2: survey questionnaire).

4.10.3: Questionnaire Administration

There are four techniques of distributing questionnaire. Sekaran and Bougie, (2009) suggested that questionnaire can be administered through mail (postage), telephone, personal interviews and online surveys via the internet. The advantages of postal questionnaires over telephone or online questionnaire are low cost and its ability to reach large population at short time (Sekaran and Bougie, 2009; Walliman, 2011; Robson, 2011; Creswell, 2011). Postal questionnaire's major deficiency is low response rate (Seale and Barnard1998; Robson, 1993; Bryman and Bell, 2007). Choice of a particular method to distribute questionnaire depends on efficiency, speeds, costs, usage and internet availability (Sekaran and Bougie, 2009). This research adopted mail questionnaire in distributing questionnaire to respondents because it is easy, cheap and efficient. Major consideration in this research was efficiency due to time and funds constraints. Efficiency refers to completing many questionnaires in short period of time (Robson, 1999). Mail questionnaire was used because it is efficient in managing researcher's time and effort. Postal questionnaire can be easiest and extremely efficient at providing large amount of data in short period of time (Robson, 2011). Additionally, the nature of this research did not require collection of sensitive data and hence mail questionnaire was appropriate. Using questionnaire, respondents may not freely disclose sensitive issues about their companies (Bell and Bryman, 2007; Sekaran and Bougie, 2009).

Questionnaires were despatched directly to CEOs of sampled companies. Postal questionnaires compel an obligation to pass on posted questionnaire alongside other mails addressed to CEOs. Each envelop posted to CEO's contained a questionnaire, covering letter to the questionnaire, and post-paid self-addressed return envelopes. TheUniversity letterhead was used for the covering letter. The covering letter carried the name and signature of the director of institute of logistics and operations management, at the University of Central Lancashire (UCLAN). The covering letter specifies details about the researcher, purpose of study and an assurance of confidentiality. This information can motivate respondents to reply (De Vaus, 2002).

4.10.4: Response Rate

Five hundred and fifty (550) questionnaires were posted. They were posted to addresses of respondents taken from Pegasus and sub-sea databases of companies, which host oil and gas businesses directory. The questionnaires were addressed to the CEO's of oil and gas companies. In case they were not free to complete the questionnaire (based on work pressure or other reasons), they were recommended in the cover letter to pass it to the appropriate employee of the company to complete it on their behalf.

Out of 550 companies sampled and posted questionnaires, 162 companies completed and returned a copy of the questionnaire giving response rate of 29.5%. This response rate is considered to be representative of studies of organisations. Since, return rates of mail questionnaires are typically low (Saunders et al, 2009; Sekaran and Bougie, 2009; Creswell, 2011; Robson, 2011). 'A 30% response rate is considered acceptable' (Sekaran and Bougie, 2009, p. 197) whilst Robson (1993) and Saunders et al. (2003) argued that questionnaire with scale response, 20% response rate is acceptable. Sample size can also be determined by checking response rate in previous studies (Melnyk et al, 2003; Saunders et al., 2003**).** In an earlier survey Stead and Stead (1995) obtained a response rate of 20.6% on 'an empirical survey on sustainability strategy implementation in industrial organisations' whilstHenri and Journeault (2008) achieved response rate of 20.9% on 'environmental performance indicators: an empirical study of Canadian manufacturing firms'. Low response rate should not discourage researchers, because a great deal of published research work also achieves low response rate (Bryman and Bell, 2007). Of the 162 questionnaires returned, 112 were useable and deemed viable for study, while the remaining 50 questionnaires were excluded from the analysis because they were either partially filled, or they were returned unfilled. Although poorly completed questionnaires still provide some data, researchers often exclude such questionnaires in order to reduce the occurrence of missing data in statistical analysis as well as improve reliability of results (Bryman and Bell, 2007; Creswell, 2007).

Response rate of 29.5% was achieved through sending follow-up letters, enclosing some small monetary amount as incentives with the questionnaires, enclosing self-addressed stamped return envelops, and keeping the questionnaire simple and brief (Sekaran and Bougie, 2009). Techniques used to increase the response rate in this study were: Firstly, stamp addressed envelope was enclosed with the questionnaire. Secondly, confidentiality of responses was assured. Thirdly, reminder questionnaires were sent out at the end of third and fifth weeks of sending out initial questionnaires. Fourthly, follow up telephone calls were also made at intervals. Fifthly, the covering letter and statement made by the DOS in the covering letter, that responses are going to be used for research purposes only, and result of the research will be made available to the respondents if they are interested. These techniques may persuade respondents to complete the questionnaire, hoping that by completing the questionnaire, the general public may be aware of their sustainability practices, which may increase their societal acceptance.

4.11: Conceptual Model of Sustainability Adoption in Oil and Gas Supply Chains with Links to Competitive Objectives

Conceptual model is a diagram illustrating the constructs (variables) studied and the proposed relationships between them. This research proposed to investigate four constructs as follows: drivers of sustainability; aggregate sustainability practices; competitive priorities and measures of business performance. Warmbrod (1986) defines it as a systematic ordering of ideas about the phenomena being investigated or a systematic account of the relations among a set of variables. In this research the conceptual model was developed taking into consideration both the systematic ordering of ideas and systematic relations among the set of sustainability variables.

4.11.1: Development of the Conceptual Model

Having considered knowledge outcomes from the literature carefully, links between these can be projected and predictions can be made on how relationships may have impact on outcomes. These concepts move from being totally abstract and unrelated to becoming a tentative or loose framework to explore and test theory. There is limited number of framework for practitioners and researchers to develop insights into the sustainable business development in manufacturing and services. Therefore, more research is required in the area of sustainability in process design, product development, remanufacturing, recycling and reverse logistics (Gunasekaran and Spalanzani, 2012).

The model proposed in this research was developed from the literature of sustainability. Conceptual models and frameworks are established from previous studies, conceptual analyses and theories that are available in the literature (Warmbrod, 1986; Dyer et al, 2003). The literature indicates that sustainability implementation in organisations is stimulated by many drivers (motives). When an organisation decides to adopt sustainability on its operations based on some drivers (objectives) of sustainability. Such company starts implementing sustainability by making sustainability investment. This investment is usually used for the purchase of modern equipment that minimise the resources use in production and produce less emission. Sustainability strategies are than adopted to redesign the production process in order to produce environmentally friendly products. Environmentally friendly products are sustainable as they minimise environmental disruptions through little or gas emission and simultaneously improved organisational competitiveness. These sequence and relationships between the research constructs available in the literature are used in the development of this conceptual model.

Over the years researchers have developed frameworks of sustainability implementation in relations to environmental protection or increased sale turnover. The model proposed in this thesis is integration of three conceptual frameworks in the literature. Table 4.5 presents the summary of the frameworks.

Table 4.5: Conceptual Frameworks in the Literature.

Authors	The Title of the Model Framework	Year of Publication
Stead and Stead	Model of sustainability strategy implementation	1995
Mohammed Dauda	Conceptual framework of cluster based Agility supply chains.	2008
Gopalakrishnan el al	Framework of essentiality of sustainable supply chains (SSC)	2012

Stead and Stead (1995) model of sustainability strategy implementation proposed three boxes (constructs): motives (drivers), content (sustainability strategies) and outcomes (financial returns, Payback period and improved environmental performance). The proposed model integrated box 2 (sustainability strategies) of Stead and Stead (1995) conceptual framework of sustainability implementation in manufacturing companies. The objective of Stead and Stead (1995) conceptual framework is to assess the financial implication of sustainability strategies implemented in five industries that have high emission rate in the world. The model proposed in this research aims to demonstrate relationship between sustainability constructs and competitiveness in oil and gas industry. While Stead and Stead (1995) conceptual framework deal with sustainability strategy implementation in five most pollutant manufacturing industries. The proposed model deals with sustainability implementation in oil and gas supply chains alone. Additionally, Stead and Stead (1995) conceptual framework deal with sustainability strategies implementation only whilst the proposed model deals with aggregate sustainability implementation (sustainability investment, sustainability strategy implementation, sustainability indicators, sustainability assessment and sustainability reporting system). Accordingly the literature on sustainability implementation includes sustainability investment, adoption of sustainability strategies, sustainability indicators, sustainability assessment and sustainability reporting systems, which were all reflected in the proposed model.

Dauda (2008) proposed conceptual framework of cluster based on agile supply chains. The framework has four boxes (constructs): attributes of agile supply chain, clusters and industrial districts, attainment of competitive objectives and business performance. Dauda (2008) framework deals with diffusion agile supply chain in oil and gas while the proposed model deals with implementation of sustainability in oil and gas supply chains. This model integrated one box (construct) of Dauda's (2008) framework that is attainment of organisational competitiveness. Both Dauda's (2008) framework of agile diffusion in oil and gas companies and the proposed model in this research have 'attainment of competitiveness in the oil and gas supply chains' as their objective. Whilst Dauda's (2008) framework proposed to attain competitiveness through diffusion of agility in oil and gas supply chain; the model in this thesis proposed to attain competiveness through sustainability implementation in oil and gas supply chain.

Gopalakrishnan et al (2012) proposed ten boxes (constructs) of essentialities of sustainable supply chain (SSC), where each box presents one construct. One of these constructs was integrated in this research model. The construct integrated in this conceptual model is key sustainability performance indicators infused through supply chain. Gopalakrishnan et al (2012) have not list the key sustainability performance indicators, but rather give guide lines on how to develop the key indicators. This model identified the key sustainability indicators use in oil and gas industry to assess and report sustainability performance in the oil and gas companies.

These indicates that some parts (sustainability strategies implemented, sustainability indicators and competitive objectives) of this model were integrated from three conceptual frameworks highlighted in table 4.3. The other variables (drivers of sustainability, investment on sustainability, sustainability assessment and sustainability reporting systems) used in this model were obtained from the literature on sustainability.

4.11.2: The Direction of the Arrows

Business organisation can embark on any business activity if the activity is underpinned by some judicious objectives. The objectives of the particular activity will push companies to undertake that activity. In figure 4.15 the first box is the drivers of sustainability, the second box is aggregate sustainability practice attributes, the third box is competitive objectives and the fourth box is measures of business performance.

The arrow from drivers of sustainability to aggregate sustainability practice constructs indicates that drivers of sustainability motivate organisations to adopt sustainability. That is there is there is relationship between drivers of sustainability and sustainability implementation. Before companies adopt sustainability they must have objectives (drivers) that they want to achieve. This means drivers of sustainability push organisations to adopt sustainability. In the literature some scholars shows that companies adopt sustainability because of the operations of law. Others argued that companies adopt sustainability in order to improve their environmental and competitive performance.

The arrow from Aggregate sustainability practices box to realisation of completive priorities box indicates that companies can attain competitiveness through sustainability implementation. This means companies that adopt sustainability are assured of achieving competitive edge over those companies that are not implementing sustainability. This indicates that there is relationship between sustainability and competitiveness of organisations. Companies are expected to compete on variety of competitive objectives, being a means of depending business performance against influences of environmental changes. Sustaining competitiveness of an organisation through competing on one dimension of competition such as lower price is no longer tenable. Companies are expected to compete in non-price based dimension as well (Li et al, 2006; Yusuf et al, 2013).

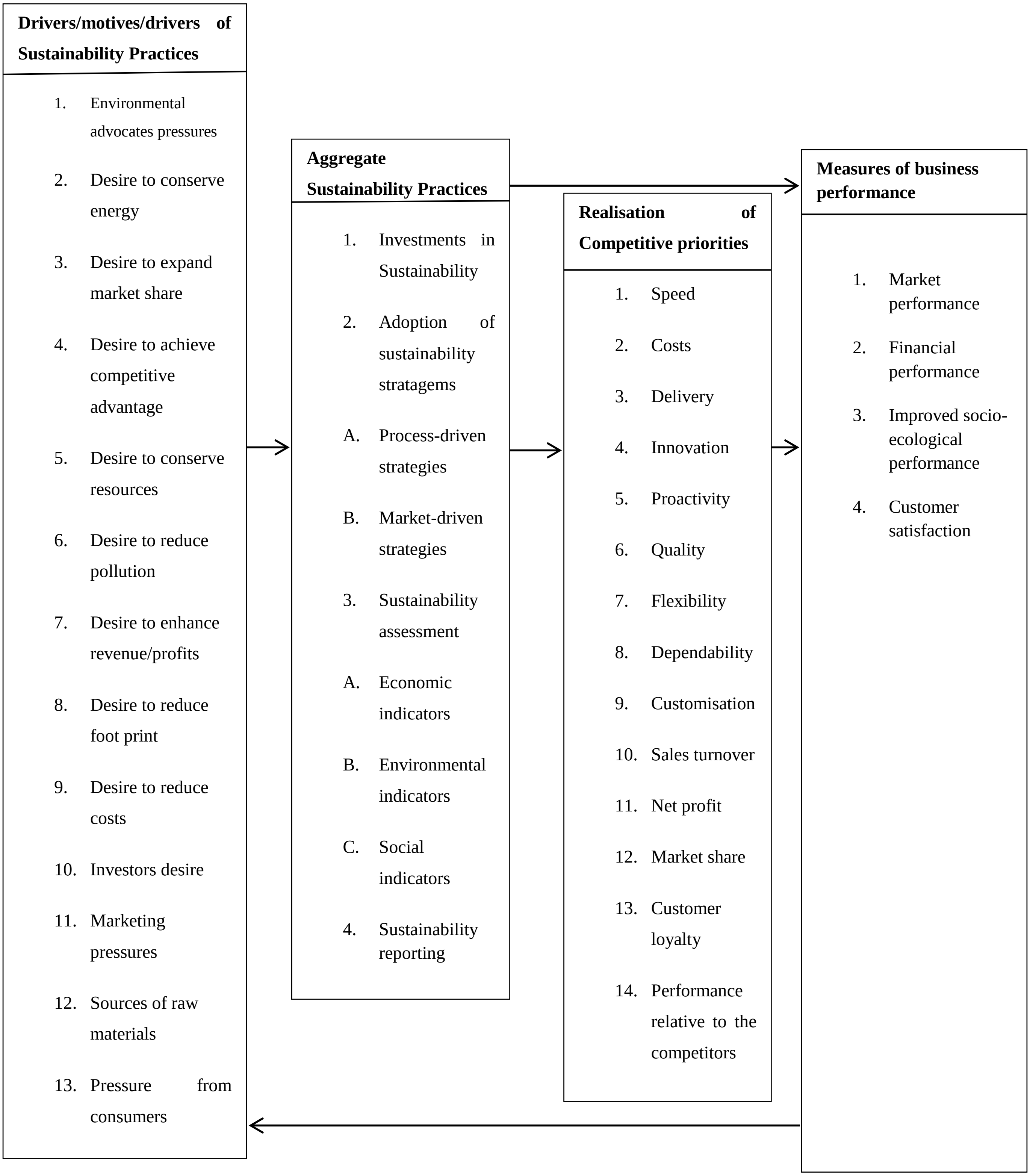
The arrow that joins aggregate sustainability practices and measures of business performance indicates that sustainability practices are directly link with business performanceof anorganisation. The arrow indicates that sustainability has relationships with business performance. Pro-activeness on sustainability practices will lead to improve corporate business performance. In the future corporation strategies and competitive priorities will be vested in capabilities that facilitate environmentally sustainable economic activity (Hard 1995). Many studies shows that proactivity on environmental activities enhances organisation performance (Hart 2001, Porter and Kramer, 2006; Yusuf et al, 2012).

The Arrow from competitive objectives box to measures of business performance shows that competitive priorities are measured on both financial performance and nonfinancial performance. The financial performance measures are market performance and financial performance. The nonfinancial performance measures are improved socio-ecological performance and customer satisfaction. The arrow indicates that by achieving multiple competitive objectives, companies are also attaining both financial and non-financial objectives. Businesses need to attain wide range of competitive objectives to defend their business performance. As business performance is a measure of business success. Business performance measures that are based on financial objectives alone may not be adequate to assess the overall strength and survival prospects of the companies that are affected by environment and social disruptions. Pollution prevention strategy requires acquisition and installation of new technologies that include higher order learning and may lead to the development of the organizational competitive capabilities (Russo and Fouts, 1997).

The arrow measures of business performance box to the drivers of sustainability box indicate that sustainability practice is a continue process. Meaning when the company achieve its set objectives on sustainability implementation, the company will go back from the beginning of sustainability implementation to the end. This will continue over and over in perpetuity.

Figure 4.2 shows the conceptual model of sustainability adoption in oil and gas supply chains with link to competitive objective. This model was adopted from the researches of Stead and Stead (1995) and Yusuf et al, (2012) with some modifications. The model is classified into four boxes. The direction of cause and effect between constructs is shown by arrows from and to boxes.

Figure 4.2: Conceptual Model of Sustainability Adoption on Organisations Supply Chains



First box in Figure 4.2 represent drivers of sustainability practices, second box is aggregate sustainability practices, third box is competitive priorities/objectives and fourth box is measures of business performance.

Sustainability practices require capabilities, such as responsiveness, competency, innovation, flexibility, speed, environmental consideration and customisation. There is the need for organisations to be more innovative, flexible and responsive to changing needs of green environment and green customers. The need for flexibility and responsiveness should not be trade-off with cost, speed and quality. Equally, cumulative competitive paradigm does not support trade-off of speed, quality, cost, innovation, flexibility or proactivity, but emphasise the need for capabilities for holistic provision of relevant competitive bases in right mix while recognizing that balance in those key bases may shift from market to market over time.Since different types of market require different mix of competitive bases (Vokurka et al., 2002; Tracey et al., 2005). Appropriate information of the level of speed, cost, quality, innovation, flexibility and proactivity is significant for long-term survival of sustainable organisations (Richardson and Snaddon, 2011; Lambert and Schwieterman, 2012; Perunovic´ et al, 2012).

4.11.3: Justification of the Proposed Conceptual Model

Model in figure 4.2 above is based on literature review undertaken in chapters two and three. The framework describes existing literature (reviewed in depth) with respect to drivers (purposes) of sustainability implementation, content of sustainability strategies and potential outcomes (competitive priorities and business performance) that can be expected from successful implementation of these strategies.

This section focuses on explanation of roles of variables and illustration of motives underlying specified relationships. The arrows shown are those that are perceived as likely to reflect and fit empirical reality. This is the practice in empirical studies that are structured on guiding conceptual frameworks (Moser and Kalton, 1979). The direction of arrows shown in the framework are validated using empirical data in chapter five. The valid direction of arrows signifying relationships existing between variables which can be confirmed based on correlation coefficients as measure of relationship and direction of impact between two variables. If the directional arrows are valid as specified, difference between correlation and regression coefficients should be no more than 0.1, and alternative reverse arrows would hence be deemed to fail the test of empirical reality (Anderson et al., 1995).

First box in figure 4.2 represent drivers of sustainability. Stead and Stead (1995) broadly classified the drivers of sustainability into three main categories, environmental motives (environmental protection, resources pressures, decrease in pollution, decrease in carbon foot print etc.); economic motives (decrease in costs, increase in revenue, profitability, competitiveness etc.) and legal drivers (legislations, nationally and internationally). While Walker et al (2008) broadly classified the drivers of sustainability into two main categories: internal drivers (comprising all forces within firms) and external drivers (comprising all forces outside firms).Drivers of sustainability are numerous and complex (Stead and Stead, 1995; Walker and Jones, 2012). They include, environmental advocates pressure, desire to conserve energy, desire to expand market share, desire to achieve competitive advantage, desire to conserve resources, desire to reduce pollution, desire to enhance revenue/profits, desire to reduce foot print, desire to reduce costs, investors desire, marketing pressures, sources of raw materials, pressure from consumers, legal pressures etc. (Linton et al, 2007; Carter and Easton, 2012; Wang et al, 2011; Yusuf et al, 2012). In this model, the drivers are mutually interdependent motives guiding choose of some mix of process-driven and market-driven sustainability strategies. The direction of arrow points from drivers of sustainability to aggregate sustainability practices indicate that adopting sustainability practices in an organisation is inspired by some motives, (drivers). That is sustainability drivers push organisations to adopt sustainability.

Second box named as ‘aggregate sustainability practices’ is the focal point of discussion in this conceptual model. While it is significant to recognise and justify appropriate drivers of competitive objectives in today’s unbalanced markets (Yusuf et al., 2004; Tracey et al., 2005). Sustainability practices involve adopting sustainability strategies for improving competitive objectives in markets that are environmentally conscious (green market) where ‘green customers’ are the main participants. The literature show that sustainability practices comprises four phases, which includes: sustainability investments, sustainability strategies adoption (process-driven or market-driven or a combination of both), sustainability and assessment sustainability reporting. This study argues that sustainability practices can enhance realisation of competitive objectives and in turn enhance business performance. Potential competitive advantages at the interaction of economic with environmental and social performance includes cost savings (Mollenkopf et al, 2005), reduce health and safety costs and lower recruitment and labour turnover costs (Carter et al, 2007) and reduce total cost of production (Hanson et al, 2004). There are varieties of environmental and social issues that firm can undertake which can improve their economic bottom line (Carter and Rogers, 2008).

Sustainability practices begin with reasonable investments in new technology of manufacturing products. Achieving sustainability requires changes in industrial processes, in type and quantity of resources used, in treatment of waste, in control of emissions and in products produced (Krajnc and Glavic, 2003). Therefore, Reasonable investments are required to implement sustainability strategies (Stead and Stead, 1995). Sustainability practice requires long term capital expenditure for innovation and for changes of operational structures and processes (Carter and Rogers, 2008; Gopalakrishnan et al, 2012; Yusuf et al, 2012). By their nature oil and gas companies requires large capital outlay in innovation and process change needed for sustainability practices (Nidumolu et al, 2009). Oil and gas companies are investing significantly in alternative energy source and policies promoting sustainability (Schweitzer, 2011).

Sustainability practices include application of various sustainability strategies. Organisations are challenged to identify and implement strategies that will allow them to effectively respond to environmental issues (Ayres, 1989; Wheeler, 2004). By implementing sustainability strategies, firms can synergistically integrate long term profitability with their efforts to protect eco-system, providing them with opportunities to achieve competitive advantages of cost leadership and market differentiation at the sometime being environmentally responsible (Stead and Stead, 1995). There are two grand sustainability stratagems which are Process-driven stratagems (redesigning pollution control systems, waste disposal systems, air and water treatment systems; recycling resources derived from external sources, use scrap materials, recycling defective end products in production process; redesigning production processes to be less polluting and more energy and resource efficient; and using renewable energy sources in production processes) and market-driven stratagems (redesigning product packaging, advertising the environmental benefits of products, redesign existing products to be more environmentally sensitive, developing new environmentally sensitive products, enters new environmentally sensitive markets and selling or donating scrap once considered wastes). Previous studies show that, these strategies have delivered the outcomes they promised. That is environmental protection, reduced total cost of production, improved financial return and enhances competitive position of the practising firms (Stead and Stead, 1995).

Companies are expected to report their sustainability practices the reports should include company performances in economic, environmental and social dimension (Delai and Takahashi, 2011). There is a great need for business to monitor, manage and report their environmental performance, (Ekins and Vanner, 2007). Companies are compelled to commit and report on overall sustainability performances of operational activities (Labuschagne et al, 2004). In some parts of the world, companies produce separate social and environmental reports (Aras and Crowther, 2009). Sustainability indicators are used to report sustainability activities of the businesses. There are large mass of literature on sustainability indicators developed for various manufacturing sectors. Some studies maintained that sustainability reporting may lead to societal acceptance of the business (Azapagic, 2004; Colantonio, 2008).

Companies required to assess their overall performances on economic, environmental and social dimensions of sustainability. Over the last few decades, increasing approaches and methods for assessment of sustainability have been devised (Colantonio, 2008). Companies must also be able to measure and assess its sustainability performance and to demonstrate continuous improvements over long term (Azapagic, 2004). There are many sustainability assessment guidelines covering the entire industrial sector such as: GRI, IChemE, ISO 14031, WBCSD indicators etc. (Veleva and Ellenback, 2001; Krajnc and Glavic, 2003; Delai and Takahashi, 2011).

Literature indicates that sustainability practices in organisations assure attainment of competitive advantage. The literatures show sustainability is becoming a significant component of operational and competitive strategies in an increasing number of firms (Shrivastava, 1995; Hart, 1995 Madu, 1997; Mann et al, 2010). Companies can enjoy competitive advantage if they excel in development of sustainability operations (Markeley Davis, 2007). Through pollution prevention companies, can realise significant savings resulting in cost advantage relative to competitors (Romm, 1993; Markley and Davis, 2007). Organisations practicing sustainability in their operations enjoys distinct advantage over their competitors and this advantage is expected to increase in size and frequency in future (Cerin and Dobers, 2011). Proactivity towards sustainable operations will improve company’s competitiveness because their initiatives will be difficult to imitate (Carter and Denser, 2001 cited in Yusuf et al, 2011). Aggregate testifies these studies.

Third box in the conceptual model is competitive priorities (objectives). Literature provides competitive objectives that include: speed, costs, delivery, innovation, proactivity, quality, flexibility, dependability and customisation (Gunasekaran and McGaughey, 2002; Hallgren et al, 2010; Hendry, 2010; Lillis and Szwejczewski, 2010; Richardson and Snaddon, 2011; Lambert and Schwieterman, 2012; Perunovic´ et al, 2012). Others are competive objectives are capabilities for companies deployed in order to compete effectively in market. The literature further emphasised on cumulative attainment of these elements (Nakane, 1986; Ferdows and De-Meyers, 1990; Noble, 1997; Boyer and Lewis, 2002). Companies need to expand extensively to attain all competitive objectives as means of protecting business performance against influence of change. Appropriate competencies that enable competitive advantage need to be recognised and deployed in order to enhance competitiveness (Gunasekaran and Yusuf, 2002; Hallgren et al, 2011). Competitive advantage is the ability companies to compete in a turbulent environment that is characterised by regular and volatile changes. Sustainability possesses capability to confer competitive advantage. Sustainability prove to be an effective strategy for seeking competitive advantage in twenty first century (Markely and Davis, 2007).

Fourth box is Business performance measures; the nature of business performance was explored by studying direction of change in four measures of business performance that are more discussed in literature. The four measures are market performance, financial performance, socio ecological performance and the customer satisfaction. When sustainability strategies are implemented in the company, its ecological and social performance will improve. This will lead to improvement on company's market performance, which will invariably improve company's financial performance. Financial measures of business performance such as sales turnover, net profit and return on investment have been used quite widely in previous studies. Business performance measures that were limited to financial measures without considering non-financial measures (such as market share and customer loyalty) might be insufficient for evaluating overall strength and survival prospects of industries faced by unprecedented market instability. The arrow connecting competitive objectives with business performance is justified by some previous studies in literature (Brown and Bessant, 2003; Squire et al., 2006).

The foregoing discussion justifies conceptual model in Figure 4.2 based on arguments presented in preceding paragraphs, justification for the four concepts of sustainability investment, aggregate sustainability practices, competitive objectives and business performance was presented. Additionally, rationales for corresponding arrows as shown in Figure 4.2 joining the constructs have been argued as well.

4.12: Conclusion

This chapter discussed the theoretical aspect of research, which are methods to undertake when conducting research. The chapter also outlined research methods adopted in this study as well as ontological and epistemological positions of research and their justifications. The chapter also clearly states the philosophical position of this research, the sampling frame and the survey by questionnaire. The rationales for using survey by questionnaire alone were also clarified, followed by the method used in the questionnaire administration. The response rates were explained, followed by declaration that the response rate is adequate supported by some previous research response rates. The last part of this chapter presents conceptual framework of research. How the framework was developed. The variables and arrows connecting the boxes were also clarified. The chapter was concluded by the justification of the framework of the study.

CHAPTER 5: SURVEY BY QUESTIONNAIRE

5.1: Introduction

Chapter five reports questionnaire administration, response rates and data analysis as well as results of descriptive and inferential statistics (cross tabulation, correlationsand chi-square test) from which findings were made. Survey by questionnaire was used to collect data so as to explore and test the relationships between the research variables. Correlation analysis and chi-square test of the research constructs (drivers of sustainability, sustainability practices and competitive objectives) were undertaken to answer the research questions and to test the conceptual model.

This research was based on two theories: first theory, that sustainability practices in manufacturing companies are the most critical solution to environmental and social destructions which companies operations caused (Daly, 1973; WCED, 1987; Meadows et al, 1974; Goodland, 1995; Hueting and Reijnders, 1998). Second theory, that sustainability has impact on organisational competitiveness (Porter and Van der linder, 1995; Rodriguez et al, 2002; Markley and Davis, 2007; Yusuf et al, 2012). This research was conducted to examine how 'companies adopt sustainability to protect the environment and to achieve competitiveness'. Intensive literature review was undertaken to gain more understanding of the theories whilst survey by questionnaire was carried out to determine the drivers and the inhibitors of sustainability and to assess the level sustainability practices in companies; as a strategy to sustain environmental challenges and to improve organisational performance. Survey by questionnaire was employed in this research because it is most appropriate research methodology of investigating practitioners' opinions on emerging concepts (Kumar, 2005). Survey by questionnaire is also suitable in testing relationships between sustainability and organisational competitiveness. Survey by questionnaire conducted in this research was extensive, since sustainability was recently open to empirical study, having few researches on sustainability implementation on organisations' supply chain (Stead and Stead, 1995; Angell, 2000; Yusuf et al, 2012).

Although, there were plenty researches on supply chain management (Cooper and Ellram, 1993; Christopher, 1998; Mentzer et al, 2001; Power, 2005; Ellinger et al, 2012; Kotzab et al, 2012), sustainability practices (Meadows et al, 1974; WCED, 1987; Goodland; 1995; Hueting and Reijnders, 1998; Filho, 2000; Agyeman and Evan, 2004; Shrivastava, 2010; Yusuf et al, 2012), sustainable operations (Kleindorfer et al, 2005; Corbett, 2009) sustainable supply chains (Carter and Rogers, 2007; Linton et al, 2007; Markley and Devis, 2007; Pagell and Wu, 2011; Carter and Easton, 2011; Gopalakrishnan, 2012) and company's competitiveness (Skinner, 1978; Nakane, 1986;Hallgren et al, 2010; Hendry, 2010; Richardson and Snaddon, 2011; Lambert and Schwieterman, 2012; Carvalho et al, 2012) have been carried out, there is no research that empirically identify the drivers and the inhibitors of sustainability and the impacts of sustainability on organisational competitiveness.Thus, this exploratory research is undertake to examine the drivers and the inhibitors of sustainability and the impacts of market driven sustainability on organisations' competitive objectives.

Survey by questionnaire was undertaken. Datawas collectedto provide answers to research questions and to test the relationships between constructs highlighted in the conceptual model in chapter four. To reduce error and enhance validity of results, right procedures of survey design, administration and data analyses were upheld (Kumar, 2005; Bryman and Bell, 2007; Creswell, 2012; Robson, 2012).

5.2: Questionnaire Outlay

In designing questionnaire for this research, total design method (TDM) was adopted which was explained in chapter four (Questionnaire design). Survey instrument (questionnaire) attached in Appendix 2 consists of twenty eight (28) questions. The breakdowns of the sections are:

Section A: Company background information

Section B: Level/aggregate of sustainability practices

Section C: Source of sustainabilityinformation

Section D: Environmental sustainability variables

Section E: Social sustainability variables

Section F: Drivers and inhibitors of sustainability

Section G: Sustainability strategies implemented

Section H: Competitive priorities

Section I: Others

Section A: Gives account of demographic characteristics of responding companies. Background information covers question 1 to question 8, which includes data on name and address of responding companies, rank of the respondents, date of the establishment of the company, work flow process, number of workforce, type of the companies, annual turnover and main product line of the company.

Section B: Deals with questions on sustainability investments and sustainability reporting. This section covers from question 9 to question 16. Questions in this section seek to collect information on level of sustainability practices in responding organisations such as, sustainability investment, previous investments (five years) and planned investments (five years) on sustainability practices, period companies taken to recoup their sustainability investments, length of time sustainability strategieshave been adopted in the companies, selection of sustainability indicators, functions of sustainability indicators and sustainability reporting systems. The literature on sustainability suggests the need for companies to make long term investments on sustainability (Gray, 1994 cited in Carter and Rogers, 2008; Nidumola et al, 2009; Yusuf et al, 2012) as well as assess and report their progress on sustainability performance regularly (Guy and Kilbert, 1998; Henri and Journeault 2008; Krajnc and Glavic, 2003; Delai and Takahashi, 2011).

Section C: Deals with sources of sustainability information. This part consists of questions 17 and 18. Various sources of information were provided for respondents to indicate which source of information provided their companies with data on sustainability. The sources provided include specialist trade press, fairs and shows, business press, internet, informal contact, seminars and conferences.

Section D: This section solicited to obtain information on environmental sustainability practices. This section covers question 19 and question 20. Question 19 attempts to discover what the organisations are doing to preserve and protect environment. This question has eight environmental concerns that organisations are expected to address and improve through their operations; the variables includes: environmentally friendly production processes, wastes reduction, free emission production system, using renewable resources in production, reuse of scrap materials in production, reuse of defective end products in production, using ecological guidelines in outsourcing and employee engagement on environmental programmes.Sustainability literature intensively expresses the necessity for organisations to protect and preserve environment for the survival of the present and future generations (Redclift, 1987;Goodland, 1995; Noorman, 1998;Wheeler, 2004; Shrivastava, 2010).

Section E: This section deal with social sustainability variables. Question 20covers the organisation's activities toward improving social wellbeing of general society. The question has ten concerns aim at collecting information on social performance of the responding companies. The social sustainability variables includes: internal code of conduct, fair employment from the immediate local community, provision of health and safety facilities, investment in infrastructural facilities, payment of taxes, support government revenue transparency, ethical business and trading, investment in poverty alleviation programme, endowment to local symphony and participation on regional and cross regional development initiatives. Literature on sustainability gave little consideration on social sustainability performance (Colantonio, 2008; Presley et al, 2007; Faber et al, 2010).

Section F: This portion of the questionnaire seeks information on drivers and inhibitors of sustainability. The section consists of questions 21 and 22 respectively. Question 21 deals with drivers of sustainability while question 22 deals with inhibitors of sustainability. Alternative drivers of sustainability were provided for the respondents to indicate their motives for adopting one sustainability strategy or another; also provided, were alternative inhibitors of sustainability for the responding companies to specify what discourages their company from adopting sustainability. The literature of sustainability maintains that there are variety of drivers and barriers that influence/affect organisations in their efforts to adopt sustainability (Haake and Seuring, 2009; Diabat and Govindan, 2010; Walker and Jones, 2010; Giunipero et al, 2012; Wu et al., 2012).

Section G: This segment of the questionnaire search for data on sustainability strategies that responding firms implemented or that is currently implementing. It covers questions 23 and 24 and 25 respectively. Question 23 comprised information on types of sustainability strategies (process-driven sustainability or market-driven sustainability strategies) implemented. Respondents can choose as many strategies as possible as their firm had implemented. Question 24 demanded information on financial impacts of sustainability strategies implemented by the responding firms. That is whether sustainability strategy adopted leads to positive impacts on revenue or lead to a significant investment

(Wheeler1992; Stead and Stead, 1995; Gopalakrishnan et al, 2012). Question 25 seeks data to examine how sustainability improved the organisational competitiveness.

Section H: Deals with competitive priorities in manufacturing operations. It consists of questions 26. Question 26 seeks to discover whether sustainability implementation leads to improved company's competitiveness. Sustainability literature maintains that there is a correlation between sustainability and competitive advantages (Kleiner, 1991; Gladwin, 1992; Hart, 2000; Linton and Davis, 2007).

Section I: Consist of two questions, question 27 ask whether the company will participate in case studies and question 28 provides an opportunity for respondents to comment freely and generally on sustainability practices in organisations.

5.2.1: Questionnaire Administration and Response Rates

Table 5.1 shows questionnaire administration and response rate:

Table 5.1: Response Rates across Business Sector

Business Sectors/ Major Product Line	**Sample**	**Rate %**	**Response**	**Rate %**
Exploration and production	125	22.7	36	28.8
Bases, Logistics, Catering, Transport, Storage and Allied services	25	2.7	9	36
Consultation including geographical services	45	8.2	17	37.8
Automobile and automotive assembly and accessories	40	7.3	10	25
Engineering services (reservoir, drilling, well engineering, facilities engineering)	85	15.5	22	25.9
Marine, subsea services and allied services	130	25.4	43	33.1
Electrical and electronic equipment, components and allied products	100	18.2	25	25
Others (please specify)	0	0	0	0
Total	**550**	**100**	**162**	**29.5**

Table 5.1 shows wide spread of response among business sectors or product groups. It can be observed that there is no bias in demographic composition of responses. After observing spread of responses among business sectors, the next section gives an account of statistical analysis undertaken on the data. The analysis forms the basis for validation to be carried out to answer research questions and to test relationships between constructs of the research. Table 5.1 shows number of questionnaires sent to each business sector, response rate and useable percentage rates per business sector of the 550 companies studied.

A total of five hundred and fifty questionnaires (550) were posted toaddresses of respondents taken from Pegasus energy database and Subsea oil and gas directory of oil companies. 550 companies were sampled and posted questionnaires, 162 responded to the survey, giving a response rate of 29.5%. This response rate is considered representative of studies on oil and gas industry in the UK. Out of 162 questionnaires returned, 112 were fully completed with logical answers. These 112 were accepted as usable for this research. A total of 50 questionnaires were rejected based on the fact that the questionnaires were either partially completed, returned uncompleted, returned with comment that ‘it doesn’t relate to our businesses or the respondents change addresses.

5.3: Statistical Results

The responses to the survey were inputted into SPSS® version 21 for windows so as to carry out statistical analysis of the data collected from the questionnaire administered. The SPSS software tool enables computation of frequency, means, standard deviation of the data collected from the study. It as well enables detailed statistical analysis such as correlation analysis of the data between the various classification of the research theme to test for association or differences among the responding organisations to the study.

5.3.1: Normality Assessment:

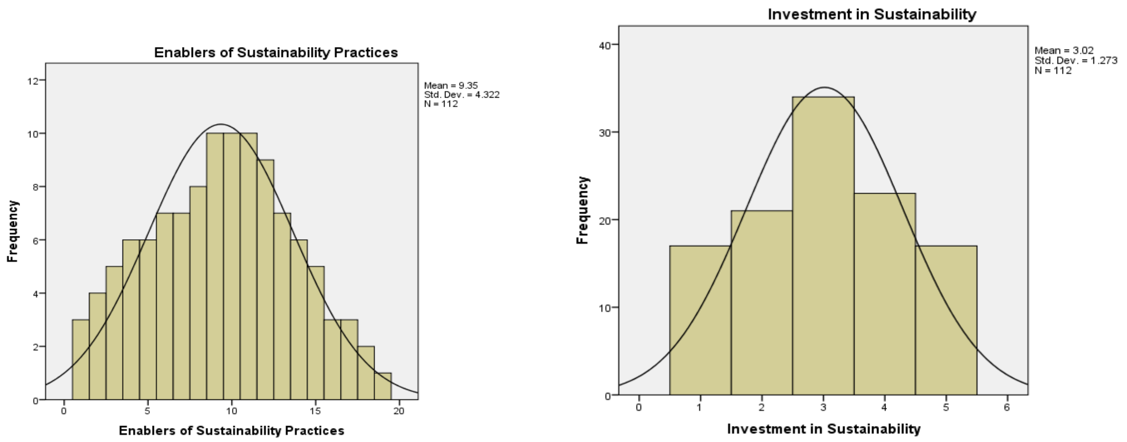
Before statistical analysis is conducted, it is a pre-requisite to assess the characteristics of distribution of the data to determine whether the variables are normally distributed. That is whether the distribution of scores on dependent variable is ‘normal’ (Pallant, 2010). Normal is used to describe a symmetrical, bell-shaped curve, which has highest frequency of scores in the centre with smaller frequencies at the ends (Gravetter and Wallnau, 2004). There are many methods of exploring the assumption of normal distribution in a data set, these includes:

Histogram, Box plot, Normal distribution plot and Detrended normal plot. Other methods are Kolmogrov–Smirnov (K-S) statistics with a Lilliefors significance level and the Shapiro-Wilk statistic, measure of Skewness and kurtosis. The most commonly used method in SPSS are ANALYZE and EXPLORE menu, EXPLORE procedure is most commonly used especially when graphs and statistics are required concurrently. In this research, normality of the data set was tested using Kolmogrov–Smirnov (K-S) statistics with Lilliefors significance level and Shapiro-Wilk statistic, histogram, normal Q-Q plots; Detrended normal plot, box plot, Skewness and kurtosis were used.

5.3.1.1: Histogram

The actual shape of the distribution for drivers of sustainability, sustainability, sustainabilityinvestment, sustainability reporting systems and company size by the number of workers were presented in the histograms below.

Figure 5.1: Histograms



The histograms show the scores were reasonably normally distributed. Nevertheless, assessment of other characteristics is necessary so as to conclude on type of the distribution. The histograms were further supported by normal Q-Q Plot below.

5.3.2: Non Response Bias

Since 1838 non response bias became a concern for researchers who employed mail questionnaires (Lambert and Harrington, 1990); because response rates to mail surveys is always very low (Saunders et al, 2009). A survey's response rate is an indirect indication of the degree of non-respondent bias. It may be easy to measure response rates; but it is difficult to identify bias (Asch's et al, 1997). 'Non response bias is the difference between the answers of non-respondents and the respondents' (Lambert and Harrington, 1990, p. 5). Nonresponse bias exists when respondents to a survey are different from those who declined to respond. It is a condition in which people who doesn't return questionnaire may have opinion that is different from the opinion of those who return the questionnaire (Sax et al, 2003). Nonresponse can either be total, where individuals failing to return the questionnaire at all or unit/item nonresponse, where the survey instrument was returned incomplete (Fraenkel and Wallen, 1993). This study focuses on total non-response bias, because there was no case of unit nonresponses in this research. Estimating nonresponse is challenging given that, in most cases, the identity of non-respondents is not known (Dey, 1997); when composition of the non-respondents is significantly different from the respondent group on characteristics of interest to the study (Lambert and Harrington, 1990). 'While some authorities insist on limiting the non-response rate to 5%, others would recommend a maximum of 20%. In practice, however, conclusions are often based on data obtained from less than 80% of the population followed. Clearly, an 'acceptable' or 'conventional' level of response cannot be generalised. Depending on the nature of the study and the event under investigation, even a small amount of bias may distort the results' (Sheikh and Mattingly, 1981, p. 295-296). Nonresponse bias is a function of how correlated response propensity is related to the attributes the researcher is measuring. In one survey, different sample estimates can be subject to different nonresponse biases (Groves, 2006).

Nonresponse bias is estimated based on any or all of the following motives (Armstrong and Overton, 1977).

1. Reanalysing previous surveys: if the survey was carried out long time ago, the only way to treat its nonresponse bias is to appraise its effects. With the establishment of data archives, the reanalysis of survey data is likely to increase in popularity.

2. Saving money: 'efforts to obtain higher response rate cost time and money, especially as the percentage of responses increase' (Lambert and Harrington, 1990, p. 6). If it is possible to estimate the nonresponse bias, it might be more economical to accept a lower rate of return.

3. Saving time: if respondents are expected to change significantly in the near future (especially in marketing and political surveys), obtaining a high response rate may not be possible because it requires too much time. In such cases, it would be desirable to estimate the nonresponse bias.

4. Non-response bias can be a threat to the external validity of any study: if sampling procedure is used and less than 100% response rate is achieved, nonresponse bias may arise (Armstrong and Overton, 1977). To ensure external validity of research findings, statistically

sound and professionally acceptable procedures and protocols for handling non-response bias are needed and should be reported (Lindner et al, 2001).

While some scholars recommended that changes in nonresponse rates do not necessarily alter survey estimates (Richard et al, 2000; Daniel and Edelman, 2002); others maintained that, 'there is no safe level of response rates below 100%. However small the non-response, a possible bias as a result of it must be investigated' (Sheikh and Mattingly, 1981, p. 293), 'although, there is little empirical support for the notion that low response rate surveys de facto produce estimates with high nonresponse bias' (Groves, 2006, p. 670). Nonetheless, it is significant for any research to reduce non-response (Armstrong and Overton, 1977; Lambert and Harrington, 1990; Alreck and Settle, 1995; Groves, 2006). Achieving small nonresponse rate is more important than making adjustments for the nonresponse that occurs (Lambert and Harrington, 1990).

5.3.2.1: Measures of Handling Non Response Bias

There are many ways to handle the potential problems of nonresponse bias (Groves, 2006). Some of them include:

Estimating methods (extrapolation); using group consensus on the direction of the bias for selected items. Using statistical weighting techniques where the sample results are adjusted for nonresponse and comparing the composition of respondents to that of non-respondents on characteristics relevant to the study. If no significant differences are observed between the two groups, the absence of non-response bias is established. If significant differences are observed, caution should be taken on making conclusion, to account for the possible nonresponse bias (Lambert and Harrington, 1990).

Researchers might use any of the following five methods of estimating non-response bias, once appropriate follow-up procedures have been conducted: Ignore non-respondents; compare respondents to population; compare respondents to non-respondents; compare early to late respondents and 'double-dip' respondents (Miller and Smith, 1983).

Other methods of non-response bias estimation include: comparisons with known values for the population, subjective estimates and assessment of the efficacy of successive-waves extrapolation method (Armstrong and Overton, 1977).

According to Groves (2006) there are five methods of assessing nonresponse bias: compare respondents and non-respondents distributions on the subgroup variables; using right sampling frame data or supplemental matched data; comparison of similar estimates from other sources; studying variations within the existing survey (non-response follow-up studies and finally contrasting alternative post survey adjustments for non-response).

Sheikh and Mattingly (1981) argued that, researchers can use one of the following non-response bias estimation. First, the difference in outcome between early and late respondents may indicate non-response bias and its extent may be proportional to the delay in response. In many studies, the event under investigation has been found to occur more frequently in the last batch of responses (last questionnaires returned) than in early responses. On the basis of such a linear or curvilinear relationship between the delay in response and the frequency of outcome, it may be possible to predict the outcome in non-respondents. Second, make use of population characteristics. For example the difference between respondents and non-respondents in terms of age, sex and social class may indicate non-response bias. In these methods, certain assumptions are made. In the former, response behaviour is assumed to be a function of the outcome; in the latter, demographic or other basic characteristics are assumed to be causally related to the outcome.

Considering above discussion on non-responsesbiasestimations, the most common and standard way to test for non-response bias is to compare the responses of those who return the first mailing of a questionnaire to those who return the second mailing. The two groups were compared on their responses to the likert scale questions using t-test. Those who return the second questionnaire are, in effect, a sample of non-respondents (to the first mailing) and are assume that they are representative of that group (Sheikh and Mattingly, 1981; Stinchcombe et al, 1981; Smith, 1983; Hutchinson et al, 1987; Connors and Elliot, 1994; Armstrong and Overton, 1977; Lambert and Harrington, 1990; Johnson et al, 2000). The successive-waves method is an extrapolation method designed to estimate, rather than to measure non-response bias. If significant differences are noted in the means for the successive-waves, the degree and direction of the bias can be estimated. If the means for the successive-waves are statistically equal for study variables, it can be concluded that non-response bias does not negatively impact the dataset, the results of the research can be generalised to different research set-ups from the one originally studied (Miller and Smith, 1983; Lindner et al, 2001; Creswell, 2011). That is, when the same research instrument is administered to a different sample from the same population it should give similar results (Wisner, 2003).

To test non-response bias inthis research, a test for statistically significant differences in the responses of early and late waves of returned surveys was conducted. The last wave of the surveys received was considered to be representative of the non-respondents. T-tests are carried out on the responses of the two waves. The result of the t-test is shown in table 5.4 below.

5.3.3: Validity and Reliability Analysis

Forza (2002) noted that without assessing reliability and validity of the research, it will be difficult to account for the effects of measurement errors on theoretical relationships that are being measured.Reliability and validity ascribe to secondary data are functions of the methods by which the data were collected and the source. For all secondary data, a detailed assessment of validity and reliability involve an assessment of method or methods used to collect data. Validity and reliability of collection methods for survey data will be easier to assess where a clear explanation of the instrument used to collect the data are given, which will usually be a questionnaire (Saunders et al, 2009).

5.3.3.1: Reliability

Since the data for this research was derived from scaled responses it is necessary to assess the reliability of the scales (Tracey et al., 2005). Having confirmed statistically the questionnaire data is free of random effects, reliability tests were conducted as a measure of the internal consistency of instruments employed. For instruments measuring a concept to be reliable, they should be correlated. Reliability is the extent to which the data collection techniques or analysis procedure will yield consistent findings (Saunders, 2009). Reliability is a test of how stably and consistently a measuring instrument taps the variables, model or theory it is measuring. That is whether two or more observers or the same observer on separate occasions, observing the same event achieve the same results (Sekaran and Bougie, 2013). It is concern with the extent to which, without bias (error free) the measure ensures consistent measurement across time and across various items in the instrument (Pallant, 2010).

Stability of Measures: This is the ability of a measure to remain the same over time despite uncontrollable testing conditions or state of respondents themselves is indicative of its stability and low vulnerability to changes in the situation. This shows its ‘goodness’ because the concept is stably measured no matter when it is done (Sekaran and Bougie, 2013). Stability of an instrument can be analysed using test-retest reliability and parallel-form reliability. In this research these two tests were not done because of shortages resource and time.

Internal Consistency of Measures: Thisis the degree to which the items that make up the scale are measuring the same underlying attribute (Pallant, 2010). It is an indicative of similarity of the items in the measure that taps the construct. In other words, the items should 'hang together as a set' and be capable of independently measuring the same concept so that the respondents attain the same overall meaning to each of the items (Sekaran and Bougie, 2009). This can be seen by examining whether the items and subsets of items in the measuring instrument are correlated (Sekaran and Bougie, 2013). Internal consistency can be analysed through inter-item reliability and split-half reliability tests.

The most commonly used statistic in measuring internal consistency is Cronbach's coefficient alpha (Flynn et al., 1990; Pallant, 2010; Sekaran and Bougie, 2013). Cronbach's alpha is a reliability coefficient that shows how well the items in a set are positively correlated to one another (Sekaran and Bougie, 2009). Cronbach's alpha values range from 0 to 1, the closer Cronbach's alpha is to 1, the greater the internal reliability. While different levels of reliability are required, depending on the nature and purpose of the scale (Pallant, 2010). In general, reliabilities less than 0.60 are considered to be poor, those in the 0.70 range, acceptable and those over 0.80 good (Sekaran and Bougie, 2013). Swafford et al. (2006) report that Cronbach's alpha at 0.70 or higher is typically used to establish reliability of a construct. However, in a broadly defined constructs 0.6 Cronbach's alpha are acceptable (Forza, 2002). When there are a small number of items in the scale (fewer than 10) Cronbach's alpha value can be quite small (Pallant, 2010).

In this research reliability tests were conducted for the main measures of the research instrument, which include the entire questionnaire, demographic characteristics, social components, environmental components, competitive objectives, source of sustainability information and Sustainability strategies.

Table5.2: Cronbach's AlphaCoefficient Reliability Test

Focus of Tests	Cronbach's Alpha	Number of items
Entire questionnaire	.747	78
Demographic data	.689	2
Social components	.726	10
Environmental components	.634	8
Competitive objectives	.838	14
Source of sustainability information	.653	6
Sustainability strategies	.634	9

Table 5.2 shows the Cronbach's alpha for the competitive objectives is .838 consisting of 14 variables, overall scale of the survey instrument consisting of 78 variables was found to

be .747 and social sustainability components have .726 with 10 variables. The remaining constructs have .6 respectively. This result portrays that the scale instrument of this research is reasonably reliable.

5.3.3.2: Validity

Validity of a research instrument assesses the extent to which the instrument measures what it is designed to measure (Saunders et al, 2009; Sekaran and Bougie, 2009; Robson, 2011). Validity requires research instrument (questionnaire) to correctly measure the concepts under the study. Validity involves collection of empirical evidence concerning its use (Pallant, 2010). It deals with whether the findings are really around what it purports to measure. The concern is whether we measure the right concept or not. Validity is concern about the authenticity of the cause-and-effect relationships (internal validity), and their generalizability to the external environment (external validity) (Sekaran and Bougie, 2013). In this research, the concern is on the validity of the measuring instrument (questionnaire). That is, when we ask a set of questions (develop a measuring instrument) we hope we are tapping the concept (Saunders et al, 2009). The main types of validity are content validity, criterion-related validity and construct validity (Pallant, 2010).

Content Validity**:** This refers to the adequacy with which a scale has sampled from the intended universe or domain of content (Pallant, 2010). This test ensures that the questionnaire includes adequate set of items that tap the concept. The more the scale items represent the domain of the concept being measured, the greater the content validity (Sekaran and Bougie, 2009).

Criterion-Related Validity: This deals with relationship between scale scores and some specific measurable criterion. It tests how the scale differentiates individuals on a criterion it is expected to predict (Pallant, 2010). This can be established by testing the power of the measure to differentiate individuals who are known to be different (Sekaran and Bougie, 2009). Criterion-related validity is divided into concurrent validity and predictive validity.

Construct Validity: This validity involves testing a scale in terms of theoretically derived hypotheses concerning the nature of underlying variables or constructs. Construct validity is explored by investigating its relationship with other constructs, both related (convergent validity) and unrelated (discriminant validity) (Pallant, 2010). This kind of validity attests how well the results obtained from the use of the scale or measure fit with the theory around which the test is designed (Sekaran and Bougie, 2009). It is assessed through convergent validity and discriminant validity (Sekaran and Bougie, 2009).Therefore, any research measurement scale should have external validity.

In this research validity was enhanced through, First, the scales were derived from exhaustive literature review of the core issues addressed in the research. Second, a guiding conceptual framework was proposed on which research variables were specified. Third, completed questionnaires were scrutinised for consistency and fullness prior to data analysis. Accordingly the instrument can be judged to be of sound construct validity. More so, wave analysis was used to analyse the validity of the survey instrument. The questionnaire was divided into two groups. Based on the two groups of the questionnaire, validity analysis was conducted by comparing the variance of the attributes of the questionnaire. The principle of wave analysis is, the first group of the returned questionnaires are representative of those willing to participate in the study while the second group to return the questionnaires are representative of the non-responding organisations. The wave analysis is based on the fact that non-respondents will still not respond to a summarised questionnaire.

Table 5.3: Two-Wave Analysis of External Validity

Variables	1st wave	2nd wave	2 tail sig.	df	Levene's test
Company size by number of employees	2.68	2.91	.747 .392	27 31	.215
Company size by sales Turnover	2.59	2.41	.266 .663	27 31	.660
Competitive objectives	4.19	4.22	.637 .666	27 31	.655
Social sustainability	2.89	2.98	.447 .458	27 31	.414
Source of knowledge	2.47	2.63	.428 .454	27 31	.302
Environmental Sustainability	2.76	2.92	.576 .410	27 31	.435
Recouping sustainability investment	2.81	2.79	.338 .703	27 31	.767
Sustainability and competitiveness	2.19	2.13	.844 .504	27 31	.239

Table 5.3 shows the results of the wave analysis between the early and late respondents to the survey as a proxy of non-response bias associated with the study respondents. The attributes measured in the wave analysis were demographic characteristics, social dimensions of sustainability, environmental dimension of sustainability, investments on sustainability and source of sustainability information. As shown in Table 5.3, the two tailed significance values

are all greater than 0.1 for all the characteristics measured. Thus, the null hypothesis that there is no significant difference between mean values of the two waves of responses cannot be rejected.Additionally Levene’s test for the equality of variance of the measured characteristics between the early and late respondents is presented in Table 5.3. Levene’s test examines the assumption of equality of variance between two groups. Levene’s test indicates that the two variances are not significantly different (if the significance level is greater than .05). Based on the first and second wave means, two tailed significance and the Levene’s T-test in Table 5.3 the questionnaire can be considered to have a high level of validity. The null hypothesis that there is no significant difference between the non-respondents and those that responded to the study cannot be rejected.

5.3.4: Descriptive and Distribution Statistics of Research Variables

A measure of descriptive and distribution statistic is another normality technique. It is conducted to satisfy the ‘assumptions’ made by the individual tests. Assumptions testing involve obtaining descriptive statistics of the selected research variables. Descriptive statistics include range of scores, mean, standard deviation, Skewness and kurtosis (Pallant, 2010). Skewness value provides an indication of symmetry of the distribution while kurtosis provides information about the ‘peakedness’ of the distribution; if the distribution is perfectly normal, Skewness and kurtosis value of ‘0’ is obtained (an uncommon occurrence in social sciences) (Pallant, 2010).

Positive Skewness values indicate positive skew while negative Skewness values indicate clustering of scores at the right hand side of a graph (at the high end). Positive kurtosis values indicate the distribution is clustered at the centre (peaked), with long thin tails. Where kurtosis value is below 0, it means the distribution is relatively flat (too many cases at extreme) (Pallant, 2010).

Table 5.4 shows that majority of the variables have positive Skewness and kurtosis, with few negative Skewness and kurtosis values. This does not necessarily indicate a problem with the scale, but rather reflects the underlying nature of the construct being measured (Pallant, 2010). Where the sample is relatively large, Skewness will not make a substantive difference in the analysis.Kurtosis can result in an underestimate of the variance, but this risk is also reducing with a large sample (Tabachnick and fidell, 2007). Table 5.4 denotes that the distribution can be considered as normal. From the normality analysis conducted in figure

5.1,it can be concluded that the data set satisfies the requirement for normal distribution, that the sample was drawn from a population that is normally distributed

Table 5.4: Descriptive and Distribution of Research Variables

Research variables		Min	Max	Mean	Std. dev.	Skew	Kurtosis
Demography	Company size by number of employees	1	5	2.97	1.189	.020	-.795
	Company annual turnover (£ millions)	1	6	3.08	1.330	.108	-.746
	Principal business sector	1	8	4.52	1.464	-.009	.550
Drivers of sustainability		1	19	9.35	4.322	.010	.678
Inhibitors of sustainability		1	9	4.80	1.940	-.109	.493
Assessment	Indicators of sustainability	1	5	3.01	1.095	.024	-.216
Reporting	Sustainability reporting systems	1	8	4.04	1.755	-.077	-.451
Competitive priorities	Speed	1	5	2.53	.920	.097	-.178
	Cost	1	4	2.31	.860	.211	-.551
	Delivery	1	5	2.37	.880	.418	.282
	Innovation	1	5	2.14	.919	.704	.472
	Proactivity	1	5	2.21	.885	.359	-.153
	Quality	1	4	2.39	.702	-.087	-.272
	Flexibility	1	4	2.30	.837	.127	-.554
	Dependability	1	4	2.32	.713	.199	-.076
	Customisation	1	5	2.32	.819	.142	.042
	Turnover	1	5	2.32	.858	.455	.056
	Net profit	1	5	2.09	.833	.781	.345
	Market share	1	5	2.32	.762	.252	.509
	Customer loyalty (repeat order)	1	5	2.33	.740	.469	.866
	Performance relative to competitors	1	5	2.33	.752	.145	.474
Environmental sustainability	Environmental friendly production process	1	5	1.96	.606	1.008	.153
	Looking for ways to reduce wastes	1	3	1.81	.546	-.094	-.013
	Emission free production	1	4	1.87	.561	.276	.516
	Uses renewable resources in production	1	5	2.04	.643	.797	.288
	Reuses scraped materials	1	5	1.85	.573	-.001	-.089
	Reprocesses defectives end products	1	4	1.98	.600	.516	.670
	Uses ecological guidelines in outsourcing	1	4	1.83	.628	.364	.464
	Employee environmental training	1	4	1.94	.634	.266	.327

Table 5.4(continues)

Social sustainability	Use internal code of conduct	1	5	1.83	.656	1.165	.668
	Fair and equitable employment from the locality	1	4	1.93	.625	.275	.444
	Provision of health and safety facilities in the company	1	4	1.89	.526	.253	2.331
	Investment in infrastructural facilities	1	4	1.90	.600	.292	.842
	Payment of taxes and levies to government	1	3	1.82	.557	-.049	-.054
	Support government revenue transparency	1	3	1.85	.449	-.647	1.103
	Ethical business through trading	1	3	1.98	.553	-.010	.363
	Investment in poverty alleviation programme	1	3	1.79	.602	.117	.418
	Endowment to local symphony	1	4	1.91	.637	.289	.300
	Regional and cross regional development initiatives	1	3	1.76	.524	-.215	-.218
Market-driven Sustainability strategies	Introduced environmentally sensitive products	1	6	3.95	2.31	-.318	-1.834
	Designed existing products to be more environmentally sensitive	1	6	4.00	2.106	-.212	-1.848
	Entered new environmentally oriented markets	1	6	4.75	2.038	-1.104	-.657
	Designed packaging to be more environmentally sensitive	1	6	5.05	1.790	-1.473	.369
	Advertising the environmental benefits of the products	1	6	4.65	1.990	-.882	-1.102
	Sold donated materials once discarded as wastes	1	6	5.28	1.555	-1.835	1.623
Process- driven sustainability strategies	Redesigned production process for environmental reasons	1	6	5.43	1.347	-2.266	2.707
	Resigned pollution controls, waste disposal and water/air treatment process	1	6	5.01	1.773	-1.445	.411
	Used recycled materials from outside sources in production	1	6	5.43	1.334	-2.199	2.481
	Recycled scrap materials once considered waste in production	1	6	5.38	1.472	-2.262	-1.388
	Recycled defective end products in production process	1	6	5.43	1.431	-2.462	-1.761
	Used renewable energy source in production	1	6	5.40	1.398	-2.282	-1.621
	Used renewable resource in production	1	6	5.57	1.096	-2.670	-1.367
Sustainability practices	Adoption: Implementation of sustainability measures	1	5	3.24	.797	.463	.989
	Length: Duration of sustainability implementation	1	5	2.97	1.078	.010	-.400
	Investment: Investment in sustainability	1	5	3.02	1.273	-.034	-.955
Recouping	Recouping sustainability investments	1	5	2.81	1.234	.072	-.704
Sustainability leads to competitiveness		1	5	2.19	1.036	1.150	1.126

5.4: Profile Characteristics of Respondents

Table 5.5 specifies core of demographic features of survey respondents that includes size of organisations measured by number of employees and by annual turnover (£m), designation of respondents, production process flow, types of companies and principal business sectorsof responding firms.

Table 5.5: Respondents Profile

Criteria	**Per cent**
Size of company by number of employees	
Up to 50	12.5
51 – 200	22.3
201 – 500	32.2
501 – 2000	21.4
Above 2000	11.6
Total	**100**
Size of company by annual turnover (£M)	
Up to £10m	14.3
11 - £50m	19.6
51 - £100m	28.6
101 - £500m	21.4
501 - £1b	13.4
Above £1b	2.7
Total	**100**
Respondents designation	
Supply chain management/Director	18.2
MDs, CEOs and or Directors	56.1
Procurement/Purchasing management	18.0
Others (please specify)	7.7
Total	**100**

5.4.1.1: Company Size by Number of Employees

Table 5.5shows 32.2% of sampled organisations have 201 to 500 employees, 22.3% of responding companies had 51 to 200 workers and 21.4% have 501 to 2000 workers. This result shows that majority of the responding companies were large scale companies with a range of respondents across small and medium size enterprises (SMEs). 66.2% of the responding companies were large scale companies whilst 33.9% of the respondents were SMEs enterprises.

5.4.1.2: Company Size by Annual Turn Over

The result of company annual turnover in table 5.5 shows that 28.6% of responding firms' have an annual turnover rate of £51m to £100m, 21.4% respondents have £101m to £500m and 19.6% have annual turnover of £11m to £50m respectively. Based on the European Union definition of SMEs, 63.4% of the responding firms of this research were large scale firms. European Union (2003) defines SMEs as those firms who have less than 250 employees with an annual turnover not exceeding 50 million Euros (www.euresearch.ch). Additionally, the literature maintains that possibly only large scale companies may be able to adopt sustainability because of the cost implication of sustainability practices.

5.4.1.3: Respondents Designation

Table 5.5 shows that Managing Directors (MDs), chief executive officers (CEOs) or Directors constitute majority at 56.1% of the total responding firms.Supply chain managers/Directors constitute 18.2% whilst procurement/purchasing managers comprised 18% of total respondents. The target respondents of this research were the CEOs of oil and gas companies. The researcher target CEOs because sustainability practices is a managerial decision that only CEOs can give precise information. Therefore, the result satisfied the researcher's requirements on target respondents.

5.4.1.4: Production Processes Flow

Table 5.5indicates that majority of the responding companies are using project production process at 45.5%; followed by those organisations using a combination of two or more production processes at 16.1%; continuous production process have 15.2% of total respondents. Equally, a number of organisations utilise mass production, jobbing and batch production process. The result indicated that most of the respondents are core oil and gas companies since majority of oil and gas companies use project production process in their production system. This result corresponds with engineer-to-order manufacturingprocess, where project and jobbing production process are dominant process capabilities of organisations involved with complex products and systems (Hicks et al, 2000).

Table 5.5: Respondents Profile (Continues)

Criteria	Per cent
Production processes Flow of Responding Organisations	
Batch	5.4
Continuous	15.2
Project	45.5
Two or more processes	16.1
Mass production	9.8
Jobbing	8.0
Total	**100**
Forms of business ownerships	
Sole proprietorship	10.7
Partnership	10.7
Public limited liability company (PLC)	31.3
Private limited liability company (LTD)	42.9
Private unlimited liability company	4.5
Total	**100**
Principal Business Sectorsof the respondents	
Bases, logistics, catering, transport, storage and allied services	3.6
Automobile and automotive assembly, parts, components and accessories	4.5
Electrical and electronic equipment, components and allied products	11.6
Engineering services (reservoir, drilling, well engineering, facilities engineering)	28.6
Exploration and production	33.0
Consultation including geological services	9.8
Marine, subsea services and allied services	5.4
Others (please specify)	3.5
Total	**100**

5.4.1.5: Forms of Business Ownerships

Table 5.5 displays majority of respondents are private limited liability companies (LTDs) 42.9%, followed by public limited liability companies (PLCs) 31.3%. Similarly, limited numbers of organisations are sole proprietorships, partnerships and private unlimited liability companies.

5.4.1.6: Principal Business Sectors of the Respondents

Table 5.5 displays that organisations in exploration and production sector are most represented at 33 %, followed by companies operating under engineering services (reservoir, drilling, well engineering and facilities engineering) 28.6%. Organisations involved with electrical and electronic equipment, components and allied products constitute about 11.6%. Additionally, companies that operate under other business sector which were not specified in the questionnaire were 3.5% of responding firms. These companies include suppliers of hired oil field equipment, chemicals, equipment service/maintenance and manufacture, environmental consultancy, wholesale, operations and construction. The results of the types of companies and the principal business sectors in table 5.5 shows the diverse nature of oil industry, which is characterised by a collection of companies with diverse background and nature (Crabtree et al, 2000; Yergin, 2008; Garbie, 2011; Schweitzer, 2011). Tables 5.4 and 5.5signify that this survey is representative in terms of size (number of employees and annual turnover), designation of respondents, production process, formsof business and principal business sectors of respondents.

5.5: Statistics Findings

Descriptive statistic is a set of brief graphic coefficients that summarize a given data set which represents either an entire population or a sample. Such summaries may be either quantitative (summary statistics) or visual, i.e. simple-to-understand graphs. Such as frequency tables, histograms, bar charts and pie charts (Robson, 2011). Even when data analysis draws its main conclusions from inferential statistics, descriptive statistics can also be presented (Pallant, 2010). Measures that describe data set are measures of central tendency and measures of variability or dispersion. Measures of central tendency include mean, median and mode while measures of variability include range, mean deviation and standard deviation (variance), minimum and maximum (Creswell, 2011; Robson, 2011). Summaries may either form foundation of initial description of data for further inferential statistics or they may be sufficient in and of themselves for particular investigation. The following section presented the research questions proposed in this research.

5.5.1: Research Questions

The research questions of this study include:

1. What are the most important drivers and inhibitors of sustainability in the oil and gas industry?

2. What is the level of sustainability practices in the oil and gas industry?

3. What types of sustainability strategies have been implemented in the oil and gas industry?

4. What are the revenue and investments implications of sustainability strategies of the oil and gas companies?

5. What is the overall impact of sustainability implementation on the competitiveness of the oil and gas companies?

5.5.2: Sustainability Practices in Oil and Gas Industry in the UK

Existing literature maintained that adoption of sustainability initiatives can reduce the environmental and social destruction (Daly and Cobb, 1989; Costanza, 1991; Meadows et al, 1992; Hardin, 1993; Goodland, 1995; Noorman, 1998). Some of the previous researches were committed on historical development of sustainability (Kidd, 1992; Wheeler 2004; Du Pisani, 2006; Ricketts, 2010). Still some others are on how sustainability leads to increase in the market value of the company stocks(Bose and Pal, 2012) while some other writers focussed their attention on the drivers and barriers of sustainability (Mann et al, 2010; Muduli et al, 2012; Dashore and Sohani, 2013). Many others devoted their contribution to literature on green/sustainable supply chain management (Carte and Rogers, 2007; Linton et al, 2007; Wagner, 2010; Carter and Easton, 2011; Gopalakrishnan et al, 2012). Additionally, the literature has also given relative attention to sustainability integration into companies supply chains. Increased awareness of ecological impacts of industrial growth; resources supply reduction and change in consumer behaviour led to the growth of sustainability practices in manufacturing companies (Wagner and Svensson, 2010). Carter and Rogers (2008) model how sustainability relates to supply chain management and explain the relationships between environment, economics and social performance within the supply chain context. Pagell and Wu (2009) developed a model of elements necessary to create sustainable supply chain and

Wassenhove and Guide (2009) demonstrated how profitability could be obtained by organisations through sustainable supply chain. Few empirical studies in literature that specifically analysed sustainability implementation in manufacturing companies are: UK oil and gas supply chain: an empirical analysis of adoption of sustainability measures and performance outcome (Yusuf et al, 2012); An empirical study of green supply chain management among UK manufacturers (Holt and Ghobadian, 2008) and an empirical investigation of sustainability implementation in industrial organisations (Stead and Stead, 1995). This according to many evidently creates severe deficiency of empirical studies on sustainability (Sarkis et al, Yusuf et al, 2012).

Markeley and Davis (2007) maintained that substantial competitive advantage can be created by firms through sustainable supply chain. But there is no empirical evidence in support of this, as important as it is. This research provides empirical investigation on sustainability implementation in oil and gas industry with link to competitive advantage. The research proposed a conceptual model for improving competitive efficiency of oil and gas industry supply chain through sustainability implementation. The research is different from previous studies in this area as it explores the notion of market driven sustainability by seeking to establish an empirical links between sustainability implementation and organisational competitiveness. The research provides a new insight for the first time on the foundation of market driven sustainability and market justification for sustainability practices. The data was collected from oil and gas companies with the aim of documenting the drivers and inhibitors of sustainability; level of sustainability implementation in oil and gas industry and the impacts of sustainabilityimplementation on the companies' competitiveness. The findings of the studyare presented in succeeding sections.

5.5.3: Drivers of Sustainability

Drivers of sustainability were multiple and complex. At the heart of these were ecological motives; conserving energy, conserving resources, reducing pollution and wastes were key considerations when implementing sustainability (Mann et al, 2010; Carter and Easton, 2011; Walker and Jones, 2012; Gopalakrishnan et al, 2012). Two of these drivers, conserving energy and resources primarily, involve process and decisions that occur at the input end of the production system. The other two, reducing wastes and pollution occur at the output end of the production processes. Drivers of sustainability were also reported to be economically motivated. That is, firms were motivated to implement sustainability because of revenue enrichment and/or cost reducing potential (Stead and Stead, 2005).

Table 5.6 demonstrates the drivers of sustainability in oil gas companies supply chain. These drivers include: environmental advocacy pressures, desire to conserve energy and desire to increase market share at 8.9% each respectively. Followed by competitive advantage 8%; desire to conserve resources 7.1%; others were urge to reduce carbon foot print, pollution reduction and desire to enhance revenue at 6.3% each respectively. 5.4% of responding companies adapt sustainability because of marketing pressures, investors' pressure and desire to reduce costs. Considering drivers of sustainability demonstrated in table 5.6, it can be observed that the drivers were combination of economic and environmental motives. This illustrates that the responding companies adopt sustainability to increase their competitiveness and concurrently improve their ecological performance (Moduli et al, 2012).

Table 5.6: Drivers of Sustainability

Variables	**per cent**	**Variables**	**per cent**
Legal/regulatory pressures	2.0	Desire to conserve energy	8.9
Desire to reduce waste	3.6	Desire to increase market share	8.9
Consumers pressure/consumer risk	4.5	Desire to improve competitiveness	8.0
Desire to reduce costs	5.4	Desire to reduce carbon foot print	6.3
Investors pressures	5.4	Pressures from markets	5.4
Desire to enhance revenues/profits	6.3	Sources of raw materials	4.5
Desire to reduce pollution	6.3	Desire to increase sales turnover	3.0
Desire to conserve resources/resources pressure	7.1	Desire to improve corporate performance	3.1
Environmental advocacy pressures	8.9	Desire to enter new markets	1.8
Others (please specify)			0.9
Total			**100**

The economic drivers empirically found in this research were:desire to improve competitive advantage, desire to enhance revenue, marketing pressures, desire to reduce cost and desire to increase market share respectively whilst the environmental drivers discovered were:environmental advocacy pressures, desire to conserve energy, desire to conserve resources, reduction of carbon foot print and pollution reduction. This means while attaining their economic objectives, oil and gas companies' simultaneously improve their environmental performance. This shows that successful integration of TBL, economic benefits could be gained through social standards and preserving the environment for the future generations (Johnson and Greening, 1999; Aras, 2002; Blackburn, 2007; Gopalakrishnan, et al 2012). Since organisational strategy and competitive advantage were rooted in capabilities that facilitate environmentally sustainable economic activity (Hart, 1995); there is a strong link between environmental consciousness and firm's competitiveness (Leal et-al, 2003).

Legal/regulatory drivers that exert the most perceived pressure on business organisations, which mirrors the findings of many studies (Stead and Stead, 1995; Holt and Ghobadian, 2009; Wang et al, 2011; Yusuf et al, 2012; Dashore and Sohani, 2013), were not among the drivers of sustainability in oil and gas companies in the UK. These shows that oil and gas companies in the UK were not enforced to adopt sustainability by legal/regulatory pressure, but were willingly motivated to implement sustainability in order to enhance their economic and environmental performance. By adopting sustainability willingly oil and gas companies may implement sustainability efficiently and effectively better than when they were force to implement.

5.5.3.1: Cross-Tabulation of Drivers of Sustainability of Company's Size

Table 5.7 shows that SMEs adopted sustainability in order to conserve energy, to increase market share, to conserve resources, investors pressure, environmental advocacy pressures, desire to enhance profit, desire to reduce cost of production, desire to improve competitiveness, desire to reduce wastes andlegal/regulatory pressures. Accordingly, large scale companies' adapted sustainability to increase market share, to increase profits, to conserve energy, to preserve resources and to increase competitiveness. This result shows that drivers of sustainability in SMEs and large scale in oil and gas companies were combination of both economic and environmental motives.

Additionally, one of the SMEs drivers of sustainability in SMEs is desire to reduce costs. This may be connected to the main inhibitor of sustainability in SMEs, that is higher costs of adaptation, because sustainability needs large capital expenditure to support the informational, green design, green manufacturing and green labelling of packaging, which may be lacking in SMEs (Presley et al., 2007; Mudgal et el., 2010; Mudili et al., 2013; Dashore and Sohani, 2013).

Hence, while SMEs adopted sustainability to minimise cost of production and to preserve the environment, large scale companies adapted sustainability to maximise competitivenessand to improve their environmental performanceso as to maintain their superiority in the market. Through pollution prevention, companies can realise significant savings resulting in decrease on cost relative to competitors (Romm, 1993; Markley and Davis, 2007). Conversely, the results for corporate environmental performance are in keeping with most of the existing literature on sustainability, which finds that efficiency gains as well as other factors such as risk reduction, cost reduction and resources conservation lead to direct positive effect on economic performance (Wagner, 2010)

Table 5.7: Drivers of Sustainability on the Company Size (Turnover)

Variables	Companies Annual Turnover					
	£1-10m	£11-50m	£51- 100m	£101-500m	£501-1b	Above £1b
Desire to reduce cost of production	16	4	9	4	6	1
Desire to increase profits	17	3	11	6	8	1
Desire to improve competitiveness	32	5	14	8	9	2
Desire to conserve energy	31	5	11	7	6	3
Desire to preserve resources	36	7	12	7	5	2
Desire to reduce pollution	13	6	7	8	8	1
Desire to reduce wastes	16	7	8	7	9	2
Consumers pressures	9	5	8	3	6	1
Legal/regulatory pressures	17	9	3	2	5	1
Investors pressures	12	11	4	2	5	0
Urge to improve corporate performance	9	7	5	6	6	1
Marketing pressures	10	7	4	6	4	0
Environmental advocacy pressures	27	5	9	7	3	1
Urge to enter new markets/segments	11	6	5	4	2	0
Urge to increase market shares	27	4	10	6	6	2
Urge to increase sales turnover	11	5	7	3	3	0
Urge to reduce carbon foot print	19	3	9	6	7	2
Serve as a source of raw materials	9	8	6	3	6	1
Others (please specify)	2	0	0	0	1	0

5.5.3.2: Cross-Tabulation of Drivers of Sustainability of the Company'sTypes

Table 5.8 shows the drivers of sustainability of sole proprietorships were: desire to conserve energy, desire to increase market share, desire to increase competitiveness and desire to preserve resources. Partnerships adopt sustainability to conserve energy, to enter new markets/segments, as a new source of raw materials, legal/regulatory pressures, investors' pressures and marketing pressures respectively.

Table 5.8: Drivers of Sustainability on Types of Companies

Variables	Types of companies				
	Sole proprietorship	Partnership	Public limited company	Private limited company	Unlimited company
Desire to reduce cost of production	3	2	16	17	2
Desire to increase profits	4	3	16	23	0
Desire to improve competitiveness	9	4	21	36	0
Desire to conserve energy	8	4	20	31	0
Desire to preserve resources	9	6	21	33	0
Desire to reduce pollution	4	4	18	14	3
Desire to reduce wastes	6	2	20	18	3
Consumers pressures	4	4	10	12	2
Legal/regulatory pressures	1	7	12	15	2
Investors pressures	3	7	8	11	5
To improve corporate performance	2	4	14	11	3
Marketing pressures	2	8	9	8	4
Environmental advocacy pressures	7	3	11	31	0
Urge to enter new markets/segments	2	6	9	9	2
Urge to increase market shares	8	3	14	30	0
Urge to increase sales turnover	2	5	11	9	2
Urge to reduce carbon foot print	6	1	18	21	0
Serve source of raw materials	0	6	10	13	4
Others (please specify)	0	0	1	2	0

The drivers of sustainability for public limited company are: to reduce pollution, to reduce carbon footprint, to conserve energy, to reduce wastes and to improve competitiveness. Sustainability adoption in private limited companies is influenced by: carbon footprint reduction, to increases profits, to conserve energy, to preserve resources, desire to increase market share environmental advocacy pressures and to increase competitiveness. This signifies that different types of in oil and gas industry were motivated to implement sustainability in order to improve economic and environmental performance. This is because the integration of economic, social and environmental criteria allows an organisation to achieve long term economic viability (Carter and Rogers, 2008). Financial measures and specific environmental behaviours such as pollution control and recycling are key issues that will drive competitive advantage for a firm (Markley and Davis, 2007).

5.5.4: Inhibitors of Sustainability

Regardless of the development of various sustainability strategies, risks arising from various supply chain activities are not significantly reduced because sustainability implementation faces many challenges (Muduli et al, 2012). The following inhibitors of sustainability implementation were identified.

Table 5.9: Inhibitors of Sustainability

Variables	**Per cent**
Internal challenges on implementing sustainability (new concept)	10.4
Stakeholders challenge	6.9
Higher adaptation costs (take up)	16.4
Shortage of information on sustainability	14.7
Inappropriate infrastructures	20
Employees lack environmental awareness	14.5
Fair of profit decrease (at take up)	8.0
Higher running costs	9.1
Total	**100**

Table 5.9 shows the most critical inhibitor of sustainability is inappropriate infrastructures 20%, higher initial cost of sustainability adoption 16.4%, inadequate information on sustainability 14.7%, unskilled employees on sustainability practices 14.5%, and challenges of implementing sustainability 10.4%. Others are: higher running costs 9.1%, fair of profit decrease (at take up) 8% and shareholders challenges 6.9% respectively.Other inhibitors given by responding firms which are not in the questionnaire were time constraints andcompany size.

The inhibitors shown in table 5.9 are consistent with inhibitors of sustainability in the literature (Haake and Seuring, 2009; Walker and Jones, 2010; Giunipero et al, 2012; Muduli, 2012; Wu et al, 2012). Generally, financial constraints can make it difficult for many SMEs to conduct a number of diverse sustainability initiatives (Azzone et al, 1991; Presley et al, 2007; Muduli et al, 2012). Over 20% of the total revenue invested by some organisations is devoted to securing equipment, adopting sustainability strategies and environmental training for employees (Nikolaou and Evangelinos, 2010).This shows how substantial funds are required to support infrastructure, innovation, informational and manpower requirements of sustainability (Nidumolu et al, 2009; Wu et al, 2012).

5.5.4.1: Inhibitors of Sustainability on SMEs and Large Scale Companies

Table 5.10 gives account for inhibitors of sustainability applicable to both SMEs and large scale companies.

Table 5.10: Cross-tabulation of Inhibitors of Sustainability by the Company Size

Variables	Company Annual Turnover					
	£1-10m	£11 - 50m	£51 - 100m	101 -£500m	501 - £1b	Above £1b
Costs of adoption	27	10	12	8	10	0
Stakeholders challenges	12	4	5	3	4	0
Insufficient information on sustainability	27	7	9	6	11	0
Inappropriate infrastructures	35	13	15	8	9	2
Fear of decrease in profit (at the take up stage)	15	6	5	4	3	0
Unskilled employees on sustainability	24	6	13	8	6	2
Challenges on implementing of sustainability	14	8	7	5	7	1
Higher running costs	16	7	7	3	4	0

The factors that inhibit sustainability adoption in SMEs as: inappropriate infrastructures, shortages of sustainability information, costs of adoption, lack of employees' environmental awareness and higher running costs. Inhibitors of sustainability for large scale companies are: inappropriate infrastructures, employees lack environmental awareness, costs of adoption and lack of information on sustainability. In SMEs, problems of infrastructural facility; cost of adoption, sustainability information and lack of sustainability experts were caused by financial deficiency. The fact that SMEs have financial deficiency may be difficult for them to acquire the infrastructure, finance, sustainability experts and necessary information to implement sustainability. When financial resources are insufficient, environmental activities could be hindered and might not attract management attention (Gerstenfeld and Roberts, 2000).

Yet relevant environmental information is necessary to translate sustainability strategies into real actions (Clark, 2000). Highly educated employees would easily understand environmental issues and find appropriate options to deal with the problems. SMEs generally lack trained personnel to take charge of the management, control and implementation of environmental programmes (Perez-Sanchez et al., 2003). Therefore, lack of experts to monitor environmental problems that arise in the operation process and to cope with external demands for new environmental technologies is also a critical obstacle inhibiting SMEs from undertaking environmental activities (Hillary, 2004). In the case large scale companies, The causes of these problems could be related to the fact that sustainability concept itself is still young and growing; as such infrastructures required to implement it may not only be expensive but may also be scarce in supply. Theinitial capital expenditure undertaken may lead to a decrease on profit in the succeeding years after the take up (Yusuf et al, 2012).

Table 5.11: Cross-Tabulation of Inhibitors of Sustainability on Types of Company

Variables	Types of Companies				
	Sole proprietorship	Partnerships	Public limited company (PLCs)	Private limited company (LTD)	Unlimited company
Costs of adoption	7	8	18	30	4
Stakeholders challenges	2	1	10	14	1
Insufficient information on sustainability	7	6	17	26	4
Inappropriate infrastructures	10	10	22	36	4
Fear of decrease in profit (take up stage)	4	3	8	17	1
Unskilled employees on sustainability	7	5	21	24	2
Challenges on implementing of sustainability	4	6	14	17	1
Higher running costs	4	4	8	20	1

Table 5.11 exhibits inhibitors of sustainability to sole traders as: higher costs of sustainability adaptation, shortage of sustainability information, lack of sustainability experts and shortages

of infrastructures. Partnership inhibitors of sustainability were shortage of sustainability information, challenges of sustainability implementation, adaptation cost and shortages of infrastructures. If majority sole traders are considered to be small scale companies, majority of partnership could also be seen as medium scale companies. Sole trader's inhibitors to sustainability may be related to the inherent nature of financial resources deficiencies that is always associated with small scale companies. Most partnerships companies are medium scale companies, partnerships may have enough financial resources to adopt and run sustainability but may not be able to possess required infrastructures and information for sustainability practices.

Problems that affect PLCs in adopting sustainability are: inappropriate infrastructures, lack of employees' environmental awareness, cost of sustainability adoption and challenges of implementing sustainability. The problems that affected LTDs from adopting sustainability are: higher running costs, unskilled employees on sustainability, lack of sustainability information, higher cost of adoption, inappropriate infrastructures. If majority of PLCs and LTDs are large scale companies particularly in oil and gas sector (Schweitzer et al, 2011; Yergin, 2008).

5.6: Level of Sustainability Practices in the UK Oil and Gas Industry

One of the objectives of this research is to determine the level of sustainability practices in oil and gas industry in the UK. The scope of sustainability implementation in the UK oil and gas companies was assessed using sustainability investments (adoption of sustainability, length of time sustainability measures have been adapted, investment on sustainability and recouping of sustainability investment). Sustainability strategies being implemented and those that have been implemented (sustainability strategies adapted and financial impacts of the sustainability strategies adapted to the responding firms) and sustainability reporting systems (indicators of sustainability measurement, sustainability reporting systems and perceived functions of sustainability indicators).

5.6.1: Adoption of Sustainability in Oil and Gas Companies

Table 5.12 shows that 52.7% of responding organisations were implementing sustainability at present, 32.1% of responding businesses have made significant progress on sustainability implementation. 8% of responding firms have plans to adopt sustainability in the future. 3.6 % of responding companies have no plan to adopt sustainability now or in the future, while 3.6%

of the respondents are undecided on sustainability implementation. The result shows 84.8% of the responding firms have implemented and/or were implementing sustainability now whilst 15.2% are not implementing sustainability at present. This signifies a high level sustainability adoption in oil and gas industry in the UK. This result reflects the findings of similar empirical researches on sustainability implementation in the literature (Stead and Stead, 1995; Yusuf et al, 2012).

Table 5.12: Level of SustainabilityImplementationin UK Oil and Gas Industry

Criteria	**Per cent**
Adoption of Sustainability	
No plan for adoption now and in future	3.6
Will adopt in future	8.0
Recent and on-going implementation	52.7
Made significant progress in implementation	32.1
Neutral/Indifferent	3.6
Total	**100**
Length of Time Sustainability Measures been Adopted	
Less than 5 years	9.8
5 - 10 years	20.5
11 - 15 years	41.2
16 - 20 years	19.6
Over 20 years	8.9
Total	**100**
Initial Sustainability Investments	
Less than £6 million	15.2
£6 - £12 million	18.7
£13 - £20 million	30.4
£21 - £30 million	20.5
Over £30 million	15.2
Total	**100**
Recouping Sustainability Investments	
Up to 2 years	15.2
3 - 4 years	21.4
5 - 6 years	31.3
7 – 8 years	20.5
Above 9 years	11.6
Total	**100**

5.6.2: Length of Time Sustainability Measures Been Adopted

Table 5.12 shows that 41.1% of the oil firms (sample size) spent 11 to 15 years on sustainability practices. 20.5% of responding organisations spent 5 to 10 years on sustainability operations. Whilst 19.6% of the responding companies spent 16 to 20 years on sustainability practices. 9.8% of total sample size spent less than 5 years' of commitment on sustainability, where organisations that spent over 20 years on sustainability practices were 8.9%. Of the total sustainability practicing companies 69.7% spent between 11years to above 20 years implementing sustainability. The remaining 30.3% of the responding companies spent less than 11years of sustainability application.

This means majority of the respondents spent at least one to two decades on sustainability practices. This is mirrors the history of sustainability implementation. Oil and gas companies being one of the most environmentally polluting companies spent some reasonable period of time on sustainability practices. This is in order as sustainability concept itself was introduced internationally in twenty six years ago by WCED to the UN assembly (WCED, 1987; Kidd, 1992; Wheeler, 2004; Du Pisani, 2006; Ricketts, 2010).

5.6.3: Initial Sustainability Investments

Table 5.12 displays the expenditures that organisations enquired at the take up phase of sustainability implementation. 30.4% of the responding companies invested £13m to £20m on sustainability. 20.5% of the respondents invested £21m to £30m on sustainability. 18.7% of the responding companies invested £6m to £12m on sustainability. 15.2% of the respondents invested less than £6m on sustainability. While the remaining 15.2% invested over £30m on sustainability. This shows that large sum of funds have been invested on sustainability. This testifies the assertion that sustainability requires long term capital investments to be implemented (Gray 1994 cited in Carter and Rogers, 2008). Thecapital investments will be used for innovation and process change necessary for sustainability practices in oil and gas companies (Nidumola et al, 2009).

5.6.4: Recouping Sustainability Investments

Table 5.12 indicates that 31.3% of the responding firms took 5 to 6 years to recover their initial capital investments. It also took 3 to 4 years for 21.4% oil firms to get back their initial investments. While 20.5% of responding firms' took 7 to 8 years to recoup their sustainability investments. Those that took over 9 years for their initial investments on sustainability to pay back were 11.6% of responding companies. The length of time that it will take companies to recover their initial investment is not universally identified (Gopalakrishnan et al, 2012); but it will take companies some reasonable period of time to recoup their investments on sustainability (Stead and Stead, 1995).

5.6.5: Previous and Future Sustainability Investments

Most of the respondents were not willing to disclose their previous annual funds invested on sustainability and those that they plan to invest in the future. Only 0.3% of the respondents gave answer to these questions. Majority of the responding companies gave the following explanations as their responses, 'the value of the investment on sustainability are integrated into business operations, therefore cannot be specified', 'the value is commercially sensitive', 'the value is not separately analysed', 'these figures are not available', and therefore, 'they are not known'. The missing information would have given some exciting idea into how serious oil and gas companies in the UK consider sustainability. On the other hand, one possible reason that may make the respondents to hide their annual previous and future investments on sustainability may be they were not reasonably investing on sustainability operations as they are expected. Instead oil companies will continue to spent vast sums of money on lobbying, likely not in support of policies that would improve their environmental performance (Schweitzer et al, 2011).

5.7: Sustainability Strategies Adopted in Oil and Gas Industry

Companies protectandimprove environmental and social wellbeing of the society through adopting some sustainability strategies. As this research shows earlier that drivers of sustainability (table 5.6) in oil and gas industry in the UK are combination of economic and environmental development.Itis significant to identify the sustainability strategies that oil and gas companies are implementing.

Sustainability strategies reflected in table 5.13 were adopted from the researches of Stead and Stead (1995) and Yusuf et al, (2012) with some little improvements. Table 5.13 indicates that a total of 173 responding firms were adopting process driven sustainability strategies and 217 responding organisations were adopting market driven sustainability stratagems. The number of companies that were implementing various types of sustainability strategies indicates a widespread sustainability adoption in oil and gas companies in the UK. This result confirms some previous empirical findings on sustainability adoption in manufacturing organisations (Stead and Stead, 1995; Yusuf et al, 2012).

Table 5.13: Sustainability Strategies Implemented/Implementing

Process Driven Strategies	**Implemented/implementing**	**Market Driven Strategies**	**Implemented/ implementing**
Redesign production process for environmental reasons	20	Introduce new environmentally sensitive products	54
Redesign pollution controls, waste disposal, water/air treatment process	31	Redesign existing products to make them more environmentally sensitive	50
Using recycled materials from outside sources in production process	19	Enters new environmentally oriented markets or market segments	33
Recycling scrap materials once considered waste in production process	21	Redesign product packaging to be more environmentally sensitive	24
Recycling defective end products in production process	19	Advertising the environmental benefits of the products	36
Using renewable energy source in production process	22	Selling donated materials once discarded as wastes	20
Design emission free production process	21	**Total**	**217**
Using renewable resource in production	20		
Total	**173**		

5.7.1: Process Driven Sustainability Strategies ImplementedbyCompanies Size

Since the responding companies comprises both SMEs and large scale companies, there is the need to identify which types of process-driven stratagems is employed by both SMEs and large scale companies. There is also the need to find the total number of process-driven sustainability strategies employed by both SMEs and large scale companies.

Table 5.14 indicates that SMEs and large scale companies were widely implementing all the process-driven strategies. 86 SMEs adopted process driven sustainability strategies whilst 87 large scale companies adopted process driven strategies. The wider implementation of process driven sustainability strategies in both SMEs and large scale companies is because sustainability adoption requires companies to redesign their production process/facilities, which involves all aspects of the company operations. To do this the company must employ different types of process driven strategies. By implementing these strategies the companies will save costs through wastes management and the pollution control.Through recycling, the companies will use fewer resources in their production processes, which will make their production environmentally friendly. Through pollution, wastes and emission control production system, the companies directly protect the general environment from further destruction. This may attract the general community to accept the companies.

Table 5.14: Process Driven Sustainability StrategiesAdopted by Size of Companies

Variables	Companies Annual Turnover					
	£1-10m	£11 - 50m	£51 - 100m	£101-500m	£501 - 1b	Above £1b
Redesign production process for environmental reasons	4	3	5	6	1	1
Resign pollution controls, waste disposal and water/air treatment process	3	6	6	11	3	2
Using recycled materials from outside sources in production process	3	2	3	8	2	1
Recycling scrap materials once considered waste in production process	1	4	5	8	2	1
Recycling defective end products in production process	2	5	5	4	2	1
Using renewable energy source in production process	3	6	5	5	2	1
Design emission free production process	3	4	5	5	3	1
Usingrenewable resource in production	2	3	7	5	2	1

Table 5.15 shows that PLCs and LTDs are implementing all the process driven strategies, this may help them to minimise cost of production and to maximise profits at the same time improve their environmental performance. As the aim of process driven sustainability strategies is to improve the company’s economics and environmental performers; table 5.15 further presented the types of sustainability strategies adopted by sole traders, partnerships, PLCs and LTDs.

Sole proprietor implemented ‘renewable energy source in production process’, ‘renewable resource in production’, ‘emission free production process’ and ‘recycling defective end products in production process’. These strategies were adopted by sole proprietors in order to minimise use of resources by the company for the present and future generations. Higher running cost will be kept under control by using renewable resource in production’ and 'recycled defective end products in production processes'. These strategies will make adoption of sustainability cheaper for sole proprietors.

Partnerships employed resign pollution controls, waste disposal and water/air treatment processes and recycling scrap materials once considered waste in production process strategies. To resolve the problems of higher costs of sustainability adoption, partnership companies recycled scrap materials once considered waste in production process. Pollution control, waste disposal and water/air treatment process are strategies that help partnerships to save costs. These initiatives may help companies to minimise their costs of production.

Table 5.15: Process Driven Sustainability Strategies Adopted by Type of Companies

Variables	**Types of Companies**				
	Sole proprietorship	Partnerships	Public limited company	Private limited company	Unlimited company
Redesign production process for environmental reasons	1	1	5	11	2
Resign pollution controls, waste disposal and water/air treatment process	1	4	8	17	1
Using recycled materials from outside sources in production process	1	1	4	12	1
Recycling scrap materials once considered waste in production process	1	4	5	10	1
Recycling defective end products in production process	3	2	3	10	1
Using renewable energy source in production process	6	2	5	7	2
Designed emission free production process	5	2	6	7	1
Using renewable resource in production	6	2	3	8	1

5.7.2: Market Driven Strategies Implemented by Companies Size

Table 5.16 shows the types of market driven sustainability strategies adopted by both SMEs and large scale companies in the oil and gas industry in the UK. SMEs introduces new environmentally sensitive products strategy, redesign existing products to make them more environmentally sensitive strategy, advertising the environmental benefits of the productsand redesign product packaging to be more environmentally sensitive strategies.

These strategies will help SMEs to protect the environment throughout the product life cycle. These actions will lead to a higher sales turnover, which may significantly improve the SMEs economic performance at the same time maintains the quality of the environment. Table 5.16 illustrates that large scale companies were implementing all market driven sustainability strategies.The aims are to gain access to the emerging environmentally conscious markets, maximise market share, maintain the leadership of the green markets and at the same time protect and improve the environmental performance.

Table 5.16: Market Driven Sustainability Strategies Adopted by Size of Companies

Variables	Companies Annual Turnover					
	£1-10m	£11 - 50m	£51 - 100m	£101 -500m	£501 - 1b	above £1b
Introduce new environmentally sensitive products	7	10	14	10	11	2
Redesign existing products to make them more environmentally sensitive	7	6	14	9	12	2
Enters new environmentally oriented markets or market segments	3	4	9	4	12	1
redesign product packaging to be more environmentally sensitive	5	4	7	3	5	0
Advertising the environmental benefits of the products	6	7	9	4	9	1
Selling donated materials once discarded as wastes	2	4	5	5	3	1

Tables 5.14 and 5.16 show that large scale companies were implementing all the process driven and the market driven sustainability strategies. This will maintain their dominance and leadership in the market. Implementing these strategies will guarantee large scale companies improved economic and environmental performance in perpetuity.

Table 5.17 illustrates the number and types of market sustainability strategies adapted by sole proprietors', partnerships; PLCs and LTDs. The result shows that sole proprietors 'introduces new environmentally sensitive products strategy and 'redesign existing products to make them more environmentally sensitive strategies. This means sole trader protects the environmental quality through making both new and existing products environmentally sensitive. Partnerships were 'advertising the environmental benefits of the products', 'redesign existing products to make them more environmentally sensitive', 'enters new environmentally oriented markets or market segments'and 'redesign product packaging to be more environmentally sensitive'. The aims of implementing these strategies by the partnerships companies are to maintain and improve their economic and environmental performance. This will maintain their market share in the emerging markets and develop their competitiveness.

Table 5.17: Market Driven Sustainability Strategies Adopted by Types of Companies

Variables	Types of Companies				
	Sole proprietorship	Partnerships	Public limited company	Private limited company	Unlimited company
Introduce new Environmentally Sensitive Products	5	3	24	19	3
Redesign existing products to make them more environmentally sensitive	4	4	21	18	3
Enters new environmentally oriented markets or market segments	2	4	15	10	2
redesign product packaging to be more environmentally sensitive	3	4	10	6	1
Advertising the environmental benefits of the products	1	5	16	13	1
Selling donated materials once discarded as wastes	0	1	6	11	2

Table 5.17 further demonstrates that PLCs and LTDs are virtually implementing all the market driven sustainability strategies. The fact that most PLCs and LTDs are large scale companies; they may have the financial abilities to implement various types of sustainability strategies.Besides enhancing their economic and environmental performance, adopting various market driven strategies will assist companies to survive the current frequent and continuous changing environment; thereby maintaining their supremacy and control of the national and international markets. This result further validates the results of table 5.15 that shows that PLCs and LTDs were implementing all the process driven sustainability strategies.

5.8: Sustainability Reporting

After the companies have invested on implementing one sustainability strategy or another; they are expected to report the rate at which the sustainability strategy they adopted have help to improve the environmental safety (GRI, 2002; Labuschagne et al, 2004; Ekins and Vanner, 2007; Delai and Takahashi, 2011).

Sustainability indicators are generally used on reporting and measuring the progress of sustainability performance in organisations (Crabtree and Bayfield, 1988; GRI, 2002; Delai and Takahashi, 2011). Table 5.18 shows majority of the responding firms analyse and report their sustainability performance using the universally accepted method of sustainability assessment and reporting (Carter and Rogers, 2008; Aras and Crowder, 2009; Delai and Takahashi, 2011). That is sustainability report that combines economics, environmental and social indicators.

5.8.1: Sustainability Performance Assessment

Institutions such as GRI, ICheme, WBCSD, UKOOA etc. have developed different criteria for manufacturing companies to evaluate and report their sustainability performance.

Table 5.18: SustainabilityAssessment

Criteria	**Per cent**
Selection of Sustainability Indicators	
Economic indicators	10.7
Environmental indicators	15.2
Combination of all the three indicators	48.2
Social indicators	14.3
Combination of two indicators	11.6
Total	**100**
Sustainability PerformanceAssessment	
Environmental sustainability index (ESI)	9.8
Ecological footprint (EFP)	10.7
Operational performance index (OPI)	15.2
Environmental performance indicators (EPI)	25.0
Human development index (HDI)	9.8
Wellbeing index (WI)	6.3
Dow Jones sustainability index (DJSI)	2.7
Others (please specify)	20.5
Total	**100**

Table 5.18 displays that 25% of responding firms use environmental performance indicators (EPI) on sustainability reporting, 15.2% uses operational performance index (OPI) and 10.7%

of the sample size uses ecological footprint (EFP). Environmental sustainability index (ESI) and human development index (HDI) has 9.8% each of the total sample size. Wellbeing index (WI) has 6.3% of the total respondents. 20.5% of the responding companies gave other sustainability reporting systems that were not reflected by the questionnaire, which were: GRI indicators, UN global compact, ISO 14000 and KPI.

The result shows that majority of oil and gas companies use environmental performance indicators (EPI) in preparing their sustainability performance reports. Considering the finding on sustainability investments, sustainability strategies implemented and sustainability reporting system, one can argue that there is a wide spread of sustainability implementation in the oil and gas companies in the UK.

5.9: Sustainability Dimensions

Sustainability is a three legged concept that comprises economic, environmental and social components. The essence of any type of sustainability strategy in companies is to protect the environmental and social components from further destructionanddecline.

Table 5.19 displays that the responding companies indicate that the sustainability strategies they adopted have positive impacts on the environment. By making the production process environmentally friendly, it means the companies uses new technology in the production process that has no negative impact to the environment. This will lead to the production of consumer friendly products. This type of technology and products will protect the environment from further deterioration.

Table 5.19 shows 92.9% of the respondents are considering ways to reduce waste. Waste management is a sustainability initiative use to protect land field from decay as a result of waste deposit. This effort will go a long way to protect and maintain the quality of the environment and the atmosphere for the present and future generations. This will help in reducing the effect of ozone layer depletion.

92% of the respondents were using emission free production system, while 8% were neutral. Effort to reduce carbon emission is what sustainability is all about, because greenhouse emission is responsible for current global warming. Greenhouse emission contaminates the atmosphere and the environment that leads to global warming. Global warming affects quality of the atmosphere and the environment thereby causing diseases, ozone layer depletion and many other social problems. Through emission free production process all these problems will be reduced, the quality of the atmosphere and the environment will be maintained. This initiative will also reduce future environmental destructions, thereby making the environment comfortable for the present and future generations.

82.2% of the respondents agree that their companies were using renewable resources in production, 17% were neutral and 1% of the respondents were not using renewable resources in their production. Sourcing non-renewable resources from the environment for production of products and services has greatly contributed to the environmentdestruction. If companies will use renewable resources as their raw materials, the remaining resources in the environment and the environment itself will be preserved for the future generation. Studies maintained that the use of renewable resources by companies must be equal to the amount of resources that is renewed.

Table 5.19: Environmental Sustainability Factors

Environmental sustainability indicators	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Environmentally friendly production process	17.9	70.5	-	0.9	-
Looking for ways to reduce wastes	25.9	67.0	7.1	-	-
Emission free production	22.3	69.7	8.0	-	-
Using renewable resources in production	16	66	17	-	1
Reuse scrap materials in production	25.0	65.2	9.8	-	-
Reprocess defective end products in production	17.0	69.6	11.6	1.8	-
We used ecological guidelines in outsourcing	28.6	60.7	9.8	0.9	-
Employee environmental training	22.3	62.5	15.2	-	-

In terms of reuse of scrap materials in production 90.2% agree and 9.8% were neutral on the use scrapped material in their production process. In addition, 86.9% of the respondents agree that their company reprocesses defective end products in production, 11.6% were neutral and 1.8% of respondents were not using this initiative. Reuse of scrap materials and reprocessing defective end products in production are initiatives under reverse/close-loop supply chain. Reverse supply chain can reduce negative environmental impacts of extracting non-renewable materials and waste disposal. Therefore, reverse supply chain had two primary dimensions: reconditioning (i.e., high-value recovery) and recycling and waste management (i.e., low- or no-value recovery). This policy is also undertaken by companies to preserve the environment and the resources for the future generation.

Table 5.19 illustrates that 89.3% of the respondentsuse ecological guidelines in outsourcing, 9.8% were neutral while 0.9% of the respondents disagree. This is an effort to make sure that the companies' suppliers are also using sustainability initiatives in their supply. If all companies in the industry will adopt this policy, then the supply chain of the industry will be sustainable.

84.8% of the respondents train their employees on environmental management while 15.2% of the respondents have no environmental management training for the employees. One of the inhibitor of sustainability is lack of sustainability experts in responding companies. Training employee on environmental management could be viewed as a device to make the responding companies employees skilled on sustainability. The result of table 5.19 demonstrates various initiatives taken by oil and gas companies to make their operations sustainable. Sustainable organisations are those that while making profits does not in any form affects the environment (Dyllick and Hockerts, 2002; Markley and Davis, 2007; Townsend, 2009).

Table 5.20: Social Sustainability Factors

Social sustainability indicators	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Used internal code of conduct	27.7	64.3	6.3	0.9	0.9
Fair employment from the locality	22.3	63.4	13.4	0.9	-
Provision of health and safety facilities in the company	18.8	74.1	6.3	0.9	-
Investments in infrastructural facilities	22.3	66.1	10.7	0.9	-
Payment of taxes and levies to the government	25.9	66.1	8.0	-	-
Support government revenue transparency	18.8	77.7	3.6	-	-
Ethical business through trading	16.1	69.6	14.3	-	-
Investments in poverty alleviation programme	30.4	59.8	9.8	-	-
Endowment to local symphony	25.0	61.5	12.5	0.9	-
Regional and cross regional development initiatives	28.6	67.0	4.5	-	-

Table 5.20 illustrates that 92% of the respondents' use internal code of conduct while 8% are not using internal code of conducts. Using good internal working condition will make employees to develop sense of belonging to the company and motivate them to offer their best because their interests were taken care of.

Accordingly, table 5.20 shows 85.7% of the respondents give reasonable employment opportunity to the citizens of the locality, 13.4% were neutral and 0.9% is not giving such consideration. This social indicator will help the company to be accepted from the immediate locality. Additionally, 92.9% of respondents provide health and safety facilities to their employees while 7.1% of the employees were not providing such facilities.Providing health and safety facilities within the company is motivation strategy and is adherence to the principle of social sustainability. These three indicators are undertaken inside the company to motivate workers to work hard, which will improve their productivity that will in turn increase the overall productivity of the company. They are also expected to avoid absenteeism, laxity, waste and strikes.

Table 5.20 shows some companies investments in infrastructural facilities such as roads, schools, hospitals; good drinking water etc. 88.4% of respondents attests they invested on infrastructural facilities whilst 11.6% have no investments on infrastructures. Additionally, 92% pays taxes and levies to government when due while 8% were neutral. In terms of supporting government revenue transparency 96.5% of the respondents supported while 3.5% were neutral. 85.7% of the respondents show that they undertake ethical business through trading and 14.3% were neutral. Respondents that invested in poverty alleviation programme were 90.2% while 9.8% were neutral. About 95.5% of the respondents support local, regional and cross regional development initiatives while the remaining 4.5% were not supporting the local development initiatives.

These indicators are activities that the respondents undertake in the immediate environments. Their aims are to improve the comfort of the environment and to influence the society to accept the companies. Other social sustainability measures range from support of charity groups, which members of staff are involved in, hospital and medical support, high health and safety standards, healthy working conditions, and support of local charity groups (Yusuf et al, 2012). Organizations build reputations (Cohen, 2006) and brand image through organizing charity fundraisers, giving donations, educational services and health facilities

(Cohen, 2006; Gopalakrishnan, et al 2012). These are willingly done to increase organisational competitiveness (Jones et al, 2005). Corporate sustainability is the process of pursuing profit by company and at the same time uphold the rights of workers and other stakeholders (Dyllick and Hockerts, 2002; Markley and Davis, 2007).

5.10: Competitive Objectives

Sustainability is an initiative used by companies to improve their environmental and competitive performance. This signifies that sustainability practices in an organisation lead to improvement of company's environmental and competitive performance (Porter and Kramer, 2006, Bose and Pal, 2012; Yusuf et al, 2012).

Table 5.21 illustrates that some 42% of the companies are of the view that sustainability has moderate impact on speed. 46.4% believe there is high and very high impact whilst 9.8% and 1.8% consider that there is low and very low impact. This indicates that sustainability leads to improve speed on providing the customers with the required customer friendly products.

In terms of cost of production, Table 5.21 shows that 60.8%, and 30.4%, believe sustainability have very high, high and moderate positive impact on the cost of production. Those that are of the view that there is low impact are 8.9%. This can be related to the fact that many companies in the industry reduce carbon footprint by reducing the rate of official trips embarked on by members of staff, thereby using alternative actions such as meetings via teleconferencing. Furthermore, some companies in the industry reduce energy consumption by using energy saving devices. Many companies also reduce the use of resources such as water and to encourage the recycling of waste as much as possible. These initiatives can lead to the decrease of the cost of production. It can be concluded that these measures go a long way in limiting waste along the supply chain and hence, in saving the companies money.

Table 5.21 indicates that 58.1% of the respondents are of the view that there is high and very high increase in delivery, 33.9% believe there is moderate increase in delivery. 6.3% experience low delivery whilst 1.8% experience very low rate of delivery. As speed experiences high increase so also the delivery will increase. The increased rate of speed is responsible for the increase rate of delivery. Since delivery depend on speed of the companies on the delivery of products to the markets.

In this research innovation and technology were used interchangeable. This is because technology leads to innovation and therefore they cannot be separated. Table 5.21 displays that 69.6% of respondents are of the view that innovation derives very high and high impact, 23.2% are of the view that there is moderate impact being derived. Some 5.4% and 1.8% have low and very low impact from sustainability. Innovation is the key strategy of sustainability. This is based on the fact that sustainability often requires an increase in technological innovation. Possible areas of innovation are wind and solar energy, hybrid and electric cars, ethanol, and other carbon free sources of energy. This situation could also be linked to the fact that many organisations in the UK oil and gas industry have been able to reduce air pollution by using electric and hybrid vehicles in their operations. If a company is not innovating it may be very difficult for such company to adopt sustainability. This might be the result of the fact that sustainability leads to invention of environmentally friendly and customer friendly products and services. This means that innovation is the only power that can make difference. It is only through innovation that companies can produce products that are not harmful to the customers and the environment.

Table 5.21 denotes that 63.4% of the respondents confirmed high and very high increase on proactivity through sustainability implementation while 30.4% achieve moderate increase of proactivity. 5.4% and 0.9% of the respondents recorded low and very low increase on proactivity. This result may be linked to the rate of innovation afforded by the respondents as a result of sustainability. Companies that are innovating are always proactive on inventing new products and services, they are also first to introduce products and services to the market.

In terms of quality, 55.3% believe that the industry derives very high and high increase on quality, 41.1% have moderate impact from sustainability, while 3.6% believe low impact is derived. This result can be linked to innovation, because innovation is responsible for producing high quality products and services. Therefore, if a company is innovative, such company can excel in producing high quality products and services. Quality can also be linked to the fact that social sustainability measures adopted result in an increase in the level of commitment from members of staff, hence higher efficiency and increased quality of services and products.

59.9% of the respondents believed sustainability had very high and highimpact on flexibility, 33% testifies moderate impact on flexibility, while 7.1%, were of the view that there was low impact. Flexibility in production depend on technology, the more efficient the technology the more dependable the company. The fact that sustainability requires new technology means that any sustainable company must excel on technology and this will made the company to be more flexible.

Table 5.21 demonstrates that 62.5% of the respondents agree that dependability has very high and high impact on sustainability while 33% agree that there is moderate increase. 4.5% of the respondents have low increase. This result is based on the fact that the responding companies excel on technology and therefore, they are highly innovative. Any company that is innovative will also have good records of dependability.

Table 5.21: Impacts of Sustainability on Competitive Objectives

Performance measures	**Very High**	**High**	**Moderate**	**Low**	**Very Low**
Speed	14.3	32.1	42.0	9.8	1.8
Low cost	17.0	43.8	30.4	8.9	-
Delivery	15.2	42.9	33.9	6.3	1.8
Innovation/technology	25.0	44.6	23.2	5.4	1.8
technology/Proactivity	22.3	41.1	30.4	5.4	0.9
Quality	8.9	46.4	41.1	3.6	-
Flexibility	17.0	42.9	33.0	7.1	-
Dependability	9.8	52.7	33.0	4.5	-
Customisation	16.1	41.1	38.4	3.6	0.9
Sales turn over	13.4	48.2	28.6	8.9	0.9
Net profit	23.2	50.0	23.2	1.8	1.8
Market share	12.5	47.3	36.6	2.7	0.9
Customer loyalty	9.8	52.7	33.0	3.6	0.9
Performance relative to competitors	12.5	45.5	39.3	1.8	0.9

Customisation increases high and very high at 57.2% andmoderate at 38.4% as a result of sustainability. Customisation according to other respondents was 3.6% and 0.9% low and very low respectively. The increase on customisation is due to the fact that at present customers like product that is customer and environmentally friendly. Having adopted sustainability oil and gas products are supposed to be customer and environmentally oriented. This will motivate customers to buy more products from the companies that adopted sustainability.

In the UK oil and gas industry, 61.1% believe that sustainability has very high and high effect on sales turnover while 28.6% agree that there is moderate positive impact. There is also 8.9%, low and 0.9% very low increase on turnover. This is due to the fact that sustainability leads to high customisation and this will eventually lead to a high sales turnover in the long run.

Only 1.8% and 1.8% are of the opinion that sustainability has low and very low impact on net profit; 73.2% and 23.2%, respectively, believe that there is high, very high and moderate positive impact. This can be linked to the fact that sustainability is a long-term means to lean and efficient production and distribution. This will increase sales turn over that will in turn increase the net profit.

Table 5.21 also shows that 59.8% of the respondents are of the view that there are some high positive and very high positive increases in market share and 36.6% have moderate increase in market share benefits derivable from sustainability. This indicates that the public and customers tend to appreciate and patronise companies that practice sustainability. Another factor contributing to this outcome is that large enterprises that believe in sustainability and subcontract some of their activities would only deal with vendors that have also adopted sustainability. Increases on sales turn over will lead to increase in market share.

Sustainability increases customer loyalty; 62.5% of the respondents stated that there was some high positive impactand very high positive impact while 33% indicated moderate positive impact respectively. This high level of impact is most likely a direct reflection of the results on market share: the higher the customer loyalty, the higher the market share, and vice versa. Innovation also has a bearing on customer loyalty and hence on the share value of the firm.

On the measure of performance relative to competitors, 1.8% of the respondents opined that there was some low impact, 0.9% recorded very low impact, while 58%, believed there was highand very high positive impact and 39.3% have moderate positive impact derivable from adopting and dispersing sustainability. This positive impact would also be an express result of the effects of high market share and customer loyalty.

5.11: Inferential Statistics

Inferential statistics test predictions (hypothesis) that are made to allow inferences from the data as to whether the data are statistically significant or due to chance factors the data is significant (Seale and Barnard, 1998). Inferential Statistics is about the confidence with which we can generalise from the sample to the entire population. This is because it is about drawing inferences about all scores in the population from a sample of those scores. Inferential statistical are techniques which help to predict the population characteristics from the sample characteristics (Howitt and Cramer, 2011). Inferential Statistics involves bivariate analysis and multivariate analysis of the research variables. Bivariate analysis is concern with the analysis of two variables at the same time, to find if they are related with each other. Multivariate analysis entails the simultaneous analysis of three or more variables to find whether or not the variables are related and if they are related which variable causes the other variable to change (Bryman and Bell, 2007). Measures of correlations coefficient, regression analysis, path analysis, structural equation method etc. are used to determine the relations and causal relationships between the research variables. In social sciences, research is often conducted with several goals in mind; most important, is the goal of answering a particular research question using survey data (Zikmund et al, 2010). To increase our understanding of the factors associated with sustainability practices and it impact on competitive objectives, correlation analysis was carried out to test and explore the relationship between the factors investigated.

5.11.1: Correlation Analysis

Correlational techniques are often used by researchers engaged in non-experimental research designs. Where variables are not deliberately manipulated or controlled, variables are described as they exist naturally (Pallant, 2010). Correlation is one of the methods of explaining bivariate relationship (Bryman and Cramer, 2005). Measures of linear correlation are most appropriate for interval or ratio variables (Bryman and Cramer, 2005; Zikmund et al, 2011). Correlation coefficient is a statistical measure of variation or association between two variables. Covariance is the extent to which a change in one variable corresponds systematically to a change in another (Zikmund et al, 2010). Therefore, correlation provides an indication that there is a relationship between two variables; it does not indicate that one variable causes the other, but gives a covariance that one variable is related with another. The relationship between two variables is determined when the distribution of values for one variable is associated with the distribution exhibited by another variable (Bryman and Cramer, 2005). Correlation coefficient is a numerical summary of the strength and direction of linear relationship between a pair of variables (Bryman and Cramer, 2005; Bryman and Bell, 2007; Pallant, 2010; Zikmund et al, 2011). Correlation provides assessment of the closeness of the relationship between pairs of variables by a measure of Pearson product-moment correlation coefficient, known as Pearson's 'r' (Bryman and Cramer, 2005; Bryman and Bell, 2007; Pallant, 2010; Zikmund et al, 2011). The strength of Pearson's correlation ranges from -1 and +1. A total relationship of -1 or +1 indicates a perfect relationship with negative or positive between the two variables respectively. A perfect correlation of -1 or +1 indicates that the value of one variable can be determined exactly by knowing the value on the other variablewhilst acorrelation of 0 indicates no relationship between the two variables (Bryman and Cramer, 2005; Bryman and Bell,2007; Pallant, 2010; Zikmund et al, 2011). The closer the r is to 1 (- or +), the stronger the relationships between the two variables. Therefore, the size of the absolute value (ignoring the signs) provides information on the strength of the relationship.The coefficient either positive or negative gives the direction of a relationship between the variables. Negative correlation indicates an inverse relationship that is as the scores of one variable increases, the values of the other variable decreases. Positive correlations indicates that higher scores of one variable is associated with higher values on the other variable (Bryman and Cramer, 2005; Bryman and Bell, 2007; Pallant, 2010; Zikmund et al, 2011).

5.11.2: Impacts of Process Driven Sustainability Strategies

Table 5.22 shows that 8 respondents were operating 'redesign production process for environmental reasons stratagem' at breakeven point (BEP). According to 5 respondents the same stratagem attracts more investments. Correspondingly 2 respondents were making loss while 2 others were making profit. 'Redesign pollution controls, waste disposal and water/air treatment process stratagem' have 11 respondents making profit, 8 respondents at breakeven point, 3 respondents were making loss and 8 respondents were making investments. 'Recycling materials from outside sources in production process stratagem' were being operated by 3 respondents at profit level, 4 respondents at BEP, 6 respondents were making loss and other 6 respondents were making investments. Recycling scrap materials once considered waste in production have 7 respondents making profits, 5 respondents operate at

BEP, 1 respondent is making loss and 7 respondents were making investments. 'Recycling defective end products in production stratagems' were operated by 8 respondents profitably, 2 respondents at BEP, 1 respondent making loss while 8 respondents were making more investments.Implementing 'using renewable energy source in production stratagem' has 5 respondents at profit level, 5 respondents at BEP, 2 respondents at loss and 10 respondents were incurring more investment. Among the respondents that wereadopting 'design free emission production process stratagem', 3 are making profit, 6 are at BEP, 2 are making loss and 10 were making investments. The respondents that are implementing 'using renewable resources in production stratagem have 1 respondents at profit level, 5 respondents at BEP, 2 respondents are making loss while the rest 10 respondents are making investments.

Table 5.22: Impacts of Process Driven Sustainability Strategies on Revenues andInvestments

Process driven sustainability Strategies	**Positive impact on revenue (profit)**	**No impact on revenue (BEP)**	**Negative impact on revenue (loss)**	**Making less investment (outlay)**	**Making significant investment (capital outlay)**
Redesign production process for environmental reasons	2	8	2	3	5
Redesign pollution controls, wastes disposal , water and air treatment process	11	8	3	7	1
recycling materials from outside sources in production process	3	4	6	4	2
Recycling scrap materials once considered waste in production	7	5	1	4	3
Recycling defective end product in production	8	2	1	5	3
Using renewable source of energy in production	5	5	2	3	7
Design free emission production process	3	6	2	4	6
Using renewable resources in production	1	5	3	4	6

Table 5.22 shows that only 'redesign pollution controls, wastes disposal, water and air treatment process stratagem' provides profit; as majority of the responding companies that are implementing this stratagem are making profit. The rest stratagems demand more investments from the companies implementing them.This indicates that process driven sustainability stratagems have investments implication to oil and gas companies.

The result in table 5.23 indicates that introduce new environmentally sensitive products stratagem, redesign existing products to make them more environmentally sensitive stratagem, enters new environmentally oriented markets stratagem and redesign products packaging to be more environmentally sensitive stratagems were being operated at profit level.Advertising the environmental benefits of the products stratagem and selling donated materials once discarded as waste stratagems were being operated at BEP. This shows that majority of market driven sustainability strategies assures positive rate of return on investment. Revenue enhancement was significantly more important for firms implementing market driven strategies (stead and stead, 1995).

Table 5.23: Impacts of Market Driven Sustainability Strategies on Revenues and Investments

Market driven sustainability strategies	Positive impact on revenue (profit)	No impact on revenue (BEP)	Negative impact on revenue (loss)	Making less investment (outlay)	Making significant investment (capital outlay)
Introduces new environmentally sensitive products	33	13	2	-	4
Redesign existing products to make them more environmentally sensitive	30	15	4	-	1
Enters new environmentally oriented markets/segments	18	7	5	-	1
Redesign products packaging to be more environmentally sensitive	10	9	4	-	1
Advertising the environmental benefits of the products	10	20	3	1	1
Selling donated materials once discarded as waste	4	11	1	2	2

Advertising the environmental benefits of the products is run at break-even point, this could be due to the fact that cost of advertisements is very high as such the revenues realised from increase on sale of the environmentally friendly products is equal to the cost enquired on advertisements. Selling donated materials once discarded as waste strategies is also run on break-even, this could be related to the fact that products made from waste (recycling) are usually expensive because of the production process involved (Sibbel et al, 2011). Tables 5.22 and 5.23show that majority of process driven sustainability strategies have cost implications (investment) to support them whilst majority of market driven sustainability strategies improves the profitability (revenue) level of the responding companies. This could be the reason that majority of the respondents are implementing market driven sustainability strategies (see table 5.13). Finding of Tables 5.22 and 5.23 serve as the responses to the research question 4 of this study.

Table 5.24: Recouping Investments on Process Driven Sustainability Strategies

Strategies	Up to 2yrs	3 – 4yrs	5 – 6yrs	7 – 8yrs	Above 9yrs
Redesign production process for environmental reasons	4	2	8	4	1
Redesign pollution controls, wastes disposal , water and air treatment process	3	3	16	5	3
Using recycled materials from outside sources in production process	3	2	7	5	1
Recycling scrap materials once considered waste in production	1	3	12	4	1
Recycling defective end product in production	1	6	6	4	2
Using renewable energy in production	1	5	12	4	-
Design free emission production process	3	2	11	3	2
Using renewable resources in production	4	2	10	3	1

Table 5.24 shows that investments on process driven sustainability strategies are recouped between 5 and 6 years respectively. Except recycle defective end product in production strategy that took minimum of 3 years and maximum of 6 years, all process driven sustainability strategies investments in oil and gas companies are recovered in a minimum of 5 years and maximum of 6 years.

Table 5.25: Recouping Investments on Market Driven Sustainability Strategies

Strategies	Up to 2yrs	3 – 4yrs	5 – 6yrs	7 – 8yrs	Above 9yrs
Introduce new environmentally sensitive products	12	8	22	6	6
redesign existing products to make them more environmentally sensitive	12	7	22	3	6
Enters new environmentally oriented markets/segments	8	4	14	2	5
redesign products packaging to be more environmentally sensitive	5	2	10	1	6
Advertising the environmental benefits of the products	5	4	16	3	8
Selling donated materials once discarded as waste	1	4	8	5	2

Table 5.25 shows that initial capital invested on market driven sustainability strategies also takes maximum of 6 years to be recouped. Still some reasonable number of respondents shows that investments on entered new environmentally oriented markets/segments strategy can be recovered in2 years. More so, some other respondents recovered their investments on advertising the environmental benefits of the products strategy in more than 9 years. Despite

these, majority of the respondents are of the view that investments on market driven sustainability strategies is recovered between 5 years and 6 years. Therefore, both process driven and market driven sustainability strategies investments took approximately 5 years to 6 years to be recovered.

5.12: Relationships of the Main Constructs of the Research

In this section correlation between constructs under study was conducted. The essence of correlation is to show how closely correlated or otherwise are the variables under considerations. Where the variables have significant correlation we assume that the variables are related with one another. The implication of this is that there is association between sustainability implementation and competitiveness. This could invariably be interpreted that sustainability implementation leads to achievement of competitive objectives of the companies. The implication of this will invariably means adoption of sustainability practices will not lead to attainment of competitive objectives of an organisation.

Table 5.26: Correlation of Drivers of Sustainability with Sustainability Investment, Sustainability Performance Assessment and Sustainability Reporting Systems

Variable	Desire to reduce cost of production	Desire to increase profits	Desire to improve competitiveness	Desire to conserve energy	Desire to preserve resources	Desire to reduce pollution	Desire to reduce wastes	Consumers pressures	Legal/regulatory pressures	Investors pressures	Improve corporate performance	Marketing pressures	Environmental advocacy pressures	Enter new markets/s	Urge to increase market shares	Urge to increase sales turnover	Urge to reduce carbon foot print	Serve as a source of raw materials
Sustainability investments			.251** (.008)	.201* (.034)						-.236* (.012)		-.243** (.010)			.211* (.025)			-.331** (.000)
Sustainability assessments	.200* (.035)											.247* (.023)						
Sustainability reporting systems		.242* (.010)	.272** (.004)	.192* (.042)							-.208* (.028)	-.254** (.007)	.243* (.045)		.166* (.050)			

***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**

Table 5.26 shows correlation between sustainability investments and the following drivers: desire to improve competition, desire to increase profit, investors' pressure, marketing pressures, urge to improve market shares and a new source of raw materials. According to the respondents (table 5.6) the most preferential drivers are: desire to conserve energy, desire to increase market shares and desire to improve competitiveness followed by investors' desire, marketing desire and a new source of raw materials. This correlation table validate the finding of this research that the drivers of sustainability in oil and gas companies are combination of economics and environmental motives (see table 5.6). Table 5.26 shows correlation between drivers of sustainability and sustainability performance assessment at: desire to reduce cost of production and marketing pressures. Additionally, Table 5.26 shows significant correlation between drivers of sustainability and sustainability reporting systems at: desire to increase profits, desire to improve competitiveness, desire to conserve energy, to improve corporate performance, marketing pressures, environmental advocacy pressures and urge to increase market shares. This shows that drivers of sustainability have good correlation with three key constructs of this research.

Table 5.27: Correlations between Drivers of Sustainability and Process Driven Sustainability Strategies

Variable	Desire to reduce cost of production	Desire to increase profits	Desire to improve competitiveness	Desire to conserve energy	Desire to preserve resources	Desire to reduce pollution	Desire to reduce wastes	Consumers pressures	Legal/regulatory pressures	Investors pressures	Improve corporate performance	Marketing pressures	Environmental advocacy pressures	Enter new markets/s	Urge to increase market shares	Urge to increase sales turnover	Urge to reduce carbon foot print	Serve as a source of raw materials
Redesign production process for environmental reasons			-.206* (.032)		-.604* (.050)	.206* (.032)									-.229* (.011)			
Redesign pollution controls, wastes disposal , water and air treatment process																		
Use recycled materials from outside sources in production process		-.243* (.019)																
Recycling scrap materials once considered waste in production																		
Recycling defective end product in production																		
Use renewable energy in production																		
Design free emission production process															-.234* (.004)			
Use renewable resources in production																		
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**																		

Table 5.27 shows correlation coefficient between drivers of sustainability and process driven sustainability are at: desire to increase profits, desire to improve competitiveness, desire to preserve resources, desire to reduce pollution and urge to increase market shares. Three of these correlations are economic motivations and the remaining three are environmental motivations.

Table 5.28: Correlations between Drivers of Sustainability and Market Driven Sustainability Strategies

Strategies	Desire to reduce cost of production	Desire to increase profits	Desire to improve competitiveness	Desire to conserve energy	Desire to preserve resources	Desire to reduce pollution	Desire to reduce wastes	Consumers pressures	Legal/regulatory pressures	Investors pressures	Improve corporate performance	Marketing pressures	Environmental advocacy pressures	Enter new markets/s	Urge to increase market shares	Urge to increase sales turnover	Urge to reduce carbon foot print	Serve as a source of raw materials
Introduce new environmentally sensitive products					.246* (.010)	.190* (.049)					.239* (.013)		.316** (.001)		-.241* (.012)			
Redesign existing products to be environmentally sensitive																		
Enters environmentally oriented markets		.337** (.000)																
Redesign product packaging to be environmentally sensitive					-.157* (.015)	-.152* (.016)												
Advertising the products environmental benefits																		
Selling materials once discarded as wastes	.198* (.040)	.539 (.060)**																

***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**

Table 5.28 demonstrates significant correlations between drivers of sustainability and market driven sustainability strategies at introduce new environmentally sensitive products strategy with: desire to preserve resources, desire to reduce pollution, desire to improve organisational performance, environmental advocacy pressures and desire to increase market share. Enters new environmentally oriented markets strategy has significant correlation with the desire to increase profit. Redesign product packaging to be environmentally sensitive strategy has correlation desire to preserve resource and desire to reduce pollution whilst selling materials once discarded as wastes strategy significant correlation with desire to reduce costs of production and desire to increase profit respectively. Table 5.28 signifies high significant correlation between drivers of sustainability and market driven sustainability strategies. This could be attributed to the fact that oil and gas companies adopted sustainability in order to improve their economic and environmental performance. This means that oil and gas companies use market driven sustainability strategies to improve revenues. Using these initiatives oil and gas companies can easily improve their environmental performance and competitiveness.

Table 5.29 demonstrates correlation between sustainability investment and market driven sustainability strategies at: enters new environmentally oriented markets and advertising the products environmental benefits strategies. These are all market driven sustainability strategies. The correlation between sustainability investments and market driven sustainability strategies could be attributed to the fact majority of market driven sustainability strategies contributed to the profitability of oil and gas companies. Table 5.26 shows that there is no correlation between sustainability investment and process driven sustainability strategies. The absence of correlation between sustainability investments and process driven sustainability strategies could be because majority of process driven sustainability strategies require additional investments.

Table 5.29 shows significant correlations between sustainability strategies and sustainability assessment methods at: introduce new environmentally sensitive products, advertising the products environmental benefits, recycling defective end products and free emission production. This result indicates that sustainability assessment method has good correlation with both process driven and market driven sustainability strategies, which signifies that UK oil and gas companies assesses their sustainability performance regularly. The assessment is based on economic, environmental and social indicators.

That is the companies assess impact of their sustainability implementation on environmental improvement (process driven strategies)and on their companies' revenues (market driven strategies).

Table 5.29: Correlation of Process Driven Sustainability Strategies with: Sustainability Investments and Sustainability Performance Assessment

Strategies	Introduce new environmentally sensitive products	Redesign existing products to be environmentally sensitive	Enters new environmentally oriented markets	Redesign product packaging to be environmentally sensitive	Advertising the products environmental benefits	Selling Materials Discarded as Wastes	Design production process for environmental reasons	Design pollution controls and waste disposal treatment	Use recycle materials in production	Recycling scrap materials in production	Recycling defective end products in production	Use renewable energy source in production	Emission free production process	Use renewable resource in production
Sustainability investments			.207* (.032)		.274** (.004)									
Sustainability assessment	.332** (.000)				-.340* (.039)						.300* (.002)		-.277* (.005)	
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**														

Table 5.30 shows significant correlation between process driven sustainability strategies and environmental component variables. This correlation means that process-driven sustainability strategies lead to improved environmental quality. This is because process-driven sustainability strategies re-design the production process of companies to make it environmentally friendly. Environmentally friendly (cleaner) production leads to production of environmentally and consumer friendly products.

Table 5.30: Correlation of Process Driven Strategies and Environmental Indicators

Variables	Redesign production process for environmental reasons	Design pollution controls, wastes disposal , water and air treatment process	Use recycle materials from outside sources in production process	Recycling scrap materials once considered waste in production	Recycling defective end product in production	Use renewable energy in production	Design free emission production process	Use renewable resources in production
Environmentally friendly production								
Reduces wastes and control pollution								
Emission free production								
Use renewable resources								
Reuse scraped materials								
Reprocess defective end products			-.885 (.014)**			-.585 (.053)**		
Use ecological guidelines in outsourcing					.195* (.004)			
Employees environmental training								
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**								

The aims of adopting sustainability are to maintain the environmental quality and to improve the companies' performance on environmental and social wellbeing of the community. Sustainability is adopted in companies by executing one sustainability strategy or other. Oil and gas industry as one of the five most polluting industries in the world, if their production process becomes cleaner, environmental problems such as land and water pollutions, ozone layer depletion, energy use, pesticides, toxic chemicals, nuclear power, climate change (carbon emissions), global warming, depletion of freshwater supplies and deterioration of natural resources that threatens the ability to sustain the world now and in the future will be under control (Goodland, 1995; Wheeler, 2004; Millennium Ecosystem Assessment, 2005; Gopalakrishnan, et al 2012; Yusuf et al, 2012).

Table 5.31: Correlation of Market Driven Sustainability Strategies and Environmental Indicators

Variables	Introduce new environmentally sensitive products	Redesign existing products to be environmentally sensitive	Enters new environmentally oriented markets	Redesign product packaging to be environmentally sensitive	Advertising environmentally benefits of the products	Selling donated waste material
Environmentally friendly production						
Reduces wastes and control pollution						
Emission free production					.220* (.023)	
Use renewable resources						
Reuse scraped materials						
Reprocess defective end products			.277** (.004)			-.581 (.054)**
Use ecological guidelines in outsourcing						
Employees environmental training						
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**						

Table 5.31 shows significant correlation between environmental component variables and market driven strategies. This means as oil and gas companies execute sustainability strategies that maintain the environment, they also implement other strategies that increase their revenue base. Tables 5.30 and table 5.31show correlation between process-driven sustainability strategies adopted in oil and gas companies with environmental component. This means that oil and gas companies implement process driven sustainability strategies to protect the environment and use market driven strategies to maximise their revenues.

Table 5.32 shows that there is correlation of process driven sustainability strategies and social component. These correlations indicate that process-driven sustainability strategies can also be used to improve the social welfare of the community. As such, oil and gas companies implement process driven sustainability strategies in order to reduce the impacts of their production on social wellbeing.

Table 5.32: Correlation of Process Driven Sustainability Strategies and Social Indicators

Variables	Use internal code of conduct	Fair employment from the locality	Provision of health and safety facilities	Investment on infrastructural facilities	Payment of taxes and levies	Support government revenue transparency	Ethical business through trading	Investment on poverty alleviation programme	Endowment to local symphony	Regional and cross regional development initiatives
Redesign production process for environmental reasons					-.221* (.022)			.199* (.039)		
Redesign pollution controls, wastes disposal, water and air treatment process										
Use recycle materials from outside sources in production process					-.260** (.007)					
Recycling scrap materials once considered waste in production										
Recycling defective end product in production				.221* (.021)	-.231* (.011)					
Use renewable energy in production										
Design free emission production									-.220* (.022)	
Use renewable resources										.190* (.049)
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**										

This correlation indicates that improvement of environmental quality will drastically reduce the adverse effects of environmental destruction to the social welfare (such as disease, war, hunger and insecurity). This will eliminate the fear that the present and future generations may terminate very soon as a result of manufacturing companies' operation that pollutes the land, water and air.

Table 5.33: Correlation of Market Driven Sustainability Strategies and Social Indicators

Variables	Use internal code of conduct	Fair employment from the locality	Provision of health and safety facilities	Investment on infrastructural facilities	Payment of taxes and levies	Support government revenue transparency	Ethical business through trading	Investment on poverty alleviation programme	Endowment to local symphony	Regional and cross regional development initiatives
Introduce new environmentally sensitive products								.195* (.039)		
redesign existing products to be environmentally sensitive					.255** (.008)					
Enters environmentally oriented markets.					.317** (.001)					
Redesign product packaging to be environmentally sensitive										
Advertising the environmental benefits of the products					.198* (.040)					
Selling donated waste materials					-.221* (.022)					
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**										

Table 5.33 displays significant correlation between market-driven sustainability strategies and social components. This signifies that responding company's makes public aware about the impacts of their sustainability strategies on the environment. Modern society is now aware that the current climatic change is the result of the greenhouse emission. This give rise to green consumers, green markets and environmental advocates,

who together form a strong pressure group against manufacturing companies. This pressures force many manufacturers to make their production process and products environmentally/consumers friendly. Now a day's company that adopts sustainability are generally accepted by the general public. This societal acceptance leads to a number of benefits to the companies. The correlation in table 5.33 could be attributed to the fact that adoption of sustainability by oil and gas companies makes their production favourable to the social wellbeing of the society.Asthe ultimate aim of sustainability initiative is to reduce environmental and social destruction.

Table 5.34: Correlation of Environmental Indicators and Social Indicators

Variables	Use internal code of conduct	Fair employment from the locality	Provision of health and safety facilities	Investment on infrastructural facilities	Payment of taxes and levies	Support government revenue transparency	Ethical business through trading	Investment on poverty alleviation programm e	Endowment to local symphony	Regional and cross regional development initiatives
Environmentally friendly production	.185* (.051)							.197* (.038)	-.244** (.010)	
Reduces wastes and control pollution		.198* (.036)	.275** (.003)			.177* (.006)				
Emission free production		.253* (.039)				-.188* (.047)				
Use renewable resources					.380 (.045)*	.208* (.029)				
Reuse scraped materials				.277* (.004)						
Reprocess defective end products							.300 (.002)**			
Use ecological guidelines in outsourcing										
Employees environmental training										
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**										

Table 5.34 shows significant correlation between environmental and social dimensions of sustainability. This means that sustainability strategies adopted in oil and gas companies have impacts on the companies' environmental and social performance improvement.

5.13: The Impacts of Sustainability on Competitive Objectives

The aim of any business organisation is to maximise shareholders wealth through manufacturing goods and service at a profit level. When a product's cost of production is less than its unit sales price, a profit is made. Companies use various initiatives to produce at lowest possible costs and to sale at highest possible prices. Companies compete among themselves in the market. Competition leads to implementation of various strategies by companies in order to differentiate their product from their competitor so as to persuade the consumer to buy the company's products. In green business environment, competition changes from cost based factors to attribute based factors such as environmentally friendly production process and consumer friendly products. Thus, in green market situations, an organisation focuses on environmentally friendly products and customer satisfaction through creating value for the customer to enhances corporate competitiveness. Thus, creating customer value is one of the aims of sustainable supply chains, as many consumers prepare to buy and use consumer friendly products at meaningful prices.

In order to determine the impact of sustainability on company competitiveness, correlation analysis of sustainably attributes and competitive objectives was carried out. In assessing the perceived correlation between sustainability attributes and competitive priorities, SPSS bivariate correlation analysis was performed between the variables. In a bid to determine and enhance the sustainability in organisations, it is suggested that sustainability implementation is an antecedent of sustainable supply chains. The proposition is based on the idea that sustainability practices leads to organisational competitiveness. In the future, only companies that make sustainability a goal will achieve competitive advantage (Markley and Davis, 2007; Nidumolu et al, 2009; Yusuf et al, 2012). Therefore, it is hypothesised that there is positive relationships between sustainability and competitiveness. Thus, in this section attempt was made to verify the proposition linking sustainability and competitive priorities.

Table 5.35: Correlation of Drivers of Sustainability and Corporate Objectives

Variable	Desire to reduce cost of production	Desire to increase profits	Desire to improve competitiveness	Desire to conserve energy	Desire to preserve resources	Desire to reduce pollution	Desire to reduce wastes	Consumers pressures	Legal/regulatory pressures	Investors pressures	Improve corporate performance	Marketing pressures	Environmental advocacy pressures	Enter new markets/s	Urge to increase market shares	Urge to increase sales turnover	Urge to reduce carbon foot print	Serve as a source of raw materials
Speed																		
Cost																		
Delivery	.417 (.057)**											.190* (.045)						
Innovation			-.220* (.033)	-.236* (.012)	- .244** (.010)								-.226* (.016)		-.237* (.012)	.204* (.031)		.207* (.028)
Proactivity		.405 (.071)*																
Quality																		
Flexibility														.210* (.026)			-.219* (.021)	
Dependability																		
Customisation																		
Sales turnover										.201* (.034)								
Net profit	.218* (015)	.310 (.043)*			-203* (.016)									-.217* (.021)				
Market share			.304 (.010)**	.243** (.010)				-.227* (.016)									.186* (.049)	-.191* (.044)
Customer loyalty																		
Performance relative to the competitors																	.196* (.039)	

***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed). NSC: no significant correlation**

Table 5.35 shows that there iscorrelation between innovation and drivers of sustainability at the following variables: improve competitiveness, conserve energy, preserve resources, environmental advocates' pressures, increase market shares, increase sales turnover and a new source of raw materials. Among these drivers energy conservation, resources preservation and new source of raw materials are benefits that can only be achieved by innovation. It is only through innovation that a company can conserve energy, preserve resources and discover a new source of raw material (recycling). The objectives of sustainability are resource utilisationand competitiveness through environmental protection. This means innovation is the key driver of sustainability, such that without innovation sustainability may not be possible. Energy can be conserved through innovation or can be changed to an alternative source of energy. Resource can be preserved through innovation by using renewable resources or recycling (new sources of resource). The correlations between these drivers of sustainability and innovation are based on environmental and economic performance that clearly shows new convergence of economic interests and potential systemic resources optimization. This will lead to increase sales turnover, which will increase market shares that will in turn lead to the improvement of the companies' competitiveness. Sustainability research clearly identifies resources as important factor on sustaining innovations. In addition to the necessary infrastructure capacity to support innovation, innovation itself must be sustainable. That is, innovation has to have specific attributes that lead to producing services to targeted stakeholders that meet specific needs (Johnson et al, 2004). Innovation is the capability to move out of the business-as-usual and to promote life cycle value chain or along other life cycles of products and services (Manzini and Vezzoli, 2003). Innovation will make production process environmentally friendly at lowest possible costs thatmay increase revenues. The process generates additional revenues from better products or empowers companies to create new businesses. Innovation is a key to progress, particularly in times of economic crisis, innovation is also central to building a sustainable supply chain. Traditional approaches to business will collapse and companies will have to develop innovative solutions. That will happen only when executives recognize innovation as a best strategy to sustainability. That is sustainability should be a touchstone for all innovation (Nidumolu et al, 2009).

Market share is correlated with drivers of sustainability at the following variables:improve competitiveness, conserve energy, consumers' pressures, enter new markets/segments, reduce carbon foot print and a new source of raw materials. These drivers are combination of economic and environmental motives. More so, in a free market economy customer is the king. That is companies exist only to serve the interest of the customers. The more the company is able to serve the needs of the customer the more the company sales and the higher the market share. Drivers such as conserving energy, reducing carbon foot print and entering new environmentally conscious markets are possible through innovation. This means, through innovation companies canconserve energy, reduce carbon foot print and enter new environmentally conscious markets (with consumer friendly products). This will improve market share, which will in turn increase companies' competitiveness.

Net profit that is correlated with the drivers of sustainability at: reduce cost, increase profitsand preserve resource. This means through resource preservation, the company's cost of production will reduce and its profits will increase. Flexibility on the other hand is correlated with enter new market and urge to reduce carbon foot print. This means through innovation companies can be flexible such that they can redesign their production process for environmental reasons (environmentally friendly production) and redesign new and existing products to be more environmentally sensitive (consumer friendly product).

Table 5.35 shows correlation between delivery and drivers of sustainability at cost and marketing pressures. This is because many companies developed new ways of distributing (electrical vehicles) products and services as well as reduced staff travelling for meeting (online internet meeting). Table 5.35 above also show that there is correlation between proactivity and Desire to increase profits. This is because proactivity in sustainability leads to societal acceptance that may lead to increase in sale turnover, increase sales turnover may in turn leads to increase in profit.

Table 5.35 indicates significant correlation of turnover and marketing pressures. As the kings in the market, green consumers pressurise companies to produce consumer friendly products. Companies that produce consumer friendly products will have their sales turnover increased, which may generate higher profit. In table 5.35 performances relative to competitors is correlatedwithurge to reduce carbon foot print. This validate the literature, which contends that companies that device free emission production system were not only maintaining and protecting the environmental quality, but will also attain competitive advantages over their competitors.

Correlation of drivers of sustainability and competitive priorities is one contributions of this research to the sustainabilityliterature. To the best of the researcher's search on sustainabilityliterature, there is no research that shows correlation between drivers of sustainability and competitive priorities. Therefore, this research is hereby for the first time, presented a market driven sustainability with links to organisational competitiveness.

5.13.1: Correlation of Sustainability Investments and Competitive Objectives

Drivers of sustainability are motives or drives that encourage companies to implement sustainability. Drivers of sustainability help companies in deciding the objectives of their sustainability implementation. After a company select its drivers (objectives) of sustainability implementation, the first stage of is investment on sustainability. This means every company has a set of objectives that it wishes to achieve when implementing sustainability initiatives. Sustainability investment and competitive objectives were among the main constructs of this research. This is because the focus of this research is relationships between sustainability implementation and competitiveness of oil and gas companies. Therefore, it becomes imperative to find the correlation of sustainability investment and competitive objectives.

Table 5.36 shows significant correlation between sustainability investments and competitive objectives at the following variables: cost, innovation, proactivity, flexibility, customisation, net profit and performance relative to the competitors. As one of the most polluting companies in the world, oil and gas companies were proactive on sustainability implementation. Being proactive in sustainability, oil and gas companies will be able to reduce the impacts of their operation on environmental and social aspects of the larger community. Sustainability implementation in oil and gas companies will make their production processes environmentally friendly and their products/services consumer friendly.Environmentally friendly production processes and consumer friendly products are the best that the consumers require (customisation) at present. These will increase the turnover rates of the companies, which will result in increase in net profit and performance relative to the competitors. This shows that oil and gas companies were making investments (proactive) on sustainability in order to achieve competitiveness through customisation, net profit and performance relative to competitors.

Table 5.36: Correlation of Sustainability Investments and Competitive Objectives

Variables	Speed	Cost	Delivery	Innovation	Proactivity	Quality	Flexibility	Dependability	Customisation	Turnover	Net profit	Market share	Customer loyalty	Performance relative to competitors
Sustainability investments		-244* (.010)		-.223* (.021)	.190* (.051)		.177* (.006)		.228* (.016)		.188* (.049)			.210* (.028)
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed).**														

Table 5.36 shows negative correlation between sustainability investments and two competitive objective variables: cost of production and innovation. This is because at the take up stage of sustainability implementation requires immense capital investments on purchasing of equipment, infrastructures and innovations. The correlation of sustainability investments and flexibility is positive, this testifies that the higher the investment on sustainability the more flexible the company. Therefore, it can be argued that the more sustainable the company the more flexibility; as organisations can change from the business as usual to a sustainable supply chains leading to switch over to environmentally friendly operation that produces customer friendly products.

Table 5.37shows correlation of process driven sustainability strategies and competitive priorities at: redesign production process for environmental reasons and net profit. This indicates that proactivity on environmental activities may lead to increase in the net profit, which could ultimately lead to increase on competitive performance. The literature specifies that changing from the business as usual to the environmentally friendly production is strongly linked with profitability, as a result of cost saving that is associated with the environmental activities (Guide and Van Wassenhove, 2001; Savaskan et al, 2004).

Table 5.37: Correlation of Process Driven Sustainability Strategies and Competitive Priorities

Variable	Speed	Cost	Delivery	Innovation	Proactivity	Quality	Flexibility	Dependability	Customisation	Turnover	Net profit	Market share	Customer loyalty	Performance relative to competitors
Redesign production process for environmental reasons											-.180* (.043)			
Design pollution/waste disposal system in production						.248** (.010)						-.279** (.018)		
Use recycle material from outside in production								-.200* (.038)	-.257** (.007)			-.228** (.018)		
Use scrap material in production												-.198* (.040)		
Recycling defective end product in production														
Use renewable energy source in production										-.246** (.010)				
Emission free production				.238* (.049)		.								
Use renewable resources in production														
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed).**														

Redesigning pollution and waste disposal systems is correlated with the following competitive objective variables: quality and market share. Reducing pollution and wastes in production process leads to saving costs. These savings can be invested on consumer friendly products that are more qualitative than business as usual made products. The customers are ready to buy environmentally friendly products at reasonable prices. This will lead to increase on sales turnover and profits that will in turn leads to increase in the market share.Organisations could contribute to environmental sustainability by restructuring product and services, aligning core business value, making operations environmentally friendly,

Friendly and implementing environmental programmes that assist in resource alteration, recycling and efficient waste disposal (Adersen and Larsen, 2009)

Table 5.37 illustrates correlation of use recycled material from outside in production and the following competitive variables: dependability, customisation and market share. Although recycling programs are often run at breakeven, while the profitability of the recycling programs themselves may be marginal (Filho, 2000; Field and Sroufe, 2007). Many have argued that companies that convert the recycled material into products benefit economically because their manufacturing costs tend to be lower than if they used virgin materials (Wheeler, 1992; Guide and Van Wassenhove, 2001; Savaskan et al, 2004; Yusuf et al, 2012). More so, the net environmental and societal effects are generally positive (Costanza, 1991; Goodland 1995: Manzini and Vezzoli, 2003; Wheeler, 2004; Anderson, 2006; Corbett and Klassen, 2006). Remanufacturing recycled material improves company's dependability, as this helps in rapid introduction and growth of mini-mills in several industries (Crandall, 1996) and preserves resource for the future generations, which will in turn make the mother company more dependable. Customisation increases as the demand for environmentally friendly products has grown, the demand for recycled material and the availability and variety of products with recycled contents continues to increase (Field and Sroufe, 2007).

Table 5.37 denotes significant correlation between use of scrap materials in production and market share. The factor that is affecting the use of scrap materials is the costs of converting scrap material to new products, which is often less than the conversion of fresh materials to finish goods. Therefore, manufacturers using scrap materials can significantly reduce pollution and increase their competitiveness (Fleischmann et al, 2001; Field and Sroufe, 2007). Table 5.37 further shows correlation between uses of renewable energy source in production and turn over. Additionally there is correlation between emission free production and innovation. The process that companies undergoes in switching from manufacturing of virgin materials to remanufacturing of used materials involves a lot of research and development leading to innovation and creativity of many alternative means of converting the used material into new product. This gradually helps companies to develop skills on innovation. More so, as demand for environmentally friendly products has grown; the technology for post-consumer waste into new products has improved (field and Sroufe, 2007); this increases innovation, quality and inventory capabilities such as reduced variability, scrap and rework (Shrivastava, 1995; Montiel, 2009).

Table 5.38: Correlation of Market Driven Strategies and Competitive Objectives

Variable	Speed	Cost	Delivery	Innovation	Proactivity	Quality	Flexibility	Dependability	Customisation	Turnover	Net profit	Market share	Customer loyalty	Performance relative to competitors
Introduce new environmentally sensitive products		-.222* (.021)			.205* (.033)						-.196* (.042)	-.241* (.012)		
Redesign existing products to be more sensitive products				.199* (.039)										
Enters new environmentally oriented markets or segments		.257** (.007)			.254** (.008)			.280** (.003)					.288** (.010)	
Redesign product packaging to be environmentally sensitive														.255* (.055)
Advertising the environmental benefits of the products														.234* (.015)
Selling donated waste materials								-.255** (.008)			-.206* (.032)	-.213* (.027)		
***.Correlation is significant at .05 levels (2-tailed). **.Correlation is significant at .01 levels (2-tailed).**														

Table 5.38 shows correlation between market driven sustainability strategies and competitive objectives at introduce new environmentally sensitive products and the following competitive variable: cost, proactivity, net profit and market share. Producing new environmentally sensitive products decrease in pollution, wastes and costs. Pollution prevention can lead to significant savings that will lower cost of production relative to competitors (Hart and Ahuja, 1994; Markley and Davis, 2007; Chaabane, 2011). Cost reduction may lead to increase on productivity at lower selling prices. Lower selling prices lead to increased sales turnover (the lower the prices the higher the quantity (demanded or sold). Higher sales turnover leads to higher net profit while market share of the company also increases as a result of increase on sales turn over.

Table 5.38 also demonstrates significant correlation of redesign existing products to be more sensitive products and innovation. This validates the literature that sustainability activities lead to increase in research and development (R&D), which will in turn lead toincreased innovation. Sustainability is the key to innovation (Manzini and Vezzoli, 2003; Nidumolu et al, 2009). Sustainability is a change process with specific action plans that strengthen system infrastructure and innovation (Johnson et al 2004).

Table 5.38 illustrates significant correlation of enters new environmentally oriented markets and the following competitive objectives: cost, proactivity, dependability and customer loyalty. Green market is the market that demand environmentally friendly product. Since the responding organisations change their existing products to environmentally friendly products and introduce new environmentally sensitive products. These will make it easy to enter green market and to reduce their cost of production. Organisations should adopt new technologies that are specifically designed to reduce resource consumption and pollution. Use of these new technologies may be encouraged by economic incentives such as cost saving (Sibbel, 2009). There is a strong relationship between environmental consciousness and a firm's competitiveness (Leal et al, 2003).

Table 5.38 also indicates significant correlation of redesign product packaging to be environmentally sensitive and performance relative to competitors. Business organisations achieve savings and competitiveness through resource use reduction, recycling and environmentally sensitive packaging systems (Chaabane, 2011). The environmental benefits are obtained by the optimization of the distribution processes, in terms of both packaging and transportation. Packaging reuse reduces raw material consumption and minimizes production processes. For the same reason, packaging landfill is reduced. Furthermore, other problems related to the waste treatments are avoided once recycled. Traditional packaging causes problems to the process because of the detergent residuals contamination; moreover, any improper disposal of packaging with possible dispersion of the inside residual detergent is minimized (Manzini and Vezzoli, 203).

Additionally, table 5.38 shows correlation between advertising the environmental benefits of the products and performance relative to competitors. Through advertising the environmental benefits of the products, companies can attract more customers. This is as a result of increased demand of environmentally friendly products by the growing number of green consumers (Manzini and Vezzoli, 203). Advertising the environmental benefits of the productsmay increase sales turnover of the company, thereby making more sells than their competitors.

Table 5.38 illustrates significant correlation between selling donated waste materials and the following competitive objectives: dependability, net profit and market share. Sustainability increases companies' sales turnover and profits. When profit increases, net profit may also increase. Increase of net profit is the resultant effect of increase on gross profits and sales turn over. The higher the sales turnover the higher the company market shares. Dependability is the resultant effect of both net profit and market share; together they improve the company competitiveness. Competitive advantage depends strongly on the proper match between distinctive internal (organizational) capabilities and fluctuating external environmental circumstances. Proactivity on sustainability leads to a high competitive advantage (Carter and Dresner, 2001; Markley and Devis, 2007; Pagell and Wu, 2009; Buyukozkan and Cifci, 2010) and also helps to manage reputational and environmental risk (Hall, 2001; Teuscher et al., 2006; Clodia Vurro et-al, 2010). There are also business added values and benefits for the implementation of sustainability in manufacturing along supply chain (Stuart et al., 2005; Baske, 2012). Environmental opportunities in the future may become a major source of revenue growth and competitive advantage to organisations (Kleiner, 1991; Hart, 1993, 2000; Walker and Carter, 2012).

Table 5.39 shows that sustainability performance assessment and competitive objectives are correlated on the following variable: proactivity, customisation and net profit. The correlation could be described as oil and gas companies were engaged on assessing their sustainability performance on the general environment. This further shows that proactivity on sustainability leads to customisation and net profit. What is being assessed is the rate at which the corporate production process reduces environmental destruction. The companies are also expected to report the result of their sustainability assessment to show the rate at which their sustainability activities improve the environmental quality.

Corporate sustainability is assessed using different types of sustainability indicators. Measuring sustainability involves recording the progress of the indicators that will give an overview of the organisational affairs (Bohringer and Jochem, 2007). This enables organisations to know how far they have gone, set their goals and determines the value of their business. Today many companies are monitoring and reporting their sustainability practices using sets of indicators (Liverman et al, 1988; Krajnc and Glavic, 2005).

Some oil and gas companies including British petroleum assess and produce company sustainability reports with triple bottom line (Rogers et al, 2008).

Table 5.39: Correlation of Sustainability Performance Assessment and Competitiveness

Variable	Speed	Cost	Delivery	Innovation	Proactivity	Quality	Flexibility	Dependability	Customisation	Turnover	Net profit	Market share	Customer loyalty	Performance relative to competitors
Sustainability performance assessment					-.224* (.018)				-.244* (.018)		-.230* (.015)			
***. Correlation is significant at the 0.05 level (2-tailed).**														

Tables 5.35 to 5.39 show that there significant correlation between all the variables of the research. The independent variables are drivers of sustainability, sustainability investment, sustainability strategies (process driven and market driven), sustainability performance assessment and sustainability reporting systems whilst the dependent variable is competitive objectives. In tables 5.35 to 5.39, it shows that there is significant correlation between all sustainability attributes and competitive objectives. It can be considered that sustainability implementation have positive relationship with competitive objectives. That is sustainability leads to the attainment of competiveness in manufacturing organisations.

To validate the correlations between the research variables, Chi-square statistical test was conducted to find whether there is significant difference between sustainability attributes and competitive objectives.Table 4.40 shows that there is statistical significance between sustainability and organisational competitiveness. That is no significant difference between sustainability practices and organisational competitiveness at 0.000. Therefore, sustainability implementation in companies' has positive impacts on the attainment of competitive objectives.

Table 5.40:Chi-square Statistics of the Impacts of Sustainability on Competitive Objectives

Variables	**N**	**Chi-squared (*X*)**	**DF**	**P Value**
Speed	112	66.702	16	.000
Low cost	112	40.872	12	.000
Delivery	112	52.515	16	.000
Innovation	112	61.834	16	.000
Proactivity	112	51.584	16	.000
Quality	112	81.288	12	.000
Flexibility	112	39.848	12	.000
Dependability	112	69.299	12	.000
Customisation	112	53.548	16	.000
Sales turnover	112	66.702	16	.000
Net profit	112	40.872	12	.000
Market share	112	19.741	16	.000
Customer loyalty (repeat order)	112	40.174	16	.000
Performance relative to competitors	112	33.305	16	.000

Table 5.40 shows that there is relationship between sustainability implementation and competitiveness of a company. That is sustainability implementation could lead to attainment of competitive objectives. The overall impact of sustainability implementation in oil and gas companies is increase on the competitiveness of the companies concerned. Additionally, if research question 5 is restated as hypothesis, the null hypothesis that sustainability has no impact on operational competitiveness would be rejected and the alternative hypothesis that sustainability has impact on performance would be accepted at a 5% level of significance ($p \leq 0.05$).

5.14: Conclusion

This chapter reported the result of a survey by questionnaire carried out to answer research questions on the impacts of sustainability implementation on UK oil and gas companies' competitiveness. Based on the empirical evidence from the survey the organisations that were implementing sustainability have positive significant competitive advantages over those that are not implementing sustainability. This is consistent with extant literature; the results from the empirical study support the link between sustainability and competitive objectives. This means that organisations implement sustainability to maintain and improve competitive advantage. Similarly, the links between sustainability and competitive objectives also support the argument that organisations are aiming at simultaneous deployment of competitive objectives, rather than concentrating on a single competitive capability. This was indicated by the correlation between competitive objectives and sustainability dimension. Although few studies were carried in the past that showed relationships between sustainability and competitive objectives, this study attempted to show the impact of the market driven sustainability dimensions on competitive objectives. Thus, the difference espoused here is that the study has proposed a clear link between each of the dimensions and its impacts on specific Competitive objectives, such that managers can be guided in making choice of an intended competitive outcome based on a specific sustainability dimension. The next chapter is chapter six that provides summary, conclusion and recommendations of the research.

CHAPTER SIX: CONCLUSION

6.1: Introduction

This chapter presents the conclusions drawn from the research; it starts by restating the research aims and objectives, research methodology and major tasks undertaken. In addition, by way of conclusion, research questions and the grounds for their validation and acceptance are reiterated. The chapter also outlines the contributions of the study to theory and practice as well as enumerates the limitations of the research; finally suggestions for further study are made.

6.2: An Overview of the Research

The primary objective of this research is to identify the most important drivers and inhibitors of sustainability implementation in the UK oil and gas industry. Additionally, the research proposed to justify market driven sustainability; that is attainment of competitive advantage in manufacturing organisations through sustainability implementation. Four attributes of sustainable supply chain were discussed in this thesis. The four attributes were drivers of sustainability, aggregate sustainability practices (sustainability investment, sustainability strategies, sustainability assessment – indicators and sustainability reporting system), competitive objectives and measures of business performance. The aim is to investigate the impacts of sustainability implementation on corporate competitiveness of oil and gas supply chain. The research is different from previous studies as it explores the notion of market driven sustainability by establishing empirical links between sustainable supply chains characteristics and organisational competitiveness.

An extensive literature review on was carried out that trace the development of supply chain. The literature shows that production started in chains where every producer creates complete product alone.In 1970s and 1980s supply chain was known as pipeline and in 1990s supply chains replaced the pipelines.Supply chain involves the flow of products and services from producer to customer (Mentzer, 2001; Kotler and Armstrong, 2008). As supply chain grow in depth and size the need to coordinate the operations of all the supply chain aroused. The coordination of supply chain management function involves supply chain management orientation, competency, partnership and integration.

The development of sustainability emerged out of critique of modernity and the path of environmentalists (Dresner, 2008).Sustainability has three components that include economic, environmental and social component. Economic componentis an organisation's financial impacts at micro (internal) level such as minimisation of cost and maximisation of value for stakeholders returns and the entire economic systems (GRI, 2002) and at macro (external) level that include company's contributions to social responsibility (Labuschagne et al, 2004; Azapagic, 2004). Environmental sustainability is what many sustainability advocates has historically focused on (Wheeler, 2004). Environment is considered differently between people depending on how they use it (Redclift, 1987). The needs for sustainability arose from the wasteful nature of the natural resources, gas emission, climate change and general environmental destruction (Daly and Cobb, 1989; Costanza, 1991; Meadows, Meadows and Randers, 1992; Hardin, 1993; Brown et al, 1995; Shrivastava, 2010). Social sustainability deals with the relationship between human rights and economic development, corporate power, environmental justice, global poverty and citizen action (Blewitt, 2008). Socially sustainable organizations are those that add value to the communities within which they operate by increasing the human capital of individual partners as well as furthering the societal capital of the communities. They manage social capital in such a way that stakeholders can understand its motivations and can broadly agree with the organization's value system (Dyllick and Hockers, 2002).

Literature on sustainability maintains that companies adopt sustainability because of some benefits that they expect to gain. These benefits are described as the drivers of sustainability (Yusuf et al, 2012). There are many drivers of sustainability in the literature. These drivers were broadly divided into three that include: economic, environmental as well as law and regulation drivers. Economic drivers are sometimes called market driven because their aim is to increase companies' earnings. Economic drivers include competiveness, market share, sales turnover, profitability, cost, revenue and return on investments etc. Environmental drivers are those that make companies' production process cleaner with lower environmental effects. They includes reducing carbon foot print, wastes, pollution, conserving energy, environmental advocacy pressures, sources of new raw materials and conservation of resources. Legal/ regulatory pressures, some organisations are forced by the laws of the land to adopt devices to reduce their carbon foot print on the environment. Government regulations are emphasised by many scholars as the most influential drivers of sustainability.

Sustainability adoption requires substantial investment to support the installation of new production facilities. These investments are expected to be recovered in some reasonable period of time at higher rate of return on investment. Companies implement sustainability through applying some sustainability strategies. Sustainability strategies can be classified into two categories: market-driven sustainability strategies and process driven sustainability strategies. Market driven sustainability strategies are designed to provide organisations with competitive advantages by producing consumer friendly products (Stead and Stead, 1995). Process-driven strategies are designed to offer organisations with competitive advantages by reducing costs through upgrading of production process to improve their environmental efficiencies (Stead and Stead, 1995). All companyare expected to use some specific indicators to assess their sustainability performance on environmental and social aspects of the societies. These indicators are drawn from economic, environmental and social components of the society. The result of this assessment is published and reported annually. The annual sustainability report is expected to comprise economic, environmental and social indicators.

Finally, the literature review studied the nature of competitive objectives. It was argued that companies should extend emphasis from cost and quality to higher order objectives such as product customisation, flexibility, proactivity, speedy delivery, dependability and innovation. The literature shows that flexibility is difficult to achieve by many companies but by adopting sustainability, companies become flexible as it possible for them to switch from unsustainable production to environmentally friendly production system. The conclusion was reached that sustainability implementation would enhance attainment of competitive objectives now and in the future.

The research reviewed literature on sustainability indicators and strategies drafted for UK oil and gas industry. The strategies and indicators reviewed include: UKOOOA wheel developed by UK Offshore Operations Association (UKOOA's) in partnership with UK government for the use UK oil and gas industry. Others are sustainability assessment model (SAM), Author D. little sustainable development assessment tool and PSI Assessment Methodology. Details of each of these strategies are explained in this chapter three.

Oil and gas industry supply chains were also discussed.Oil and gas industry is involved in a global supply chain that includes national and international transportation, ordering, inventory visibility and control, materials handling, and import/export facilitation and information technology. Thus, the industry offers a classic model for implementing sustainability and supply chain management techniques. In a supply chain, a company is linked to its upstream suppliers and downstream distributors as materials, information, and capital flow through the supply chain (Chima, 2007).Oil industry is broadly divided into three parts: upstream, midstream, and downstream. The upstream comprises exploration and production. The midstream is the distribution system, consisting of tankers and pipelines that carry crude oil to refineries. The downstream includes refining, marketing and retail distribution, through gasoline stations and convenience stores' (Schweitzer, 2011, p. 5).

This research adopted quantitative research method in data collection and analysis. Survey by questionnaire was used to collect primary data from CEOs of oil and gas companies in the UK. SPSS 20' was used in data analysis. A conceptual model was proposed consisting of four constructs namely, drivers of sustainability, sustainability attributes (sustainability investments, sustainability strategies, sustainability performance assessment, sustainability reporting systems), competitive objectives and measures of business performance. The synopsis of the conceptual model is that sustainability implementation is a requisite attainment of competitive objectives. Based on this, five research questions were proposed to test the validity of relationships specified in the conceptual framework.

To test the impact of sustainability integration into organisation's supply chains, a survey by questionnaire was undertaken. The total number of questionnaire administered is 550. Responding companies are selected randomly from a wide range of industries. One hundred and twelve companies provided useful data, the analysis and results of which were used as a basis for making inferences and reaching conclusions. The survey collected data from companies on their sustainability investments, sustainability strategies adopted or being implementing, the impacts of sustainability strategies on environmental and social performance of the company, sustainability performance assessment, sustainability reporting systems and attainment of competitive priorities. The survey results validated some aspects of the five research questions and therefore, certain aspects of central argument espoused in the conceptual model. The survey results confirmed that a significant relationship existed between sustainable supply chain attribute and competitive advantage. Equally, a significant relationship was also identified between the variables of the research. Furthermore, the data was tested to demonstrate that the dimensions of sustainable supply chain have impact on competitive objectives.

6.3: Research Questions

The purpose of this research was to identify the drivers and inhibitors of sustainability in the oil and gas supply chain as well as to examine the impacts of sustainability on competitiveness of the UK oil industry. There were six research questions altogether. In order to answer these questions a survey by questionnaire was conducted and the data collected from the survey was analysed using SPSS. The research questions and their answers are as follows:

6.3.1: Research question 1. What are the most important drivers and inhibitors of sustainability in the oil and gas industry?

The drivers of sustainability are potential benefits that companies expect to gain from implementing sustainability. These benefits can be to the companies, stake holders, environment, general public, government, national and international community or all. These drivers can be monetary, for example, profit maximisation, or non-monetary such as environmental safety and law enforcement. Economic drivers are those benefits that provide financial advantages to the companies and to other stake holders including competitiveness, profitability, increase in sales turnover, and increase in market share whilst environmental drivers include resource conservation, energy preservation, reduction of carbon footprint, pollution and emission reduction. Legal drivers are national and international laws introduced to enforce companies to adopt sustainability measures. On the other hand, inhibitors of sustainability are obstacles that made implementation of sustainability difficult for organisations.

The most important drivers of sustainability in this research are the desire to conserve energy, desire to increase market share and desire to improve competitiveness as well as environmental advocacy pressures whilst the least important drivers are legal and regulatory pressures and the desire to enter new markets. It is noteworthy that in contrast to the general thrust of the literature, this research found that legal and regulatory pressures as among the least important drivers of sustainability practices in the UK oil and gas industry.

The results show that inappropriate infrastructural facilities, higher take up costs, shortage of information on sustainability and employees lack of environmental awareness are the most important inhibitors whilst the least important ones are stakeholders challenge and fear of loss of profit at take up.

As the drivers of sustainability in this research are a mixture of economic (market driven) and environmental motives, it can be concluded that oil companies implement sustainability in order to achieve their primary objective of profit maximisation while simultaneously improving their environmental performance. It can also be concluded that the companies were not forced by the operation of the law to implement sustainability. Further, it can be argued that if companies understand that sustainability implementation can assist them in achieving their primary business objective of profitability, as indeed profitability means business sustainability or business continuity, they will be more determined to undertake sustainability initiatives. In addition, a more profound implications of the results of this study is that it has been shown empirically that in the oil and gas industry, there is a clear synergy between the environmental objectives of governments and environmental advocates on the one hand and profitability objectives of businesses. Additionally, the study has delineated the inhibitors of sustainability, which organisations embarking on sustainability initiatives can proactively mitigate to make the path to sustainability easier for them.

Sustainability is a concept that needs specific type of facilities' which are lacking in most organisations. Where these types of facilities are available they are costly to buy and to maintain. These are some of the reasons why a number of people view sustainability as a very costly initiative that can lead to profit reduction. Underpinning this is a lack of adequate information on how to integrate sustainability successfully into companies' supply chains. The lack of readily available information and employees' lack of knowledge on sustainability practices are the reasons why most stakeholders reject sustainability given that as a new concept, its consequences are unknown. This study has shown that in the oil and gas industry sustainability is something that must be embraced for environmental, economic, profitability and competitiveness reasons thus the study has helped to clarify and eliminate current misgivings on sustainability implementation as it has both short term and long term paybacks.

6.3.2: Research question 2. What is the level of sustainability practices in the oil and gas industry?

There are two views in the literature on sustainability implementation in manufacturing organisations. First view maintains that oil and gas companies' are engaged in sustainability practices whilst the second view claims that oil and gas companies are not practicing sustainability. This research was proposed to empirically find the level of sustainability implementation in oil and gas companies to determine the efficacy of any of these two opposing viewpoints.

To determine the level of sustainability implementation in oil and gas companies in the UK, some sustainability variables were taken into consideration. These variables are the length of time the companies spent on sustainability implementation, stage of sustainability implementation, initial sustainability investment, sustainability strategies adopted, sustainability performance assessment and sustainability reporting system.

The results show that the majority of the respondents are either currently in an on-going stage of implementation or have made significant progress. However, the results also show that the majority of the respondent adopted the concept within the last 15 years. In terms of sustainability investment, the majority of the respondent's initial investment was between 13m to 30m (see Table 5.13). The result further shows that the industry use economic, environmental and social indicators to assess and report their sustainability performance. Annual sustainability reports in the UK oil and gas companies were made using environmental performance indicators (EPI), operational performance index (OPI) and human development index (HDI). In addition, the minimum time that the respondents spend on sustainability practices is 5 years whilst the maximum time spent is 20 years. The results stated here show that there is a wide spread sustainability implementation in the UK oil and gas industry. Therefore, it can be argued that there is a high level of sustainability practices in the UK oil and gas supply chain. In order words, there is a high degree of commitment by companies to sustainability adoption across UK oil and gas supply chain.

Although sustainability has attracted a lot of attention globally in the past two decades, many companies, especially Small and Medium size Enterprises (SMEs), lack the financial resources to adopt the concept. Smaller firms need financial and technical assistance and continuing support from the industry giants, governments and international agencies (such as those connected with the UN and regional, economic and industrial groups, institutions and forums). The smaller enterprises also need aids in complying with environmental legislations. Therefore, establishing and ensuring sustainability is not the responsibility of an individual company alone but a collective task of governments, businesses, individuals and multilateral institutions.

This work indicates the initial investments on sustainability, the method of sustainability performance assessment and sustainability reporting systems being used by oil and gas companies. Thus, the research validates the view that there is high level sustainability practices oil and gas companies in the UK. The significance of this result is that oil and gas industry, being one of the most polluting industries in the world, has been shown to be extensively taking measures to reduce their carbon footprints. This should lead to improved environmental quality through greenhouse gas emission reduction.

6.3.3: Research question 3. What types of sustainability strategies have been implemented in the oil and gas industry?

The survey firms were asked to identify the type of sustainability strategies they were currently implementing. The nature of the firm is important in determining specific mix of strategies which constitute the content of a given firm's sustainability strategy. Firms operating in industries that produce commodities and intermediate goods implements process driven strategy and customer focused firms operating in industries focusing on producing consumer goods implement market driven strategies. Market driven sustainability strategies were more likely to require low capital investments whilst process driven sustainability strategies require higher level of capital investment. Similarly, market driven sustainability strategies are expected to generate more positive revenue and shorter payback period than process driven sustainability strategies.

The results show that oil and gas companies are implementing a mixture of process driven and market driven sustainability strategies at reasonable proportion. The companies use process driven sustainability strategies to improve their environmental performance and to minimise their costs of production whilst market driven sustainability strategies are being implemented to protect the environment and maximise competitiveness.

The oil and gas industry in the UK have implemented both process driven and market driven sustainability strategies. The contribution to knowledge here is that the nature and types of sustainability strategies implemented in the industry since the introduction of the concept to date have now been identified. This is new as no previous research indicates the types of sustainability strategies prevalent in the oil and gas industry and at best the information was patchy. For example, Stead and Stead (1995) find the total number of process and market driven strategies implemented in chemicals, metals, utilities pulp and paper industries but not the broader oil and gas industry whereas the work of Yusuf et al (2012) pointing to sustainability measures in the UK oil and gas industry was preliminary, limited and not as comprehensive as the current study documented in this thesis.

6.3.4: Research question 4. What are the revenue and investments implications of sustainability strategies of the oil and gas companies?

Revenue enhancement is a prime objective of a firm's decision to implement any kind of strategy. Therefore, organisations will adopt sustainability if there is the potential of reducing their costs of production and maximising profits. The answer to this research question shows that process driven and market driven sustainability strategies have the potential for creating synergy between economic success and ecological protection. This means improved environmental performance of oil and gas companies in the UK is compatible with their economic objectives and outcomes.

The process driven strategies in this research include the redesigning of pollution controls, waste disposal, water/air treatment, recycling defective end products in production and emission free production. Others are using recycled materials from outside sources in production; recycling scrap materials once considered waste in production; using renewable energy source in production and using renewable resource in production. The majority of the process driven strategies require significant capital investments. Similarly, market driven strategies include introduction of new environmentally sensitive products; entering new environmentally oriented markets or market segments; designing product packaging to be more environmentally sensitive and advertising the environmental benefits of the products, selling donated materials once discarded as wastes. Whilst the majority of process driven strategies require significant capital investments, without a commensurate return on investment, all the market driven strategies are associated with maximising profitability.

In all, this research has demonstrated that sustainability strategies have the potential for some type of meaningful economic benefits. In other words economically feasible answers to environmental issues are possible. The results further demonstrate that both process driven and market driven sustainability strategies are economically attractive and both of them have positive revenue impacts and reasonable period of time for recouping investment. This eliminates the fear that ecological responsibility is expensive. To the environmentalists, this research will significantly increase their ability to influence environmental performance of business organisations by putting more of their energies into collaboratively seeking solution with the business community rather than seeking judgement against them. As to governments, these results should inspire the design of future environmental protection laws that have economic gains in focus and therefore more effective and business friendly laws.

The importance of this finding is that sustainability strategies have potential for creating synergy between economic success and ecological protection. The fact that the sustainability strategies implemented in the oil and gas companies are both environmentally feasible and economically viable attests to this assertion. More importantly no previous research has studied the types and the financial implication of sustainability strategies implemented in the oil and gas industry.

6.3.5: Research question 5. What is the overall impact of sustainability implementation on the competitiveness of the oil and gas companies?

The research question is based on the expression that sustainability implementation enhances competitive objectives. There has been much research examining the association between corporate environmental performance and organizational competitiveness (Hart, 1995; Michalisin and Stinchfield, 2007; Markely and Davis, 2007: Yusuf et al, 2012). Earlier Yusuf et al (2014) have shown that the performance of industrial clusters, as widely claimed by the proponents of cluster theory, is not tenable in the oil and gas supply chain The significance of answering this question therefore is to underpin the assertion that sustainability implementation is an influential strategy for attainment of corporate competitiveness and show that oil and gas industry is not an exception in this case.

Research question 6 was tested through correlation analysis, regression analysis and chi-square method analysis. The correlation analysis shows that there is significant statistical relationship between sustainability attributes and competitive priorities. Regression coefficient shows significant positive effect of sustainability on competitive objectives. Equally the chi square statistics shows that sustainability has impact on competitive objectives at 5% level of significant ($P<0.05$). Therefore, taken together, the correlation, regression analyses test and chi square statistics indicate that attainment of competitive objectives is significantly influenced by sustainability implementation.

6.4: Contributions to Knowledge

WCED (1987) lists chemicals, metals, pulp/paper and utilities as the most polluting industries in the world. Sustainability challenge companies to change their source of energy to renewable energy source such as hydroelectric power, wind power and solar power generation and make their production process more sustainable with little or no impacts to the environment. This research examines what measures oil companies were taking to make their production environmentally friendly. The research aims to determine the impacts of market driving sustainability on competitiveness of the oil and gas companies.The contributions of the research to the knowledge are as follows:

1. Research question one is on the drivers and inhibitors of sustainability implementation in oil and gas companies in the UK. Though there are numerous theoretical and empirical researches on the drivers of sustainability in the literature. Most of these researches are on all manufacturing companies with very few researches on oil and gas industry. Therefore, drivers and inhibitors of sustainability discovered in this research will increase the intensity and quality of research on drivers of sustainability in oil and gas industry in the literature.This is a contribution to the knowledge. More importantly, the drivers of sustainability discovered in this research were not consistent with those available in the literature. This is the first time an empirical results indicates that law and regulations are not drivers of sustainability implementation (UK oil and gas industry). As important as law enforcement in the UK, oil and gas companies CEOs responded that they are implementing sustainability not because of the influence of law and regulations but because of some benefits such as environmental advocacy pressures, desire to conserve energy, desire to increase market, competitive advantage, desire to conserve resources, others were urge to reduce carbon foot print, pollution reduction and desire to enhance revenue.

Coming up with a new thing is a contribution to knowledge. The new thing that this research discovered is sustainability implementation in the UK oil and gas industry is influenced by market driven and environmental motives not by law enforcement. This finding may go a long way in reducing some oil and gas companies from lobbying government particularly in USA to stop the government from forcing them to implement sustainability. The finding can influence the direction of government laws from forcing companies to implement sustainability; towards using some potential benefits of sustainability to convince companies to adopt sustainability.

2. This research has enriched the literature of sustainability with something new both in quality and quantity. Researchers point the need for incorporating sustainability into supply chains of companies (Linton et al, 2007). Others emphasised on environmental impacts and competitiveness on integrating sustainability in companies supply chain (Stead and Stead, 1995; Markley and Davis, 2007: Yusuf et al, 2012). Yet others argued that substantial competitive advantage could be achieved by companies through social sustainability (Vilanova et al, 2009). This research brings for the first time in the literature of sustainability the concept of market driven sustainability. In this research, the market aspects of sustainability is brought into

focus, the emphasis is on how sustainability implementation leads to reduction on cost of production, increase in profitability, net profit and increase market share. Since profit maximisation is the main objective of companies, therefore, for companies to accept and implement anything new, they make sure that such concept will maximise their profit level otherwise the companies will not implement it. It is on this background that this research argued that oil and gas companies in the UK are not influenced by law to implement sustainability but were implementing sustainability in order to maximise the marketability of their products. This position has been validated by the drivers of sustainability and sustainability strategies (market-driven) adopted by oil companies in the UK. Most previous research theoretically and empirically discusses economics, environmental and social sustainability. It is not out of the approach to empirically discuss market driven sustainability implementation in companies supply chain. Therefore, this thesis is hereby declaring that many companies refused to implement sustainability because they assumed that sustainability will increase their cost of production and minimise their profit. For the first time, this research is hereby argue and empirically discovered that in addition to the environmentalprotection, sustainability implementation will reduce cost of production and maximise the profitability of companies. This observation is ably justified in answers to the research questions one and five. This empirical evidence will go a long way in enriching literature of sustainability.

3. Many researchers maintained that substantial competitive advantage can be created by firms through sustainability implementation (Kleiner, 1991; Gladwin, 1992; Hart, 1993, 2000; Drumwright, 1994; Santos, 2000; Markley and Davis, 2007 Wassenhove and Guide, 2009). But there is no empirical evidence in support of this; answer to the research question five of this research empirically validated this assertion. Correlation coefficient result expressed significant correlation between sustainability constructs and competitive objectives. This is a substantial contribution to the knowledge having validated a theoretical framework in the literature with empirical evidence from oil and gas companies.

4. This research developed a conceptual model of the characteristics of sustainable supply chains management with links to organisational competitiveness. This framework has contributes to the sustainability literature in three ways:

(a) The conceptual model of this research is an integration of the theoretical framework of Stead and Stead (1995), Gopalakrishnan et al (2012) and Yusuf et al (2012). Though the conceptual model of this research shares some constructs with these frameworks, they differ in approach and objectives.This means there is an improvement from the former theoretical frameworks. The improvements made in this model over the theoretical frameworks contribute new thought in the literature of sustainability. In future some researchers may use this conceptual framework as their theoretical framework.

(b) The conceptual framework is specifically applicable to oil and gas industry and it was found feasible. In other words it is believe with high esteem that this framework could smoothly be applicable in oil and gas industry. This is because it is tested in the in the analysis of this research. It is found applicable to oil and gas industry because it shows that sustainability implementation has positive relationships with environmental proactivity and competitiveness. This is a contribution to knowledge as this is the first conceptual model on the characteristics of sustainable supply chains management with links to organisations competitiveness in the literature.

5. This study shed light on the on oil and gas industry, UK up steam and downstream oil and gas sustainability strategies of which, to the best knowledge of the author no prior research has been carried out from the point of view of operations management. This is important because the industry is in transition and insights from application of sustainable supply chain management in other industries may be inadequate for implementation in this industry. However there is scope for more studies to be carried since one PhD research can only open the arena for more studies rather than being a panacea.

6. Answer to the research question three, the types of sustainability strategies being implemented in the UK oil and gas industry and research question four, the impacts (revenue or investments implications) of sustainability strategies implemented in oil and gas companies in the UK, servers as a contribution to knowledge. In this research it was found that oil companies in the UK is implementing different types of process-driven and market-driven sustainability strategies. The literature of sustainability does not specify the payback period of the investments on sustainability strategies. This research discovered that investments made on sustainability strategies were recovered

in four to six years, with majority being recovered in six years. To the knowledge of the writer no prior research has been carried out in operations management that gives this kind of result in oil industry. Therefore, this research is hereby declaring that in oil industry the payback period of sustainability strategies investments is average of six years.

7. This research serves as the founding research on justification of market-driven sustainability in oil and gas industry. This will give prospective researchers an insight of conducting market driven sustainability in other industries all over the world. Justifying sustainability practices with marketing potentials will attract more companies in different industries to implement sustainability. Implementing sustainability will lead increase profitability (one of their objectives), environmental protection and societal acceptance. This research will change the direction of sustainability campaigns all over the world from environmental protection alone to campaigns for profitability and environmental protection. This will attract more sustainable practices as opposed to law enforcement.

8. One of the contributions of this research to sustainability literature is the empirical findings of the drivers of sustainability that are specific to SMEs and large scale companies as well as the drivers of sustainability for various types of companies in the oil and gas sector. Though, there are reasonable number of research on drivers of sustainability to SMEs (Kim, 2006), oil and gas industry (Yusuf et al, 2010) and manufacturing organisations (Gopalakrishnan et al, 2012; Dashore and Sohani, 2013). There is no research that looks on an empirical analysis of these drivers on SMEs, large scale companies and other types of companies with particular reference to oil and gas industry. This research finding fills this gap on the literature.

9. Empirical result of inhibitors of sustainability practices on SMEs and large scale companies as well as the inhibitors of the various types of companies is yet another contribution of this research to sustainability literature. This is because where these inhibitors were discussed in the literature they were not specific to a company size or to a specific types of companies in a given industry. As such these findings enormously fill the gap in the literature on this issue.

6.5: Limitations of the Current Research

This research covers drivers of sustainability, inhibitors of sustainability, sustainability investments, level of sustainability implementation, sustainability strategies (process driven and market driven). Others are sustainability performance assessment, sustainability reporting systems and competitive objectives. The overall results identified the most important drivers and inhibitors of sustainability in the oil and gas industry. More so, the results demonstrate that sustainability implementation leads to increased organisational competitiveness. However, like any other type of research, this research is not free from limitations. Some of the limitations of this research are as follows:

This research focuses on oil and gas industry and as such the generalisation of results may not be extended to other industrial sectors alone. In addition, the Triple bottom line of sustainability emphasised equal integration of all the three components in a company's supply chain. This research emphasised drivers and inhibitors of sustainability as well as the impacts of sustainability on corporate competitiveness. There was little emphasis given to environmental and social components of sustainability. Although the assumption of this research is that firms responding to this survey had actually improved their environmental performance via implementing the sustainability strategies they reported, the survey did not measure the environmental improvements. However, this provides opportunity for future research in oil and gas industry or other industries with emphasis on environmental and social components of sustainability. In addition, current research did not consider the development of metrics for sustainability and the issue of developing measurement systems for sustainability or quantification of sustainability indicators remain an important research opportunity.

6.6: Suggestion for Further Research

Based on the findings of this research and the limitations set out above, the following research is proposed to address opportunities for further research.

6.6.1: Introduction

The importance of the measurement and use of sustainability indicators constitute very important aspects of sustainability information system. The current study has demonstrated the effectiveness of sustainability strategies and their impacts on organisational performance and improving the quality of the environment. But there remain the need for metrics for sustainability which will enable us to measure progress in sustainability attainment of organisations.

6.6.2: Aims of the Study

The widespread interest in the concept of sustainable environment has been accompanied by the need to develop useful systems of measurement. The research will develop a framework of sustainability assessment in oil and gas industry, which could be used as strategic metrics for assessing the sustainability level of oil companies and for identifying more sustainable options for the future. The metrics will enable a large amount of information to be compressed into a format easier to manipulate, compare and understand. The proposed research will focus on the economic, environmental and social aspects of oil exploration and production.

6.7: Summary

The aim of this research was to identify the most important drivers and inhibitors of sustainability and to study the impacts of market driven sustainability on organisational competitiveness in the UK oil and gas industry. Empirical study using survey by questionnaire was conducted in the UK oil and gas companies. Six research questions were asked and answered in order to accomplish the research aim and objectives. In light of the findings from the study, the aim and objectives of this research have been met through answering the research questions. Further elaborations of how the research questions have been answered and the significance of answering those questions have been stated in this chapter. The limitations of the current research and suggestion for further research have also been presented.

APPENDIX 1

INVESTOR IN PEOPLE

University of Central Lancashire

Lancashire Business School
Professor Yahaya Yusuf
Director of the Institute of Logistics and Operations Management
University of Central Lancashire
Preston PR1 2HE
Tel: (Office) 01772 894534
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www.uclan.ac.uk

01 May 2012

Dear Sir,

Re: Research questionnaire on sustainability adoption in Oil and Gas industry

Tijjani Abubakar, a PhD student attached to the Institute of Logistics and Operations Management, University of Central Lancashire, Preston, is undertaking a research project to investigate the adoption and implementation of sustainability strategies in oil and gas industry in the UK.

The project investigates links between sustainability adoption, competitiveness and supply chain management. By participating in the study, your organisation will be able to assess its operations and competitiveness against tested criteria.

We would very much appreciate your contribution to this important research by completing the enclosed questionnaire. It will take only a short time (twenty minutes) to complete this questionnaire as most of the questions require only a tick(✓). It will be most helpful if you could be as accurate as possible and return your responses within two weeks.

In the event that you find you are unable to respond to some or all of the questions, we would welcome your passing the questionnaire to someone in your organisation that you judge qualified to make the necessary response.

Information for the study and the results will be used for academic purposes only; you and your organisation's names will not be divulged as strict confidentiality is assured. If you are interested a summary of the findings of the research will be made available to you.

If you have any queries please contact Tijjani Abubakar on phone 07501075529 or by email at Tabubakar@uclan.ac.uk.

Thanking you so much for your time and support.

Yours sincerely,

Professor Yahaya Yusuf
Director of the Institute of Logistics and Operations Management
Lancashire Business School
University of Central Lancashire
Preston PR1 2HE

englandsnorthwest
BE INSPIRED

APPENDIX 2

SUSTAINABILTY ADOPTION IN OIL AND GAS INDUSTRY IN UK STUDY QUESTIONNAIRE

A. General Company Information

1. Company name………………………………………………………………………

2. Rank of the respondent (optional)…………………………………………………

3. When this company was established? (Appropriately).................…………………..

4. What workflow process is being used in this company?

Project ☐ Mass Production ☐ Continuous ☐ Jobbing ☐ Batch ☐

5. How many employees work in this company?

Up to 50 ☐ 51 – 200 ☐ 201-500 ☐ 501 – 2000 ☐ above 2000 (Please specify)…...

6. What is the major line of products of this company?

Major Product Line	**Tick**
Exploration and production	
Bases, logistics, catering, transport, storage and allied services	
Consultations including geographical services	
Automobile and automotive assembly, parts, component and accessories	
Engineering services (reservoir, well drilling, Facilities management and well engineering)	
Maritime, subsea services and allied services	
Electrical and electronic equipment, components and allied products	
Others (please specify)………………………………………………………...	

7. What legal form of classification of companies does this company falls in?

Sole proprietorship ☐ Public limited Company (PLC) ☐ Private limited company (Ltd) ☐ Partnership ☐ Private Unlimited company ☐ others (specify)..

8. What is the average sales turnover per annum of this company?

Up to £10M ☐ £11M - £50M ☐ £51M - £100 ☐ £101M - £500M ☐ £501M - £1B ☐ Above £1B (please specify)...………………...

B.<u>**Level of Sustainability Practices**</u>

9. Identify the stage of sustainability implementation of your company.

Adoption of Sustainability Practices	**Tick**
No plan for adoption now and in future	
Will adopt in future	
Recent and on-going implementation	
Made significant progress in implementation	

10. What is the initial (take up) investment made by this company's on sustainability?

Less than £6M ☐ £6M - £12M ☐ £13M - £20M ☐ £20M - £30M ☐ over £30M ☐

11. What was your company investment on sustainability practices over the past five years?

2007 £……………… 2008 £…………… 2009 £…..……… 2010 £……….……….

2011 £……………………………………………………………………………...

12. What do you plan spending on sustainability practices over the next five years?

2012 £……………… 2013 £……………..… 2014 £…………………………………

2015 £………………….. 2016 £………………………………..........................

13. For how long has your company adopted sustainability measures?

Less than 5years ☐ 5 - 10years ☐ 11 - 15years ☐ 16 - 20years ☐ over 20years ☐

14. The indicators of sustainability report in your company are selected from which of the following?

Economic ☐ Environmental ☐ Equity ☐ a combination of all the three components ☐ Combination of two components (please specify)………………….

15. What type of sustainability performance assessment system your organisation use to assess and report its sustainability performance?

Sustainability Performance Assessment Systems	**Tick**
Environmental sustainability index (ESI)	
Environmental performance indicators (EPI)	
Ecological foot print (EFP)	
Operational performance index (OPI)	
Human development index (HDI)	
Wellbeing index (WI)	
Dow Jones sustainability index (DJSI)	
Others (please specify)……………………………………………………….	

16. Which of the following functions do the sustainability indicators serve in your organisation?

Functions of sustainability indicators	**Tick**
Provides early warning information	
Compare organisations and situations	
Anticipates future condition	
Highlight the happenings in the larger system	
A benchmark of sustainability performance in industrial sector	
Others (Please specify)……………………………………………………….	

C. <u>Sources of Sustainability Information</u>

17. Please rate the importance of the following sources of knowledge (information) on sustainability practices in your organisation.

Source of Information	**Very important 1**	**Important 2**	**Moderately important 3**	**Little importance 4**	**Not important 5**
Specialist trade press					
Fairs/shows					
Business press					
Internet					
Informal contact					
Seminars/Conferences					

18. Does sustainability strategy(s) implemented leads to competitiveness of your company?

Strongly Agree ☐ Agree☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

D. Environmental Sustainability variables

19. Please show how sustainability measures adapted improve this company's environmental performance. Tick (√) the most appropriate boxes provided below.

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

E. Social Sustainability Variables

20. Please tick (√) the appropriate boxes provided below to indicate how sustainability strategies implemented improve this company's social performance.

Social Sustainability	Strongly agree 1	Agree 2	Neutral 3	Disagree 4	Strongly disagree 5
Internal code of conduction					
Fair employment from the locality					
Provision of in plant health and safety facilities					
Investment in infrastructural facilities					
Payment of taxes and levies to government					
Support government revenue transparency					
Ethical business and trading					
Investment in poverty alleviation programme					
Endowment to local symphony					
Intervention in regional and cross regional development initiatives.					

F. Drivers and Inhibitors of Sustainability Practices

21. Identify (as many as possible) the primary drivers/motives for your company's choice of the sustainability strategies you have implemented.

Drivers	**Tick**
Desire to reduce cost.	
Desire to enhance revenues/profits.	
To achieve competitive advantages.	
Desire to conserve energy.	
Desire to conserve resources/resources pressures.	
Desire to reduce pollution.	
Desire to reduce waste.	
Pressure from consumers/reduce consumer risk.	
Legal/regulatory pressures.	
Pressures from investors.	
Urge to improve organisational performance.	
Marketing pressures.	
Environmental advocacy pressures.	
Desire to enter new markets.	
To increase market share.	
Increase sales turnover.	
Carbon foot print reduction.	
Sources of raw materials.	
Others (please specify)…………………………………………………………..	

22. What difficulties your organisations encounter in adopting / practising sustainability?

Inhibitors of Sustainability Practices in Organisations	**Tick**
Higher cost of adaption (take up)/higher running costs	
Problems of other stakeholders pressures	
Lack of relevant information	
Inappropriate infrastructures	
Decline of profit level	
Lack of expertise/unskilled employees on sustainability practices	
Difficulties of implementing sustainability (new concept) in the firm	
Problems of market pressures	
Others (please specify)…………………………………………………………..	

G. Sustainability Strategies Implemented

23. Identify which of the following sustainability strategies your company has implemented (You can choose more than one strategy).

Market Driven Strategies	**Tick**
Introduce new environmentally sensitive products.	
Design existing products to make them more environmentally sensitive.	
Enter new environmentally oriented markets or market segments.	
Design product packaging to be more environmentally sensitive.	
Advertising the environmental benefits of product.	
Sold donated materials once discarded as wastes.	
Process Driven Strategies	
Redesign production process for environmental reasons.	
Redesign pollution controls, waste disposal and water/air treatment process.	
Use recycled material from outside sources in production process.	
Recycle scrap materials once considered waste in production process.	
Recycle defective end products in production process.	
Use renewable energy source in production process.	
Design free emission production process.	
Use renewable resources in production.	
Others (please specify)…………………………………………………………	

24. If the sustainability strategy you have adopted required significant investment, what period of time do you expect to recoup the investment?

Period of Time Required to Recoup the Investments	**Tick**
Up to 2 years	
3 to 4 years	
5 to 6 years	
7 to 9 years	
Above 10 years (please specify)…………………………………………………	

25. What are the financial impacts to your organisation of implementing the following sustainability strategies?

Strategies	**Positive impacts on revenue 1**	**No impact on revenue 2**	**Negative impact on revenue 3**	**Making less investment 4**	**Making significant investment 5**
Introduce new environmentally sensitive products.					
Design existing products to make them more environmentally sensitive					
Enter new environmentally oriented markets or market segments.					
Design product packaging to be more environmentally sensitive.					
Advertising the environmental benefits of product.					
Sold donated materials once discarded as wastes.					
Process Driven Strategies					
Redesign production process for environmental reasons.					
Redesign pollution controls, waste disposal and water/air treatment process.					
Use recycled material from outside sources in production process.					
Recycle scrap materials once considered waste in production process					
Recycle defective end products in production process.					
Use renewable energy source in production process.					
Design free emission production process					
Use renewable resources in production					
Others (please specify) ……….……………………..					

H. Competitive Objectives in Operation

26. Please indicate by a tick (√) your company's attainment of competitive priorities.

Competitive priorities (objectives)	**Very high 1**	**High 2**	**Moderate 3**	**Low 4**	**Very low 5**
Speed					
Cost					
Delivery					
Innovation					
Proactivity					
Quality					
Flexibility					
Dependability					
Customisation					
Turnover					
Net Profit					
Market share					
Customer repeat order (customer loyalty)					
Performance relative to competitors					

27. Would you agree to participate in a follow-up research involving visit to your company site?

Yes ☐ No ☐

28. Please comment freely and generally on any aspect of sustainability practices in your company in the spaces provide below.

....

....

....

....

....

Please return the Questionnaire by mail (using the enclosed self-addressed envelope) to the address below:

Tijjani Abubakar,

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Lancashire Business School,

University of Central Lancashire (UCLAN)

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